



UNITED STATES MARINE CORPS
MARINE CORPS AIR STATION
BEAUFORT, SOUTH CAROLINA 29904-5001

ASO 5100.3
DSS
30 AUG 2012

Air Station Order 5100.3

From: Commanding Officer, Marine Corps Air Station Beaufort
To: Distribution List

Subj: ELECTRICAL SAFE WORK PRACTICES SAFETY PROGRAM

Ref: (a) MCO 5100.24C Marine Corps Occupational Safety and Health Program
(b) National Fire Protection Association (NFPA), 70E
(c) 29 CFR 1910.269

Encl: (1) MCAS Electrical Safe Work Practices Program and Protocol
(2) Initial Program Deployment
(3) Personal Protective Equipment (PPE) Requirements Matrix
(4) Site-Specific Electrical Safe Work Practices Program Documentation

1. Situation. Per the references, this Order promulgates the standard operating procedures for the safe use and operation of all electrical work to be conducted aboard the Marine Corps Air Station (MCAS) Beaufort.

2. Mission. To establish an installation electrical safe work practices program, including an energized work permit process, that meets the requirements of the installation's occupational safety and health program (Air Station Order 5100.24C) as well as the spirit and intent of National Fire Protection Association (NFPA) 70E, for personnel protection while performing electrical work.

3. Execution

a. Commander's Intent and Concept of Operations

(1) Commander's Intent

(a) This Order is applicable to all individuals and organizational elements aboard MCAS Beaufort that routinely operate or work on energized hazards.

(b) The Electrical Safe Work Practices program shall be administered at all times in accordance with Marine Corps rules and regulations as well as NFPA 70E guidelines pertaining to power transmissions and distribution systems.

(c) Personal protective equipment (PPE) requirements outlined in enclosure (3) shall be adhered to at all times until all energized equipment has been completely de-energized.

(2) Concept of Operations

(a) Working on or near energized hazards, except for authorized troubleshooting with an approved meter, requires a minimum of two qualified

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personnel both current in cardiopulmonary resuscitation (CPR) and first aid and a written energized work permit.

(b) Working on or near live equipment, as defined in section 1 of enclosure (1), is permitted only when it is impossible to shut off the equipment or circuits, when de-energizing the equipment would introduce additional or increased hazards, or is infeasible due to equipment design or operational limitations.

(c) The Air Station's Safety Office shall administer and manage the Electrical Safe Work Practices Safety Program at this activity.

b. Subordinate Element Missions

(1) Director of Safety

(a) Manage and coordinate the overall electrical safe work practices program.

(b) Report adverse events such as an electrocution related death, a serious injury, or illness. Report such incidents to the appropriate higher level as well as to the Occupational Health and Safety Administration.

(2) Marine Corps Community Services (MCCS-SC) Maintenance Division

(a) Provide quality maintenance practices that include flash protection boundaries as well as limited approach boundaries. This will include but not be limited to establishing an electrically safe work condition for all employees.

(b) Maintain control and accountability of all personal protective equipment (PPE) requirements that are used by qualified individuals within the MCCS Community as outlined in enclosure (2).

(3) Communications, S-6 Department

(a) Ensure all communication repair procedures are in line with enclosure (2) to provide all employees a safe installation work practices program.

(b) When working within close proximity to power lines and electrical manholes, ensure all proper safety protocols are adhered to.

(c) Workers shall not wear conductive apparel (e.g. watches rings, bracelets, key chains, necklaces, metalized aprons, cloth with conductive thread, metal head gear, wire/metal rimmed glasses, etc.).

(4) Public Works Division

(a) Public Works will work with MCCS-SC and Ahtna Technical Services Incorporated (ATSI) units to establish and provide an electrically safe work condition that will include providing the proper PPE.

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(b) Provide all general warning signs and marking requirements on all electrical hazards found aboard the MCAS Beaufort and Laurel Bay.

(c) Thoroughly read and review this Order to gain a detailed understanding of proper electrical work safe practices.

(d) Maintain control and accountability of all PPE requirements that are used by qualified individuals within the Public Works Division and ATSI as outlined in enclosure (2).

4. Administration and Logistics. The Safety Office will administer any revisions and/or modifications of this Order. All recommendations concerning changes to this Order shall be submitted to the Air Station's Safety Office for review.

5. Command and Signal

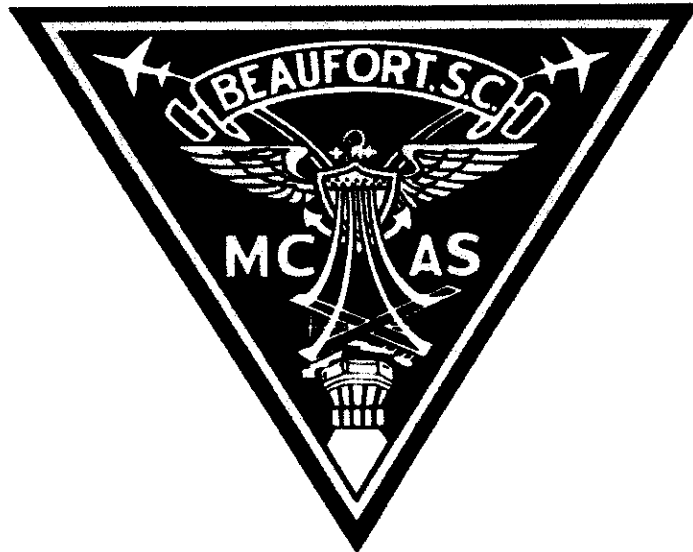
a. Command. This Order is applicable to all affected military and civilian personnel assigned to MCAS Beaufort.

b. Signal. This Order is effective the date signed.



B. C. MURTHA

DISTRIBUTION: A



MCAS Beaufort
Electrical Safe Work Practices
Program & Protocol

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- PURPOSE:
 - To establish an installation electrical work practices program, including an energized work permit process, that meets the requirements of the installation's occupational safety and health program (ASO 5100.24C) as well as the spirit and intent of NFPA 70E, for personnel protection while performing electrical work.
 - Power transmission and distribution systems are not covered in detail. Departments that perform work on power transmission and distribution systems shall develop additional system specific written programs and employ work practices that comply with industry standards as well as the spirit and intent of 29 CFR 1910.269.
 - General guidance for initial program deployment and a summary of recurring program management requirements are contained in Enclosure (2). Site specific program requirements are contained in Enclosure (4).
- SECTION 1 - Work On or Near Energized Hazards
 - Work on or near energized hazards, except for authorized troubleshooting with an approved meter, requires a minimum of two qualified personnel both current in Cardiopulmonary Resuscitation and First Aid and a written energized work permit.
 - Work is considered to be "on or near" anytime any of the following conditions occur:
 - Any part of the body, regardless of the level of PPE protection, enters or may inadvertently be placed within the Restricted Approach Boundary based on the maximum potential voltage involved.
 - Any tool or piece of equipment (regardless of whether it is insulated) enters or may inadvertently be placed within the Restricted Approach Boundary based on the maximum potential voltage involved.
 - An energized work permit is required when performing any work, even non-electrical work, within the restricted approach boundary.
 - Work "on or near" live equipment as defined above is permitted only when it is impossible to shut off the equipment or circuits; or when de-energizing the equipment would introduce additional or increased hazards; or is infeasible due to equipment design or operational limitations. Examples of situations that would meet the requirements of "increased or additional hazards" include:
 - Interruption of life safety equipment.
 - Deactivation of emergency alarm systems.
 - Shutdown of hazardous location ventilation equipment.
 - Removal of illumination from a large area.

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- o Energized electrical work permits shall be issued by a manager or supervisor, after notification to the department head, installation safety manager, or a designated representative, who has been appointed in writing, by the department head. A copy of the energized electrical work permit shall remain at the worksite until work is completed and then shall be retained and filed as part of the work order/job order package. The energized work permit provides documentation of the justification for working the circuit or equipment energized, identifies the specific personnel who are to perform the work and the specific PPE requirements for the task, defines the scope of the task, and details additional special protective and work practices required to protect both the workers and other personnel in the area.
- o If all exposed live components of 50 volts or greater in a cabinet, vault, box, or other piece of electrical equipment are not completely de-energized through lockout/tagout, ANSI approved voltage rated tools shall be used anytime the plane of the cabinet, vault, box, or opening is breached.
- o Metering during authorized troubleshooting is not considered working on or near. However, full PPE shall be worn based on maximum potential voltages as defined in Section 4. American National Standards Institute (ANSI) approved voltage rated tools, rated for maximum voltages that may be encountered, are required during metering.
- SECTION 2 - Installation Approach Boundaries for Live Parts
 - o The approach boundaries listed below shall be used to define energized work permit requirements, tool and equipment requirements, and PPE requirements by all installation personnel.
 - o Flash Protection Boundary: The minimum flash protection boundary is 4 feet for voltages between 50 volts and 600 volts. Arc flash protection is required for all parts of the body for any worker within this boundary when work is being performed that could lead to an arc flash. Flash protection boundaries at voltages above 600 volts shall be calculated following NFPA 70E on a case-by-case basis using the formula found in NFPA 70E, paragraph 130.3 (A) or applying the maximum level of protection recommended in Table 130.7(C) (9) (a) based on the work being performed.
 - o Limited Approach Boundary: The limited approach boundary establishes an area around exposed energized hazards of 50 volts or greater where unqualified employees must be escorted and directly supervised by a qualified employee. Insulated voltage rated ANSI approved tools based on the maximum voltage are also required within this boundary. Limited approach boundaries include the following (refer to NFPA 70E for higher voltages):
 - 50 to 750 volts - 3 feet 6 inches
 - 751 volts to 15 kV - 5 feet
 - 15.1 kV to 36 kV - 6 feet
 - 36.1 kV to 121 kV - 8 feet
 - o Restricted Approach Boundary: The restricted approach boundary establishes an area around exposed energized hazards of 50 volts

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or greater where unqualified employees are prohibited and insulated tools and full PPE based on the maximum voltage are required. A worker is considered to be working "near" energized systems when any part of the body or tool could approach an energized component closer than the distances below. An energized work permit is always required in these cases except during troubleshooting with an approved meter. Restricted approach boundaries include the following (refer to NFPA 70E for higher voltages):

- 50 to 750 volts - 1 foot
- 751 volts to 15 kV - 2 feet 2 inches
- 15.1 kV to 36 kV - 2 feet 7 inches
- 36.1 kV to 46 kV - 2 feet 9 inches
- 46.1 kV to 72.5 kV - 3 feet 3 inches
- 72.6 kV to 121 kV - 3 feet 4 inches

- o Prohibited Approach Boundary: The prohibited approach boundary establishes an area around exposed energized hazards of 50 volts or greater where approach within the boundary is considered "working on" an energized system. A worker is considered to be working "on" energized systems when any part of the body or tool could approach an energized component closer than the distances below. Unqualified workers are prohibited and full PPE based on the maximum voltage is required. An energized work permit is always required in these cases except during troubleshooting with an approved meter. Prohibited approach boundaries include the following (refer to NFPA 70E for higher voltages):

- 50 to 750 volts - 1 inch
- 751 volts to 2.1 kV - 7 inches
- 2.1 kV to 36 kV - 10 inches
- 36.1 kV to 46 kV - 1 foot 5 inches
- 46.1 kV to 72.5 kV - 2 feet 2 inch
- 72.6 kV to 121 kV - 2 feet 9 inches

- SECTION 3 - Establishing an Electrically Safe Work Condition

- o Every attempt shall be made to establish an electrically safe work condition before performing work (other than authorized metering as a part of troubleshooting) within the Limited Approach Boundary of exposed electrical hazards as defined in Section 2.
- o Performing complete lockout/tagout of all electrical potentials of 50 volts or greater within the cabinet, vault, box, or work area is considered establishing an electrically safe work

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condition so long as the lockout/tagout process accomplishes all of the following:

- Includes a documented hazard evaluation (TSI) at the site including the identification of the person in charge of the LOTO.
 - Identifies every source of electrical energy of 50 volts or greater remaining inside the cabinet, vault, box, and completely eliminates them through lockout/tagout.
 - Tests every phase conductor or circuit part with an approved meter (phase-to-phase and phase-to-ground) to verify they are de-energized (meter shall be checked before and after each test to confirm it is operating properly).
 - Applies ground connecting devices to any part or circuit where there is a possibility of induced voltages or stored electrical energy including grounding out of capacitors or similar devices which may hold stored energy.
 - If both locks and tags cannot be installed, a second alternative method such as removal of a fuse shall be employed in addition to a tag. All circuits and equipment are considered energized until an electrically safe work condition has been established and verified.
- o If an electrically safe work condition as described above has not been established then the following work practices shall be followed:
- If the Restricted and/or Prohibited Approach Boundary may be breached an energized work permit shall be secured and work practices shall comply with those required for "working on or near" energized hazards.
 - If the Limited Approach Boundary may be breached a qualified person must be present and directly supervise the work.
 - If the Arc Flash Boundary may be breached and any work is performed which has the possibility causing an arc flash, all personnel within the flash boundary shall be protected with appropriate levels of arc flash protection as detailed in Section 5.
- SECTION 4 - Insulated Tools and Equipment
- o ANSI approved insulated tools and/or handling equipment shall be used when working near exposed energized conductors or circuit parts. The insulating materials on these items must be protected during storage or transportation. When removing or installing fuses from an energized fuse terminal, use of fuse handling equipment capable of withstanding the circuit voltage is necessary. Also, only nonconductive ropes and hand lines are permitted near exposed parts.
 - o Insulated tools and equipment shall be inspected prior to each use. The inspection shall include an examination for damage to the insulation or damage that may limit the tool from performing its intended function or which could increase the potential for

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an incident. Defective tools and equipment shall be immediately removed from service.

▪ Insulated tools and insulated equipment shall be used when:

- Breaking the plane (or opening) of an electrical fixture (cabinet, vault, panel, etc.) where any live voltage of 50 volts or greater remains (including metering for troubleshooting). Cabinet shall be considered as containing live voltage until all sources of 50 volts or greater have been completely de-energized through lockout/tagout and confirmed to be de-energized through metering.
- Any part of the body or a tool or piece of equipment may cross the Limited Approach Boundary for the maximum voltage present.
- All tools used in either case above shall be voltage rated ANSI approved tools rated to the maximum voltage hazard present.
- Insulated tools and equipment shall also comply with the following:
 - Grounding and testing devices shall be stored in a clean and dry area and properly inspected and tested before each use.
 - Fuse or fuse holding equipment shall be used to remove or install a fuse if the fuse terminals are energized. Fuse or fuse holder shall be rated and insulated for the circuit voltage.
 - Ropes or hand lines used near exposed live parts operating at 50 volts or greater shall be non-conductive.
 - Fiberglass-reinforced plastic rod and tube tools used for live line work shall meet the requirements of ASTM F 711.
 - Portable ladders shall have non-conductive side rails. Metal ladders are prohibited in areas where electrical hazards exist.
 - Workers shall not wear conductive apparel (e.g., watches, rings, bracelets, key chains, necklaces, metalized aprons, cloth with conductive thread, metal head gear, wire/metal-rimmed glasses, etc.).

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- SECTION 5 - Personal Protective Equipment Requirements

- Protective equipment requirements outlined below and in Enclosure (3) are mandatory when any part of the body or a tool or piece of equipment may be placed within the Restricted Approach Boundary (Section 2).
- All personnel shall wear the required PPE as outlined in this section until all energy sources of 50 volts or greater within the Restricted Approach Boundary have been completely eliminated through lockout/tagout and de-energization has been confirmed through metering. The ratings in this section, of cal/cm², represent arc flash protection ratings. If protective equipment is not marked with these ratings it does not meet the requirements of NFPA 70E and shall not be used. Exceptions to these requirements are limited to those specifically addressed under each type of protective equipment.
- Protective equipment shall be maintained in a safe, reliable condition and visually inspected before each use. It shall also be stored in a manner to prevent damage from physically damaging conditions and from moisture, dust, or other deteriorating agents.
- Arc flash clothing that is contaminated with grease, oil, or flammable liquids or combustible materials or is damaged to an extent where the protective qualities are impaired shall not be used. Arc flash clothing shall be stored so as to avoid physical damage, damage from moisture, dust, or other deteriorating agents or contamination from flammable or combustible material. It shall be cleaned following manufacturer's instructions so as to avoid loss of protection. If it is repaired, it shall be repaired using the same flame retardant materials as used in the original garment.
- When body protection is required, underclothing must be all cotton (never nylon, polyester or rayon) and contain no metal.
- Trim, name tags, or logos affixed to flame retardant clothing shall also be flame retardant rated.
- Hairnets and/or beard nets shall be of non-melting and flame resistant design.
- Class E hardhats rated for electrical protection shall be worn when inside any substation or other power transmission and distribution equipment area.

- SECTION 6 - Hazard Alerting/Control Requirements

- Special precautions shall be employed to warn employees of unusual electrical hazards until they are corrected or eliminated. For example, if breakers or breaker blanks are found missing inside a breaker panel a warning sign limiting access to qualified electricians shall be placed on the panel door until the electrical hazard below is returned to compliance with electrical code.

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- o Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas containing live parts. Barricades shall be of non-conductive design and shall be placed so as to prevent access to the Limited Approach Boundary by non-qualified personnel (10 feet for exposed movable conductors and 3 ½ feet for non-movable conductors up to 750 volts).
- o Exposed energized components shall never be left unattended and/or unprotected. If signs or barricades cannot assure warning and protection from electrical hazards an attendant shall be stationed to warn and protect personnel. When an attendant is used they shall remain in the area so long as there is a potential for personnel to be exposed to the electrical hazards. Their primary duty is to keep unqualified personnel outside a work area where the unqualified employee might be exposed to the electrical hazard. At an absolute minimum this is outside the Limited Approach Boundary.
- o Where work is performed on equipment that is de-energized and placed in an electrically safe condition in a work area with other energized equipment that is similar in size, shape, and construction, additional alerting methods such as signs, barricades, or attendants shall be employed to prevent the employee from entering look-alike equipment.
- SECTION 7 - Electrical Protective Equipment Requirements
 - o Insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber shall meet the following requirements:
 - o Blankets, gloves, and sleeves must be produced by a seamless process.
 - o Each item shall be clearly marked with its Class number.
 - o Markings shall be non-conductive and shall not impair the insulating qualities of the equipment.
 - o Markings on gloves shall be confined to the cuff portion of the glove.
 - o Equipment shall also meet the specifications contained in the governing ASTM
 - o standard outlined in the following table:

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| Item | Standard |
|----------------------|--------------------------------|
| Insulating matting | ASTM D 178-93 (or D 178-88) |
| Insulating blankets | ASTM D 1048-93 (or D 1048-88a) |
| Insulating covers | ASTM D 1049-93 (or D 1049-88) |
| Insulating line hose | ASTM D 105-90 |
| Insulating sleeves | ASTM D 1051-87 |

- Insulating equipment with any of the following defects shall not be used:
 - Holes, tears, punctures, or cuts.
 - Embedded foreign objects.
 - Texture changes, swelling, softening, hardening, or becoming sticky or inelastic.
 - Any other defect that may damage insulating properties.
- Insulating equipment shall be cleaned as needed to remove foreign substances and stored in a location and manner that protects it from light, temperature extremes, excessive humidity, ozone, and other injurious substances and conditions. A thorough visual examination by the worker is always required immediately before each use.
- Rubber insulating equipment shall be inspected and tested as outline in the following table:

| Item | Inspection | Testing by Qualified Agency |
|-----------------------------|-----------------|--|
| Rubber insulating line hose | Before each use | Upon indication that the insulating value is suspect |
| Rubber insulating covers | Before each use | Upon indication that the insulating value is suspect |
| Rubber insulating blankets | Before each use | Before first issue and every 12 months thereafter |
| Rubber insulating gloves | Before each use | Before first issue and every 6 months thereafter |
| Rubber insulating sleeves | Before each use | Before first issue and every 12 months thereafter |

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- NOTE: In the case of blankets, gloves, and sleeves, if the equipment has been electrically tested but not issued for service, it may not be placed into service, unless it has been electrically tested within the past 12 months. However, in all cases a process or procedure shall be deployed that assures identification of, and confirmation of, inspection currency for individual pieces of equipment by both the worker and an inspecting/auditing agency.
- SECTION 8 - General Electrical Safe Work Practices
 - Rated-load switches or circuit breakers shall be used to disconnect electric power and lighting circuits. Non-electrical workers may reset a tripped single-pole convenience outlet or lighting circuit breaker one time, provided it is not located in a designated emergency panel and when, based on their knowledge, it is safe to do so. If the circuit breaker trips again, contact supervision so an appropriate response can be authorized and initiated. Other types of circuit breakers may only be reset by personnel who are trained and knowledgeable of the affected systems.
 - Use of pocket knives or standard box cutters is strictly prohibited. Wire strippers and cable strippers shall be used to strip wire and cable including high voltage cable.
 - If electrical equipment is used near sources of flammable vapors, such as in identified Class 1, Division 1 or Class 1, Division 2 locations, the equipment must meet the requirements of NFPA and/or NEC for these locations.
 - Lamps and fixtures shall be guarded and secured to preclude injury. Open fluorescent fixtures must have wire guards, lenses, tube guards and locks, or safety sockets that require force in the horizontal axis to remove the lamp.
 - Lamps for general illumination shall be protected from inadvertent contact or breakage either with a suitable guard or by separation of at least 7 feet from normal working surface.
 - All portable electric hand tools must be double insulated.
 - Portable electrical hand tools shall be unplugged when not in use.
 - Electrical cords shall not be used to raise or lower equipment.
 - Equipment with frayed cords or three-wire cord ends that have had the grounding prong removed shall not be used.
 - The proper power receptacle shall be used for each application. Cord-end prongs shall not be manipulated to fit the wrong receptacle.
 - The use of temporary wiring shall be avoided. Appropriate ground fault circuit interrupters (GFCI) shall be employed with any temporary wiring including extension cords used for portable electrical equipment and tools.
 - Extension cords shall not be used in place of permanent wiring (affixed to structure, run around poles, under doors, through holes in walls or structure, etc.).

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- o High current draw items such as coffee pots, refrigerators, microwaves, toaster ovens, and toasters must be plugged directly into an approved outlet, never into extension cords or power strips.
- o Power strips (surge protectors) shall be plugged directly into an approved outlet, not into other power strips or into extension cords. Surge protectors shall be listed by a nationally or internationally recognized testing laboratory. Loads plugged into these devices shall not exceed the maximum recommended by the manufacturer.
- o Extension cords and cords on electrical equipment shall be inspected before each use. Equipment or extension cords with damaged wiring or missing plug prongs shall be taken out of service until the damage is repaired.
- o Only trained and qualified personnel may defeat electrical safety interlocks and then, only temporarily, when directed to do so by an approved procedure or work practice, while working on the equipment. The interlock shall be returned to its operable condition as soon as possible.
- o Circuits shall be de-energized immediately if an electrical shock victim is still in contact with electrical energy. If not possible to de-energize the circuit, only trained and qualified employees may attempt to remove the victim. NOTE: Electrical shocks are medically serious regardless of the voltage. Even if the victim shows no apparent signs of injury, they shall be seen by a qualified health care professional.
- o The following GFCI protection requirements are applicable to all operations:
 - GFCI protection shall always be used in wet or extremely damp areas.
 - A GFCI device shall be used to protect personnel when they use portable electric tools and portable electric equipment including portable lights.
 - If an extension cord is used, GFCI protection is required, even if the cord is plugged into an indoor outlet (if the indoor outlet is GFCI protected, this is sufficient).
 - GFCI protection for extension cord use shall be located between the extension cord and the electrical outlet into which it is plugged.
 - Permanently mounted GFCI devices shall be checked monthly by pushing the test button on the device.
 - Portable GFCI devices shall be tested by workers by pushing the test button on the device before each use.
- o Installing conductors in or removing conductors from raceways containing energized or potentially energized conductors shall be avoided, as a general rule, because of the possibility of conductor damage. If this type of work is unavoidable, circuits

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shall be identified and locked out/tagged out or the task shall be considered energized work and an energized work permit shall be secured.

- o Personnel must remain alert at all times when working near exposed electrical parts or in situations where electrical hazards may exist. Personnel must never reach blindly into areas that may contain live circuits. If alertness is recognizably impaired due to illness, fatigue, or other reasons, the person shall not be permitted to work in areas containing electrical hazards.
 - o Personnel shall not enter an area containing exposed electrical circuits unless adequate illumination is provided. When the illumination or obstructions affect visibility and the worker might contact the exposed circuits or equipment, they shall not perform the task.
 - o Tasks shall not be performed within the Limited Approach Boundary of energized electrical components if lack of illumination or obstructions precludes observation of the work to be performed.
 - o Conductive materials and equipment in contact with a worker's body must be handled carefully so they do not come into contact with exposed conductors. Conductive material and equipment includes, but is not limited to ducts, pipes, tubes, conductive hoses or ropes, metal-lined rules and scales, and steel tapes or chains.
 - o Protective shields, barriers, or insulating materials shall be used to protect workers from exposed energized parts which might be inadvertently contacted or where dangerous electric heating or arcing is likely to occur.
 - o When work is performed in a confined or enclosed space such as a manhole or vault, precautions to avoid contact with the energized part are required. Work in confined spaces also requires special training in confined spaces and a confined space entry permit before entry.
 - o Housekeeping and custodial duties shall not be performed adjacent to energized parts where such parts present an electrical contact hazard. Cleaning materials such as water, steam, conductive cleaning fluid, steel wool, metalized cloth, or silicon carbide shall not be used in the proximity of energized parts.
 - o Form 3010-051, Electrical Safety Checklist, may be used as an aid to help check for compliance with the major items covered in this section.
- SECTION 9 - General Warning Signs and Marking Requirements
 - o A summary of the warning signs and marking requirements for electrical systems and areas contained in industry standards is provided in the table below. Projects shall comply with these requirements or provide alternate and equally effective warnings for personnel involved.

| Warning Signs and Markings | |
|--|---|
| Condition | Requirements |
| Entrance to rooms or other guarded locations containing exposed live parts (600 volts nominal or less). | Post conspicuous warning sign forbidding unqualified persons from entering. |
| Entrance to buildings, rooms, or enclosures containing exposed live parts (over 600 volts nominal). | Post warning sign reading <i>Danger-High Voltage - Keep Out</i> or similar language. Entrance must remain locked. |
| All electrical equipment. | Mark equipment with the manufacturer's name, trademark, or other marking indicating the organization responsible for the product. Additional requirements for marking voltage, current, wattage, or other ratings maybe specified by the NEC. |
| Disconnection of power sources (including circuit breakers). | Mark each disconnection required for motors, appliances, and each service feeder or branch circuit at the point where it originates to indicate its purpose unless located and arranged so that the purpose is evident. |
| Circuit breakers or fuses applied in compliance with Series Combination Ratings. | Mark equipment enclosure to indicate the equipment has been applied with Series Combination Rating. Markings must state <i>Caution-Series Rated System Amps Available: Identified Replacement Component Required</i> . |
| Exposed live parts of transformers. | Mark with operating voltage. |
| Fused cutouts not interlocked with the switch to prevent opening of the cutouts under load. | Post conspicuous sign at the cutouts reading <i>Warning - Do Not Open Under Load</i> . |
| More than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors. | Post conspicuous sign reading <i>Warning - Switch May be Energized by Backfeed</i> at each switch. |
| Fuses potentially energized by backfeed. | Post sign on enclosure door reading <i>Warning - Fuses May Be Energized By Back feed</i> . |

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- SECTION 10 - Power Transmission/Distribution Requirements
 - Locations that perform work on power transmission and distributions systems shall develop additional location specific written procedures that cover site specific systems and define work practices that meet the spirit and intent of 29 CFR 1910.269 (see 3-1-45, Electric Power Generation Transmission and Distribution). This section DOES NOT eliminate this requirement, nor does it cover all of the work practices necessary to protect personnel in these highly unique and hazardous work conditions. It simply summarizes the main industry standard requirements that shall be followed by company personnel when working on power transmission/distribution systems.
 - The operating voltage of equipment and lines shall be determined before working on or near energized parts.
 - Bare wire communication conductors on power poles or structures shall be treated as energized lines unless protected by insulating materials suitable for the highest voltage that may be inadvertently applied to the line.
 - New lines or equipment may be considered de-energized and worked as such where the lines or equipment are grounded or where the hazard of induced voltages is not present and adequate clearances or other means are implemented to prevent contact with energized lines or equipment.
 - Persons not qualified and trained as outlined in 29 CFR 1910.269 shall:
 - Always maintain a minimum of 10 feet separation from all power transmission and distribution components and power lines up to 50 kV. (Company limit is increased to 20 feet for voltages above 50 kV).
 - Persons properly trained and qualified as outlined in 29 CFR 1910.269 shall:
 - Avoid contact with energized overhead lines, either with a body part, a conductive material, a tool, or piece of equipment. If contact with energized overhead lines is possible:
 - The lines shall be de-energized, guarded, or insulated. These precautions must be taken before work in the area begins.
 - If the lines cannot be de-energized or guarded, personnel shall maintain a safe distance from the conductors.
 - Be current in CPR and First Aid and a first aid kit must be present at the work site.
 - Use hot work procedures and wear required PPE until equipment and lines have been confirmed to be de-energized by tests or other means and grounds have been applied.
 - The following minimum requirements shall be followed when de-energizing lines and equipment in excess of 600 volts unless the

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means of disconnecting from electric energy is visibly open or visibly locked out:

- The section of line or equipment to be de-energized shall be clearly identified and shall be isolated from all sources of voltage.
- Notification and assurance from the controlling authority shall be obtained that:
 - All switches and disconnects through which electric energy may be supplied to the particular section of line or equipment to be worked have been de-energized.
 - All switches and disconnects are plainly tagged indicating that persons are at work.
 - All switches and disconnects capable of being rendered inoperable are rendered inoperable.
- After all designated switches and disconnects have been opened, rendered inoperable, and tagged, visual inspections shall be conducted to ensure that equipment or lines are de-energized.
- Protective grounds shall be applied on the disconnected lines or equipment to be worked on.
- Guards or barriers shall be erected as necessary to adjacent energized lines.
- When more than one independent crew requires the same or equipment to be de-energized, a prominent tag for each such independent crew shall be placed on the line or equipment by the designated person in charge.
- Upon completion of work on de-energized lines or equipment, each designated person in charge shall determine that all personnel in the crew are clear and protective grounds installed by the crew have been removed and shall report to the controlling authority that all tags and locks protecting the crew may be removed.
- When opening or closing a disconnect switch or circuit breaker on a power transmission and distribution line, exposure to potential explosion shall be limited. Safe operating procedures shall be established to minimize the risk of explosion.
- When the crew working on a line or equipment can clearly see that the means of disconnecting from electrical energy are visibly open or visibly locked-out, the following provisions are mandated:
 - Guards or barriers to adjacent lines shall be erected as necessary.
 - Upon completion of work on de-energized lines or equipment, each designated person in charge shall determine that all employees in the crew are clear, all equipment grounds

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installed by the crew have been removed, and shall report to the controlling authority that all tags and locks protecting the crew may be removed.

- o Follow the minimum requirements below during grounding:
 - Test de-energized conductors and equipment that are to be grounded for voltage.
 - Attach ground end of ground wire first, then attach the other end. Always use insulated tools or other suitable devices when attaching ground wires.
 - Always use insulating tools or other suitable devices when removing grounds.
 - Place grounds between the work location and all sources of energy and as close as practicable to the work location.
Additionally:
 - If work is to be performed at more than one location in a line section, the line section must be grounded and short circuited at one location in the line section and the conductor to be worked on shall be grounded at each work location.
 - The minimum distance in the tables in this section shall be maintained from ungrounded conductors at the work location.
 - Where the making of a ground is impracticable, or the conditions resulting from it would be more hazardous than working on the lines or equipment without grounding, the grounds may be omitted and the line or equipment worked as energized. In all cases, if grounds are not installed, "Hot Work" procedures shall be followed.
 - Grounds may be temporarily removed only when necessary for test purposes and extreme caution shall be exercised during test procedures. The lines or equipment from which grounds have been removed shall be considered energized.
 - When grounding electrodes are used, such electrodes shall have a resistance to ground low enough to remove the danger of harm to personnel or permit prompt operation of protective devices.
 - Grounding to tower shall be made with a tower clamp capable of conducting the anticipated fault current.
 - A ground lead, to be attached to either a tower ground or driven ground, shall be capable of conducting the anticipated fault current and shall have a minimum conductance of No. 2 American Wire Gauge (AWG) copper.

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- All hydraulic fluids used for the insulated sections of derricks, trucks, aerial lifts, and hydraulic tools that are used on or around energized lines and equipment shall be of the insulating type.
- SECTION 11 - Minimum Training Requirements and Designation of Qualified Personnel.
 - Affected personnel, both those qualified to perform electrical work and those not qualified who may still work on or near energized systems, shall be trained in the safe work practices outlined in this section on an annual basis (see definitions of "qualified" and "unqualified" in section 12). Training may be at different levels for qualified and unqualified, but shall be sufficient to afford the electrical safe work practices and hazard recognition knowledge they require to safely perform their tasks. Training shall also cover how a GFCI operates, hazards associated with portable electric power and extension cord use, and when GFCI use is required. Affected personnel shall also be instructed on how to inspect the specialized PPE required for electrical work prior to beginning placed in a position where this PPE is required.
 - All training shall be documented. Affected personnel shall be trained either as "qualified" or "unqualified" with qualified being at a level sufficient to afford protection during actual electrical work. Form 3010-052 and/or Form 3010-053, or equivalent forms or methods may be used for this documentation.
 - Personnel who are "qualified" to perform electrical work shall meet the training and qualification requirements of this section and be identified in writing.
 - Qualified personnel are identified and documented in Enclosure (3).
 - Qualified personnel are personnel who have also been trained, at a minimum, in the following:
 - The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment.
 - The skills and techniques necessary to determine the nominal voltage of exposed live parts.
 - Clearance distances for working near live circuits or equipment.
 - Military or civilian personnel that perform work on electrical circuits shall also meet the following minimum requirements:
 - Have experience servicing the electrical components of the equipment that they are assigned to service
 - Have experience working on energized electric circuit parts or equipment

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- Meet any governing statute or regulatory requirement, host nation, or customer requirement for special certifications or licenses
 - Personnel who work on power transmission/distribution systems shall have additional training and experience that meets or exceeds the spirit and intent of that outlined in 29 CFR 1910.269. This includes the requirement to identify hazardous tasks not routinely performed, and establish procedures to ensure personnel have performed these tasks within the past 12 months, or that they are re-trained or supervised before performing them. These additional requirements are mandatory before exposure to the hazards. This additional training shall be documented. All personnel who work on power/transmission distribution systems or their components shall also be current in CPR, First Aid, and Bloodborne Pathogens.
- SECTION 12 - Thermography and Other Non-Contact Inspections
 - Performing infrared thermography and other non-contact inspections typically involves exposing energized components. Qualified personnel shall perform all tasks, including preparatory tasks, and shall wear PPE and follow safe work practices as defined in this procedure based on the maximum potential voltages inside the cabinet or component. Once the equipment is setup for performing the infrared thermography or other non-contact inspections, minimum protective equipment shall still be worn based on maximum voltages and approach distances as outlined in Section 5.
 - SECTION 13 - Definitions
 - Arc Flash Hazard: A dangerous condition associated with the possible release of energy caused by an electric arc.
 - Arc Rating: The value attributed to materials that describe their performance to exposure to an electrical arc discharge. Arc rating is expressed in cal/cm².
 - Barricade: A physical obstruction such as tapes, cones, or a-frame-type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.
 - Barrier: A physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts or to prevent unauthorized access to a work area.
 - Bonding: The permanent joining of metallic parts to form an electrically conductive path which provides electrical continuity and the capacity to safely conduct current and complete a circuit.
 - Bonding Jumper: A reliable conductor to achieve the required electrical conductivity between metal parts to be electrically connected.
 - Boundary, Arc Flash Protection: When an arc flash hazard exists, an approach limit at a distance from a prospective arc source with which a person could receive a second degree burn if an electrical arc flash were to occur.

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- o Boundary, Limited Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.
- o 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.
- o 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.
- o Conductive: Suitable for carrying electric current.
- o Conductor, Bare: A conductor having no covering or electrical insulation whatsoever
- o Conductor, Covered: A conductor encased within material of composition and thickness that is not recognized by electrical standards as electrical insulation.
- o Conductor, Insulated: A conductor encased within material of composition and thickness that is recognized by electrical standards as electrical insulation.
- o Electrical 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 deemed necessary.
- o Electrical Safe Work Practices Training: Workers who meet the criteria of either qualified or unqualified require electrical safety training at a level commensurate with their exposure and their work requirements.
- o Enclosed: Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized electrical conductors or circuit parts.
- o 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.
- o Externally Operable: Capable of being operated without exposing the operator to contact with energized electrical conductors or circuit parts.
- o Flame-Resistant (FR): The property of material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source. Material which is FR is commonly referred to as flame retardant.

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- o Grounded: A conductive body, such as the earth, used as a common return for an electrical circuit.
- o Ground Fault Circuit Interrupter (GFCI): A device which interrupts the electric circuit to the load when a fault current to ground exceeds some predetermined value less than that required to operate the over current protective device of the supply circuit.
- o 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 or contact by persons or objects to a point of danger.
- o Insulated: Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of currents
- o Labeled: Equipment is considered labeled if there is an identifying mark or symbol attached to it. The label or symbol distinguishes a nationally recognized testing laboratory which makes periodic inspections of the production of such equipment and whose labeling indicates compliance with nationally recognized standards or performance in a specified manner.
- o Listed: Equipment, materials or services are listed if they are included in a list which is published by an organization that is acceptable to the authority having jurisdiction over the product or services and which is concerned with evaluation of products or services. Listed equipment, materials, or services shall also meet internationally recognized standards or have been tested and found suitable for the specified purpose using internationally recognized testing methods and procedures.
- o Live Parts: Energized conductive components.
- o Motor Control Center: An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.
- o Outlet: A point on the wiring system at which current is taken to supply utilization equipment.
- o Panelboard: A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic over current devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.
- o Power Generation, Transmission, and Distribution: Installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees. These installations include the generation, transmission, and distribution installations of electric utilities, as well as equivalent installations of industrial establishments. They do not include supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes.

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- o Qualified Person: A person familiar with the operation, installation and construction of the electrical equipment and the hazards involved. The following additional information also applies to qualified employees:
 - An employee is considered a qualified person based upon various circumstances in the workplace. An individual may be considered qualified regarding certain equipment, but unqualified for other equipment.
 - When an employee is undergoing on-the-job training and in the course of the training has demonstrated an ability to perform duties safely at that level of training, the employee is then considered to be a qualified person for the performance of those duties. Training should always be performed under the supervision of a qualified person.
- o For the purpose of Power Transmission and Distribution, a qualified person must also be fully qualified and current as outlined in 29 CFR 1910.269.
- o Raceway: An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or bus bars, with additional functions as permitted in electrical standards. Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquid tight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical metallic tubing, electrical nonmetallic tubing, under floor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wire ways, and bus ways.
- o Receptacle: A receptacle is a contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.
- o Unqualified Person: A worker whose work exposes them to electrical hazards, but the worker may not be cleared to perform tasks of a qualified employee (i.e. electrical work). Examples of personnel who, at a minimum, would normally be considered unqualified due to the exposure potential and thus require electrical safety training include the following:
 - Maintenance Supervisors
 - Material Handling Equipment Operators
 - Painters
 - Electrical and Electronic Engineers
 - Electrical and Electronic Technicians
 - General Maintenance Workers
 - Mechanics and Repairers
 - Welders

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Initial Program Deployment

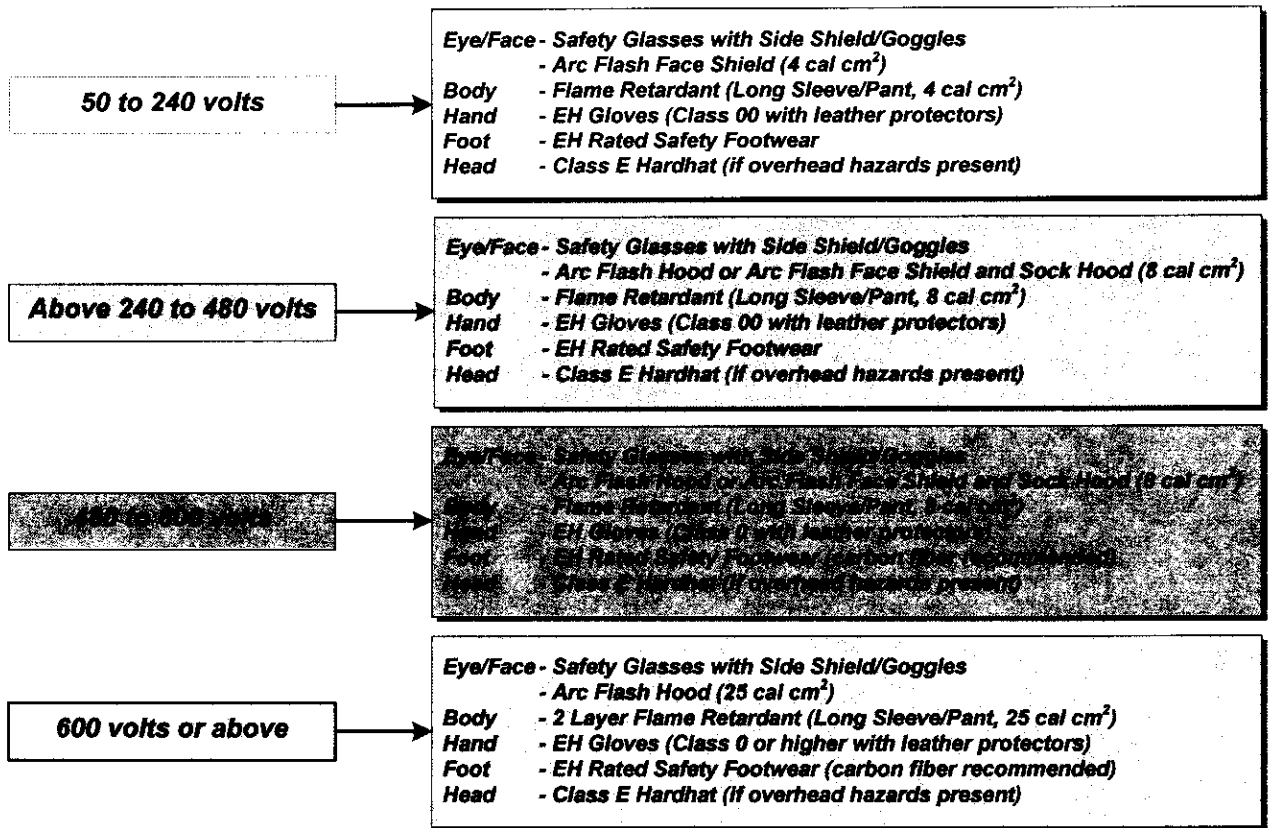
- o Perform initial inspection of company assigned work areas and review of contract requirements to identify electrical work requirements
- o Determine maximum voltages to which personnel may be exposed
- o Determine PPE requirements (including clothing) based on maximum voltages:
 - Gloves
 - Flame retardant clothing
 - Arc flash face shield
 - EH rated footwear
- o Determine best method of protection for clothing:
 - Individual uniform
 - Coveralls (either individual issue or shared in a kit)
 - Protective equipment kits
- o Determine requirements for ANSI approved tools including types, numbers, and deployment method (individual issue or deployed kits).
- o Inspect existing PPE and tools and discard defective PPE and equipment.
- o Secure required PPE and ANSI approved tools to support contract requirements.
- o Identify personnel who meet qualification requirements in Section 11:
 - Train personnel in the requirements contained in this program.
 - Document training.
- o Document qualified personnel in Appendix C.
- o Conduct and document general electrical safe work practices training at the non-qualified level for all project personnel.
- o Deploy energized work permit.
- Recurring Program Oversight/Management:
 - o Only approve energized work permits for work that conforms to the requirements for energized work identified in Section 1.
 - o Periodically inspect/monitor work which involves potential exposure to energized circuits and equipment.
 - o Include PPE, ANSI tools, and compliance with general electrical requirements including power strips and extension cords in spot inspections as well as semi-annual inspections.
 - o Spot check energized work to assure work practices conform to the requirements in this program

ENCLOSURE (2)

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PPE Requirements Matrix

- Protective equipment requirements outlined below are mandatory when any part of the body or a tool or piece of equipment may be placed within the Restricted Approach Boundary (Section 2)



PPE Requirements Apply to All Work with Protection Boundaries – Not Just Electrical Work

NOTE 1: Removal/installation of non-hinged electrical panel covers 50 to 240 volts requires flame retardant long sleeve/pant (4 cal cm²); safety glasses with side shields/goggles; arc flash face shield (4 cal cm²); and EH gloves (class 0); EH rated footwear

NOTE 2: Removal/installation of non-hinged electrical panel covers above 240 and below 600 volts requires flame retardant long sleeve/pant (8 cal cm²); safety glasses with side shields/goggles; arc flash face shield (8 cal cm²); and EH gloves (class 0); EH rated footwear

NOTE 3: Face shield is not required when the only exposure to electrical hazards is from metering to confirm LOTO at wall outlets of 240 volts or less (at the outlet) or lighting fixture circuits of 300 volts or less (at the lighting fixture)

NOTE 4: Work on 600 volt class motor control center, 600 volt class switchgear, and other 600 volt class equipment requires a double layer switching hood. This includes during application of safety grounds after voltage testing and during removal of bolted covers to expose bare energized parts

NOTE 5: Work on metal clad switchgear and other equipment above 1 kV may require layers of flame retardant clothing and a double layer switching hood with minimum ratings of 40 cal/cm² depending on arc flash potential (see NFPA 70E)

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Site-Specific Electrical Safe Work Practices Program Documentation

• Qualified Personnel

- o Personnel who are "qualified" to perform electrical work shall be identified in writing below either by listing personnel by name or using job titles or job classifications. If job titles or job classifications are used, then all personnel within these designations shall be trained to the qualified level. Personnel not on the list below are not authorized to perform electrical work.

| Qualified Personnel (List by Name, Title, or Job Classification) | |
|--|-----------------------------|
| Connelly, Wayne | Lead, HV Electrician |
| Smith, Tommy | HV Electrician |
| Burnsed, Julius | Electrician |
| Connelly, Billy | Electrician |
| Martinez, Julio | Electrician |
| Sanders, Leonard | Electrician |
| Stuart, Robert | Electrician |
| Wilson, Jimmy | Maintenance Electrician, SS |