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CP3-SM-0019 FRev. 2B	**TITLE**: Electrical Safety Guidelines	Page 1 of 66

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1.0 PURPOSE AND SCOPE

1.1 Purpose

The Paducah Gaseous Diffusion Plant (PGDP) Deactivation & Remediation (D&R) contractor is committed to promoting an electrically safe workplace free from exposure to electrical hazards for all workers and subcontractors.

The purposes of the Electrical Safety Guidelines (ESG) are as follows:

1.1.1 To establish the safety requirements, precautions and responsibilities for safe execution of electrical work greater than 50 volts (AC/DC).

NOTE:
Systems operating under 50 volts AC /DC where there is no increased hazard from electrical arcing, burns, or high current capacity are **NOT** covered under the ESG.

1.1.2 To promote an electrically safe workplace free from exposure to electrical hazards for all workers and contractors, using Integrated Safety Management Principles, approved procedures, approved work control documents, and a hierarchy of risk control measures to minimize the electrical risks to workers. Risk control measures shall be implemented using the following hierarchy listed in order of preference:

A. Eliminate the hazards

B. Substitution to avoid the hazard

C. Engineering Controls

D. Awareness

E. Administrative controls

F. Personal Protective Equipment (PPE)

1.1.3 To provide direction to implement practices that will satisfy the electrical safety requirements of the following:

A. U.S. Department of Energy (DOE) Orders, criteria, and guides

B. 10 Code of Federal Regulations (CFR) § 851, *Worker Safety and Health Program*

1.1.4 To describe and implement the requirements to achieve compliance with the following standards and regulations:

A. American National Standards Institute (ANSI)/Institute of Electronic and Electrical Engineers (IEEE) C2, *National Electrical Safety Code* (NESC)

B. National Fire Protection Association (NFPA) 70, *National Electrical Code®*

C. NFPA 70E, Standard for Electrical Safety in the Workplace®

D. Occupational Safety and Health Administration (OSHA) 29 CFR 1910, 269

E. OSHA 29 CFR 1926, Subpart K, Electrical

F. OSHA 29 CFR 1910, Subpart S, Electrical

G. OSHA 29 CFR 1926, Subpart V, Electrical

1.2 Scope

Unless otherwise specified, the use of the term "Contractor" refers to the PGDP D&R contractor.

The ESG apply to all Contractor, subcontractor, and vendor personnel who plan, perform, supervise, and/or execute electrical work, or work in the vicinity of electrical systems; unless working under an approved or equivalent plan.

2.0 REFERENCES

2.1 Use References

CP3-HS-2008, *Accident Prevention/Equipment Control Tags*

2.2 Source References

- 10 CFR § 851, *Worker Safety and Health Program*
- ANSI/IEEE C2, *National Electrical Safety Code (NESC)*
- CP2-HS-1000, *Integrated Safety Management System Description for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
- CP2-HS-2000, *Worker Safety and Health Program*
- CP2-QA-1000, *Quality Assurance Program Description for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
- CP2-TR-0100, *Training Program*
- CP3-HS-2004, *Job Hazard Analysis*
- CP3-HS-2010, *Instructions for Lockout Tagout*
- CP3-HS-2012, *Construction and Work Zone Barricades and Signs*
- CP3-SM-0017, *Measuring and Test Equipment*
- CP3-SM-0052, *Energized Electrical Work Permit*
- DOE-HDBK-1092, *DOE Handbook Electrical Safety*
- EV-C-CEE-15-05, *Work on 120-240 VAC Energized Equipment (PGDP Acceptance)*
- EV-C-CEE-18-002, *Compensatory Measures for Non-PM Electrical Equipment*
- NFPA 70, *National Electrical Code®*
- NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*
- NFPA 70E, *Standard for Electrical Safety in the Workplace®*
- OSHA 29 CFR 1910, *Subpart S, Electrical*

- OSHA 29 CFR 1926, *Subpart K, Electrical*
- OSHA 29 CFR 1926, *Subpart V, Electrical*

3.0 COMMITMENTS

None

4.0 RESPONSIBILITIES

4.1 Stabilization & Deactivation Director

4.1.1 Ensures that the ESG adequately identify roles and responsibilities.

4.1.2 Ensures the implementation of the requirements.

4.1.3 Assists in the investigation of electrical incidents and accidents.

4.1.4 Selects the Electrical Safety Committee (ESC) chair and approves the committee's charter.

4.1.5 Ensures the ESG is reviewed and updated as required.

4.1.6 Assists in the implementation of the ESG.

4.2 Electrical Safety Committee

4.2.1 Provides management with the requirements and training recommendations needed to implement the ESG.

4.2.2 Advises management of the need to fund and support the ESG.

4.2.3 Assists functional organizations with the implementation of ESG requirements.

4.2.4 Reviews, maintains, and revises or updates the ESG, as necessary.

4.2.5 Provides technical guidance to organizations through interpretation of the electrical requirements of DOE Orders, criteria, guides and other national codes, standards, and practices.

4.2.6 Provides oversight of ESG with input from Electrical Authority Having Jurisdiction (AHJ).

4.2.7 Ensures ESG quality and adherence through routine walk downs and surveillances of project electrical work activities, and documented NEC electrical inspections of PGDP modifications.

4.2.8 Maintains a copy of each electrical safety code or requirement interpretation.

4.2.9 Interfaces, as required, with DOE Portsmouth/Paducah Project Office (PPPO) representatives.

4.3 Electrical Authority Having Jurisdiction

4.3.1 Enforces and interprets all required documents stated in Section **1.0** of this procedure.

4.3.2 Documents company-specific Authority Having Jurisdiction (AHJ) decisions and interpretations.

4.3.3 Executes responsibilities as described in memo to DOE (*FPAD-15-0167*).

4.3.4 Reviews and concurs with the use of non-listed or labeled electrical components when applicable.

4.3.5 Ensures National Electrical Code (NEC) inspections are completed in accordance with and using CP3-SM-0019-F02, *National Electrical Code (NEC) Electrical Inspection Request Form* (*EIRF*), and approves the inspection results.

4.4 Safety & Health/Industrial Hygiene Program Manager

4.4.1 Ensures that electrical safety is integrated into CP2-HS-2000, *Worker Safety and Health Program*.

4.4.2 Assigns Safety & Health (S&H) personnel to perform electrical safety hazard analyses in accordance with CP3-HS-2004, *Job Hazard Analysis*.

4.4.3 Assigns S&H personnel to perform routine oversight and assessments, to assure compliance with the ESG and applicable standards is maintained by workers.

4.5 Functional Area Managers

4.5.1 Ensures procedures are established for PM intervals, inspections, tests, and service requirements for electrical equipment.

4.5.2 Ensures records are maintained of all tests, inspections, service, and inventory of electrical equipment.

4.5.3 Ensures copies of all manufacturer's installation, operating, and maintenance instructions are maintained in a retrievable manner.

4.5.4 Ensures components are identified properly and safety-related instructions are provided, as required.

4.5.5 Ensures warning signs and/or circuit/voltage identification labels are affixed and legible, where required.

4.6 Project Managers

4.6.1 Ensures implementation of ESG requirements and the development of electrical safety work procedures or instructions, as applicable to their organization's work activities.

4.6.2 Ensures personnel performing electrical work activities or job tasks are properly trained and qualified.

4.7 Supervisors

4.7.1 Implements, at the project or job level, electrical safety work requirements through approved work control documents.

4.7.2 Works with the ESC to identify electrical hazards associated with work activities.

4.7.3 Assists S&H personnel in the performance of hazard analyses in accordance with CP3-HS-2004.

4.7.4 Ensures supervised personnel working with, or in proximity to, electrical equipment receive appropriate electrical safety training.

4.7.5 Ensures workers use the appropriate Personal Protective Equipment (PPE) for electrical work they are assigned to perform.

4.7.6 Ensures employees implement the Cord Set Inspection Program (CSIP) defined in Sections **5.6.3** and **6.2** of this procedure.

4.7.7 Ensures the Contractor and subcontractors comply with the applicable requirements of the ESG.

4.7.8 Conducts safety meetings and/or pre job briefings that include relevant electrical safety topics.

4.7.9 Performs periodic workplace observations and inspections to evaluate electrical safety performance, and to identify and correct unsafe work practices.

4.7.10 Ensures NEC Inspections are performed as required by work control documents and documented on CP3-SM-0019-F02, *EIRF*.

4.8 Engineering

4.8.1 Provides technical input to identify ESG requirements and implementation means.

4.8.2 Provides technical troubleshooting and response to ESG implementation issues or questions.

4.8.3 Ensures engineer-approved design documents are provided for temporary power installation for the Contractor.

NOTE:

PGDP is contractually required to use the 2017 version of the National Electric Code (NFPA 70) by DOE Standard 10 CFR 851 and has chosen to implement the 2018 version of the NFPA 70E which supersedes the 2015 version of the NFPA 70E as identified by DOE 10 CFR 851.

4.8.4 Ensures that all workplace modification designs comply with 29 CFR § 1910, *Subpart S*; 29 CFR § 1926, *Subpart K*; and NFPA 70 and/or NFPA 70E, as applicable.

4.8.5 Ensures the latest approved revision of modification drawings and/or sketches used for Contractor modifications to electrical equipment are available through the approved Design Change and Plant Drawing processes.

4.8.6 Ensures electrical parts and materials are specified with a requirement to meet applicable nationally recognized standards and are listed and labeled when available for use as required.

4.8.7 Ensures electrical parts, materials or assemblies are specified and used with a Nationally Recognized Testing Laboratory listing when available.

NOTE:
Various items are unavailable to be purchased with a Nationally Recognized Testing Laboratory (NRTL) listing. If electrical parts, materials, or assemblies are specified that are not covered by a NRTL, then an evaluation of the non-NRTL parts is required to determine their acceptability for use by the Electrical AHJ.

4.8.8 **If** electrical parts, materials, or assemblies specified are unavailable to be purchased with a Nationally Recognized Testing Laboratory Listing, **then** prepare an engineering evaluation documenting their acceptance for concurrence by the Electrical AHJ for the site.

4.8.9 Reviews and/or assists work control in developing work instructions for removal of electrical components or systems, and for the installation of temporary power.

4.8.10 Ensures Preventive Maintenance documentation, tests, test intervals, and procedures are guided by using NFPA 70B, manufacturer's recommendations, industry standards, and/or DOE standards and/or regulations for electrical equipment.

4.8.11 Maintains technical expertise in applicable electrical standards.

4.8.12 Provides Arc Flash Incident Energy for Arc Flash PPE selection.

4.9 Employees and Subcontractors

4.9.1 Maintains an awareness of the electrical hazards in the workplaces.

4.9.2 Reports all electrical shocks as injuries, according to Section **5.29** of this document.

4.9.3 Reads, understands, and follows applicable safe operating procedures and work instructions having electrical requirements.

4.9.4 Ensures barricades and signs are placed in work areas in accordance with CP3-HS-2012, *Construction and Work Zone Barricades and Signs.*

4.9.5 Performs only those electrical-related work tasks they are trained and qualified to perform.

4.9.6 Adopts and implements safe electrical work practices.

4.9.7 Uses flagging or other memory methods to identify equipment which is being worked and marks surrounding look-a-like energized equipment, where feasible (for example, places "Danger-High Voltage" tape on related energized equipment in the immediate job task area).

4.9.8 Attends appropriate Electrical Safety Awareness Training and other equivalent job-specific training as required by 29 CFR § 1910.332 and the employee's training program.

4.9.9 Uses appropriate PPE assigned for work tasks.

4.10 Purchasing Representative(s)

NOTE:
Various items are unavailable to be purchased with a Nationally Recognized Testing Laboratory (NRTL) listing.

Verifies that electrical items are listed by a NRTL, such as Underwriters Laboratories®, prior to purchasing (if the item is available, listed). If electrical items are not listed by a NRTL, then ensure engineering has completed the required evaluation/documentation.

4.11 Quality Assurance/Quality Control Program Manager

4.11.1 Includes any identified assessments of the ESG on the assessment schedule.

4.11.2 Tracks the findings and observations identified during the assessments in the Issues Management/Corrective Action and Preventative Action Tracking System Database, as applicable.

5.0 GENERAL INFORMATION

5.1 Objectives

5.1.1 Implementation Objectives

To ensure an effective ESG is implemented, the following objectives have been identified:

A. Establish the requirements and standards for implementing the ESG.

B. Identify resources to implement and maintain ESG requirements.

C. Provide guidance to the Contractor organizations and subcontractors for development and implementation of safe operating procedures with electrical requirements.

D. Ensure periodic independent evaluation of the ESG to assess ESG compliance and effectiveness.

5.1.2 Safe Workplace Objectives

To ensure a safe workplace with the lowest practicable risk from electrical hazards to personnel, the following safe workplace objectives have been established by the Contractor:

NOTE:

PGDP has chosen to implement the 2018 version of NFPA 70E which supersedes the 2015 version required by the latest version of DOE standard 10 CFR 851. However, to assure that current electrical safety controls are used, PGDP will follow the Electrical Safety Guidelines, which will meet the requirements of our contract but may also implement requirements that are above and beyond the contractual requirements, such as applicable Operating Experiences, Lessons Learned, OSHA interpretations, Industry Newsletters, and new editions of safety standards (for example, NFPA 70E revisions).

A. Training modules or safe electrical work practices that meet the requirements of 29 CFR §1910.331-335 and NFPA 70E shall be provided for qualified persons and unqualified persons.

B. Contractor project activities shall comply with the requirements of 29 CFR §1910, 29 CFR §1926, NFPA 70E, and NFPA 70, as applicable.

C. Work activities shall comply with ANSI/IEEE C2, NESC, DOE Orders, and applicable state, country, or local electrical codes.

D. Information regarding electrical safety shall be communicated to affected employees through monthly Electrical Safety briefings and Daily Safety Sheets.

5.1.3 Immediate electrical safety concerns shall be communicated through alerts and Functional Directives, if warranted.

5.1.4 Integrated Safety Management Principles, approved procedures, approved work control documents, and a hierarchy of risk control measures to minimize the electrical risks to workers is used to identify, control and plan for working on or near electrical hazards.

5.1.5 The following risk control measures shall be implemented using the following hierarchy listed in order of preference:

A. Eliminate the hazards

B. Substitution to avoid the hazard

C. Engineering Controls

D. Awareness

E. Administrative controls

F. Personal Protective Equipment (PPE)

5.1.6 A hazard risk assessment will be conducted that identifies the likelihood of harm, potential consequences, the level of risk, and the controls and/or personal protective equipment PPE needed for personnel exposed to electrical hazards (shock or arc flash). The results of the risk assessment will be flowed into the appropriate work control document (task instructions or procedure).

5.2 Organization

5.2.1 The Stabilization & Deactivation (S&D) Director and the ESC have the responsibility for ESG oversight and assurance that ESG elements are flowed down into implementing procedures.

5.2.2 The ESC governs the ESG as it is implemented by the various project or functional organizations. Individual projects shall ensure that operating procedures and/or work control instructions specifically address the electrical hazards and precautions associated with project activities.

5.2.3 S&D has organizational ownership and maintenance responsibility for this procedure. The approval authority for this document is the Surveillance and Maintenance Manager.

5.2.4 Electrical Safety Committee Subcommittee(s)

A. ESC subcommittees may be formed to address project-wide electrical safety issues and may be comprised of ESC members as well as non-ESC members.

B. The committee chair may appoint subcommittee chairs who are **NOT** required to be members of the ESC.

C. All subcommittee reports and recommendations will be approved by a majority of the ESC.

5.3 Training

The scope of PGDP's electrical training includes, but is not limited to, the following:

5.3.1 General Training Scope

Electrical Safety training shall be provided to applicable Contractor and Subcontractor personnel as outlined in their position description, regulatory training requirement(s), and/or as specified under the contract.

A. Personnel who face the risk of electric shock and/or are exposed to the presence of energized voltages of 50 volts or greater will have additional formal Electrical Safety training.

B. Training content shall include the safety-related work practices required by 29 CFR § 1910.331-335.

C. Personnel working with high voltage (greater than 600 volts) must have additional, specialized job-specific training.

D. The Electrical Safety training content is the responsibility of the respective work group management with advisement from the ESC.

5.3.2 Qualified Person Training Scope

A. Qualified persons (for example, electricians, electrical engineers, operators, etc.) are workers who are at risk of electric shock while working on or near energized electrical equipment or systems as a part of their job assignment. (Example: F00053 NFPA 70E National Electrical Code.)

B. Qualified persons shall be trained on NFPA 70E requirements every three years and evaluated on work practices annually on the following (example: F00367EV Electrical Safety Proficiency Evaluation for NFPA 70E):

1. Qualified persons shall be trained in electrical safety related work practices, safety procedures, and other requirements related to their job position and assignment. (See Appendix D, *Electrician, Instrument Technician, and Task Qualified Operator Qualifications.*)

2. Qualified persons shall be familiar with the proper use of PPE, insulating and shielding materials, and insulated tools and test equipment. (Example: F00367EV Electrical Safety Proficiency Evaluation for NFPA 70E)

C. According to 29 *CFR* § 1910:332(b), *Training*, qualified persons permitted to work within the LAB of exposed energized electrical conductors or circuit parts operating at 50 volts or greater shall be trained on the following (example: F00367EV Electrical Safety Proficiency Evaluation for NFPA 70E):

3. Skills and techniques to identify exposed energized parts from other parts of the electrical equipment.

4. Skills to determine the nominal voltage of exposed energized electrical conductors or circuit parts.

5. The approach distances specified in Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document) and the corresponding voltages to which a person will be exposed.

6. The decision-making process necessary to determine the degree and extent of the hazard, as well as the required PPE and job planning necessary to perform the task safely.

7. Demonstrated skills and knowledge of the operation of electrical equipment.

D. Electricians working on new installations subject to NEC inspections shall be trained on applicable codes and standards (example: F00469CR Understanding NEC Fundamentals, NFPA 70-2017).

5.3.3 Nonelectrical Workers Training Scope

A. NFPA 70E states, in part, that unqualified persons shall be trained in and familiar with any of the electrical safety related practices that are necessary for their safety and job performance.

B. Training topics may include, but are **NOT** limited to, electrical safety awareness training, general and job specific training in safe electrical work practices, as required in 29 CFR § 1910, *Subpart S,* and training in applicable codes and standards.

C. All applicable Contractor personnel and subcontractors shall receive a course on electrical safety awareness.

D. Training shall also be provided to select nonelectrical personnel to perform certain electrical related tasks (for example, change light bulbs).

E. This training shall include the use of proper PPE and safe methods, the proper use of extension cords in an office environment, and proper and safe requirements for changing light bulbs in office environments.

5.4 Requirements

5.4.1 Introduction

A. This section identifies the minimum safety requirements for performing work on or around electrical equipment, systems, components, and/or circuits in Contractor facilities.

B. Identified requirements shall be flowed down and implemented within applicable Contractor work activities.

C. The Contractor's Management and Supervisors are required to do the following:

1. Identify electrical hazards in their workplaces.

2. Familiarize personnel with electrical hazards.

3. Develop and implement job-specific procedures or work instructions that ensure safe electrical work practices are defined for work activities and tasks.

4. Conduct periodic inspections of their workplaces and electrical equipment to identify potential hazards.

5. Develop and implement corrective action for identified electrical deficiencies.

6. Ensure that personnel receive applicable electrical safety training.

7. Involve all workers in the electrical safety process, to ensure successful ESG implementation and personnel safety through the Integrated Safety Management System.

5.4.2 General Safety Requirements

The following list of general electrical safety requirements apply to all personnel performing electrical work activities under the ESG, including those **NOT** trained as electrical workers.

A. Workers who are **NOT** trained as electrical workers shall **NOT** perform activities within the LAB, as shown in Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document) unless they are escorted by a qualified person.

B. When establishing an electrically safe work condition, all electrical equipment and circuits shall be treated as energized until Lockout/Tagout (LOTO) protection is in place and the equipment or circuit has been tested to verify absence of hazardous voltage.

C. Barricades and signs shall be placed and utilized according to CP3-HS-2012 to define work areas and equipment electrical status/hazards.

D. **If** the wrong equipment could be accessed inadvertently due to look-a-like concerns, **then** it shall be ensured that any equipment remaining energized in the work zone is identified and marked

E. Prior to entering into the work area, personnel shall meet all identified requirements (for example, proper PPE, training requirements, required briefings, notifications, etc.).

F. No conductive items such as watches, jewelry, tools, pens, steel objects, or other conductive materials, including metal badge lanyards, shall be worn or placed on or around energized electrical circuits or equipment inside the restricted approach boundary.

G. Energized electrical parts or equipment over 50 volts shall be guarded against accidental contact by unqualified person through use of approved cabinets or enclosures.

H. Entrances to areas with exposed energized electrical conductors or circuit parts over 600 volts shall be locked or made inaccessible to nonqualified workers.

I. A clear working space shall be maintained in front of electrical equipment such as switchboards, control panels, fusible switches, circuit breakers, motor controllers, relays, and similar equipment that require examination, adjustment, servicing, or maintenance while energized.

J. The minimum working space shall be determined according to Appendix C, *Working Spaces*.

K. When working on or near exposed energized parts, approved safety equipment shall be used. Approved equipment may include, but is not limited to, arc rated clothing, appropriate class of rubber insulating gloves, rubber insulating blankets, voltage test meters, and barricades and signs to alert unqualified person.

L. For all electrical work, lighting shall be provided that enables the employees to perform their work safely.

M. When performing electrical-related work activities, only nonconductive ladders shall be used.

N. Rolling platforms made of conductive materials may be used to gain access to Air Circuit Breaker cabinets in the switchyard provided the minimum approach distance of one foot is maintained by a qualified person, due to exposed 250 VDC and 480 VAC.

O. Protective shields, barriers, or insulating materials shall be used for close quarter work that does **NOT** provide for adequate clearance.

P. Any potential imminent danger situation shall be corrected immediately. **If** unable to correct, **then** personnel shall be removed from the hazard.

Q. Housekeeping and cleanliness shall be maintained in all work areas.

5.4.3 Job Briefings

A. Pre-Job Briefs shall be conducted prior to the start of each new work activity, prior to each task of the work activity, and during the course of job activities as may be required. The briefing shall cover subjects including, but **NOT** limited to, the following:

- Hazards associated with the job
- Work procedures involved
- Special precautions
- Energy source controls, such as LOTO
- PPE requirements
- Information regarding CP3-SM-0052, *Energized Electrical Work Permit (EEWP)*, if required

B. Additional job briefings shall be held if changes that might affect the safety of workers occur during the course of the work.

5.4.4 Electrical Systems and Wiring

General requirements for temporary wiring in facilities or work areas shall include, as applicable, the following provisions:

A. Feeders shall originate in an approved distribution center.

B. Conductors will be routed in-accordance with the NEC requirements.

C. Branch circuits shall originate in a power outlet or panel board. Conductors will be protected by over current devices at their ampacity. Branch circuit conductors must be elevated or protected.

D. Inspections shall be requested by the installer for any of the following, and shall be conducted using CP3-SM-0019-F02, *National Electrical Code (NEC) Electrical Inspection Request Form (EIRF)*:

- New electrical installations
- Modifications to existing systems or equipment
- Temporary installations
- Engineered changes (such as equivalencies, substitutions, facility changes, and applicable installations approved by Engineering)

E. Receptacles shall be of the grounding type. Unless installed in a continuous grounded metal raceway or metal-covered cable, all branch circuits shall contain a separate equipment-grounding conductor, and all receptacles shall be electrically connected to the equipment grounding conductors. Receptacles for uses other than temporary lighting shall **NOT** be installed on branch circuits that supply temporary lighting.

F. Disconnecting switches or plug contactors shall be installed to permit the disconnection of all grounded conductors of each temporary circuit. Multi-wire branch circuits shall be provided with the means to disconnect simultaneously all ungrounded conductors at the power outlet or panel board where the branch circuit originated.

G. All lamps for general illumination shall be protected from accidental contact or breakage. Metal case sockets shall be grounded.

H. Adequate illumination shall be provided before workers are allowed to enter spaces containing exposed energized parts.

I. Temporary lights shall **NOT** be suspended by their cords, unless the cord and light is designed for this means of suspension.

J. Flexible cords and cables shall be protected from damage. Extension cord sets may pass through doors or other pinch points if properly protected to prevent damage.

K. Flexible cords and cables entering enclosures that contain devices requiring termination shall be secured to the box with the fittings designed for that purpose.

L. Cables and cords shall be supported at such intervals to be protected from physical damage.

M. Extension cord sets used with portable electric tools shall be the three-wire type and designed for extra hard usage.

N. Table 1. Premise Wiring (Below Service Point) Color Code, illustrates what shall be used for new installations and for repairs that require rewiring (unless delineated by other color codes explicitly by approved drawings).

Table 1. Premise Wiring (Below Service Point) Color Code

AC Power

Function	label	Color, common	Color, alternative
Protective ground	PG	bare, green, or green-yellow	green
Neutral	N	White/gray	grey
Line, single phase	L	black or red (2nd hot)	N/A
Line, 3-phase 120/208/240 Volt	L1	black	N/A
Line, 3-phase 120/208/240 Volt	L2	red	N/A
Line, 3-phase 120/208/240 Volt	L3	blue	N/A
Line, 3-phase 277/480 Volt	L1	brown	N/A
Line, 3-phase 277/480 Volt	L2	orange	N/A
Line, 3-phase 277/480 Volt	L3	yellow	N/A

Chg B

DC Power

Function	label	Color
Equipment ground	PG	bare, green, or green-yellow
2-wire ungrounded DC Power System		
Positive	L+	red
Negative	L-	black
2-wire grounded DC Power System		
Positive (of a negative grounded) circuit	L+	red
Negative (of a negative grounded) circuit	N	white
Positive (of a positive grounded) circuit	N	white
Negative (of a positive grounded) circuit	L-	black
3-wire grounded DC Power System		
Positive	L+	red
Mid-wire (center tap)	N	white
Negative	L-	black

5.5 General Electrical and Preventive Maintenance

5.5.1 Electrical maintenance is defined as preserving or restoring the condition of electrical equipment and installations, or parts of either, for the safety of workers who work on, near, or with such equipment.

5.5.2 Electrical maintenance and routine electrical preventive maintenance (PM) shall be performed to ensure safe and reliable operation of electrical wiring, protection devices, and operating equipment, such as switches, circuit breakers, utilization equipment, and appliances.

5.5.3 The Preventive Maintenance Program (PMP) is a program of regular inspection, service, and tests of equipment to detect potential problems and to take corrective measures to reduce or eliminate the problems.

5.5.4 Means of disconnect identification shall be provided as described below, to allow the electrical worker to know the identification elements from the source of power through the entire circuit:

A. Switches in service panels or elsewhere shall be marked to show what loads or equipment are supplied.

B. All disconnecting means (for example, switches or circuit breakers) shall be located for easy access, and clearly marked to show the disconnect purpose.

C. Labeling shall match and be traceable to appropriate approved design documents.

D. Disconnecting means shall be capable of being locked out where required.

E. Panel board circuit directories shall be provided and clearly filled out. The source supplying power to the disconnecting means and load shall be labeled.

5.5.5 Enclosures for panel boards, switchgear assemblies, disconnect switches, etc., shall be kept free of material that would create a hazard.

5.5.6 Current carrying conductors and bracing shall be maintained to conduct rated current without overheating and withstand available fault current.

5.5.7 Insulation integrity and protective devices shall be maintained so these devices can perform their intended function.

5.5.8 Wiring system component covers shall be in place with all associated hardware and there shall be no unprotected openings.

5.5.9 Raceways and cable trays shall be maintained to provide physical protection and support for conductors.

5.5.10 Portable electrical tools and equipment shall be maintained properly. At a minimum, the following shall apply for attachment plugs, receptacles, cover plates, and cord connections:

A. No visible breaks, damage, or cracks exposing energized electrical conductors or circuit parts.

B. No missing cover plates.

C. Terminations have no stray strands or loose terminals.

D. No missing, loose, altered, or damaged, blades, pins, or contacts.

E. Polarity is correct.

5.5.11 Inspection and testing of protective equipment and tools shall be performed as follows:

A. **Visual Inspections:** Safety and protective equipment and protective tools shall be visually inspected for damage and defects before initial use and at intervals thereafter as service conditions require, but in no case shall the visual inspection interval exceed one year for any safety or protective equipment or tool in inventory for use in electrical work activities.

B. **Testing:** Before initial use and at intervals as service conditions and applicable standards and instructions require, the insulation of protective equipment and protective tools (for example, rubber glove and sleeves, blankets, insulating mats, voltage test indicators, etc.) shall be verified by the appropriate test and visual inspection, in order to ascertain that insulating capability has been retained. In no case shall the test verification exceed three years for those protective equipment or protective tools in inventory for use in electrical work activities.

5.6 Extension Cords & Power Strips

5.6.1 Extension Cords & Power Strips (Excluding Office Environments)

A. All extension cords, power strips, and/or equipment cord sets shall conform to applicable code and 29 CFR 1910.305 and/or 29 CFR 1926.405.

B. Only hard-usage or extra hard-usage industrial grade rated items shall be used.

C. The following additional requirements apply:

1. All 120-volt cords and power strips shall contain a ground wire, three prong plug, strain relief or molded cord, and plug assembly, and shall be approved through a NRTL.

2. Ground Fault Circuit Interrupter (GFCI) protection shall be provided when an employee is operating or using cord- and plug-connected tools related to maintenance and construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits.

3. **If** used, **then** 480-volt extension cords shall include 3-pole, 4 wire connectors, “make first, break last” ground connector pins; dedicated ground wire; and use “hard or extra hard usage” flexible cord.

4. Equipment cords, power strip cords, and extension cords shall be protected from damage and shall **NOT** be allowed to cause a tripping hazard in the workplace.

NOTE:

Daisy chaining is the connection of two (2) or more extension cords, power strips or combination, to gain additional outlets and/or length, and shall only be allowed on 480-volt circuits by special permission from the Electrical AHJ.

5. Combinations of power cords and power strips shall **NOT** be connected by the "daisy chain" method unless approved by the Electrical SME or the ESC.

6. Each cord set, (for example, extension cord) and any equipment connected by cord and plug, except cord sets which are fixed and **NOT** exposed to damage, shall be visually inspected before each use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage.

D. Equipment found damaged or defective shall be taken out of service and properly disposed.

5.6.2 Extension Cords & Power Strips (Office Environments)

A. All 120-volt cords and power strips shall contain a ground wire, three prong plug, strain relief or molded cord, and plug assembly, and be approved through a NRTL

B. Equipment cords, power strip cords, and extension cords shall be protected from damage and NOT allowed to cause a tripping hazard in the workplace.

NOTE:

Daisy chaining is the connection of two (2) or more extension cords, power strips or combination, to gain additional outlets and/or length.

C. Combinations of power cords and power strips shall **NOT** be connected by the "daisy chain" method unless approved by the Electrical SME or the ESC.

D. Each cord set, (for example, extension cord) and any equipment connected by cord and plug, except cord sets which are fixed and **NOT** exposed to damage, shall be visually inspected before each use for external defects, such as deformed or missing pins, or insulation damage, and for indications of possible internal damage.

E. Equipment found damaged or defective shall be taken out of service and properly disposed.

5.6.3 Extension Cord Set Inspection and Testing Policy

A. It is the policy of PGDP to establish and implement a Cord Set Inspection Program (CSIP) on equipment that is in accordance with NFPA 70E, *110.5*.

B. This policy shall apply to all industrial, maintenance and construction type areas where GFCIs are **NOT** available.

C. The scope of the policy includes all cord sets which are **NOT** a part of the permanent wiring of the building or structure, and equipment connected by cord and plug which are available for use or used by employees.

1. Damaged cord sets shall be discarded.

2. Cord sets that have minor breaks in insulation may be repaired by a qualified person so that the insulation is equal to or better than the original.

3. Extension cord sets greater than 125-volts shall be tested for continuity and to verify there is no connection between the ungrounded conductors and the ground conductors.

5.7 Circuit Breaker Trip or Failure

If a circuit breaker/fuse trips or fails, **then** personnel shall perform the actions identified in Section **6.5**.

5.8 Ground Fault Circuit Interrupter

5.8.1 For all construction activities, all 15-, 20-, and 30-amp 125-volt (nominal) receptacle outlets that are **NOT** part of the permanent wiring of the building or structure shall be provided with GFCI protection.

5.8.2 **If** a 15-, 20-, and 30-amp 125-volt receptacle is part of the permanent wiring of the building or structure and supplies temporary power to tools used by personnel, **then** GFCI protection shall be provided for personnel protection. The GFCI protection may be provided by a GFCI circuit breaker, receptacle, cord set, or device incorporating listed GFCI protection identified for portable use.

5.8.3 **If** GFCI receptacle outlets create a greater hazard to powered equipment when power is interrupted, or have a design that is **NOT** compatible with GFCI protection, **then** an Assured Grounding Program (AGP), approved by the ESC or ESC Chairman, may be permitted in its place.

5.8.4 Testing of GFCI units shall be performed according to manufacturer instructions and Section **6.4**:

A. GFCI receptacles and breakers installed in de-activated facilities or areas where the receptacles or breaker loads are not normally accessible to personnel are only required to be tested prior to use by a qualified electrical person.

B. GFCI installed receptacles in areas that are normally accessed by personnel (offices, kitchens, bathrooms, etc.) shall be tested monthly (approximately 30 day intervals) by qualified electrical personnel.

C. Testing of GFCI units should be performed using a load or test device to ensure the circuit is interrupted when the test button is initiated.

D. GFCI protection supplied by a breaker or receptacle with exposed conductors shall only be tested by qualified electrical person.

E. GFCI receptacles, portable cords, or breakers that fail the operational test shall be tagged as defective and/or removed from service and replaced.

5.9 Application of Grounds

5.9.1 Personal protective grounds shall be applied on circuits 600 volts and above **or** on lesser voltages where residual charges may accumulate.

5.9.2 Personal protective grounds shall be selected and installed in accordance with appropriate standards.

5.10 Energized Electrical Work and Lockout/Tagout

5.10.1 Energized electrical work is defined as work performed within the limited approach boundary of exposed energized electrical systems or equipment, or equipment operating at 50 volts AC/DC or greater if a person is interacting with the equipment in a manner that increases the risk of serious injury due to shock or arc flash. See Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document), for additional information.

5.10.2 Energized electrical work also may include work where less than (<) 50 volts is present and increased potential exposure to electrical burn or explosion hazard exists due to arcing, as well as testing a system thought to be de-energized, but **NOT** yet proven to be.

5.10.3 All exposed conductors or parts of electrical equipment that are **NOT** under LOTO and verified to be de-energized shall be treated as energized.

5.10.4 Where required, **if** energized electrical conductors or circuit parts are **NOT** placed in an electrically safe work condition, **then** work to be performed shall be considered energized electrical work and shall be performed by written permit only, except when there is an exemption.

NOTE:

CP3-SM-0052, *Energized Electrical Work Permit,* has been developed to address and document energized electrical work; however, PGDP procedures and/or task instructions may be used, provided they meet the requirements identified.

5.10.5 An energized electrical work permit or approved procedure or task instruction for qualified electrical workers shall be required when work is performed within the restricted approach boundary or when the employee interacts with equipment that could increase the likelihood of injury from an exposure to an arc flash unless specifically exempted by CP3-SM-0052, *Energized Electrical Work Permit*. The approved procedure or work control document should incorporate the electrical hazards and risks encountered and have the same level of approval as an EEWP. The permit, approved procedure, or task instructions should incorporate the following items:

- Description of the circuit/equipment to be worked on and location
- Description of the work to be performed
- Justification for why the work must be performed with the equipment energized
- Description of the safe work practices
- Results of the shock risk assessment
- Results of the arc flash risk assessment
- Means employed to restrict work area from unqualified workers
- Evidence of a job briefing to address the specific hazards
- Approval by management authorizing the work

5.10.6 Exemptions to Work Permit:

Exceptions to a work permit are allowed if the work will be performed by a qualified electrical worker and the worker is provided with and uses the appropriate safe work practices and PPE in accordance with the electrical shock and arc flash risks analysis for the following tasks:

- Testing, Troubleshooting, or voltage measuring
- Thermography, ultrasound, or visual inspections if the restricted approach boundary is **NOT** crossed
- Access to and egress from an area with energized electrical equipment if no electrical work it performed and the restricted approach boundary is **NOT** crossed
- General housekeeping and miscellaneous non-electrical tasks if the restricted approach boundary is **NOT** crossed

5.10.7 Safe procedures for de-energizing circuits and equipment shall be determined before the circuit or equipment is de-energized, in accordance with CP3-HS-2010, *Instructions for Lockout/Tagout*.

5.10.8 The process for establishing and verifying an electrically safe work condition requires the following steps:

- All possible sources of electrical supply shall be determined.
- After properly interrupting the load currents, the disconnecting devices for each source shall be opened.
- If possible, it shall be visually verified that all blades of disconnect switches are fully open or that drawout type circuit breakers are withdrawn to the fully disconnected position.
- Stored electrical energy shall be released.
- Stored mechanical energy shall be release or blocked.
- Lockout/tagout controls shall be applied.

NOTE:
If possible, a voltage test should be conducted between each phase and between each phase and ground.
For 161-kV equipment above the service point, only phase to ground testing on each phase is required.

- Adequately rated test equipment shall be used to test each phase conductor or circuit part to verify it is de-energized.
- Before and after each test, it shall be verified that the test equipment is working properly.
- Where the possibility of induced voltages or stored energy exists, phase conductors or circuit parts shall be grounded before touching them.

5.10.9 Electrical equipment and circuits shall be considered energized unless they meet one of the following conditions:

A. Disconnected, verified to be de-energized, and labeled where **NOT** obvious, such as the load end of the circuit (for example, physical separation of conduit from equipment).

B. Isolated by LOTO **and** positively determined to be de-energized.

5.10.10 Tests and/or verification to verify the absence of hazardous voltage shall be made by qualified persons.

A. Voltage tests shall be with a properly rated, Test Equipment contact-type multi-meter. Non-contact meter is allowed for voltages above 1000 volts.

B. When testing for absence of hazardous voltage, the proper operation of the test instrument shall be verified before and after the test.

C. Proximity testers and solenoid-type devices may be used for the verification of AC voltage greater than 1,000 volts.

5.10.11 Before starting work, verification shall be performed by a qualified person to determine the actual condition and state of energization of the electrical equipment and circuits.

A. A qualified person shall perform voltage verification (absence of hazardous voltage), and inspect open switches and draw out breakers to ensure that energy sources are isolated.

B. A qualified person shall use appropriate Test Equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed, and shall verify that the circuit elements and equipment parts are de-energized.

5.10.12 Work on energized electrical systems may **only** be approved and performed for one of the following reasons:

A. For testing or calibration, when tests cannot be done with the circuit or equipment de-energized.

B. For troubleshooting, when the problem cannot be identified unless the circuit or equipment is energized.

C. When removal of power could potentially cause any of the following conditions:

1. Release of hazardous or radioactive material to the environment.

2. Could introduce additional or increased hazards.

3. Is **NOT** feasible due to equipment design.

4. Poses a greater safety risk than working on exposed energized circuits or equipment.

5.10.13 An EEWP may be used repetitively when incorporated into a standard work package that is routine and **NOT** subject to change from evolution to evolution. For these conditions, a hazard assessment shall be performed in accordance with the Contractor's procedure to identify any limitations and PPE requirements.

5.11 Shock Approach Boundaries to Energized Electrical Conductors or Circuit Parts

5.11.1 Authorized energized work areas shall be cordoned off or barricaded to minimize accidental bumping or physical contact by electrical workers, and to restrict unqualified persons from entering the work area.

5.11.2 Approach boundaries shall be established to provide shock protection from energized electrical conductors or circuit parts for qualified persons, according to the values listed in Table 2. Shock Approach Boundaries.

Table 2. Shock Approach Boundaries

Nominal System Voltage Range, Phase-to-Phase	Limited Approach Boundary		Restricted Approach Boundary, Includes Inadvertent Movement Adder
	Exposed Movable Conductor	Exposed Fix Circuit Part	
Less than 50 V	Not Specified	Not Specified	Not Specified
50 V to 150 V	10 ft. 0 inch	3 ft. 6 inch	Avoid Contact
150 V to 750 V	10 ft. 0 inch	3 ft. 6 inch	1 ft. 0 inch
751 V to 15 kV	10 ft. 0 inch	5 ft. 0 inch	2 ft. 2 inch
161 kV to 169 kV	11 ft. 8 inch	11 ft. 8 inch	4 ft. 3 inch

5.11.3 No qualified person shall approach or take any conductive object closer to exposed energized electrical conductors or circuit parts operating at 50 volts (or greater) than the restricted approach boundary set forth in Table 2. Shock Approach Boundaries **unless** either of the following applies:

A. The qualified person is insulated or guarded from the energized electrical conductors or circuit parts.

B. The energized electrical conductor or circuit part is insulated from the employee and from any other conductive object at a different potential.

5.12 Unqualified Person Approach Boundaries to Energized Electrical Conductors or Circuit Parts

5.12.1 Where there is a need for an unqualified person(s) to cross the LAB, a qualified person shall advise him or her of the possible hazards and continuously escort the unqualified person(s) while inside the LAB.

5.12.2 Under no circumstance shall the escorted unqualified person(s) be permitted to cross the restricted approach boundary.

5.12.3 When an unqualified person(s) is working on the ground or in an elevated position near overhead lines, the location shall be such that the unqualified person(s) and the longest conductive object the unqualified person(s) might contact do **NOT** come closer to any unguarded, energized overhead power line than the LAB, as shown in Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document).

5.12.4 Unqualified person(s) shall be required to wear the proper Arc Flash PPE protection rated for the arc flash boundary that they enter.

5.13 Additional Personnel Safety Precautions for Energized Work Activities

The following additional safety precautions shall be incorporated and implemented in work activities, as applicable:

5.13.1 **Alertness -** Workers shall be instructed to be alert at all times when working near energized electrical conductors or circuit parts.

5.13.2 **Fitness for Duty -** Workers shall **NOT** be permitted to work near energized electrical conductors or circuit parts if impaired due to illness, fatigue, or other reasons.

5.13.3 **Blind Reaching -** Workers shall be instructed **NOT** to reach blindly into areas that may contain exposed energized electrical conductors or circuit parts.

5.13.4 **Illumination -** Work shall **NOT** be performed in spaces where there is **NOT** adequate illumination or an area where an obstruction precludes observation of the work to be performed.

5.13.5 **Conductive Materials, Tools, and Equipment –** These items shall be handled in a manner that prevents accidental contact with energized electrical conductors or circuit parts and are kept at the minimum permitted distance specified by Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document).

5.13.6 **Confined or Enclosed Work Spaces –** Workers shall be provided protective shields, barriers, or insulating materials to protect against inadvertent contact. Doors, hinged panels, etc., shall be secured to prevent swinging into employee and causing the employee to contact exposed energized electrical conductors or circuit parts.

5.13.7 **Housekeeping –** Workers shall **NOT** perform housekeeping duties inside the LAB where there is a possibility of contact with energized electrical conductors or circuit parts.

5.13.8 **Flammable Materials –** This type of material shall **NOT** be brought into the work area; **if** in the area, **then** these materials shall be protected to prevent accidental ignition.

5.13.9 **Opening and Closing of Circuits –** Load-rated switches, circuit breakers, or other devices specifically designed for disconnection shall be used for opening, reversing, or closing circuits under load conditions.

5.13.10 **Reclosing Circuits after Protective Device Operation –** After the circuit is de-energized by a circuit protective device, the circuit shall **NOT** be energized manually until it has been determined it is safe to do so.

5.14 Ground or Structure Penetration or Excavation

5.14.1 Search and verification that all hidden utilities are identified shall be performed prior to making any penetrations or excavation of building structures or grounds. Identification of hidden utility lines, components, etc., shall be performed by a qualified person using the appropriate equipment and available drawings.

5.14.2 The following precautions shall be incorporated into any work activities involving penetration or excavation:

A. Work package instructions shall specify appropriate controls and equipment, describe potential hazards, and identify the appropriate PPE to be used for the penetration or excavation activity.

B. An excavation/penetration permit shall be required when drilling holes, coring, chipping, or cutting holes in concrete walls or slabs greater than 1 ¼ inches, or when the outermost layer of cover material is fully penetrated.

C. Power tools or equipment shall be grounded, double insulated, or battery operated.

D. Cord and plug electric power tools shall be used on GFCI protected circuits.

NOTE:

A drill stop box shall **NOT** be relied upon for shock protection. **If** the possibility of contacting a hidden energized circuit **CANNOT** be ruled out, **then** appropriate electrical PPE, based upon a documented hazard evaluation, shall be used.

E. Prior to digging in the ground, an excavation permit shall be required and utilities lines shall be painted on the surface according to Table 3. APWA Uniform Color Code.

Table 3. APWA Uniform Color Code

	WHITE - Proposed Excavation
	PINK - Temporary Survey Markings
	RED - Electric Power Lines, Cables, Conduit, and Lighting Cables
	YELLOW - Gas, Oil, Petroleum, or Gaseous Materials
	ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
	BLUE - Potable Water
	PURPLE - Reclaimed Water, Irrigation and Slurry Lines
	GREEN - Sewer and Drain Lines

5.15 Removing Electrical Items from Disposition and Decontamination and Decommissioning Facilities

5.15.1 Managers, supervisors, and work control planners shall incorporate the following requirements, as applicable, into disposition and Decontamination and Decommissioning activities:

A. Measures shall be implemented so that before cutting, workers can identify that electrical systems and components have been de-energized.

B. The two-person rule described in Section **5.16** shall be implemented.

C. When "air-gapping" or disconnecting electrical conduit, the preferred method shall be to mechanically remove or unscrew conduit fittings versus cutting with a power tool.

D. Required PPE, tools, and clothing requirements shall be specified in accordance with the electrical hazards associated with the scope of work.

5.15.2 As applicable, work packages and/or instructions shall include the following:

A. Prior to actual work, configuration shall be verified to ensure understanding of all sources of power to the system or equipment component to be removed.

B. Appropriate approved drawings or sketches showing sources, loads, and work boundaries for the identified scope of work and LOTO voltage testing locations.

C. Air-gapping locations, interlocks, common grounds and neutrals, and potential stored energy, inductive or feedback power locations.

5.16 Two-Person Rule (Safety Watch)

5.16.1 The Two-Person Rule for qualified persons shall be enacted when working on, or in close proximity to, exposed energized electrical equipment with an electrical shock or arc flash hazard.

NOTE:

When performing absence of hazardous voltage check, trained medical personnel shall be at work location **until** grounds have been installed. After grounds have been installed, for all other absence of hazardous voltage checks (also known as Test Before Touch), medical personnel shall be onsite and able to respond within **four minutes**

5.16.2 When the Two-Person Rule is required for an energized electrical work task, it shall require that the first person assigned is qualified to perform the work, while the second person stands by to provide assistance or summon help for the first person in the event he/she is inadvertently shocked.

A. The second person shall:

1. Be certified in cardiopulmonary resuscitation, if Plant Emergency Squad is **NOT** staffed or functional.

2. Know the isolation or cut-off device for the equipment being worked on.

3. Know the procedures to be followed for the work to be performed.

B. The second person shall **NOT** be assigned other tasks or duties while the first person is performing work on the energized system.

C. Workers may alternate first or second person duties as long as they both are qualified to perform those duties.

5.17 Personal Protective Equipment

5.17.1 Personnel working in areas where there are electrical hazards shall be provided with and use Personal Protective Equipment (PPE) that is designed and constructed for that part of the body to be protected and the work to be performed.

5.17.2 The selection of PPE is based on the electrical hazard associated with the work task.

A. The electrical hazard shall be determined, as required, by performing a hazard assessment according to the Contractor's procedure(s).

NOTE:

Arc flash PPE determinations may be specified in approved PGDP procedures or work control documents **or** supplied by Engineering.

Refer to EV-C-CEE-15-05, *Work on 120-240 VAC Energized Equipment (PGDP Acceptance).*

B. All energized work by qualified persons (including voltage testing) requires an arc flash PPE determination, **except** for the following:

- 240 VAC single-phase circuits (or less), when circuits are fed by a single transformer less than (<) 125 kVA
- 240 VAC (or less) (typically 208 VAC) three-phase circuits, when circuits are fed by a single transformer less than (<) 125 kVA
- 100 VDC (or less) circuits, supplies, storage batteries, and battery banks

C. Electrical PPE selection shall be documented on CP3-SM-0019-F01, *Risk Assessment and Electrical PPE Selection Form,* with the following information (**unless** specified in approved PGDP procedure or work control document):

1. Location

2. Activity

3. Job Scope

4. Shock Exposure (Volts)

5. Incident Energy Exposure

6. Arc Flash Boundary [less than or equal to (≤) 1.2 calories/cm^2]

7. Whether protective device(s) is within PM date

8. Arc Flash PPE Selection

9. Shock PPE Selection

NOTE:

Engineering Evaluation EV-C-CEE-18-002, *Compensatory Measures for Non-PM Electrical Equipment*, contains approved compensatory measures that may be applied.

10. Preventive Maintenance (PM) status of up-stream trip devices relied upon to clear a fault at the work location. If PM status is not current, engineering shall specify compensatory measures required to perform the work safely.

D. **If** arc flash PPE is required for an evolution, **then** equipment shall have arc flash label(s) shall be applied to the exterior of the electrical enclosures, if they have not already been applied. [See Appendix E, *Arc Flash Label (Typical Label Used),* for label example.]

NOTE:

Depending on the hazards of the task, **both** arc flash **and** shock PPE may be needed together, **or only** arc flash PPE or shock PPE may be needed separately.

5.17.3 Examples of PPE and tools appropriate for electrical work include, but are **NOT** limited to, the following: (See CP2-SM-0019-F01, for arc flash and shock PPE selection.)

A. Nonconductive rated hard hats (ANSI Z 89.1)

B. Insulated gloves rated for the voltage being worked

C. Leather protectors

D. Arc Rated and/or all cotton underwear, shirts, pants, and coveralls

E. Safety glasses, goggles, or face shield (ANSI Z 87.1)

F. Voltage rated tools

G. Voltage rated mats, sleeves, or blankets

H. Arc flash hoods

I. Safety shoes (ANSI Z 41)

5.17.4 Protective equipment and clothing shall be maintained in a safe, reliable condition.

J. Workers shall visually inspect their equipment before each use.

K. Equipment or clothing that is soiled or contaminated with grease, oil, flammable or combustible liquid materials, or torn or damaged shall **NOT** be used until it is cleaned and/or repaired.

L. Workers shall be trained in the care, inspection, and use of all safety apparel and equipment required for their work assignments.

5.17.5 Insulated Gloves

A. Insulated gloves shall be current in required testing.

B. All new gloves ordered shall be specified to have the manufacturer or supplier test date included.

C. Depending on dating method, insulated gloves shall be used within test due date as stamped on glove or on tracking mechanism, or are **NOT** to be used beyond six-month testing date as stamped on glove or on tracking mechanism.

D. Any visible defects, such as cracking, pitting, swelling, hardening, or inelasticity, shall be cause for removing gloves from service.

E. Removed gloves shall be discarded.

F. Gloves shall be inspected visually prior to use for any deterioration or damage, and to verify the expiration date is still valid.

G. Gloves shall be stored in a cool, dry, and dark location (out of direct sunlight) with the cuff down inside a bag box, or container designed for glove storage.

H. **If** there is justification to use voltage rated gloves without leather protectors, **then** the gloves shall be removed from service until electrically tested.

5.17.6 Insulated Sleeves, Mats, and Blankets

A. Insulating blankets, matting, and sleeves made of rubber shall be seamless and marked with the appropriate voltage class. These devices shall be inspected for damage before use and after any incident in which damage may be suspected.

B. Insulating blankets and sleeves shall be tested initially, 12 months after being placed in service, and every 12 months after each test date applied to the equipment.

C. Testing for sleeving shall conform to the requirements listed in 29 *CFR* § 1910.137 and American Society for Testing and Materials (ASTM) F496-01, *Standard Specification for In-Service Care of Insulating Gloves and Sleeves.*

D. Blankets may be stored rolled provided the inner diameter of the roll is at least 2 inches.

E. Blanket and mats may be cut into smaller pieces, either to eliminate damaged portions or to fit a particular application. Voltage class and expiration dates shall be placed on each cut piece.

F. Blankets with defects too extensive to repair may be salvaged by severing the defective area from the undamaged portion of the blanket, provided that in Class 1, 2, 3, and 4, the remaining portion of the blanket is **NOT** reduced to a size smaller than 22 inches by 22 inches.

5.18 Tools and Equipment

5.18.1 Workers shall use the appropriate voltage rated insulated tools or handling equipment if the tool or handling equipment might make contact with live conductors or parts, and when working inside the LAB of exposed energized electrical conductors or circuit parts as indicated in Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document).

5.18.2 Factory manufactured connectors or adapters rated for the voltage involved shall be used where available.

5.18.3 Other equipment and tool safety requirements include the following, as applicable:

A. Fuse of fuse holder equipment shall be insulated properly for the circuit voltage on which it is to be used.

B. Ropes or hand lines shall be nonconductive.

C. Portable ladders shall have non-conducting side rails.

D. Physical or mechanical barriers shall be installed no closer than the restricted approach boundaries to energized electrical conductors or circuit parts for shock protection given in Table 2. Shock Approach Boundaries, (located in Section **5.11** of this document).

5.18.4 Before using any tools that may have been modified from their original configurations (for example, insulating blankets or mats), approval shall be obtained from the responsible Project Electrical Technical Authority whose decision shall be based on a safety evaluation of the modification.

5.18.5 Voltage and Testing Equipment

A. Voltage instruments and test equipment shall be used by qualified persons.

B. Voltage instruments and test equipment used for verification of absence of hazardous voltage shall be Test Equipment in accordance with CP3-SM-0017, *Measuring and Test Equipment*.

C. Test instrument and equipment and all associated leads, cables, power cords, probes, and connectors shall be inspected visually before use.

D. **If** there is a defect or evidence of damage that might expose an employee to injury, **then** the item shall be removed from service until repaired and tested.

E. Test instruments and their accessories shall be electrically rated for their intended use in both voltage and class.

5.19 Working with Test Instruments and Equipment

5.19.1 The test instruments and equipment used shall be rated for the application.

NOTE:

Proximity testers can be very useful in certain applications. For example, a proximity tester can find cables that go through a panel but that do **NOT** terminate in the panel. However, if a proximity tester fails to detect voltage, this does **NOT** guarantee that the equipment or device being tested is de-energized. Therefore, proximity testers **may** be used for test before touch, but **may NOT** be used to test for absence of hazardous voltage.

5.19.2 For systems above the service point, a voltage test by an electrically qualified person can be conducted using a non-contact or contact meter, but if testing for absence of voltage to support a lockout/tagout as required by CP3-HS-2010 testing shall be performed using an M&TE approved contact meter. Chg A

5.19.3 The following will apply when working with test instruments and equipment on energized circuits:

A. **Qualified Persons –** Only knowledgeable, qualified persons who have been trained to work safely with test instruments and equipment on energized circuits shall be permitted to perform testing work on electrical circuits or equipment where there is danger of injury from accidental contact with energized parts or improper use of the test instruments and equipment.

B. **Visual Inspections –** Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects or damage before being used on any shift. **If** there are defects or evidence of damage that might expose an employee to injury, **then** the defective or damaged item shall **NOT** be used until required repairs and tests have been made.

C. **Rating Instruments and Equipment –** Test instruments, equipment, and their accessories shall be rated for the circuits and equipment to which they will be connected and shall be suitable for the environment in which they will be used.

5.20 Verification of Absence of Hazardous Voltage

NOTE:

The following are the minimum instructions required to be in a field procedure used for verifying absence of hazardous voltage.

5.20.1 Qualified persons shall use appropriate calibrated Test Equipment to test the circuit elements and electrical parts of equipment to which workers will be exposed, and shall verify that the circuit elements and equipment parts are de-energized.

5.20.2 The test shall also determine if a hazardous energized condition exists because of induced voltage or voltage backfeed after specific parts of the circuit have been de energized.

NOTE:

If equipped, **then** the medium and high voltage meter internal self-testing option must be used for pre- and post-meter checks.

5.20.3 Test equipment shall be checked for proper operation immediately before and immediately after this test.

5.20.4 Testing shall be performed as if the circuit is energized. The voltage verification device used shall be rated for the application.

5.21 Operation in Switchyards

Additional qualifications and/or requirements and supplemental training to meet 29 CFR 1910.269 may be required to perform work within the switchyards.

5.22 Working Near Communication Lines

Where any mobile equipment structure will be elevated near communication lines, they shall be operated to avoid contact.

5.23 Activities Involving Equipment Working Within 20 Feet of Energized Overhead Power Lines

NOTES:

Section **5.23** applies to activities conducted in the vicinity of, (but **NOT** on), overhead electrical conductors. It does **NOT** apply to qualified persons working on or near overhead line distribution systems.

A hazards analysis will determine if the proposed activity has the potential to place the worker or equipment within the LAB of energized overhead power lines.

If the proposed activity will be performed within the LAB, **then** it shall be performed according to Section **5.24**. Otherwise, the hazard controls in Sections **5.23.1** through **5.23.2** shall be followed.

5.23.1 Mandatory Barrier Control

A. Power & Utilities shall be informed of work near overhead lines.

B. Trained Operators and Spotters shall be used and shall meet the following requirements:

1. The spotter shall be in place prior to movement of the equipment and be positioned to effectively gauge the clearance distance.

2. Operators of equipment and spotters who work near energized overhead power lines shall be trained to perform the following:

- Visually determine when equipment is nearing the LAB for overhead power lines.
- To establish and maintain effective communications between the operator and spotter.

3. The spotter shall have no duties other than being a spotter for a single specific operation.

4. Spotters shall have direct communication with the equipment operator. The method of communication must take into account potentially high noise levels common with heavy equipment operation.

5. Spotters shall be easily identifiable by the equipment operators.

5.23.2 Secondary Barrier Control

As a minimum, **one** of the following secondary barrier controls shall be used in addition to a trained spotter:

A. Install physical barriers to prevent encroachment into the LAB.

B. Use stakes and/or cones or painted lines to provide constant reminders to operators and spotters of the proximity to energized overhead lines.

C. Use materials to enhance visibility of energized overhead lines for spotters.

D. Have qualified persons measure line height. Signs shall be posted to indicate overhead power line height to warn of energized overhead power lines and enable the spotter to accurately determine the clearance distance.

E. Have qualified persons raise or relocate energized overhead lines to reduce the possibility of an inadvertent contact.

F. Other control(s) may be permitted following review and approval by the Electrical AHJ. This review shall verify that the alternate controls are as effective as the controls listed above.

5.24 Planning Work with the Potential to be Within the Limited Approach Boundary of Overhead Lines

NOTE:

Section **5.24** applies to activities performed by **unqualified persons** in the vicinity of, (but **NOT** on), overhead electrical conductors. It does **NOT** apply to qualified persons working on or near overhead line distribution systems.

5.24.1 **If** the area 360 degrees around the equipment, up to the equipment's maximum working radius, intersect the LAB, **then** work shall be considered to have the potential to come within the LAB.

5.24.2 Overhead lines shall be de-energized when work is planning to be performed in the LAB or when the work activity or equipment has the potential to enter the LAB unless it is determined after a documented evaluation, considering probability, consequence, and risk for each phase or activity of the work scope, that de-energizing is infeasible or creates a greater hazard.

5.24.3 **If** work will be performed within the LAB of energized overhead power lines under the exclusive control of Power & Utilities, **then** it is the responsibility of the organization performing the work to contact Power & Utilities to determine if either of the following apply:

- Overhead lines can be de-energized and grounded
- De-energizing overhead power lines are infeasible

5.25 Equipment Operations Near Overhead Lines

If energized overhead lines are to be de-energized, **then** arrangements shall be made with the person or organization that operates or controls the overhead lines to de-energize them and implement appropriate hazardous energy control measures.

5.26 Overhead Lines De-Energized and Grounded

5.26.1 De-energized and grounded is the preferred condition under which equipment operation should be performed because the hazard of injury or death due to electrocution has been removed.

5.26.2 The following steps shall be taken to ensure overhead lines are de-energized:

A. Power & Utilities, or the owner of the overhead lines, shall de-energize the lines.

B. Grounding methods shall be determined by Power & Utilities or the owner of the overhead line.

C. The owner of the overhead lines or a designated representative of Power & Utilities shall ensure the overhead lines are no longer energized.

5.26.3 **If** de-energizing lines is infeasible, **then** the responsible manager shall provide documented justification for performing the work energized, considering probability, consequence, and risk for each phase or activity of the work scope and a qualified worker shall be present at the job site.

5.26.4 The affected or involved organizations shall be involved in the work planning.

5.26.5 The work location and all paths of travel shall be walked down to identify potential electrical hazards.

5.26.6 **When** arrangements are made to use protective measures, (such as guarding, isolating, or insulating), **then** these precautions shall prevent each employee from contacting such overhead lines directly with any part of his or her body, or indirectly through conductive materials, tools, or equipment.

5.27 Vehicular and Mechanical Equipment in Use by Qualified Person(s)

5.27.1 Persons standing on the ground shall **NOT** contact the vehicle, or mechanical equipment or attachments, unless they are qualified persons and appropriate protective means, such as insulation, grounding, and PPE, are utilized.

NOTE:
Hazardous ground potentials (step and touch potential) may develop within several feet of the grounded point of an elevated vehicle or mechanical equipment near energized overhead power lines.

5.27.2 People shall be prevented from standing near a vehicle or mechanical equipment capable of elevating near an energized overhead line that is grounded, and from standing near its grounding locations, by the use of barricades or insulation to protect the workers.

5.27.3 Aerial lift devices (for example, cranes and bucket trucks) operating in switchyards shall be grounded to the station grid before work starts.

5.27.4 To ensure minimum approach distances to energized electrical equipment are **NOT** exceeded, a spotter shall be designated when operating aerial lift devices near exposed lines and equipment.

5.27.5 The approach distance to exposed lines and equipment shall be observed and timely warnings given before the minimum approach distance is reached.

5.28 Equipment in Transit

NOTE:

In this section the term "transit" refers to equipment (for example, fork trucks, excavators, aerial lifts, back hoes) that is moving under its own power or being transported by trailer, without load and the structure lowered to its lowest practical stowed position prior to movement.

5.28.1 Any equipment **NOT** in the lowered configuration is considered to be performing work. Prior to movement, controls shall be implemented to ensure the equipment is configured in the lowest practical stowed position.

5.28.2 A truck (for example, dump, garbage, etc.) is considered in transit when moving under its own power with the structure lowered to its lowest stowed position.

A. **If** the truck is carrying a load, **then** the combined height of the equipment and load shall be less than (<) 14 feet.

B. **When** loading and unloading trucks, **then** an audible alarm or a spotter shall be used to verify that the bed is fully lowered prior to movement.

5.28.3 **If** the vehicle is in transit with its structure lowered to its lowest practical stowed position, **then** the minimum clearance distances to energized overhead lines while traveling with no load may be found in Table 4. Vehicles/Mobile Equipment in Transit.

5.28.4 **If** insulated barriers, rated for the voltage involved, are installed and they are **NOT** part of an attachment to the vehicle, **then** the clearance shall be permitted to be reduced to the design working dimensions of the insulating barrier.

Table 4. Vehicles/Mobile Equipment in Transit

Voltage (Nominal, kV, AC)	While Traveling-Minimum Clearance Distance (Feet)
Up to 0.75	4
Over 0.75 to 50	6
Over 50 to 345	10

5.28.5 Assemblies Near Overhead Power Lines

A. Assembly or disassembly of equipment near overhead lines is considered to be an operation, see Section **5.25**, Equipment Operations Near Overhead Lines.

B. Scaffolds shall be erected no closer to energized power lines than specified in Appendix B, *Scaffold Distances to Energized Power Lines*.

C. Where contact with insulated or uninsulated overhead lines or equipment is possible, Power & Utilities is to be contacted to consult and to de-energize the overhead lines or equipment, if feasible.

5.29 Electrical Occurrence and Shock Reporting

5.29.1 Any electrical shock sustained by a Contractor or subcontractor employee shall be reported to supervision immediately, and a medical evaluation shall be performed by medical personnel.

5.29.2 Shock incidents or electrical emergencies also shall require reporting to the PSS office and the PPPO. Electrical occurrences, including electrical shocks, shall be reported in accordance with the Contractor's occurrence reporting procedure.

5.30 Exemptions and Waivers

5.30.1 All requests for code and regulation exemptions and waivers shall be submitted to the ESC for review and action.

5.30.2 Requests for exemptions and waivers shall include the following:

A. A description of the problem and the reason for requesting noncompliance.

B. Code and/or regulation references.

C. Proposed mitigation steps to be taken, such as warning signs, barriers, and procedures, to provide equivalent protection.

D. Proposed dates for the variance.

5.30.3 Normally, exemptions and waivers will **NOT** be granted for the following:

A. Longer than 180 days.

B. The time it takes to correct the deficiency.

C. The duration of an approved program or operation.

5.31 Grandfathered Equipment Installations

Equipment installed to previous versions of code is **NOT** required to be retrofitted, **unless** any of the following apply:

5.31.1 The installation is in an unsafe condition.

5.31.2 The Electrical AHJ has required the retrofit.

5.31.3 Later code versions explicitly require equipment installations be retrofitted.

5.32 Service Point Demarcation

NOTES:

This document serves as the Power & Utilities Manager decision that defines the typical service point for the PGDP electrical distribution system.

The primary regulations that govern the installation and work practices for electrical transmission and distribution equipment and systems on the supply side of the service point include the following:

- 29 CFR 1910.269
- 29 CFR 1926.950-960
- National Electrical Safety Code (ANSI C2) (2012)

The primary regulations that govern the installation and work practices for electrical equipment and systems on the load side of the service point include the following:

- 29 CFR 1910.300-399
- 29 CFR 1926.400-499
- NFPA 70 (NEC®)
- NFPA 70E

5.32.1 The service point shall be as follows:

A. For electrical service to a structure or facility that operates at a nominal voltage less than (<) 13,800 volts, and is provided from an overhead drop, the service point shall be the splice point near the weathercap of the service mast containing the service entrance conductors.

B. For electrical service to a structure or facility that operates at a nominal voltage less than (<) 13,800 volts, and is provided from an underground service lateral supplied from an elevated transformer, the service point shall be the connection of the lateral conductors at the first equipment mounted on or near the served structure or facility.

C. For electrical service to a structure or facility that operates at a nominal voltage less than (<) 13,800 volts, and is provided from a pad-mounted transformer, the service point shall be the connection of the secondary conductors to the secondary terminals of the transformer.

5.32.2 Additionally, the following systems are considered on the supply side of the service point:

A. Security and street lighting system

B. Circuitry that monitors and/or controls supply side electrical distribution (for example, SCADA, control panels, etc.)

C. Direct Current systems used to operate and control electrical utility switching devices.

NOTE:

CP4-UT-0100, *Power Supplier Permits*, is used to control power supplier permits and devices in conjunction with CP3-HS-2010, *Lockout/Tagout Permits*, for on-site components.

5.32.3 Protection permits between the power suppliers and the site are to be controlled as defined under the National Electrical Safety Code (ANSI C2-2012) section 444. Once the appropriate devices are controlled, tagged and communicated, workers will conduct an absence of voltage check at the work site and install temporary grounds of sufficient size prior to the work site and if feasible down-stream of the electrical work zone prior to performing work.

5.32.4 For situations **NOT** covered by the above, or for questions regarding this decision, the Electrical AHJ or the ESC shall be contacted.

6.0 INSTRUCTIONS

6.1 Personal Protective Equipment Selection Guidance

PGDP Employees and Subcontractors

NOTES:

Work should be performed only on de-energized conductors, unless approved under this procedure, other approved procedures, or as exempted in CP4-SM-0052, *Energized Work Permits*.

The preferred hierarchy of controls to minimize electrical hazards is:

1. Eliminate the hazards
2. Substitution to avoid the hazard
3. Engineering Controls
4. Awareness
5. Administrative Controls
6. Using Personal Protective Equipment

Arc flash PPE determinations may be specified in approved PGDP procedures or work control documents **or** supplied by Engineering.

Refer to EV-C-CEE-15-05, *Work on 120-240 VAC Energized Equipment (PGDP Acceptance).*

All energized work (including working in the vicinity of any live, or potentially live exposed conductors) by qualified persons (including voltage testing) requires an arc flash PPE determination, **except** for the following:

- 240 VAC single-phase circuits (or less), when circuits are fed by a single transformer less than (<) 125 kVA
- 240 VAC (or less) (typically 208 VAC) three-phase circuits, when circuits are fed by a single transformer less than (<) 125 kVA
- 100 VDC (or less) circuits, supplies, storage batteries, and battery banks

Refer to Section **5.17** of this document for more information about PGDP's PPE requirements.

6.1.1 Complete CP3-SM-0019-F01, *Risk Assessment and Electrical PPE Selection Form,* with the following information (**unless** specified in approved PGDP procedure or work control document)*:*

A. Location

B. Activity

C. Job Scope

D. Define the Risk associated with performing the activity and how it is being controlled or minimized.

E. Shock Exposure (Volts)

F. Incident Energy Exposure

G. Arc Flash Boundary [less than or equal to (≤) 1.2 calories/cm^2]

H. Whether protective device(s) is within PM date

1. Ensure Engineering indicates on CP3-SM-0019-F01 whether protective device(s) is within PM date.

2. Obtain Engineering's printed name, signature and date in the Arc Flash Section of the form.

I. Arc Flash PPE Selection

J. Shock PPE Selection

6.1.2 Print name, sign **and** date as Craft/PPE Wearer on CP3-SM-0019-F01.

6.1.3 Obtain Supervisor printed name, signature and date on CP3-SM-0019-F01.

6.1.4 **If** arc flash PPE is required, **then** perform the following:

A. **If** PPE has arc flash hazard labeling, **then** no further labeling is required.

B. **If** PPE does **NOT** have arc flash hazard labeling, **then** apply arc flash labels. [See Appendix E, *Arc Flash Label (Typical Label Used),* for label example.]

6.2 Extension Cord Set Inspection Guidance

NOTE:

Section **6.2** applies to all industrial, maintenance and construction type areas where GFCIs are **NOT** available; to all cord sets which are **NOT** a part of the permanent wiring of the building or structure, and to equipment connected by cord and plug which are available for use or used by employees.

Refer to Section **5.6.3** of this document for more information about PGDP's Extension Cord Set Inspection and Testing Policy.

PGDP Employees and Subcontractors

6.2.1 Before each use, visually inspect each of the following items for external defects such as deformed or missing pins, insulation damage, and indication of possible internal damage:

A. Flexible cord

B. Attachment cap and connector

C. Receptacle of cord set

D. Any equipment connected by cord and plug

6.2.2 **If** any evidence of damage is found, **then** perform the following:

A. Remove the damaged item from service.

B. Dispose of the damaged item or tag it according to CP3-HS-2008, *Accident Prevention/Equipment Control Tags,* until it is repaired.

C. **If** appropriate, **then** submit a request to have the damaged item repaired.

6.2.3 **If** extension cord sets and/or cord and plug connected equipment have remained in place and have **NOT** been exposed to physical damage, **then** perform the following:

A. Inspect each device when it is relocated.

B. **If** the equipment has **NOT** been relocated, **then** ensure it is inspected at an interval that does **NOT** exceed one year.

6.3 Extension Cord Set Testing Guidance

PGDP Employees and Subcontractors

NOTE:

Section **6.3** applies to all industrial, maintenance and construction type areas where GFCIs are **NOT** available; to all cord sets which are **NOT** a part of the permanent wiring of the building or structure, and to equipment connected by cord and plug which are available for use or used by employees.

Refer to Section **5.6.3** of this document for more information about PGDP's Extension Cord Set Inspection and Testing Policy.

6.3.1 Test each of the items listed in Step **6.2.1** as follows:

A. Before first use.

B. Before equipment is returned to service following any repairs.

C. Before equipment is used after any incident which could have caused damage (for example, when a cord set is run over).

D. **If** damage is detected, **then** perform the following:

1. Remove the damaged item from service.

2. Dispose of the damaged item or tag it according to CP3-HS-2008, *Accident Prevention/Equipment Control Tags,* until it is repaired.

3. **If** appropriate, **then** submit a request to have the damaged item repaired.

Qualified Person

6.3.2 Annually test each extension cord set designed for electrical systems greater than 125 volts as follows **and** document the test in the appropriate work control document.

A. All equipment grounding conductors for continuity, ensuring they are electrically continuous.

B. All ungrounded conductors for continuity.

C. All ungrounded conductors to ensure there is no continuity between the grounded and ungrounded conductors.

6.4 GFCI Device Testing Guidance

NOTE:

Refer to Section **5.8** of this document for more information about PGDP's GFCI testing requirements.

PGDP Employees and Subcontractors

6.4.1 **If** the GFCI device is readily accessible at an outlet or is a portable unit, **then** test each device before use each day by pushing the test button and determine that the down-stream devices have no power.

6.4.2 Once the test is completed push the re-set button and determine that the down –stream device has power restored.

6.4.3 **If** power is **NOT** interrupted when the test button is pushed or if power is not restored, **then** tag it according to CP3-HS-2008, *Accident Prevention/Equipment Control Tags*, until it is repaired.

6.4.4 If appropriate, submit a request to have the damaged item repaired.

Qualified Person

6.4.5 **If** the GFCI protection (receptacle or breaker) is readily accessible, **then** test each device at least monthly **and** document the test in the appropriate work control document.

6.4.6 **If** power is **NOT** interrupted when the test button is pushed **or** if power is not restored, **then** tag it according to CP3-HS-2008, *Accident Prevention/Equipment Control Tags*, until it is repaired.

6.4.7 **If** appropriate, **then** submit a request to have the damaged item repaired.

6.5 Circuit Breaker Trip or Failure Guidance

NOTE:

Refer to Section **5.7** of this document for more information about PGDP's Circuit Breaker Trip or Failure requirements.

PGDP Employees and Subcontractors

6.5.1 **If** a circuit breaker trips or fails, **then** perform the following:

A. Inform the responsible manager or supervisor for that area, equipment, or building.

NOTE:

Determining the cause should include electrical troubleshooting unless the responsible manager or supervisor for the area, equipment, or building knows the cause is **NOT** fault related (for example, too many loads plugged into circuit causing a trip).

B. **If** qualified and authorized to do so, **then** try to determine the cause of the trip or failure.

NOTE:

A circuit breaker that operates due to a known overload condition may be reset **once** by trained, qualified (qualified for the building in question to address any issues with energizing or de-energizing building-specific equipment), and authorized personnel.

Trained, Qualified and Authorized PGDP Employee or Subcontractor

C. **If** circuit breaker operated due to a known overload condition, **then** reset it.

NOTE:

Only trained, qualified (qualified for the building in question to address any issues with energizing or de-energizing building-specific equipment), and authorized personnel are permitted to reset protective devices in buildings or work areas.

D. Perform the following:

NOTES:

The safety of the employee manually operating the circuit breaker is at risk if the short circuit condition still exists when reclosing a breaker.

Repetitively manually reclosing a circuit breaker is **NOT** permitted.

1. Determined if the tripped or failed equipment and circuit can be safely re-energized.

2. **If** the tripped or failed equipment and circuit can be safely re-energized, **then** re-energize it.

3. **If** the breaker tripped due to a fault, **then** perform the following:

a) Investigate the cause of the fault.

b) Repair the breaker.

c) Investigate the condition of the installed equipment.

4. **If** the reason for the fault cannot be determined, or its condition is in any way questionable, **then** replace the circuit breaker.

6.5.2 **If** required by procedure or work instruction, **then** document the actions taken in response to the trip or failure as required.

6.6 NEC Electrical Inspections Guidance

Requestor

6.6.1 Complete Sections **1** through **12** of CP3-SM-0019-F02, *National Electrical Code (NEC) Electrical Inspection Request Form (EIRF),* to request an inspection for any of the following conditions:

A. New electrical installations

B. Modifications to existing systems or equipment

C. Temporary installations

D. Engineered changes (such as equivalencies, substitutions, facility changes, and applicable installations approved by Engineering)

6.6.2 Include form associated with the task in the work package.

Electrical AHJ (or Designee)

6.6.3 Perform inspection, completing Sections 13 through 15 of CP3-SM-0019-F02.

6.6.4 Return completed CP3-SM-0019-F02 to Requestor.

6.7 Physical Separation of Electrical Equipment Out of Service (Air-Gapped) Guidance

NOTE:

Lockout/Tagout in accordance with CP3-HS-2010 is **NOT** required for demolition activities involving electrical equipment that is out of service, is no longer considered connected to a source of power (voltage), which has been air-gapped effectively (Also see definition of air-gapped in Appendix A).

PGDP Employees and Subcontractors

6.7.1 Conductors must be unterminated from the supply source and a section of raceway or cable containing the conductors be removed to create a physical separation from the equipment enclosure such that the conductors cannot be re-terminated or re-energized unintentionally.

6.7.2 Conductors that enter an enclosure shall be cut-off at the point of entry and capped or otherwise separated by a permanent barrier to prevent potential energization and re-termination. It is preferred to have a viewing window to inspect the source enclosure of the air-gapped raceway or cables status, but if not feasible a label should be placed on the enclosure to reference the work activity documentation associated with the air-gapping performed.

6.7.3 Other methods of un-terminating supply conductors from the supply source terminals and separation of the raceway or cable from the supply equipment enclosure not covered by Step **6.7.1** or **6.7.2** may be approved by engineering and the AHJ as needed.

7.0 RECORDS

7.1 Records Generated

The following records may be generated by this procedure:

- CP3-SM-0019-F01, *Risk Assessment and Electrical PPE Selection Form*
- CP3-SM-0019-F02, *National Electrical Code (NEC) Electrical Inspection Request Form* (EIRF)

Forms are to be completed in accordance with CP3-OP-0024, *Forms Control*.

7.2 Records Disposition

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

Appendix A – Acronyms/Definitions

ACRONYMS

AC – Alternating Current

AFB – Arc Flash Boundary

AGP – Assured Grounding Program

AHJ – Authority Having Jurisdiction

Amp – Ampere

ANSI – American National Standards Institute

APWA – American Public Works Association

ASTM – American Society for Testing and Materials

CAS – Contractor Assurance System

CFR – Code of Federal Regulations

CSIP – Cord Set Inspection Program

D&R – Deactivation & Remediation

DC – Direct Current

DOE – U.S. Department of Energy

EEWP – Energized Electrical Work Permit

EIRF – Electrical Inspection Request Form

ESC – Electrical Safety Committee

ES&H – Environment, Safety & Health

ESG – Electrical Safety Guidelines

FPB – Flash Protection Boundary

GFCI – Ground Fault Circuit Interrupter

HSS&Q – Health, Safety, Security & Quality

IEEE – Institute of Electronic and Electrical Engineers

ISM – Integrated Safety Management

kA – Kilo-ampere

Appendix A – Acronyms/Definitions (continued)

LAB – Limited Approach Boundary

LOTO – Lockout/Tagout

M&TE – Measuring and Test Equipment Chg A

NEC – National Electrical Code

NESC – National Electric Safety Code

NFPA – National Fire Protection Association

NRTL – Nationally Recognized Testing Laboratory

OSHA – Occupational Safety and Health Administration

PA – Performance Assurance

PAF – Position Assignment Form

PGDP – Paducah Gaseous Diffusion Plant

PMP – Preventive Maintenance Program

PPE – Personal Protective Equipment

PPPO – DOE Portsmouth/Paducah Project Office

PSS – Plant Shift superintendent

QA – Quality Assurance

RAB – Restricted Approach Boundary

S&D – Stabilization & Deactivation

S&H – Safety & Health

DEFINITIONS

NOTE:

The following Terms are used in NFPA 70E, *Standard for Electrical Safety in the Workplace®.* Additional definitions, or clarifications within definitions, are italicized.

Absence of Hazardous Voltage – *A term used to declare that a circuit is free from hazardous energy (nominal 50 volts or less).*

Accessible (as applied to equipment) – Admitting close approach; not guarded by locked doors or other effective means.

Appendix A – Acronyms/Definitions (continued)

Air-Gapped – *The physical separation by removal of a section of raceway or cable containing supply conductors from the supply equipment enclosure in a manner that renders the original configuration permanently unusable. If other conductors remain energized in the enclosure the air-gapped cables shall be removed from the enclosure or protected from potential re-energization by the installation of covers or barriers to prevent the air-gapped conductors from being energized. Air-gapping requires the removal of enough of the conductor, cable, or conduit (typically 12" to 24") to require rewiring to reconnect and installing covers or barriers if needed. Lifting and taping of leads, removing fuses, removing bus links, and opening disconnects do not qualify as physical air-gaps.*

American Public Works Association (APWA) Uniform Color Codes – *Utility color codes used to identify existing underground utilities in construction areas, to protect them from damage during excavation. Colored lines, flags, or both are used to mark the location and denote the type of underground utility.*

Approved – Acceptable to the authority having jurisdiction (AHJ).

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. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of break open threshold (E_{BT}) (should a material system exhibit a break open response below the ATPV value). Arc rating is reported as either ATPV or E_{BT}, whichever is the lower value.

Authority Having Jurisdiction – 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.

Barricade – A physical obstruction such as tape, cones, A-frame type wood or metal structures intended to provide a warning about and to limit access.

Barrier – A physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts or to prevent unauthorized access to a work area.

Boundary – *An approach limit at a distance from exposed energized electrical conductors or circuit parts within which an unprotected person could receive a second-degree burn if an electrical arc flash were to occur.*

Boundary, Arc Flash – When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

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

Boundary, Restricted Approach – An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

Branch Circuit – The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Appendix A – Acronyms/Definitions (continued)

Cablebus – *An assembly of insulated conductors with fittings and conductor terminations in a completely enclosed ventilated protective metal housing. This assembly is designed to carry fault current and to withstand the magnetic forces of such current.*

Circuit Breaker – A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

Conductive – Suitable for carrying electric current.

Conductor, Bare – A conductor having no covering or electrical insulation whatsoever.

Conductor, Covered – A conductor encased within material of composition or thickness that is not recognized by NFPA 70E as electrical insulation.

Conductor, Insulated – A conductor encased within material of composition and thickness that is recognized by NFPA 70E as electrical insulation.

Controller – A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

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

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

Electrical Safety – Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.

Electrically Safe Work Condition – A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with *applicable procedures* and established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Electrical Shock, Reportable – *Any electrical shock is classified as an injury and must be reported immediately to supervision in accordance with DOE Order 231.1A. The employee must not attempt to evaluate the severity of the shock or its effects without medical consultation.*

Energized – Electrically connected to, or is, a source of voltage.

Equipment – A general term including fittings, devices, appliances, luminaires, apparatus, machinery,, and the like, used as part of, or in connection with, an electrical installation.

Equipment Utilization – *Equipment that uses electrical energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.*

Examination – *Examination process described in 29 CFR § 1910.303(b) (1), Examination, and NFPA 70, Article 110.3, Examination, Identification, and Use for Equipment. These examinations are performed by a qualified person to ensure that electrical equipment is free from recognized hazards that are likely to cause death or serious physical harm.*

Appendix A – Acronyms/Definitions (continued)

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.

Exposed (as applied to wiring methods) – On or attached to the surface or behind panels designed to allow access.

Flame Resistant – The property of a 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.

Fuse – An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it**.**

Ground – A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth or to some conducting body that serves in place of the earth.

Grounded (Grounding) – Connected (connecting) to ground or to a conductive body that extends the ground connection.

Ground Fault – An unintentional, electrically conducting connection between an ungrounded conductor of an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth.

Grounded, Solidly – Connected to ground without inserting any resistor or impedance device.

Grounded Conductor – A system or circuit conductor that is intentionally grounded.

Ground Fault Circuit Interrupter – A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device.

Incident Energy – The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter ($cal/cm^{2)}$

Insulated – Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

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

Nationally Recognized Testing Laboratory – An organization acceptable to the AHJ and concerned with product evaluation that maintains periodic inspection of production of listed equipment and materials. The NRTL ensures that the equipment or materials meet appropriate designated standards or have been tested and found suitable for use in a specified manner (refer to 29 CFR § 1910.7, Definition and Requirements for a Nationally Recognized Testing Laboratory).

Appendix A – Acronyms/Definitions (continued)

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

Overcurrent – Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit or ground fault.

Panelboard – A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent 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..

Personnel – Contractor workers, subcontractor workers, and other on-site vendors working under direction of the Contractor.

Qualified Person – One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved. Qualified personnel will include, but not be limited to, degreed electrical engineers and electricians/instrument technicians (see Appendix D for qualifications) and electrical/instrument supervisors.

Raceway – An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in NFPA 70E. *Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate conduit, flexible metallic tubing, flexible metal conduit, electrical metallic tubing, electrical nonmetallic tubing, underfloor raceways, surface raceways, wireways, and busways.*

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.

Restricted Approach Boundary – An approach limit at a distance form an exposed energized electrical conductor or circuit parts within which there is an increased risk of shock, due to the electrical arc over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

Service – The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

Service Equipment – The necessary equipment, usually consisting of a circuit breaker or switch(es) and fuse(s), and their accessories, connected to the load end of service conductors to a building or other structure and intended to constitute the main control and cutoff of the supply.

Service Point – Service Point, as defined in NFPA codes and standards, is the point of connection between the facilities of the serving utility and the premises wiring. (1.) The point usually is established by the serving electrical utility. (2.) Since PGDP acts as the serving utility, the PGDP Power & Utilities Manager will establish the point for the site, with approval of the ESC. Locations other than that established with this decision shall be permitted to be identified as the service point with special permission in writing by the Electrical AHJ.

Shock Hazard – A dangerous condition associated with the possible release of energy caused by contact or approach energized electrical conductors or circuit parts**.**

Appendix A – Acronyms/Definitions (continued)

Spotter – A designated person whose function is to direct industrial equipment operators under or near overhead installations or other hazardous travel obstructions or areas to ensure that required safe clearance is maintained.

Unqualified Person – A person who is not a qualified person. One who does not have the skills and knowledge related to the construction and operation of electrical systems and equipment, and has not received training on the hazards involved.

Voltage, Nominal – A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts).

Working Near (energized electrical conductors or circuit parts) – Any activity inside a limited approach boundary.

Working On (energized electrical conductors or circuit parts) – Intentionally coming in contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment (PPE) a person is wearing. There are two categories of "working on": **Diagnostic (testing)** is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment; **repair** is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.).

Appendix B – Scaffold Distances to Energized Power Lines

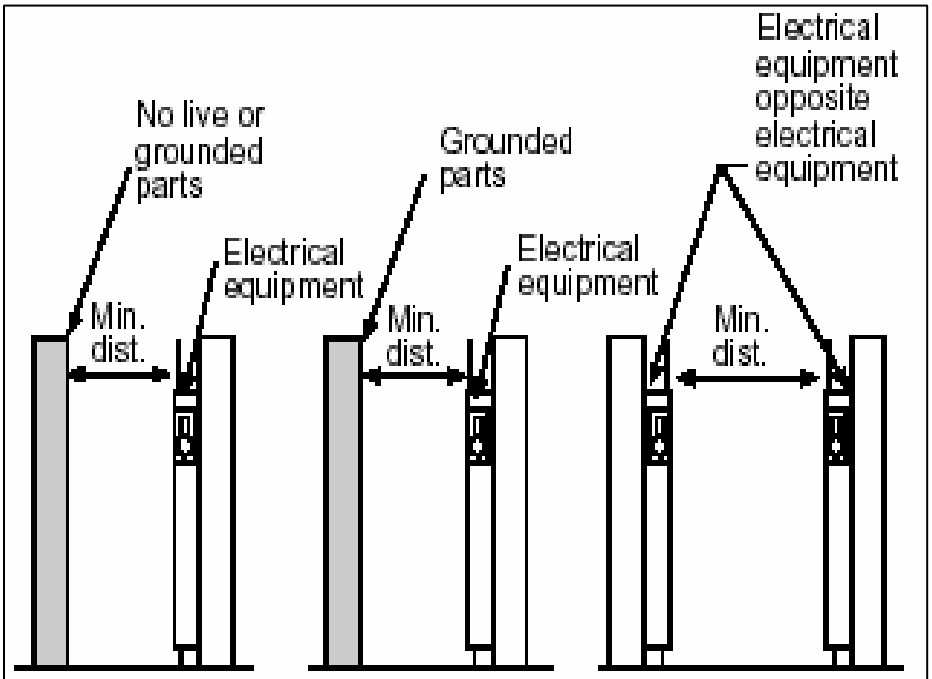
SCAFFOLD DISTANCES TO ENERGIZED POWER LINES

Insulated Lines		
Voltage	**Minimum Distance**	**Alternatives**
Less than 300 Volts	3 Feet (0.9 m)	
300 Volts to 50 kV	10 Feet (3.1 m)	
More than 50 kV	10 Feet (3.1 m) plus 0.4 inches (1.0 cm) for each 1 kV over 50 kV	2 times the length of the line insulator, but never less than 10 feet (3.1 m)

Uninsulated Lines		
Voltage	**Minimum Distance**	**Alternatives**
Less than 50 kV	10 Feet (3.1 m)	
More than 50 kV	10 Feet (3.1 m) plus 0.4 inches (1.0 cm) for each 1 kV over 50 kV	2 times the length of the line insulator, but never less than 10 feet (3.1 m)

Appendix C – Working Spaces

WORKING SPACES



Condition 1		Condition 2		Condition 3	
Volts to ground	Min. dist.	Volts to ground	Min. dist.	Volts to ground	Min. dist.
0 - 150 V	3 ft.	0 - 150 V	3 ft.	0 - 150 V	3 ft.
151 - 600 V	3 ft.	151 - 600 V	3 1/2 ft.	151 - 600 V	4 ft.

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Appendix D – Electrician, Instrument Technician, and Task Qualified Operator Qualifications

Qualified Electrician

Qualification:

Documented evidence of qualification shall be provided and maintained for each Qualified Electricians [qualified to work on/or near installed electrical systems up to 161 kV (nominally)]. The employer shall make the determination as to qualification, but one of the following should be considered as guidelines for a determination basis:

1. Be an established journey-level electrician working on the Paducah Site before the date of implementation of this document.

OR

2. Meet at least **one** of the following:

A. Verification of completion of a recognized apprenticeship program that includes:

i. Minimum of 8,000 hours on-the-job supervised experience.

AND

ii. Minimum of 900 hours classroom training.

B. Equivalent military experience with any combination of five years training or experience applicable to the task assignment.

C. Minimum five years industry experience related to job responsibilities.

D. Verification of completion of a technical school and equivalent industry experience that includes:

i. Minimum of two years at a recognized technical school.

AND

ii. Minimum of three years of industry experience with related responsibilities.

E. Management has conducted observations and evaluations and determined the employee, based on experience, training, and/or education, is qualified to perform job responsibilities.

Appendix D – Electrician Technician, Instrument Technician, and Task Qualified Operator Qualifications (continued)

Qualified Instrument Technician

Qualification:

Documented evidence of qualification shall be provided and maintained for each Qualified Instrument Technician [qualified to work on/or near installed instruments/instrumentation systems operating up to 250 Volts (nominally) and to work near installed electrical systems up to 480 Volts (nominally)]. The employer shall make the determination as to qualification, but one of the following requirements should be considered as guidelines for a determination basis:

1. Be an established instrument specialist working on the Paducah Site before the date of implementation of this document.

OR

2. Meet at least one of the following:

A. Verification of completion of a recognized apprenticeship program that includes:

i. Minimum of 8,000 hours in a recognized apprentice program.

AND

ii. Minimum of three years of industry experience.

B. Equivalent military experience with any combination of five years training or experience applicable to the task assignment.

C. Minimum five years industry experience related to job responsibilities.

D. Verification of completion of a technical school and equivalent industry experience that includes:

i. Minimum of two years at a recognized technical school.

AND

ii. Minimum of three years of industry experience with related responsibilities.

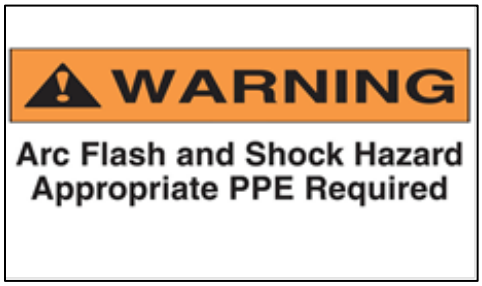
E. Management has conducted observations and evaluations and determined the employee, based on experience, training, and/or education, is qualified to perform job responsibilities.

Task Qualified Operator

Qualification:

Documented evidence of qualification shall be provided and maintained for each task qualified operator [qualified to work on/or near installed energized electrical equipment up to 480 Volts (nominally) and rack switchgear breakers on energized switchgear using the appropriate PPE up to 5,000 volts]. The employee shall complete plant training module 04315CBT and F00367 prior to performing work on or near electrical equipment.

Appendix E – Arc Flash Label (Typical Label Used)



CP3-SM-0019-F01 – Risk Assessment and Electrical PPE Selection Form

Job Scope, Location and Activity Information

Location: _____ **Activity:** _____

Job Scope: _____

Risk Analysis/Hazards/Controls or Compensatory Actions used to eliminate or minimize risks

Shock

Shock Exposure: _____ Volts

Arc Flash

Incident Energy Exposure (@18 inches unless otherwise stated): _____ Calories/cm^2

Arc Flash Boundary (≤ 1.2 cal/cm^2): _____ feet/inches

Are protective devices within PM date? ☐ **YES** ☐ **NO** ☐ **N/A**

Engineering: _____
Printed Name/Signature/Date

PPE Selection

Arc Flash PPE Selection: _____

_____

_____

Shock PPE Selection: _____

Supervisor: _____
Printed Name/Signature/Date

Craft / PPE Wearer: _____
Printed Name/Signature/Date

CP3-SM-0019-F01 – Risk Assessment and Electrical PPE Selection Form (continued)

Information for Completing Electrical PPE Selection Form (Page 1 of 2)

Arc Flash PPE By Incident Energy Exposure	
Incident Energy Exposure	**Protective Clothing and PPE**
≤ 1.2 cal/cm^2	
Protective clothing, nonmelting or untreated natural fiber	Shirt (long sleeve) and pants (long) or coverall
Other PPE	Face shield for projectile protection (AN) Safety glasses or safety goggles (SR) Hearing protection (in the ear) Heavy-duty leather gloves or rubber insulating gloves with leather protectors (SR)
≥ 1.2 to 12 cal/cm^2	
Arc rated clothing and equipment with an arc rating equal to or greater than the determined incident energy (see NOTE 2)	Arc rated long-sleeve shirt and arc rated pants or arc rated coverall or arc flash suit (SR) (see NOTE 3) Arc rated face shield and arc rated balaclava or arc flash suit hood (SR) (see NOTE 1) Arc rated jacket, parka, or rainwear (AN)
Other PPE	Hard hat Arc rated hard hat liner (AN) Safety glasses or safety goggles (SR) Hearing protection(in the ear) Heavy-duty leather gloves or rubber insulating gloves with leather protectors (SR) (see NOTE 3) Leather footwear
> 12 cal/cm^2	
Arc rated clothing and equipment with an arc rating equal to or greater than the determined incident energy (see NOTE 2)	Arc rated long-sleeve shirt and arc rated pants or arc rated coverall and/or arc flash suit (SR) Arc rated arc flash suit hood Arc rated gloves Arc rated jacket, parka, or rainwear (AN)
Other PPE	Hard hat Arc rated hard hat liner (AN) Safety glasses or safety goggles (SR) Hearing protection (in the ear) Arc rated gloves or rubber insulating gloves with leather protectors (SR) (see NOTE 3) Leather footwear

AN: As needed
SR: Selection of one in group is required
NOTES:
(1) Face shields with a wrap-around guarding to protect the face, chin, forehead, ears, and neck area are required by
(2) Arc ratings can be for single layer, such as an arc rated shirt and pants or a coverall, or for an arc flash suit or a multi-layer system consisting of a combination of arc rated shirts and pants, coverall, and arc flash suit.
(3) Rubber insulating gloves with leather protectors provide arc flash protection in addition to shock protection. Higher-class rubber insulating gloves with leather protectors, due to their increased material thickness, provide increased arc flash protection.

CP3-SM-0019-F01 – Risk Assessment and Electrical PPE Selection Form (continued)

Information for Completing Electrical PPE Selection Form (Page 2 of 2)

Gloves with Leather Protectors (for Hand Protection Only)					
Maximum Use Voltage ac rms	500V	1000V	7500V	17000V	26500V
Glove Class	Class 00	Class 0	Class 1	Class 2	Class 3

Shock Approach Boundaries

Nominal System Voltage Range, Phase-to-Phase	Limited Approach Boundary		Restricted Approach Boundary, Includes Inadvertent Movement Adder
	Exposed Movable Conductor	Exposed Fix Circuit Part	
Less than 50 V	Not Specified	Not Specified	Not Specified
50 V to 150 V	10 ft. 0 inch	3 ft. 6 inch	Avoid Contact
150 V to 750 V	10 ft. 0 inch	3 ft. 6 inch	1 ft. 0 inch
751 V to 15 kV	10 ft. 0 inch	5 ft. 0 inch	2 ft. 2 inch
161 kV to 169 kV	11 ft. 8 inch	11 ft. 8 inch	4 ft. 3 inch

CP3-SM-0019-F02 – National Electrical Code (NEC) Electrical Inspection Request Form (EIRF)

[Includes: new electrical installations, modifications to existing systems or equipment, temporary installations, and engineered changes (such as equivalencies, substitutions, facility changes, applicable installations approved by Engineering)]

1. Request No.:		
2. Issue Date:	3. Close Date: (if applicable)	
4. Request Issued By: (Print Name & Signature)		
5. Location Area:	6. Building:	7. Room:
8. Project or Work Package No:		
9. Directions (if no building number):		
10. Description of Electrical Installation, including designated NEC inspection points:		
11. Job Supervisor: (Print Name & Signature)	Phone No.:	
12. Point of Contact: (Print Name)	Phone No.:	

13. *TO BE COMPLETED BY DESIGNATED NEC INSPECTOR ONLY*

The following inspection areas shall not be concealed until inspected.					**Inspection Type**	**Approved By**		**Field Report**	
Inspection Type (Rough)	**Approved By**		**Field Report**			Initials	Date	Yes	No
	Initials	Date	Yes	No	**Service**				
Walls					**Transformer**				
Ceiling					**Generator**				
Grounding					**Feeder/Subpanel**				
Trench					**Mobile Office Service**				
Slab					**Final**				
Underground									

14. Notes:	
15. Date Completed:	NEC Inspector: (Print Name & Signature)