



UNITED STATES MARINE CORPS
MARINE CORPS LOGISTICS BASE
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ALBANY GEORGIA 31704-0302

MCLBAO 5100.5B
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15 Aug 22

MARINE CORPS LOGISTICS BASE ALBANY ORDER 5100.5B

From: Commanding Officer
To: Distribution List

Subj: ELECTRICAL SAFETY PROGRAM

Ref: (a) 29 CFR 1926 Safety and Health Regulations for Construction
(b) USACE EM 385.1.1 Safety and Health Requirements Manual
(c) 29 CFR 1910 Occupational Safety and Health Standards
(d) NFPA 70E Standard for Electrical Safety in the Workplace
(e) NAVMC DIR 5100.8 Marine Corps Occupational Safety and Health Program Manual
(f) NFPA 70 National Electric Code

Encl: (1) Electrical Safety Program Procedural Guidance

1. Situation. According to the Occupational Safety and Health Administration (OSHA) electrocution is the third leading cause of workplace death in the United States. Since electricity is deeply integrated into our environment and lives, every Marine, civilian Marine, contractor or visitor aboard the base is potentially exposed to electrical hazards. Personnel who work with electrical systems are at greater risk, and must exercise caution and follow proper work practices.

2. Cancellation. BO 5100.5A

3. Mission. To publish minimum training requirements and specify standards for work with electrical systems in order to prevent work-related injuries.

4. Execution

a. Commander's Intent. I expect all Marine Corps Logistics Base (MCLB) Albany personnel to become aware of potential hazards within their respective work places, and for those whose job entails working with electrical systems to adhere to

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distribution is unlimited.

regulatory requirements and to use industry best practices while working on them.

b. Concept of Operations. The objective of this Order is to establish an installation electrical work practices program that meets the requirements of the references.

c. Tasks

(1) Installation Safety Manager (ISM). Administer this Order and ensure it remains current and accurate.

(2) Division Directors and Special Staff

(a) Ensure all personnel receive basic electrical safety training.

(b) Divisions that perform work on electrical systems shall develop additional system-specific written programs and employ work practices that comply with industry standards and conform to the spirit and intent of the references.

5. Administration and Logistics. Recommendations pertaining to the contents of this Order are invited and should be submitted through the Division, Special Staff or Headquarters Company Unit Safety Officer to the ISM.

6. Command and Signal

a. Command. This Order is applicable to all personnel aboard MCLB Albany.

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

M. J. FITZGERALD

DISTRIBUTION: A

LOCATOR SHEET

Subj: ELECTRICAL SAFETY PROGRAM

Location: _____
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RECORD OF CHANGES

Log completed change action as indicated.

Change Number	Date of Change	Date Entered	Signature of Person Incorporated Change

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Chapter 1

Basic Electrical Safety Requirements

1. General. This chapter provides detailed information on the policy, definitions, authorities, responsibilities, and procedures associated with the Electrical Safety Program aboard Marine Corps Logistics Base (MCLB) Albany.

2. Background. According to OSHA electrocution is the third leading cause of industrial fatalities in the United States. The current required to light a 7.5 watt, 120 volt (V) night light, if passed across the chest, is enough to cause a fatality. All personnel at MCLB Albany may be exposed to the hazard of electrical shock.

3. Responsibilities

a. Installation Safety Manager (ISM). The ISM is responsible for the development, implementation, and administration of the Electrical Safety Program. This involves:

(1) Developing and maintaining the written program, training programs and other training resources that can be used by base personnel;

(2) Providing technical assistance to base personnel and departments; and

(3) Evaluating the overall effectiveness of the Electrical Safety Program on a periodic basis and making the necessary changes.

b. Director, Installation and Environment Division (I&E). In consultation with the ISM, the I&E Director shall appoint and designate an Electrical Safety Program Manager (ESPM). The ESPM should be a Certified Electrician or Electrical Engineer.

c. ESPM. The ESPM shall provide oversight and management for the Electrical Safety Program.

d. Division Directors and Special Staff. Division Directors and Special Staff are expected to maintain a safe and healthful working environment for their Marines, civilian Marines, contractors and visitors. They are expected to ensure that all employees are trained on the electrical hazards relative to their job requirements, are thoroughly familiar with

their safety responsibilities, and safety practices are followed at all times. Directors and Special Staff shall ensure that supervisors inspect their worksites as required to identify and correct hazards.

e. General Contractors. General Contractors must comply with all local, state, and federal safety requirements and ensure all of their employees and sub-contractors performing work on MCLB Albany property have been suitably trained. Contractors must comply with the requirements of references (a), (b), (c), (d), and (f).

f. Unit Safety Officer (USO). The USO shall coordinate all training required by this Order, and ensure that training is properly documented in the Enterprise Safety Applications Management System (ESAMS).

g. Employees. Employees are expected to comply with all safety requirements and be proactive in preventing accidents and injuries by reporting hazards to supervisors, the USO, or directly to Risk Management (RM).

4. Training

a. All Marine Corps personnel, including direct support contractors, employed by MCLB Albany shall receive basic electrical safety training. This training may be provided by the individual supervisor or the USO, using DoD sponsored/approved sources. All training will be documented in ESAMS, and will, at a minimum, include:

(1) How to recognize common electrical hazards, such as broken receptacle or switch covers, arc burns on receptacles, damaged electrical cords and plugs, indications of overloaded circuits, improper use of extension cords and surge protectors; and

(2) Proper response for tripped circuit breakers, hazards, and electrical shock.

b. Personnel, including direct support contractors, who work with or on electrical systems and equipment, shall receive electrical safety training commensurate with their exposure to hazards. Training may be provided by the individual supervisor, and must, at minimum, satisfy the requirements of references (c), (d) and (f). Job specific electrical training may be

obtained from nationally-recognized resources, equipment manufacturers or trade schools. General contractors hired for specific projects will comply with the safety requirements of their contract. The training breakdown shall be as follows:

- (1) Less than or equal to 50V nominal;
- (2) Between 50 V and 600 V nominal; and
- (3) 600 V or greater nominal.

c. Employees who face an increased risk of electrical hazards that are not reduced to a safe level by the electrical installation must be trained per the requirements of this Order. Employees in the following occupations must be trained unless their work does not bring them inside the limited approach boundary as defined by reference (d) Tables 130.4(E)(a) and 130.4(E)(b): supervisors of employees performing work around or on electrical systems; electricians; electrical and electronic engineers; electrical and electronic equipment assemblers; electrical and electronic technicians; welders; material handling equipment operators; mechanics and repairers; painters; heating, ventilation and air conditioning technicians; engineers; industrial machine operators; and project managers.

d. Employees who face a risk of electrical hazard that is not reduced to a safe level by installation requirements shall receive the following training in a classroom environment and/or on-the-job training (OJT):

- (1) Specific hazards associated with electrical energy;
- (2) Safety-related work practices and procedural requirements necessary to provide protection from the electrical hazards associated with their respective job or task; and
- (3) How to identify and understand the relationship between electrical hazards and possible injury.

e. Qualified personnel (see Appendix A for detailed definition) shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and trained to recognize and avoid electrical hazards that might be present with that equipment or work method. These employees must be familiar with proper precautionary work practices, personal protective equipment including arc flash suit, insulating, shielding materials and the use of insulated

tools. This training will be coordinated by the work unit supervisor, and customized to reflect the scope of work performed within that work unit. The work unit supervisor will, on an annual basis, coordinate the review of the work performed by each employee to ensure they demonstrate the skills and techniques needed to safely perform their work.

(1) Training must be performed before the employee is assigned duties involving work around or on electrical systems.

(2) Retraining will be performed when inspections performed by RM or the employee's supervisor indicate the employee does not have the necessary knowledge or skills to safely work on or around electrical systems. Retraining will also be performed when policies or procedures change and/or new equipment or systems are introduced into the work area.

f. Refresher training shall be performed at intervals not to exceed three years per reference (d).

5. Requirements for Use of 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):

a. Extension cords may only be used to provide temporary power (less than 30 days). If you need access to electrical power for a long-term or permanent basis, request installation of additional receptacles.

b. 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 (see Figure 1-1 below for an example of a defect). 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.



Figure 1-1.--Cord with Damaged Outer Jacket

c. Extension cords must be of the three-wire type. Ungrounded two-wire cords are not authorized (Figure 1-2). 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 clearly visible (Figure 1-3).



Figure 1-2.--Ungrounded Two-Wire Cord



Figure 1-3.--Cord Usage Rating Example

d. Job-made extension cords may only be built by qualified personnel and must be tested and certified prior to use. Job-made extension cords may only be constructed using parts approved for this use. Metal electrical boxes with knockouts, for example, may not be used for job-made extension cords.

e. The following Ground Fault Circuit Interrupter (GFCI) protection requirements are applicable to all operations:

(1) GFCI protection shall always be used outdoors, and in wet or extremely damp areas.

(2) A GFCI device shall be used to protect personnel when they use portable electric tools and portable electric equipment, including portable lights and extension cords.

(3) GFCI protection for extension cord use shall be located between the extension cord and the electrical receptacle into which it is plugged.

(4) Permanently mounted GFCI devices shall be checked monthly by pushing the test button on the device.

(5) Portable GFCI devices shall be tested by workers by pushing the test button on the device before each use.

f. 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.

g. Extension cords must be protected from damage. Sharp corners and projections must be avoided. Extension cords may not be run through windows, doors or walls unless protected from damage, and then only on a temporary (one shift maximum) basis. Extension 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.

h. Cords must be covered by a cord protector or tape when they extend into a walkway or other path of travel in order to avoid creating a trip hazard.

i. 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.

j. Flexible cords may only be plugged into grounded receptacles.

k. 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 and connected to GFCI protected circuits.

l. Employee's hands must not be wet when plugging and unplugging flexible cords and cord and plug connected equipment.

m. Surge protectors and power strips shall only be plugged into a wall receptacle. They may not be used with extension cords or plugged into another device forming a daisy chain as depicted in (Figure 1-4). 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.

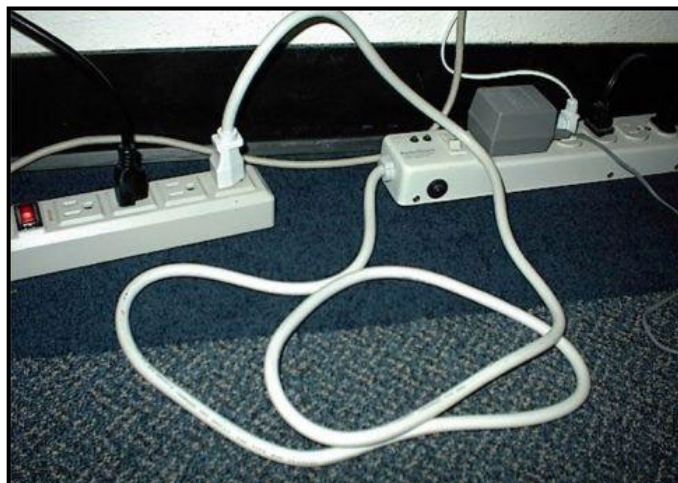


Figure 1-4.-- Unsafe and Unauthorized

n. Refrigerators, microwaves, coffee pots and other high-load equipment shall be plugged directly into a wall receptacle.

o. 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.

p. Multi-plug receptacle adapters that may not maintain ground continuity or may overload circuits shall not be used. If additional receptacles are needed in a work location, additional circuits and/or receptacles must be installed. Multi-plug power strips with over-current protection are acceptable for use with electronic equipment if they are used to reduce line noise or to provide surge or over-current protection.

5. Common Electrical Hazard Findings. There are several common hazards that may expose personnel to electrical shock. The following hazards must be reported to the area supervisor, the USO, or MCLB Albany RM:

a. Outer cord insulation pulled from plug, exposing inner conductor to contact and physical load strain.

b. Broken or missing light switch or wall receptacle cover plate (Figure 1-5).



Figure 1-5.--Broken Cover Plate

c. Missing knock-out on surface mounted receptacle box that allows access to energized conductors (Figure 1-6).

d. Missing circuit breakers or breaker blanks allowing access to energized components.

e. Burned and/or blackened electrical wall receptacle, cord or plug (Figure 1-7).

f. Heavy load appliances, such as refrigerators, microwaves, or coffee pots plugged into power strips or

extension cords. These items must be plugged directly into wall receptacles.



Figure 1-6.--Missing Knockouts

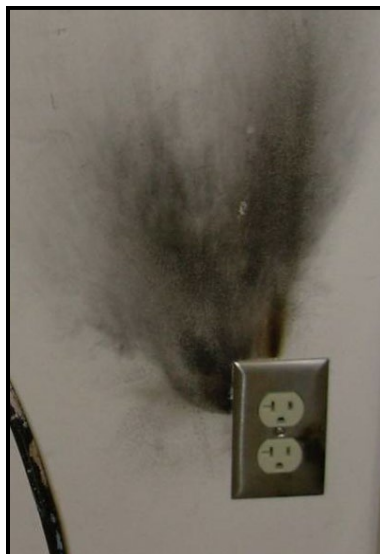


Figure 1-7.--Burned Receptacle

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Chapter 2

Electrical Work Less Than 600 Volts Nominal

1. General. Personnel working with or on electrical systems rated less than 600 V fall into 2 categories: less than 50 V, and equal to or greater than 50 V and less than 600 V. Most communication systems and electronic devices operate at less than 50 V. Energized electrical conductors and circuit parts that operate at less than 50 V to ground shall not be required to be de-energized.

a. Qualified Persons. Those who have received specific training and have demonstrated the skills necessary to safely work on or near exposed energized parts. A person may be qualified to work, for example, on circuits less than 600 V, but may be unqualified to work on higher voltages. Only qualified personnel, who have also successfully completed the Lock Out/Tag Out (LOTO) Program training, reference (e), chapter 12, may place or remove locks and tags on energized electrical systems.

b. Unqualified Persons. Unqualified personnel are those with little or no such training or limited experience.

2. Electrical Installation Requirements

a. Recognized Hazards. Electrical equipment must be free from recognized hazards that are likely to cause death or serious physical harm. Equipment must be suitable for the installation and use, and must be installed and maintained in accordance with the manufacturer instructions, references (a), (c), (d) and (f). Suitable means that the equipment is listed or labeled for the intended use by a nationally recognized testing laboratory such as Factory Mutual or Underwriters Laboratories Incorporated. Personnel working on energized electrical systems must be aware of the Hazard Risk Category of electrical systems and equipment within the flash protection boundaries. Reference (d), Article 130 provides specific information on recognized electrical hazards associated with various voltages and work classifications.

b. Labeling of Disconnects. Each disconnecting means, the switch or device used to disconnect the circuit from the power source, must be clearly labeled to indicate the circuit's function, unless it is located and arranged so the purpose is evident. Identification should be specific rather than general. For example, a branch circuit serving receptacles in a main

office should be labeled as such, not simply labeled "receptacles". All labels and marking must be durable enough to withstand the environment to which they may be exposed.

(1) New Installations. All new installations shall be labeled in accordance with references (d) and (f) labeling standards.

(2) Existing Installations. All existing installations will be evaluated and labeled accordingly with Arc Flash rating and the Hazard Risk Category. These installations will be evaluated and the arc flash ratings established by an experienced electrical professional in accordance with reference (d). See chapter 3, Para 4 and table 3.1 for details.

c. Guarding of Live Parts. Live parts of electric equipment operating at 50 V or more must be guarded against accidental contact. Proper guarding can be achieved by use of an approved cabinet or other approved enclosure, by location in a room or vault that is accessible only to qualified personnel, or by elevating the equipment or controlling the arrangement of the space to prevent contact by unqualified personnel. If electric equipment is located in an area where it is potentially exposed to physical damage, the enclosure or guard must be of sufficient strength to prevent such damage.

d. General Wiring Design and Protection. New electrical wiring, and the modification, extension or replacement of existing wiring must conform to the requirements of references (c) and (f).

e. Requirements for Temporary Wiring. Temporary electrical power and lighting installations with less than 600 V , including flexible cords, cables and extension cords may only be used during and for construction, renovation, maintenance, or repair. Temporary wiring may also be used for decorative lighting for special events and similar purposes for a period not to exceed 90 days. The following additional requirements apply:

(1) Ground-fault protection (e.g., GFCIs) must be provided on all temporary-wiring circuits, including extension cords.

(2) 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.

(3) 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.

(4) Branch circuits must originate in an approved power outlet or panel board.

(5) Neither bare conductors nor earth returns may be used for the wiring of any temporary circuit.

(6) Receptacles must be of the grounding type. Each raceway or conduit must contain an equipment-grounding conductor, and all receptacles must be electrically connected to the grounding conductor.

(7) Flexible cords and cables must be of an approved type and suitable for the location and intended use. They may be used solely 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.

(8) 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.

(9) 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, and are allowed only for the work shift when they are installed.

f. Open Conductors, Clearance From Ground. Open conductors must be located at least 10 feet above any finished grade, sidewalk or projection, 12 feet above areas subject to non-truck traffic, 15 feet above areas subject to truck traffic, and 18 feet above public streets, roads or driveways.

g. Working Space Around Electric Equipment. Sufficient access and working space must be provided and maintained around all electric equipment to allow ready and safe operation or maintenance of the equipment. Working clearances may not be less than 30 inches in front of electric equipment. Except as permitted by references (a), (b), or (f), the working space in front of live parts operating at any voltage that require servicing, inspection or maintenance while energized may not be less than indicated in Table 2-1. This working space may not be used for storage.

Table 2-1.--Working Clearances (Reference (f), Table 110.26(A) (1) & 110.34(A))

Nominal Voltage to Ground (V)	Minimum Clear Distance for Condition ⁽¹⁾		
	Condition 1	Condition 2	Condition 3
0-150	3' ⁽³⁾	3' ⁽³⁾	3'
151-600	3' ⁽³⁾	3 1/2'	4'
600-2,500	3'	4'	5'
2,501-9,000	4'	5'	6'
9,001-25,000	5'	6'	9'
25,001-75,000 ⁽²⁾	6'	8'	10'
Greater than 75,000 ⁽²⁾	8'	10'	12'

Notes:

1. Conditions 1, 2, and 3 are defined as follows:

Condition 1: Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides are effectively guarded by an insulating material.

Condition 2: Exposed live parts on one side and grounded parts on the other. Concrete, brick or tile walls are considered to be grounded.

Condition 3: Exposed live parts on both sides of the workspace not guarded as per Condition (1), with the operator between.

2. Minimum clear distance in front of electrical equipment with nominal voltage to ground above 25,000 V may be the same as for 25,000 V under Conditions 1, 2 and 3 for installations built prior to April 16, 1981.

3. Minimum clear distance may be 2 1/2' for installations built prior to April 16, 1981.

3. Selection And Use Of Work Practices For Working On Electrical Systems. The work practices used must be sufficient to prevent electric shock or other injuries that could result from either direct or indirect electrical contact. These work practices must be used when work is performed near or on equipment or circuits that are or may be energized. The work

practices used must be consistent with the nature and extent of the electrical hazard.

a. Energized Parts. Only qualified employees are allowed to work on electric parts or equipment that has not been de-energized. Live parts to which an employee may be exposed will be de-energized using approved LOTO procedures before the employee works on or near them, unless:

(1) De-energizing introduces additional or increased hazards. Examples of additional or increased hazards include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of fume hood ventilation systems, or removal of illumination for an area.

(2) De-energizing is not possible due to equipment design or operational limitations. Examples include testing that can only be performed with the electrical circuit energized, and work on circuits that form an integral part of a continuous process that would need to be completely shut down in order to permit work on one circuit or piece of equipment.

(3) Live parts operate at less than 50 V to ground and there is no increased exposure to electrical burns or to explosion due to electric arcs.

(4) If de-energizing exposed live parts can add to or increase the hazard or is not possible, then other approved work practices must be used to protect employees who may be exposed to the electrical hazards. The work practices used must be suitable for the conditions under which the work is performed and for the voltages of exposed electric conductors or circuit parts. Approach boundary distances must be maintained as per reference (d) Tables 130.4(E)(a) and 130.4(E)(b). *Note: When assessing distance, include the length of any conductive tools being used to perform work.*

b. De-Energized Parts. When employees work on exposed de-energized parts or near enough to them to expose the employee to an electrical hazard, then the following safety-related work practices will be followed:

(1) Any conductors or parts of electric equipment that have not been properly locked and/or tagged out must be treated as energized even if these systems have been de-energized.

(2) If the potential exists for an employee to contact parts of fixed electric equipment or circuits that have been de-energized, the circuits energizing the parts must be locked and/or tagged out. *Note: Stored electrical energy may remain in capacitors and battery banks and other components after electricity source or sources have been de-energized. Appropriate care must be taken, including the use of grounding wands where provided to dissipate any stored charge.*

c. De-Energizing Equipment. Safe procedures for de-energizing circuits and equipment will be determined by a qualified worker before the circuit or equipment is de-energized. Circuits and equipment to be worked on will be disconnected by the worker from all electric energy sources. Control circuit devices, such as push buttons, selector switches, and interlocks, will not be used as the sole means for de-energizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for LOTO procedures unless designed by the manufacturer.

(1) Stored electrical energy that might endanger personnel must be released prior to the work. This might include, for example, discharging capacitors, short-circuiting and grounding high capacitance elements. If the capacitors or associated equipment are handled during this work, they must be treated as energized.

(2) Stored non-electrical energy (e.g., hydraulic or pneumatic energy) in devices that could energize electric circuit parts must be blocked or relieved so that circuit parts cannot be accidentally re-energized by the device.

(3) A lock and tag must be placed on each disconnecting means used to de-energize circuits and equipment on which work is to be done. The lock must be attached so as to prevent personnel from re-energizing the circuit unless they resort to undue force or the use of tools.

(4) Verification of De-Energized Condition. The following requirements must be met before any circuit or equipment is considered de-energized or may be worked on as de-energized.

(a) A qualified person must activate the equipment operating controls or use other methods to verify that the equipment cannot be restarted.

(b) A qualified person must use test equipment to ensure that electrical parts and circuit elements are de-energized. The test must confirm there is no energized condition from induced voltage or voltage back-feed.

(c) Test equipment and instruments must be visually inspected for external defects or damage before being used to verify that the equipment or circuit is de-energized.

(d) If all exposed live components of 50 V or greater in a cabinet, vault, box, or other piece of electrical equipment are not completely de-energized through LOTO, American National Standards Institute (ANSI) approved voltage rated tools shall be used anytime the plane of the cabinet, vault, box, or opening is breached.

d. Re-Energizing Equipment. In addition to the requirements of the LOTO Program, the following requirements must be met, in the order given, before circuits or equipment are re-energized, even temporarily:

(1) A qualified person must conduct tests and visual inspections as necessary to verify that all tools, electrical jumpers, shorts, grounds and other such devices have been removed so that circuits and equipment can be safely energized.

(2) Employees potentially exposed to the hazards of re-energizing of the circuit must be warned to stay clear.

(3) Each employee removes his or her lock(s) and tag(s).

4. Overhead Power Lines. As MCLB Albany personnel do not perform these operations as part of their routine job functions, special work permit and job safe analysis must be performed before such work can begin. If it is not possible to de-energize and ground overhead lines, then other protective measures, such as guarding, isolating or insulating, must be taken before the work is started. These protective measures must prevent direct contact by the qualified person or indirect contact through conductive materials, tools, or equipment. Only qualified personnel from the power distribution company are allowed to install insulating devices on overhead power transmission and distribution lines. All other personnel, and any conductive object used by these employees, may not approach closer than the minimum distance specified in Table 2-2 when working in an elevated location near unguarded, energized overhead lines.

a. Cranes, Hoists, Other Equipment. When it is necessary to operate cranes, hoists, lifts or other equipment under or near overhead power lines, no part of the equipment, load line, or load (including rigging and lifting accessories) is allowed below a power line unless the supervisor has confirmed that the utility owner/operator has de-energized and (at the worksite) visibly grounded the power line.

Table 2-2.--Overhead Power Line Distances (29 CFR 1926.1408)

Voltage (nominal, kV, alternating current)	Minimum Clearance Distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	As established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution.

Note: The value that follows "to" is up to and includes that value. For example, "over 50 to 200" means up to and including 200 kV.

b. Other Work Around Overhead Power Lines. Reference (d), Article 130.8 provides detailed instructions for personnel and equipment working near or under overhead power lines. MCLB Albany personnel will adhere to these provisions.

5. Test Equipment and Instruments. Only qualified personnel may perform testing work on electric circuits or equipment. Test instruments and equipment (including all associated test leads, cables, power cords, probes and connectors) must be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item must be tagged out of service. The device may not be returned to service until it has been repaired and tested safe for use. Test instruments, equipment, and their accessories must be rated for the circuits and equipment to which they will be connected and designed for the environment in which they will be used.

6. Personal Protective Equipment (PPE). All personnel shall wear the required PPE until all energy sources of 50 V or greater within the Restricted Approach Boundary have been

completely eliminated through LOTO and de-energizing has been confirmed through metering. Employees working in areas where there are potential electrical hazards must be provided with and must use electrical protective equipment that is appropriate for the specific parts of the body to be protected and the work to be performed. The department must provide electrical safety-related personal protective equipment required by this program at no cost to the employee (reference (d) Article 130.7).

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Chapter 3

Electrical Work 600 Volts Or Greater Nominal

1. General. Personnel working on or near exposed energized high voltage electrical systems are at risk of injury or death. Furthermore, nearby personnel are also at risk of injury or death. Thus, it is imperative that proper safe practices and PPE are used at all times. For purposes of this Order, "High Voltage" is defined as any element of an energized electrical circuit 600 V and above. This Order prohibits most work on or near exposed energized electrical systems.

Only the Base Commanding Officer (CO) can approve "live work" on energized circuits 600 V and greater. Knowledgeable supervisors can approve all other work on or near de-energized High Voltage systems. A qualified supervisor shall be on site during High Voltage work. The supervisor will ensure compliance with this Order and all applicable references.

2. Responsibility. Director, I&E Division shall:

a. Ensure that access to all High Voltage systems, substations, transformers, or other equipment is controlled. Establish and maintain a "key control" system that will ensure that only properly trained and authorized personnel have access to High Voltage circuits. Trained and authorized personnel include contractors requiring access to substations and/or work on exposed energized circuits 600 V and greater.

b. Ensure all base maintenance personnel under the cognizance of I&E who perform work on electrical systems or components are properly trained in trade skills, and are provided PPE in accordance with reference (d) guidelines.

c. Ensure that local Standard Operating Procedures are current and contain adequate safety controls. A Job Hazard Analysis (JHA) will be completed for all operations.

3. 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 (CPR) and First Aid, and a written Energized Electrical Work Permit (EEWP). All energized systems shall be adequately guarded to prevent accidental contact.

a. Work is considered to be "on or near" anytime any of the following conditions occur: (1) 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; or (2) 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.

Authorized personnel, equipped with the proper PPE and equipment (e.g. electrical hot-stick) may enter these exclusion zones for the purpose of energizing and de-energizing circuits.

Work "on or near" energized high voltage 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, but are not limited to:

- (1) Interruption of life safety equipment;
- (2) Deactivation of emergency alarm systems;
- (3) Shutdown of hazardous location ventilation equipment; and
- (4) Removal of illumination from a large area.

b. An Energized Electrical Work Permit (EEWP) is required when performing any work, even non-electrical work, within the restricted approach boundary. An example of an Energized Electrical Work Permit can be found in reference (d), Annex J. The EEWP will include a signature block for the CO.

The ISM shall be notified upon the initiation of the EEWP. After CO approval of energized electrical work is obtained, the EEWP shall be issued by the Public Works manager or designated alternate. A copy of the EEWP 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 EEWP provides documentation of the justification for working the circuit or equipment energized, identifies the specific personnel who are to perform the work, the specific PPE requirements for the task, defines the scope of the task, and details additional special

protective equipment and work practices required to protect both the workers and other personnel in the area.

c. If all exposed live components of 600 V or greater in a cabinet, vault, box, or other piece of electrical equipment are not completely de-energized through LOTO, American National Standards Institute (ANSI) approved voltage rated tools shall be used anytime the plane of the cabinet, vault, box, or opening is breached.

d. Metering during authorized troubleshooting is not considered working on or near. However, full PPE shall be worn based on maximum potential voltages and ANSI approved voltage rated tools, rated for maximum voltages that may be encountered, are required during metering. When voltages greater than 600 V are tested, the test equipment must be checked for proper operation immediately before and after the test.

4. Installation Approach Boundaries For Live Parts. The approach boundaries listed below shall be used to define energized work permit requirements, tool and equipment requirements, and PPE requirements for all installation personnel. The conditions of tables 2-1 and 2-2 must also be followed.

a. Arc Flash Protection Boundary. The arc flash boundary for systems 600 V and greater shall be the distance at which the incident energy equals 5 J/cm^2 (1.2 cal/cm^2). 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 V may be calculated following reference (d) Annex D on a case-by-case basis. PPE requirements may be determined based on the calculated energy at the Flash Protection boundary, or by applying the maximum level of protection recommended in reference (d), Table 130.7(C) (15) (a) and 130.7(C) (15) (b) based on the work being performed. All electrical equipment shall be labeled per reference (d) 130.5(H).

b. Limited Approach Boundary. The Limited Approach Boundary establishes an area around exposed energized hazards of 50 V or greater where unqualified employees must be escorted and directly supervised by a qualified employee (see Table 3-1). Insulated voltage rated ANSI approved tools based on the maximum voltage are also required within this boundary.

c. Restricted Approach Boundary. The Restricted Approach Boundary establishes an area around exposed energized hazards of 50 V or greater where unqualified employees are prohibited and insulated tools and full PPE based on the maximum voltage are required (see Table 3-1). 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 EEWP is always required in these cases except during troubleshooting with an approved meter.

Table 3-1.--Installation Approach Boundaries

Voltage	Approach Boundary	
	Limited	Restricted
50 V to 300 V	3' 6"	Avoid contact
301V to 750 V	3' 6"	1'
751 V to 15 kV	5' 0"	2' 2"
15.1 kV to 36 kV	6' 0"	2' 7"
36.1 kV to 46 kV	8' 0"	2' 9"
46.1 kV to 72.5 kV	8' 0"	3' 3"

Note: refer to reference (d) for higher voltages.

5. Establishing An Electrically Safe Work Condition. 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 above.

a. Performing complete LOTO of all electrical potentials of 50 V or greater within the cabinet, vault, box, or work area is considered establishing an electrically safe work condition so long as the LOTO process accomplishes all of the following:

(1) Includes a documented hazard evaluation (JHA) at the site including the identification of the person in charge of the LOTO;

(2) Identifies every source of electrical energy of 600 V or greater remaining inside the cabinet, vault, box, and completely eliminates them through LOTO;

(3) 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); and

(4) 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.

b. 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.

c. If an electrically safe work condition as described above has not been established then the following work practices shall be followed:

(1) If the Restricted and/or Prohibited Approach Boundary may be breached, an EEWP shall be secured and work practices shall comply with those required for "working on or near" energized hazards.

(2) If the Limited Approach Boundary may be breached, a qualified person must be present and directly supervise the work.

(3) If the Arc Flash Boundary may be breached and any work is performed which has the possibility of causing an arc flash, all personnel within the flash boundary shall be protected with appropriate levels of arc flash protection.

6. PPE Requirements. Protective equipment requirements outlined below and in Appendix B of this Order are mandatory when any part of the body or a tool or piece of equipment may be placed within the Restricted Approach Boundary:

a. All personnel shall wear the required PPE as outlined in this section until all energy sources of 600 V or greater within the Restricted Approach Boundary have been completely eliminated through LOTO and de-energizing 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 reference (d) and shall not be used. Exceptions to these requirements are limited to those specifically addressed under each type of protective equipment.

b. 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.

c. 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.

d. When body protection is required, underclothing must be all cotton (never nylon, polyester or rayon) and contain no metal.

e. Trim, name tags, or logos affixed to flame retardant clothing shall also be flame retardant rated.

f. Hairnets and/or beard nets shall be of non-melting and flame resistant design.

g. Class E hardhats rated for electrical protection shall be worn when inside any substation or other power transmission and distribution equipment area.

7. Hazard Alerting and Control Requirements. Special precautions shall be employed to warn employees of unusual electrical hazards until they are corrected or eliminated. As an 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 is returned to compliance with the electrical code.

a. 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 3.5 feet for non-movable conductors up to 750 V).

b. Exposed energized components shall never be left unattended and/or unprotected. If signs or barricades cannot ensure 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.

c. 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.

8. 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 Appendix A.) Training may be at different levels for qualified and unqualified personnel, 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 being placed in a position where this PPE is required.

a. All training shall be documented in ESAMS. Affected personnel shall be trained either as "qualified" or "unqualified" with qualified being at a level sufficient to afford protection during actual electrical work. 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 personnel who have also been trained, at a minimum, in the following:

(1) The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment;

(2) The skills and techniques necessary to determine the nominal voltage of exposed live parts; and

(3) Clearance distances for working near live circuits or equipment.

b. Base personnel that perform work on electrical circuits shall also meet the following minimum requirements:

(1) Have experience servicing the electrical components of the equipment that they are assigned to service;

(2) Have experience working on energized electric circuit parts or equipment; and

(3) Meet any governing statute or regulatory requirement for special certifications or licenses.

c. Personnel who work on power transmission and distribution systems shall have additional training and experience that meets or exceeds the spirit and intent of that outlined in reference (c). 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 in ESAMS. All personnel who work on power transmission and distribution systems or their components shall also be current in CPR, First Aid, and Blood Borne Pathogens, per reference (c).

APPENDIX A

Glossary

A. The following definitions and terms are authorized for use in connection with matters concerning the Electrical Safety Program:

1. Accessible. (Readily Accessible) Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc.
2. Arc Flash Hazard. A dangerous condition associated with the possible release of energy caused by an electric arc.
3. 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.
4. Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.
5. 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.
6. 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.
7. 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.
8. Bonding Jumper. A reliable conductor to achieve the required electrical conductivity between metal parts to be electrically connected.
9. 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.

10. Boundary, Limited Approach. An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.
11. 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.
12. Break open. A material response evidenced by the formation of one or more holes in the innermost layer of flame-resistant material that would allow flame to pass through the material.
13. Conductive. Suitable for carrying electric current.
14. Conductor, Bare. A conductor having no covering or electrical insulation whatsoever.
15. Conductor, Covered. A conductor encased within material of composition and thickness that is not recognized by electrical standards as electrical insulation.
16. Conductor, Insulated. A conductor encased within material of composition and thickness that is recognized by electrical standards as electrical insulation.
17. De-energized. Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential difference from that of the earth.
18. Disconnecting Means. A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.
19. Electrical Hazard. A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn or blast.
20. 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.

21. 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.
22. Energized. Electrically connected to or having a source of voltage.
23. Enclosed. Surrounded by a case, housing, fence, or wall(s) that prevent(s) persons from accidentally contacting energized electrical conductors or circuit parts.
24. 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.
25. Externally Operable. Capable of being operated without exposing the operator to contact with energized electrical conductors or circuit parts.
26. Feeder. All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit over-current device.
27. Flame-Resistant. 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 flame-resistant is commonly referred to as flame retardant.
28. Flash Hazard. A dangerous condition associated with the release of energy caused by an electric arc.
29. Flash Hazard Analysis. A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices and the appropriate levels of personal protective equipment.
30. Flash Protection Boundary. An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.

31. Ground. A conductive body, such as the earth, used as a common return for an electrical circuit.
32. Grounded, Effectively. Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to personnel.
33. 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.
34. 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.
35. High Voltage: Voltage 600 volts or greater.
36. Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.
37. Isolated (as applied to location). Not readily accessible to persons unless special means for access are used.
38. 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.
39. 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.
40. Live Parts. Energized conductive components.

41. Lockout/Tagout (LOTO). The Lockout/Tagout Program ensures personnel are protected from injury during any servicing or maintenance done on machinery or equipment, where the unexpected energization, start-up, or release of any type of energy (e.g., electricity, steam, and hydraulic, pneumatic, gravity) could occur. The machinery or equipment will be rendered safe to work on by being locked or tagged out under requirements of 29 CFR 1910.147, Control of Hazardous Energy (Lockout/Tagout); and 29 CFR 1910.333, Selection and Use of Work Practices; and guidance of ANSI Z244.1-2003, American National Standard for Control of Hazardous Energy, Lockout/Tagout and Alternative Methods.

42. Low Voltage. Voltage less than 600 V.

43. Motor Control Center. An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

44. On-The-Job Training. An employee undergoing on-the-job training who has demonstrated the ability to perform duties safely at his or her level of training, and who is under the direct supervision of a qualified person, is considered to be a qualified person for the purpose of those duties.

45. Outlet. A point on the wiring system at which current is taken to supply utilization equipment.

46. 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.

47. 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.

48. Qualified Person. A person familiar with the operation, installation and construction of specific electrical equipment and the hazards involved. The following additional information also applies to qualified employees:

Qualified Persons are those who have received specific training and have demonstrated the skills necessary to work safely on or near exposed energized parts. A person may be qualified to work, for example, on circuits up to 600 volts, but may be unqualified to work on higher voltages. Only qualified persons, who are trained on the Lock Out / Tag Out Program, may place or remove locks and tags on energized electrical systems. 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. Training records must specify the qualifications of the individual.

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.

For the purpose of Power Transmission and Distribution, a qualified person must also be fully qualified and current as outlined in reference (c) section 269.

49. 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 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.

50. 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.

51. Unqualified Person. A worker whose work exposes them to electrical hazards, but the worker may not be cleared to perform

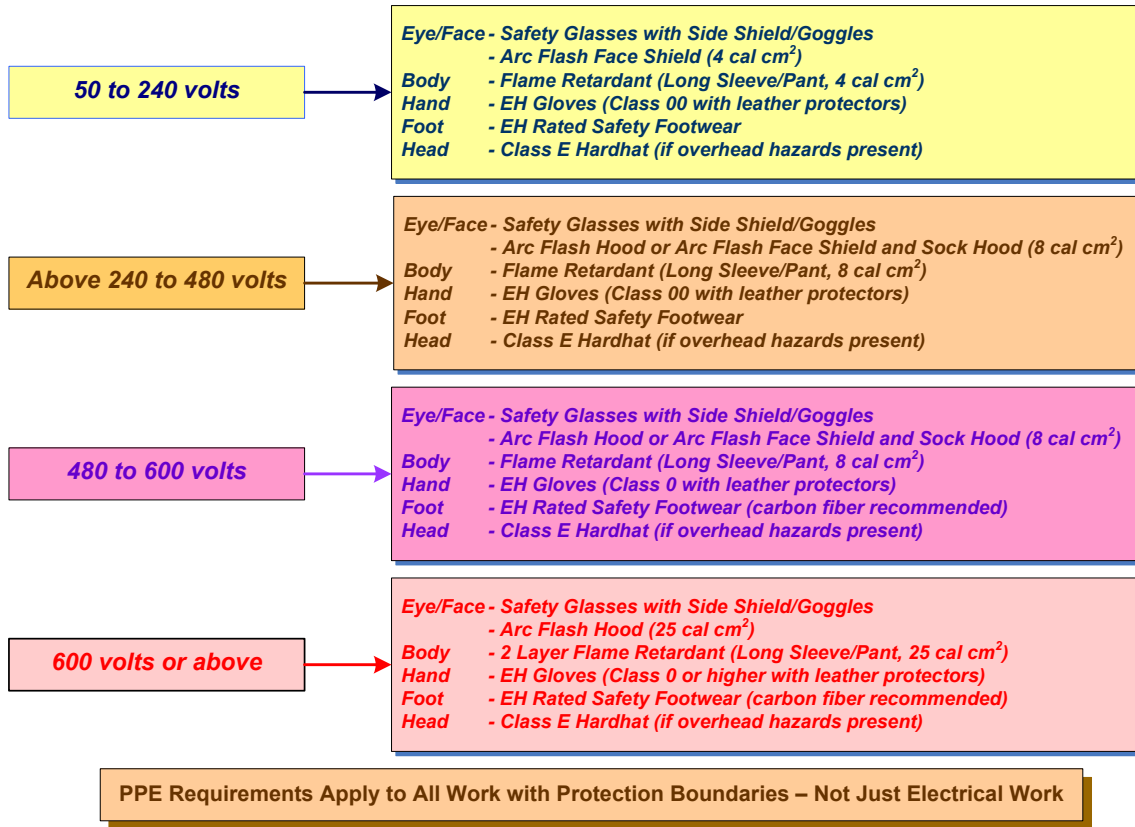
tasks of a qualified employee (i.e., electrical work). Examples of personnel who, at a minimum, would normally be considered unqualified due to the exposure potential and thus require electrical safety training include the following: Maintenance Supervisors, Material Handling Equipment Operators, Painters, Electrical and Electronic Engineers, Electrical and Electronic Technicians, General Maintenance Workers, Mechanics and Repairers, and Welders.

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APPENDIX B

Personal Protective Equipment Requirements Matrix

B. 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).



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)