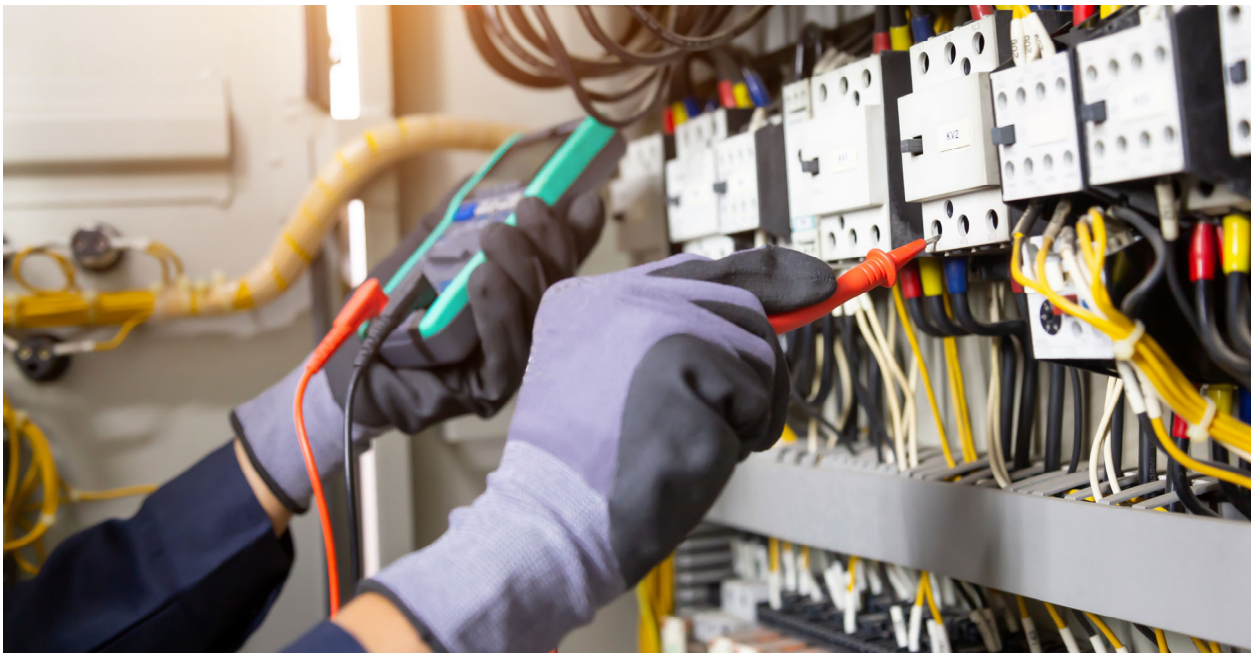
CAL POLY

Environmental Health and Safety,
Risk Management (EHSRM)

ELECTRICAL SAFETY PROGRAM



Prepared by: Melonee Cruse

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Policy

California Polytechnic State University, San Luis Obispo (Cal Poly) affirms its commitment to proactively identifying electrical hazards and controlling associated risks to ensure a safe working environment. The university prioritizes establishing an electrically safe work condition whenever feasible and expects all individuals working with or near electrical systems to follow safe work practices. This includes students, staff, faculty, and contractors engaged in tasks involving electrical wiring, conductors, equipment, or systems. All electrical work must be performed by qualified personnel who are trained in hazard recognition, mitigation, and compliance with applicable standards.

The Cal Poly Electrical Safety Program is built on the framework of NFPA 70E and incorporates all relevant codes, standards, and regulations, including those from OSHA, Cal/OSHA, and other recognized authorities. All personnel must be familiar with and adhere to current electrical safety requirements, including the use of appropriate personal protective equipment, lockout/tagout procedures, and hazard assessments. At a minimum, individuals working on or near electrical systems must understand and follow the Cal Poly Electrical Safety Program to ensure regulatory compliance and prevent injury.

At a minimum, all personnel performing activities with, or around electrical systems shall know, understand, and follow all the requirements contained within this written Cal Poly Electrical Safety Program.

Scope and Application

This Electrical Safety Program applies to all personnel, contractors, vendors, and visitors (herein referred to as “persons”) who perform or are exposed to electrical work at California Polytechnic State University, San Luis Obispo (Cal Poly), and is applicable for work at low (600V or less) and high (greater than 600v) voltages. Electrical work (herein referred to as “work”) includes any direct or indirect contact with electrical utilization equipment, such as operating (e.g., inspecting, switching, racking), maintaining (e.g., tightening, troubleshooting, replacing), commissioning (e.g., installing, testing, tuning), and decommissioning (e.g., removing, demolishing). This includes work on or near electrical wiring, conductors, equipment, and optical fiber cables in proximity to electrical sources.

This document establishes the minimum requirements and safe work practices for the design, operation, and maintenance of electrical systems in all Cal Poly-owned, managed, and leased facilities. It applies to both new and modified installations. Existing installations are not required to be physically altered unless necessary to eliminate a recognized hazard or comply with regulatory mandates. Personnel servicing office equipment, medical devices, vending machines, appliances, or similar items must follow manufacturer safety recommendations. All persons are responsible for adhering to the written electrical safety rules, procedures, and practices outlined in this program. When in doubt, individuals must STOP WORK and consult their supervisor or manager. More stringent local codes, standards, or design criteria shall take precedence over the minimum requirements in this document.

Roles and Responsibilities

Please see the California State University Environmental Health and Safety Policy, EO 1039, and the Cal Poly Injury and Illness Prevention Program Section 7.0 for a detailed description of staff and faculty safety responsibilities.

All Cal Poly employees shall comply with the following::

- An employee who observes or detects any health or safety hazard shall report it to the appropriate administrator as soon as possible.
- When an employee, in good faith, believes that he/she is required to work under unhealthy and unsafe conditions, or without adequate safety equipment and clothing, he/she shall notify the appropriate administrator.

Facilities Management and Development (FMD) and Facilities Operation (FacOps) shall:

- Disseminate the Electrical Safety Program to all relevant staff and qualified contractors to ensure awareness and compliance.
- Review and verify that employees assigned to electrical work are properly qualified and capable of performing their specific job duties safely.
- Inform contract employers of any known electrical hazards related to their scope of work that fall below the standards of this program.
- Ensure that area-specific safety rules, practices, and procedures outlined in the Electrical Safety Program are properly implemented. Managers may delegate this responsibility to electrically qualified personnel.
- Enforce compliance with Lock Out/Tag Out procedures in accordance with the Cal Poly Control of Hazardous Energy Program and electrical safety training guidelines.
- Initiate necessary administrative actions to uphold and enforce electrical safety practices across all applicable areas.
- Provide ongoing financial support to maintain and sustain the Electrical Safety Program.

Departments managers and supervisors with qualified and non-qualified personnel are responsible for the safety of all persons under their direction, and must:

- Ensure all program users have received the Electrical Safety Program and understand their roles and responsibilities within it.
- Confirm that all qualified persons and qualified electrical workers have been properly designated and have completed the necessary training to perform their assigned tasks safely.
- Monitor and ensure that workers consistently follow safe work practices aimed at preventing injuries and illnesses related to electrical hazards, including conducting observations and reviewing Job Hazard Analyses (JHAs).
- Verify that all personnel adhere to established safety rules and standard operating procedures during electrical work.
- Ensure that unqualified and unprotected individuals are kept outside the Limited Approach Boundary and Arc Flash Boundary of energized electrical equipment unless accompanied by a qualified person.
- Oversee compliance with Cal Poly job planning documents for both qualified and unqualified electrical personnel.

- Confirm that approved workers are knowledgeable about the appropriate tools and devices for their tasks and understand how to inspect and test them prior to use.
- Provide employees with the necessary safety equipment, including personal protective equipment (PPE) designed to prevent electrical and arc flash injuries, at no cost to the employee.
- Stay informed and up to date on all specifications, standards, and rules relevant to the electrical work performed by their teams.

Program Users

Employees who repair, maintain, or work with or near electrical equipment or installations must:

- Read and comply with procedures and guidelines provided by their supervisors.
- Inform their supervisors of workplace hazards without fear of reprisal.
- Attend established training sessions; understand and comply with all applicable safety requirements.
- Recognize and report that malfunctioning electrical equipment must be repaired or replaced before use,
- Ask their supervisors questions when there is concern about an unknown or potentially hazardous situation.

Other Roles

Qualified Electrical Person - A Qualified Person who by reason of a minimum of two years of training and experience with high-voltage (over 600V) circuits and equipment and who has demonstrated by performance familiarity with the work to be performed and the hazards involved.

A Qualified Electrical Person is approved by their manager and capable of:

- All skills and knowledge of a Qualified Peron,
- Properly apply energy isolation procedures to ensure safe work conditions before beginning electrical tasks.
- Inspect and test electrical equipment and tools for damage or defects prior to use.
- Safely perform work on energized components using appropriate precautionary practices, including the correct use and selection of personal protective equipment (PPE), insulating and shielding materials, and insulated tools.
- Identify and address specific electrical hazards associated with their assigned tasks.

<u>Qualified Person</u>
One who has skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training on the hazards involved. A Qualified Person is designated by the employer or manager by demonstrating their ability to safely perform their duties and, where required, is properly licensed in accordance with federal, state, or local laws and regulations. They are responsible for:

- Identifying hazards and how to reduce risks
- Following the proper safety precautions and applicable Cal Poly job planning documents.

- Knowing the appropriate tools and devices for each task assigned to them and how to inspect and test those tools and devices before beginning work.
- Distinguishing exposed live parts from other parts of electrical equipment
- Determining nominal voltage of exposed parts and the clearance distance specified in OSHA and the corresponding voltages to which they are exposed.
- Being knowledgeable and current on the applicable specifications and rules applying to their jobs.

Only Trade staff, in circumstances approved by supervisor, can work on low voltage electrical circuits of less than 600volts.

Non-Qualified Person

A person who may be exposed to electrical hazard or work within the limited approach boundaries but who is not authorized as a Qualified Person or Qualified Electrical Worker. A Non-Qualified Person:

- Must be aware of possible electrical hazards, even when task does not involve electrical work.
- Is not permitted in Arc Flash, Limited Approach, or Restricted Approach Boundaries unless escorted by a Qualified Electrical Person and wearing appropriate PPE.

Un-Qualified Persons

A person who does not have the training to work near exposed electrical hazards or within the limited approach boundaries. An Un-Qualified Person must:

- Always be aware of possible electrical hazards even when their tasks do not involve electrical work, such as the operation of power tools or mobile cranes, use of ladders, and materials handling.
- Never enter an Arc Flash Boundary or Limited Approach Boundary of energized parts unless escorted by a qualified person and wearing the proper Arc-Rated PPE. Unqualified Personnel will not need shock protection PPE, because they are not permitted to cross the Restricted Approach Boundary.

Escorts

A Qualified Person or Qualified Electrical Worker escorts an Un-Qualified Person. An Escort:

- Must continually safeguard the people in their care and ensure that safety regulations are observed.
- Must ensure that unqualified personnel never cross the Restricted Approach Boundary.

Contractors, Subcontractors, and Contracted Services

- Employees of contractors, subcontractors, and contracted services to Cal Poly (herein referred to as “contractors”) shall follow all safety regulations required through their own written Electrical Safety Program.
- Contractors to Cal Poly shall certify that their program is in concert with the latest NFPA 70E edition and has been updated within the last three years. When such persons are unable to provide their own program, they shall undertake to comply with this program. In such instances, a documented undertaking of compliance is required before work commences.

Environmental Health and Safety

- Shall review and update this program periodically or when regulatory changes occur.
- Review training and training vendors, as necessary.
- Provide consultation upon request.
- Shall conduct annual program audits.

Program Requirements and Procedures

I. Approved Workers

Knowledge of this document does not make a person qualified. Only Cal Poly shall determine the appropriate level of electrical work experience, and the amount of training required to deem a person qualified for specific electrical work or specific tasks. Approved worker titles include:

- Electrician
- Lead Electrician
- Supervising Electrician
- Building Service Engineer
- Refrigeration Mechanic
- Facilities Control Specialist
- Facility Worker 2
- Maintenance Mechanic
- Supervising Building Service Engineer

Any non-University employee performing work on electrical conductors and equipment must be a licensed contractor holding a valid C-10 license issued by the State of California and working under an approved Building Permit or contract issued by Facility Services.

EXCEPTION: Properly trained employees may work on department-owned electrically powered equipment (such as power tools, machines, computers, etc.) which has been disconnected from the building electrical system by one of the following means:

- Disconnection of the attachment plug from the receptacle.
- Operation and lockout of a mechanical disconnect means to disconnect the equipment from the source of supply. The campus lockout procedure must be followed, and this lockout may ONLY be performed by a campus electrician.

II. Hazard Assessments Procedures

Risk Assessments

Cal Poly shall identify all hazards (electrical and non-electrical), assess, and estimate the risk of the hazard resulting in harm, and provide means to control the risk using the Hierarchy of Risk Control methods. Where the hazard cannot be eliminated, appropriate personal protective equipment and training shall be provided. The risk assessments shall be completed using the NFPA 70E procedures (2024) (Annex J, Energized Electrical Work Permit, Part II). The NFPA form or similar must be completed to indicate work will be conducted on energized or non-energized equipment. Other acceptable Risk Assessment documents include:

- Job Safety Planning Checklist or Task Hazard Assessment
- Energized Electrical Work Permit.

- A Qualitative Two-by-Two Risk Assessment Matrix as described in NFPA 70E.

IMPORTANT: The completed Risk Assessment and all energized electrical work procedures and SOPs must be documented and available upon request to affected personnel, regulatory officials, including Cal Poly EHS and Cal/OSHA.

Hierarchy of Risk Control Methods

During the risk assessments, (Shock and Arc Flash), the qualified person(s) shall ensure that risks are controlled using the following Hierarchy of Controls in this order of effectiveness:

- Elimination – Removal of the energy source(s); e.g., create an electrically safe work condition using the Cal Poly Control of Hazardous Energy (Lockout/Tagout, LO/TO) Policy and Program and taking into consideration the failure of the physical lockout system or the infrastructure on which the lockout equipment is built
- Substitution – Replacing with less hazardous equipment or materials, e.g., utilization of control voltages less than 50 Vac, the use of internally arc resistant equipment, substitution of persons with remote racking devices.
- Engineering Controls – Implementing safety through engineering control and design. These may include the optimization of protective device settings, use of Class A GFCIs at the distribution source instead of portable Class A GFCIs; system interlocks: preventing unauthorized access/operation by mechanically interlocking doors and switches.
- Awareness – The use of alerting techniques through warning labels, barricades, and attendants.
- Administrative Controls – These types of controls vary from organizational to individual level and will include, among others, compliance to this CAL POLY written Electrical Safety Program, training of groups, and training of individuals.
- Personal Protective Equipment (PPE) – PPE for arc flash and electrical shock is the last line of defense against electrical hazards. It is important that workers understand that PPE is the last option when the above-mentioned controls fail to adequately control the risks. PPE is also considered the least effective control.

Shock Risk Assessment

A shock risk assessment shall be performed to identify the shock hazards, estimate the likelihood of occurrence, and potential severity of injury, risk control methods and additional protective measures required.

The assessment to identify the shock hazards, and estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health shall take into consideration:

- the design of the electrical equipment and the electrical equipment operating condition and condition of maintenance.
- The human performance error precursors and required human performance tools. (Reference NFPA 70E Annex Q - 2024),
- If additional protective measures are required, including the use of PPE.
- If additional protective measures are required, they shall be selected and implemented according to Hierarchy of Risk Control Methods.

When additional protective measures include the use of PPE, the following shall be determined:

- The voltage to which the personnel will be exposed.
- The boundary requirements.
- The personnel and other protective equipment are required to protect against

the shock hazard.

Shock Protection Boundaries

Shock protection boundaries are identified as the Limited Approach Boundary and the Restricted Approach Boundary. They are applicable to situations in which approaching personnel are exposed to uninsulated energized electrical conductors or circuit parts (e.g., busbar, terminations, lugs, etc.).

Distances associated with Shock Protection Approach Boundaries to Exposed Electrical Conductors or Circuits for Alternating and Direct Current Systems, are found in NFPA 70E Article 130.
Note: Voltages are limited to values that align with this Cal Poly electrical systems and this program.

Arc Flash Risk Assessment

An Arc Flash Risk Assessment is required before a person interacts or works on an electrical equipment (excluding cord and plug connected equipment) that has not been placed in an electrically safe work condition. The Arc Flash Risk Assessment aims to protect personnel from the possibility of being injured by an arc flash by identifying the arc flash hazards, determining the appropriate safety-related work practices, arc flash boundary, and PPE to be used within the arc flash boundary. The results of the arc flash risk assessment shall be documented. An arc flash risk assessment shall be performed to identify the arc flash hazards, estimate the likelihood of occurrence, potential severity of injury, risk control methods and additional protective measures required.

The following information is required as part of the assessment to identify the arc flash hazards, estimate the likelihood of occurrence of injury or damage to health, and the potential severity of injury or damage to health. It shall take into consideration the following:

- The design of the electrical equipment including its overcurrent protective device and its operating time;
    - The electrical equipment operating condition and condition of maintenance, and.
    - The human performance error precursors and required human performance tools. (Reference NFPA 70E Annex Q)

If additional protective measures are required, they shall be selected and implemented according to the Hierarchy of Risk Control Methods.

When additional protective measures include the use of PPE, the following shall be determined:

- Appropriate safety-related work practices.
- The arc flash boundary.
- The PPE to be used within the arc flash boundary.

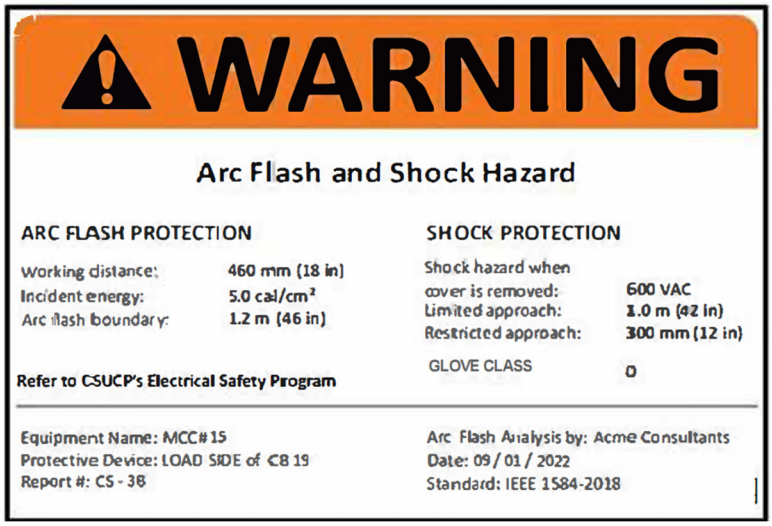
Table 130.5(C) from NFPA 70E shall be permitted to be used to estimate the likelihood of occurrence of an arc flash event to determine if additional protective measures are required.

<u>Arc Flash Boundary</u>

The arc flash (protection) boundary shall be the distance at which the incident energy equals 1.2 cal/cm² (onset of a second-degree burn). It shall be determined through an Incident Energy Analysis Calculation using IEEE 1584 or the Arc Flash PPE Category Method.

Arc Flash and Shock Labels

Labels with the voltage for shock PPE, arc flash boundary, and the site-specific PPE level or incident energy in cal/cm² and working distance shall be attached to all electrical devices that have space to accept at least a 4x4 inch label.



Methods for Determining Incident Energy

An Arc Flash Hazard Incident Energy Analysis Method shall determine the potential incident energy based on the IEEE 1584 guidelines and parameters using calculation software to predict the available arc thermal energy from the source of an electric arc fault. The incident energy analysis and shock equipment labels shall be updated when:

- A major modification or renovation or any changes in the electrical distribution system have taken place that could affect the results of the current arc flash incident energy analysis.
- If no changes in the electrical distribution system have taken place, the current arc flash incident energy analysis shall be reviewed at intervals not exceeding five (5) years.

The Arc Flash PPE Category Method shall be used as follows if an Incident Energy Analysis has not been completed to predict the available arc thermal energy from the source of an electric arc fault:

- Determine the maximum available fault current and the maximum fault clearing time of your upstream protective device, for example at a fused disconnect switch or circuit breaker. They must fall within the parameters as found at NFPA 70E(2024)Tables 130.7(C)(15)(a) for AC or Table 130.7(C)(15)(b) for DC or less to be valid. If not, an incident energy analysis shall be done.

- Next determine the arc flash boundary. These boundary distances can be found at NFPA 70E (2024)Tables 130.7(C)(15)(a) for AC or Table 130.7(C)(15)(b) for DC).

- The Arc Flash PPE Category and the Working Distance can also be found using NFPA 70E Tables 130.7(C)(15)(a) for AC or Table 130.7(C)(15)(b) for DC.
- Work on life safety systems (e.g., emergency lighting, fire alarms, ventilation systems) shall be performed using energized electrical work practices or preferably during off-hours when these systems can be safely taken out of service. If de-energization is required, prior approval from Cal Poly EHS is mandatory. Additional safeguards such as fire watch, security notification, and emergency response team coordination must be implemented to maintain life safety protection.

See OSHA 1910.269 Appendix E – Protection from Flames and Electric Arcs for further guidance if required.

Fall Protection

A fall protection assessment shall be done on equipment before any task begins. Fall protection shall meet the requirements of Cal Poly Fall Protection Program. Fall protection equipment shall be arc tested per ASTM F887 for use within an arc flash boundary.

Human Performance

Human performance influences the risk of worker injury. To reference human performance, this electrical safety program is in concert with the NFPA 70E (2024) – *Informative* Annex Q – Human Performance and Workplace Electrical Safety. In addition to items listed elsewhere, human performance shall be specifically addressed in all job safety plans. The following error reduction tools assist in reducing the potential for human errors. These are just some of the examples.

- Job Safety Planning Checklist and Tailgate
- Job site hazard identification: Shock and arc flash risk assessments included in the Job Safety Planning Checklist.
- Post job review: Learn from prior experiences to improve processes.
- Procedural use and adherence: Step-by-step list of actions to be performed, with each item checked off as the task is completed.
- Self-check: Verbalize the action to be performed, again while performing the action, and finally upon completion.
- Communication: Usage of phonetic alphabet for *"robust clarity"* with three-way communication: action read out by the sender to the receiver, receiver verbally confirms action to sender, sender confirms instruction to receiver.
- Stop when unsure: Addresses vague or generic instructions or procedures. STOP all work and clarify with supervisors and/or managers before proceeding.
- Flagging and blocking: Identifies equipment that is energized and that which is de- energized. Prevent access or force access into a single zone only.

Job Safety Planning Checklist

A "Quality" Job Safety Planning Checklist shall be completed before working on or near electrical circuits and parts. The Job Safety Planning Checklist shall be completed by a qualified person to identify the information required. Following the completion of the Job Safety Planning Checklist, a formal tailgate shall be completed and recorded.

Job Briefing:

The job briefing shall cover the job safety plan and the information on the energized electrical work permit if a permit is required. Additional job safety planning and job briefings shall be held if changes occur during the work that might affect the safety of employees. For routine or repetitive tasks, a daily tailgate shall be conducted before the beginning of each shift. The tailgate is permitted to be a brief discussion and shall cover such subjects as identified hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements. Additional tailgates shall be held if any changes that might affect the safety of employees occur during the work. Before a non-routine or complex electrical work operation begins, personnel shall evaluate the safety concerns and precautions regarding the task. Whenever work conditions or methods change that could potentially compromise personnel safety, additional safety evaluations shall be conducted.

Emergency Preparedness

Life Safety Protocols

Work on life safety systems (e.g., emergency lighting, fire alarms, ventilation systems) shall be performed using energized electrical work practices or preferably during off-hours when these systems can be safely taken out of service. If de-energization is required, prior approval from Cal Poly EHS is mandatory. Additional safeguards such as fire watch, security notification, and emergency response team coordination must be implemented to maintain life safety protection.

Electrical Injury Response Protocol

In the event of an electrical injury, do not touch the injured person unless you are certain they are no longer in contact with the electrical energy source and the area is confirmed to be safe. Making direct physical contact with someone still energized can result in secondary injury. Immediately call emergency services/UPD (dial 911) before initiating any first aid procedures. Do not attempt to remove burned clothing, as this may cause further harm or interfere with medical treatment.

Per OSHA standards, exposure to voltages 50 volts and above is considered hazardous due to the risk of cardiac arrest or ventricular fibrillation. For work involving 600 volts or more, Cal Poly requires that two qualified workers always be present with one worker to perform the task and the other to assist or provide CPR/first aid if necessary. This protocol ensures rapid response in case of an emergency and reinforces Cal Poly's commitment to safe electrical work practices.

Investigations

Any incident that resulted in harm or could have resulted in harm to a person or damage to equipment shall be reported and documented. Note: Any electrical shock incident of any kind at any level shall require immediate medical attention at the nearest hospital. Cal Poly shall determine whether a formal investigation is required. Cal Poly shall trend and analyze incidents to determine areas of improvement. Electrical incidents shall be investigated using the existing investigation procedure. If an investigation procedure does not exist, Cal Poly shall ensure that a suitable procedure, addressing investigation guidelines with the necessary forms, is developed and workers are trained on the procedure .Contractor incidents shall be independently reviewed by Cal Poly and formally reported to form part of the safety trending and analysis.

Protective Measures

Personal Protective Equipment (PPE)

Personnel shall wear the personal protective equipment required to provide protection against hazards associated with a specific task. When performing tasks on equipment that might produce an arc flash, personnel shall take the appropriate safety precautions and wear the appropriate level of personal protective equipment for the incident energy and estimated risks at the work location.

Personnel shall not wear articles containing conductive material, such as rings, metal watch bands, metal-framed eyewear including metal-framed safety glasses, and dangling metal jewelry or keys, when within the most restrictive electrical safety boundary. These articles may be allowed, as per the risk assessments, only if totally covered or protected against

conducting electricity from the source or heating (and exacerbating burns) from an arc flash.

Determining PPE for the Arc Flash Hazard

When the arc flash risk assessment is conducted using the Incident Energy Analysis Method, using IEEE 1584, Table 3 provides guidelines for selecting PPE.

Head Protection

Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with energized electrical conductors or circuit parts or from flying objects resulting from electrical flash / blast. Employees shall wear nonconductive protective equipment for the face, neck, and chin whenever there is a danger of injury from exposure to electric arcs or from flying objects resulting from arc blast. If employees use hair nets or beard nets, or both, these items shall be arc rated.

Eye Protection

Personnel shall wear ANSI Z87 approved eyewear with non-metallic frames when in areas with exposed, energized conductors.

Hearing Protection

Ear canal insert hearing protection shall be worn when working within the Arc Flash Boundary. Earmuffs can also be used at the same time for double protection. Hand

Protection - Gloves

Personnel shall wear rubber insulating gloves with approved leather protectors when working with or on any of the following:

- Energized or potentially energized conductors or parts.
- Any task within the restricted approach boundaries.
- Using rated insulated or live-line tools.

Personnel shall use the appropriate gloves rated for the electrical voltage task involved.

Personnel shall only use rubber insulating gloves that have been detected dielectrically tested within the previous six months. New rubber gloves shall be dielectrically tested before first use. The dielectric testing of insulating rubber gloves shall be in accordance with ASTM F496 Standard.

Personnel shall always inspect, and air test their rubber insulating gloves before each day's use. If any damage is suspected, personnel shall not use the gloves until the gloves have been dielectrically tested and approved for further use. Rubber-insulating gloves shall be stored, fingers up, in an approved canvas glove bag or equivalent protective location. The approved leather protectors shall also be checked daily for damage, e.g., embedded metal and contaminants.

Voltage-Rated Sleeves, Blankets, Covers

New voltage-rated blankets or covers shall be dielectrically tested before use and then again once every 12 months. They shall be visually inspected for damage each day before use. When not in use, they shall be stored in containers designed for the purpose. If damage is suspected, they should be dielectrically tested before being used again.

Foot Protection

Footwear shall comply with corporate or location requirements. Personnel shall wear leather footwear with EH (Electrical Hazard) rated soles meeting the requirements of ASTM F 2413 when in areas with exposed, energized conductors. Fall harnesses and lanyards used within the Arc Flash Boundary shall be arc tested and meet ASTM F887.

Arc Flash Protective Equipment

- Arc-rated clothing - Flash suits and daily work clothing shall meet the requirements of ASTM F1506. Note: All AR is FR but not all FR is AR.
- Arc-rated head protection - Arc-rated fabric used in head protection shall meet the requirements of ASTM F1506. Arc-rated flash suit hoods, face shields, arc rated goggles, balaclavas and completed head protection assemblies shall be tested to ASTM F2178.
- Arc-rated hand protection - Arc-rated hand protection shall be tested to ASTM F2675

Care and Maintenance of Arc-Rated Clothing

Arc-rated clothing that is heavily contaminated (with grease, oils, flammable liquids, etc.) shall not be used. An incidental amount of contamination will not normally impair the protective rating of the clothing. No arc-rated garment shall be repaired by the user. Garments requiring repair shall be returned to the supplier. All arc-rated clothing and protective equipment shall be stored in a storage bag, in a clean, room temperature type environment.

Tools

Listed and Rated Test Equipment and 1000V Insulated Hand Tools Each person shall use listed and rated insulated hand tools meeting ASTM F1505 and test equipment within the Restricted Approach Boundary of exposed electrical conductors or circuit parts where tools or handling equipment might make accidental contact.

All electrical test equipment shall be inspected for damage before and after use. Functionality must be verified using a known voltage source. Test equipment shall be calibrated annually at a minimum and recalibrated immediately if calibration is in doubt. When using and caring for hand tools, personnel shall keep them in proper working condition.

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II. Required Safe Work Practices

Applicable for 50 to 15 kV Vac and to 1000 Vdc

Electrical Spaces

Employees shall not enter spaces containing exposed energized circuit parts or conductors nor perform tasks within the limited approach boundary of exposed energized circuit parts or conductors if the work cannot be seen because of obstructions or a lack of lighting.

Electrical Equipment

- Electrical equipment shall be properly labeled such that the power source and service are well described as accurate and up-to-date Single Line Diagrams (SLD's) and easily located. Notify staff personnel when labels are missing, incorrect, or illegible. This is a critical component of Cal Poly's LO/TO Program.
    - In the event of a fire in any electrical equipment, de-energize the source before extinguishing the fire(s). Do not use water to fight fires unless specifically trained to do so.
    - Do not rack electrical circuit breakers in or out while they are in the closed position or onto an energized bus.
    - Do not operate a non-load break switch under load.

- Do not block push buttons in "start" or "run" positions.
- Purged Enclosures (Enclosures which are purged to reduce Electrical Hazard Classification):
    - Do not open purged enclosures in hazardous areas without a safe/hot work permit unless all power is in the electrically safe work condition.
    - Do not restore power to an enclosure that has been opened by staff personnel until the enclosure has been sealed and purged for the time period stated on the enclosure nameplate.
    - Do not direct steam vents, water, or steam hoses directly on enclosures.
    - Report malfunctioning purge pressure gauges, damaged enclosures, faulty purge tubing, and fittings, loose or missing bolts/latches, open doors, missing enclosure labels, and missing or loose sealing conduit plugs immediately to staff personnel for correction.
- Employees shall not reach blindly into areas which may contain energized parts.

Electrical Supply Conductors

- 0 to 22 kV, nominal, phase to ground:
    - Electrical supply conductors shall have a minimum vertical clearance over *roadways* of 18.5 feet from grade.
- For any electrical supply conductors lower than the minimum vertical clearances listed above, safe work practices and documented procedures shall be taken to safely raise the conductors up to, or exceeding, the above minimum vertical clearances. Appropriate signage shall be safely placed under the conductors to warn personnel of the restricted clearances.

Damaged Electrical Equipment - Report to management any observed physical damage to motor control centers, transformers, or other electrical equipment immediately. DO NOT TOUCH damaged equipment until proven safe by qualified electrical personnel.

Hazardous Area Classification and Equipment

- All equipment shall be approved for use in the Hazardous Area Classification in which it is located.
- Notify management immediately of any loose or missing bolts or latches on explosion-proof or purged enclosures. All bolts and latches are required to be in place and tight. See [§VIII(A)(ii)]: Purged Enclosures.
- Approved conduit seals shall be properly installed where required.
- If unapproved equipment must be used temporarily in a hazardous area, CAL POLY safe work practices shall be used.

Operating Electrical Equipment - Under no circumstances shall unqualified or unauthorized personnel operate electrical equipment.

Overcurrent Protective Devices

- The repetitive manual re-closing of circuit breakers or re-energizing circuits through replaced fuses is prohibited.
- After any overcurrent protective device operation, DO NOT re-close the circuit until the fault has been repaired or cleared by a qualified person from the circuit and the circuit can be safely energized. The only exception is if a device indicates a trip due to an overload rather than a fault condition, the circuit may be re-

energized one time only after the overload condition is cleared. If the circuit trips a second time, do not re-close; contact a qualified person for repair of the circuit.

- Overcurrent protection of electrical equipment shall not be modified even on a temporary basis, beyond that allowed by the current edition of the National Electric Code (NFPA 70).
- No system overcurrent protective device (OCPD) shall be removed from service while the circuit is energized, except as permitted by the current edition of National Electrical Code (e.g., removal for the purposes of an OCPD Preventative Maintenance (PM) program, as long as other circuit OCPDs are functional).
- Trip circuits on energized circuit breakers shall never be made inoperative.

Equipment Access Interlock Systems

Interlock systems shall not be bypassed or otherwise rendered inoperative while the equipment is energized, except when authorized testing is being performed or when work is being completed under an Energized Electrical Work Permit. A qualified person shall perform these tasks. Work areas must be clearly marked with labels, tags, or barriers during such operations. Upon completion of the task, the interlock system shall be restored to full operable condition. Under no other circumstances shall the interlock system be disabled or permanently rendered inoperable.

Working Surfaces

When performing any work on circuit parts or conductors, the working surfaces on which employees will stand or sit shall have the strength and structural integrity for adequate personnel support. Cable tray, cables, and raceways exist to support electrical wiring and, as such, do not inherently have the requisite strength and structural integrity to support personnel safely when working.

Electrical work in wet or damp locations shall be avoided unless absolutely necessary. If unavoidable, approval from the responsible supervisor is required. Precautions include using GFCI-protected cords, placing dry barriers over wet surfaces, removing standing water, and avoiding extension cords in such environments.

Raising/Lowering Material, Tools, and Equipment

All small equipment and tools used overhead shall be raised and lowered by a non-conductive hand line (such as clean polypropylene), canvas bucket, or other suitable method. Nothing shall be thrown or intentionally dropped. Personnel shall take care when working overhead to prevent dropping tools and materials. Tie off all tooling and devices as appropriate to the work task and area. Personnel below are to stay clear of overhead work to avoid being struck by falling objects. Always use danger barrier tape in a safe manner to ensure this safe work area.

Creating and Identifying the Safe Work Zone

Cal Poly shall comply with this policy for creating a safe work zone or its equivalent. Each task supervisor shall identify the safe work zone steps for the task(s) that is to be performed. The task supervisor shall detail the steps listed in this section and the personnel responsible for completing each step. Until these steps are completed, a safe work zone is not established. This method shall be used to establish a safe work zone together with the Cal Poly Lock Out/Tag Out Program.

Isolation and Safe Work Zone Creation

- De-energize and Confirm. The de-energize and confirm step includes instruction

or switching orders (Attachment E) (See CAL POLY's Lockout/Tagout Policy and Program) and confirmation of energy isolation to protect personnel and equipment, and to minimize disruption to plant operation.

- Tag and Lock Isolation Devices. Isolation devices shall be tagged and locked. (Refer to Cal Poly's Lock Out/Tag Out Policy and Program.)
- A written procedure outlining the agreed-upon lockout/tagout procedure to be used shall be mandatory between parties when generating and switching locations are influenced by distance, ownership, or organizational structure.
- Identify Work Zone. Personnel shall identify the safe work zone with appropriate barricading and warning signs.
    - During maintenance, testing, troubleshooting, renovations to existing installations and additions to installations where exposed energized parts or conductors are present, appropriate barricades or other identification shall be erected. The minimum boundaries of the work zone shall be determined by the size of the work area required for the task at hand, the arc flash boundary and limited approach boundary, whichever is greatest.
    - Appropriate warning signs and barricades shall be installed and/or attendants utilized to identify the work area, restrict unqualified personnel from entering, and prevent accidental contact with exposed, energized parts. At a minimum, the following protective measures shall be taken:
        - ✓ Restrict unqualified personnel from entering the area by displaying danger signs and erecting barricades or by posting an attendant.
        - ✓ Clearly mark the safe work zone.
        - ✓ In areas where equipment is similar in location and appearance, a clear identification method shall be used to identify the equipment safe to work on. This does not eliminate the need for independent verification of energy isolation.
        - ✓ Barricades and warning signs or attendants shall be used to differentiate and separate energized equipment from de-energized equipment and to lead personnel to the equipment safe for work or safe work zone.
        - ✓ Protection for qualified personnel from accidental contact with adjacent energized equipment shall be determined. Where protection is necessary, barricades or temporary barriers shall be installed.
        - ✓ In areas where the safety of vehicles and unqualified pedestrian traffic may be compromised, appropriate warning signs and barricades or attendants shall be used to identify where work on electrical equipment is being conducted.

Verify by Testing and Grounding - A qualified person shall test that all energy sources have been de-energized, verified for the absence of voltage and put in the electrically safe work condition using CAL POLY's LO/TO Program and Policy.

The test equipment used shall be verified both before and after testing.

Grounding is not generally used on lower voltage systems, 480 V/600 V. If grounding is required, it shall be approved by a Professional Engineer.

Releasing the Safe Work Zone

- Upon completing the work and it is safe to do so, the responsible personnel using CAL POLY's LO/TO Policy and Program shall:

- Remove warning signs and barricades.
- Remove personal locks and tags.
- Release the safe work zone for restoration of power.
- Notify the affected departments or units that power is ready to be restored before switching begins.

- Power shall be restored to the safe work zone in a controlled, safe way through a properly issued CAL POLY LO/TO Policy and Program process and procedures.

Where LOTO observations are required by Cal Poly Environmental Health and Safety to meet Cal/OSHA compliance, Attachment A or other comparable form may be used.

Signage

- Signs shall be used to provide information regarding a potential electrical hazard.
- Signs shall be made of a durable material consistent with the anticipated environmental conditions and expected length of exposure.
- The color and shape of signs shall be consistent with regulatory requirements. Reference ANSI Z535.
- The letters shall be large, highly visible, and easily seen in darkened, low-light situations.
- Standard International symbols (using SI units) shall be used as much as is practical.
- At a minimum, information or warning signs shall be located at the following locations:
  - On all substation doors, gates, and fences.
  - On all doors to all switchgear rooms, or other similar compartments where exposed, energized electrical parts are located.
  - Where a low voltage bus is supplied from two or more sources and an interlock system is not provided, thereby creating a back feed opportunity. Signs warning of this potential back feed shall be prominently displayed.
  - If temporary alterations made to the secondary voltage supply system may have back feed potential, a sign warning of this potential problem shall be conspicuously displayed until the need for the temporary alteration is abated.
  - At all low-profile electrical equipment installations where physical distance requirements for personnel and/or handling of conductive material cannot be met or are marginal.
  - At all overhead pipes, bridges, etc., where adjacent exposed, energized electrical conductors and parts pose potential electrical shock hazards to maintenance or construction personnel.
  - Where inadvertent electrical contact is possible and can reasonably be anticipated.
  - Where electrical supply conductors are lower than the minimum clearances as stated in [§VIII(A)(iii)].
  - These signs are temporary until minimum clearances are met.

Switching Requirements Operating Electrical Switches and Breakers with Doors Closed

Using the proper stand-to-the-side method: the following may be used by Cal Poly qualified

and task qualified persons for operating electrical switches and circuit breakers. This method of operating switches and circuit breakers should only be used after arc flash analysis calculations have been completed and arc flash and shock labels applied on non-internally arc resistant switchgear. For arc-resistant switchgear and motor control centers, personnel shall wear PPE protection as indicated by the manufacturer of the equipment and the site shock and arc flash risk assessment procedures.

- For electrical switches or breakers with an incident energy of 1.2 cal/cm² (Level 0) or less and considering a comprehensive arc flash risk assessment procedure and with all doors closed and all latches and covers in place per the manufacturer's design, e.g.; normal operating condition, no arc-rated clothing is required but is highly recommended if any arc flash risk is estimated at all. PPE shall be selected as per this Cal Poly Electrical Safety Program.
- For all electrical switches or breakers with incident energy greater than 1.2 cal/cm², PPE appropriate for the calculated incident energy and appropriate to a comprehensive arc flash risk assessment procedure shall be used when operating switches with doors closed. If any air vents or other openings are in the front or side of the enclosure, personnel shall wear the required level of PPE indicated on the arc flash label.
- For enclosures containing a Level 2 or less hazard the following applies:
    - Wear a clean heavy duty all-leather work glove, arc-rated glove, or voltage-rated glove on the hand operating the switch or breaker. This will offer protection from any heat escaping around the enclosure gasket.
    - If the circuit breaker has tripped or the switch fuses have opened due to a fault condition, wear the required PPE defined by the arc flash label and a comprehensive arc flash risk assessment procedure when the breaker is reset.
    - Transient personnel passing through electrical equipment rooms and outside the arc flash and limited approach boundary of any electrical work being performed require no special electrical PPE.

Maintenance

A maintenance program for CAL POLY is suggested for their electrical equipment as noted below. Where applicable, the following minimum condition-based monitoring shall be performed at the listed intervals. (See NFPA 70B for guidance)

- A thermographic inspection of all current carrying components shall be completed annually. Components needing repair found during the survey shall be scheduled as soon as possible.
- A visual inspection for cleanliness of all switchgear, motor control centers and power panels shall be completed annually.

This inspection can be combined with the thermographic inspection. Cleaning can be scheduled as required by condition with all panels cleaned every three years. It is recommended that one-third of the panels be scheduled for cleaning each year.

- Vibration analysis on all motors greater than 50HP
- Transformer oil analysis (where applicable) with the following tests/observations: color, dielectric breakdown voltage, dissolved gas analysis, e.g., ASTM D3612, frantic compounds (as needed), and Karl Fischer method of moisture detection.
- The site ground grid shall be tested every three years in accordance with NFPA 70B 14.3.2.

- Substation Power Circuit Breakers shall be removed from service every three years for cleaning, lubricating, maintenance as per the manufacturer's instructions and re- calibration. (Reference NFPA 70B Annex L Table L.1)
- Standby generators shall be exercised monthly for a minimum of 30 minutes (reference NFPA 110 – 2016 Article 8.4). As part of the monthly exercise, perform engine checks of oil, fuel, and battery water level.
- On an annual basis, standby generators shall be operated under load for a minimum of 1.5 hours. Generator use during an actual power outage that lasts 1.5 hours or longer can be substituted for the required annual test.

Electrical Work (50 Volts – 15 kV Volts Vac and to 1000 Vdc)

Always consider electrical equipment energized until locked, tagged and verified for absence of voltage, (electrically safe work condition). All persons working around low voltage systems shall understand and comply with the arc flash and shock PPE requirements. During high voltage work, a second Qualified Electrical Worker or trained observer must be present to monitor the task and provide immediate assistance in case of emergency. This observer shall not engage in the work but remain focused on safety oversight.

When the task requires working near exposed, energized parts:

- Unqualified persons shall not cross the three-foot six inch (42 inch) (is voltage dependent) limited approach boundary for fixed parts.. An unqualified person shall be continuously escorted by a qualified person if a need is present to cross the limited approach boundary, but under no circumstances can the unqualified person cross the restricted boundary.
- If a qualified person is working at or inside the restricted approach boundary listed in Table 1 or Table 2 special precautions shall be used.
- Working inside the restricted approach boundary is considered energized work.
- To ensure equipment is de-energized by verifying for the absence of voltage, as per the electrically safe work condition in NFPA 70E, qualified personnel shall perform the following using all PPE as appropriate for the arc flash and shock hazards and risks:
    - Choose a CAT III or CAT IV direct contact meter as approved by Cal Poly appropriate for the system voltage to be measured. Solenoid operated meters (Wiggies, etc.) and proximity detectors shall not be used for this purpose.
    - Check the test equipment for proper operation immediately before use (see Note below).
    - Verify that all necessary energy sources within the work zone have been de-energized using the CAL POLY LO/TO Program and Policy.
    - Test circuit elements and exposed electrical parts to verify that all elements and parts are de-energized.
    - Verify that no energized condition exists (or may exist) because of accidentally induced voltage or back feed.
    - Check the test equipment for proper operation immediately after use (see Note below).

    Note: Before performing energized electrical work, the operating voltage of equipment and conductors must be verified using calibrated voltage probes.

Voltage detection tools must be rated for the expected voltage level. Test the meter on the setting (function) that it will be used on.

Working on Energized Parts

- No maintenance work shall be performed on energized parts (inside the restricted approach boundary) without an Energized Electrical Work Permit (Attachement B) authorized by a signature of the appropriate CAL POLY supervisor or their designee.
- When performing authorized and justified testing or troubleshooting work on or near insulated cables or wiring, the cables or wiring shall not be moved, handled, contacted, or otherwise touched while energized without a Job Safety Planning Checklist. Cables and wiring exempted from this requirement are those that are inside an enclosure, are contained in a raceway, are part of a festoon cable assembly, or are temporary flexible cord and cables intended for that use. (See NFPA's National Electrical Code (NEC) ®, Article 400.4 for types of flexible cords and cables.) See raceway definition.

The condition of the insulation shall be safely examined by a CAL POLY qualified person before personnel perform construction or installation work on or near the cables or wiring.

Overhead Voltage Line Procedures

Work on overhead voltage lines shall only be performed by personnel experienced in such tasks, typically outside vendors. Proper tools, hoists, and fall protection equipment must be used, and all work shall comply with applicable safety standards.

Mobile Equipment

For operation of mobile equipment e.g., manlift, in the general vicinity of exposed energized parts (50 V to 15 kV Vac or to 1000 Vdc), shock and arc flash risk assessment procedures shall be used before starting any tasks.

Control Houses, Switchgear, Motor Control Centers, and Similar Equipment

If exposed, energized parts are present, control houses, motor control centers, and similar equipment shall be locked or otherwise restricted to allow access to only qualified personnel.

In control houses, switchgear, motor control centers and similar equipment, all equipment doors shall be closed, all latches shall be in place and operable, and all equipment shall be kept in proper safe, operable, and normal equipment condition.

Control houses, switchgear, motor control centers, and similar equipment shall be kept free of debris. Only materials and equipment necessary for electrical system repair and maintenance (R&M) may be stored in control houses and switchgear facilities. Those storage locations established for electrical system R&M materials shall be specifically identified and periodically inspected.

Materials and equipment are not to be stored in front of electrical equipment. A clear working space the width of the equipment or 30 inches, whichever is wider, and the height of the equipment or 6 ½ feet, whichever is higher, shall be provided and maintained for a minimum depth of 36 inches.

Combustible and flammable material shall not be stored in these locations unless properly stored in an approved metal cabinet or enclosure.

New Electrical Equipment and Modifications

New electrical installations shall minimize touch potential, access to energized parts, and minimize electrical arc flash hazards. *(See NFPA 70E (2024) – Informative Annex O – Safety-Related Design Requirements for guidance).* All new electrical systems shall be

designed and constructed in accordance with Cal Poly company-drafted engineering specifications and legislated codes if applicable. Touch safe terminals shall be seriously considered in all designs.

Existing installations need not be physically modified to comply unless such modifications are considered necessary to protect personnel.

When any modifications are made to existing electrical systems, these modifications shall be designed to current standards and best practices.

Modification to equipment or new installations shall comply with the state-legislated electrical wiring code, OSHA 1910 Subpart S, the locally adopted version of the National Electrical Code, and any Cal Poly company-specific procedures (in the order mentioned). Cal Poly shall ensure that new installations and modifications are approved by a local inspector, site engineer, or outside consultant as applicable for electrical safety compliance before energizing the equipment.

It is recommended that:

- All new electrical installations be designed, installed, and maintained to limit personnel exposure to arc thermal energy to 8 cal/cm² or less as a minimum. All new switchgear and motor control centers should be an arc resistant design to accepted standards if the calculated potential arc thermal energy is greater than 40 cal/cm².
- All new static capacitor banks should have a permanently installed shorting/grounding switch key or be mechanically interlocked with the main line disconnect switch. The interlock will prevent both the line disconnect and the grounding switches from being closed simultaneously and will require the five-minute waiting interval between opening the line disconnect and closing the grounding switch. Conspicuous signage warning that the capacitor bank frame is energized will be placed on all sides of the frame accessible to personnel. *(See NFPA 70E-21, Informative Annex R: Working with Capacitors)*
- Substation auxiliary systems, such as lighting, shall be installed so maintenance personnel cannot come within proximity to any exposed or unguarded energized parts while servicing the device.
- Control voltages, indication lamps, local push buttons, switches etc., shall operate at below 50 Vac.

Audits

<u>Electrical Safety Program Audit</u>

- The electrical safety program shall be reviewed to ensure the principles and procedures included herein follow OSHA 1910 Subpart S, OSHA 1910.269, as applicable and NFPA 70E (latest edition).
- An electrical infrastructure documented audit for each location will be conducted, so that any changes to equipment can be incorporated into the program.
- Comprehensive documented audits shall be performed at intervals not exceeding three years.
- Annual spot audits, on randomly selected sections in this program, shall be performed.
- Audits will be conducted by trained and experienced CAL POLY personnel and/or qualified third-party consultants.
- All identified items will be documented with repair/remediation plans developed.

Supervisory Audit

- Supervisors shall conduct documented field audits monthly to ensure that electrical safety work practices and procedures are being performed in compliance with the company's electrical safety program and procedures.
- Re-training shall be performed to address any deficiencies noted in the supervisory audits.

Cal Poly LO/TO Policy and Procedure Audit

- A Cal Poly qualified person shall audit compliance to the Cal Poly LO/TO Program and Policy for electrical equipment annually.
- In addition to the Cal Poly LO/TO Program and Policy audit, at least one in-progress task shall be audited. The audit results shall be used to:
  - Address gaps in the Cal Poly LO/TO Program and Policy.
  - Improve the Cal Poly LO/TO Program and Policy training program.
  - Optimize the execution of the Cal Poly LO/TO Program and Policy.

Training Requirements

Policies

- Training may be in the form of classroom, online, on-the-job, or in combinations.
- This training shall be documented (content of training), and records (through sign-in sheets or similar) maintained for the duration of employment.
- Initial training shall be given upon employment with annual refresher training.
- Safety proficiency shall be audited and documented on an annual basis and refresher training shall be provided if deficiencies in the employees' safety-related work practices are found.
- Training providing an understanding of recent technology, work techniques and procedural changes shall be provided.
- Retraining shall be performed at intervals not exceeding three years.
- Length/type of retraining can be determined by the location based on the results of the supervisory audit.

Qualified Personnel

- All qualified personnel shall remain knowledgeable and stay current on the rules and specifications contained in this document. To be considered either qualified or task qualified for electrical work, individuals shall be trained on the requirements and shall then demonstrate competencies in all safety related work practices, procedures, and requirements regarding their respective job assignments. Training shall include as well as determined by a Training Needs Analysis:
- Skills and techniques to distinguish exposed energized parts from the non-energized parts of structures and other items in the environment.
- Skills and techniques to determine the nominal voltage of exposed energized electrical conductor or circuit parts and how to verify absence of voltage. Employees shall be trained to select an appropriate voltage detector, and they shall demonstrate how to inspect and use the device to verify for the absence of voltage.
- Knowledge and understanding of the required distances that must be maintained from exposed energized parts for both arc flash and shock. This shall include the interpretation of the arc flash and electrical shock warning labels.
- Proper inspection, use, and storage of personal protective equipment for arc flash and electrical shock protection, insulating and shielding materials, and rated, insulated tools associated with working on or near exposed, parts of electrical equipment.

- Knowledge and understanding of the required distances that must be maintained from parts as required by Table 1 and Table 2.

- The decision-making process is necessary to determine the degree and extent of the hazard to which they will be exposed along with the PPE and job safety planning necessary to the perform the task safely.
    - Qualified persons working at a site without readily available qualified medical assistance that can arrive at the accident site within four minutes must first aid and CPR training.
    - Any location-specific skills and rules required of qualified personnel.

All Other Personnel

All other personnel not classified as Cal Poly qualified, or task qualified shall receive electrical safety awareness training as required for their job assignment. This training shall include emergency shock procedures and knowledge of the barricading used at the location. These personnel are considered unqualified for electrical work and may not operate, service, or repair any equipment that is not in an electrically safe work condition as per Cal Poly's LO/TO Policy and Program.

Definitions

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

Arc Flash Hazard – A source of injury or damage to health associated with the release of energy caused by an electric arc.
Note 1: The likelihood of occurrence of an arc flash incident increases when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in a manner that could cause an electric arc. An arc flash incident is not likely to occur under normal operating conditions when enclosed energized equipment has been properly installed and maintained. See 110.4(D) for further information.

Note 2: See NFPA 70E, Table 130.5(C) for examples of tasks that increase the likelihood of an arc flash incident occurring.

Arc Flash Suit – A complete arc-rated clothing and equipment system that covers the entire body, except for the hands and feet.
Note: An arc flash suit may include pants or overalls, a jacket or a coverall, and a beekeeper-type hood fitted with a face shield.

Arc Rating – The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm² and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (EBT) (should a material system exhibit a breakopen response below the ATPV value). Arc rating is reported as either ATPV or EBT, whichever is the lower value.
Note 1: Arc-rated clothing or equipment indicates that it has been tested for exposure to an electric arc. Flame resistant clothing without an arc rating has not been tested for exposure to an electric arc. All arc-rated clothing is also flame-resistant.

Note 2: ATPV is defined in ASTM F1959/ F1959M, Standard Test Method for Determining the Arc Rating of Materials for Clothing, as the incident energy (cal/cm²) on a material or a multilayer system of materials that results in a 50 percent probability that sufficient heat transfer through the tested specimen is predicted to cause the onset of a second degree skin burn injury based on the Stoll curve.

Note 3: EBT is defined in ASTM F1959/ F1959M, Standard Test Method for Determining the Arc Rating of Materials for Clothing, as the incident energy
(cal/cm²) on a material or a material system that results in a 50 percent probability of breakopen. Breakopen is defined as a hole with an area of 1.6 cm^2 (0.5 in^2) or an opening of 2.5 cm (1.0 in.) in any dimension. Breakopen is a material response evidenced by the formation of one or more holes the defined size. [An area of 1.6 cm² (0.5 in.²) or an opening of 2.5 cm (1.0 in.) in any dimension] in the innermost layer of arc rated material that would allow thermal energy to pass through the material.

Arc-Rated Clothing Category (Category) – A determination of the PPE required outline in Table 4 for an arc flash hazard after the arc flash risk assessment has been performed using the NFPA 70E Arc Flash PPE Category (Table) Method.

Authorized (as applied to persons) – A CAL POLY Qualified person identified by management to perform a specific task.

Balaclava - An arc-rated head-protective fabric that protects the neck and head except for a small portion of the facial area.
Note 1: Some balaclava designs protect the neck and head area except for the eyes while others leave the eyes and nose area unprotected.

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

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

Boundary, Arc Flash – When an arc flash hazard exists, an approach limit from an arc source at which incident energy equals 1.2 cal/cm² (5 J/cm²).
Note 1: According to the Stoll skin burn injury model, the onset of a second degree burn on unprotected skin is likely to occur at an exposure of 1.2 cal/cm² (5 J/cm²) for one second.

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.

Conductive – Suitable for carrying electrical current.

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 that contact, or equipment failure can result in electric shock, arc-flash burn, thermal burn, or arc blast injury.

Electrical Safety – Identifying hazards associated with the use of electrical energy and taking

precautions to reduce the risk associated with those hazards.

Electrically Safe Work Condition – A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personnel protection.
Note 1: An electrically safe work condition is not a procedure, it is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are maintained in a de-energized state for the purpose of temporarily eliminating electrical hazards for the period of time for which the state is maintained.

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

Energized Electrical Work Permit (EEWP) – A document complete by the task supervisor and authorized by management which permits certain energized work inside the restricted approach boundary.

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

Escort – A CAL POLY qualified person who briefs an unqualified person(s) on the hazards of being within the limited approach boundary and accompanies them when within the limited approach boundary. Escorts safeguard the people in their care and ensure that safety regulations are observed.

EWP (Electrical Work Practice) – A detailed procedure for performing an electrical task that is part of a written program.

Exposed (as applied to wiring methods) – 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.

Grounded (effectively grounded) – Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current- carrying capacity to limit the buildup of voltages to levels below which may result in undue hazard to persons or to connected equipment.

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

Ground Fault Circuit Interrupter (GFCI) – A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period 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, 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).

Job Safety Plan (JSP) – A documented, step-by-step analysis of a task, including hazard identification, estimation of risks, methods of risk control, and all other information to complete the task safely.

Labeled – Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and

concerned with product evaluation, which maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Location Responsible Person(s) – The CAL POLY electrically qualified person or persons identified by management and documented in writing as the final authority for decisions related to this policy.

Policy – Intentions and direction of an organization, as formally expressed by its top management.

Qualified Person – One who has demonstrated the skills and knowledge related to the construction and operation of the electrical equipment and installations and who has received safety training to recognize and identify the hazards and reduce the associated risks. For activities and work within the limited approach boundary, such persons shall be trained at a minimum in the following:

The skills necessary to distinguish exposed live parts from other parts of electric equipment.
The skills necessary to determine the nominal voltage level of exposed energized parts.
The minimum safe approach distances.
The skills necessary to:
Perform job safety planning.
Identify electrical hazards.
Assess the associated risks; and
Select appropriate risk control methods, including PPE.

Note: Only CAL POLY can determine who is qualified.

Raceway – An enclosed channel of metal or nonmetallic material designed expressly for holding wires, cables, or busbars, with additional functions as permitted in NFPA 70E (latest edition).

Risk – A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from hazard.

Risk Assessment – An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health, and determines if protective measures are required.
Note 1: As used in NFPA 70E, arc flash risk assessments and shock risk assessments are types of risk assessments.

Shock Hazard – A source of injury or damage to health associated with current through the body caused by contact or approach to exposed electrical conductors or circuit parts.
Note 1: Injury and damage to health resulting from shock is dependent on the magnitude of the electrical current, the power source frequency (e.g., 60 Hz, ac, 50 Hz, dc), and the path and duration of current through the body. The physiological reaction ranges from perception, muscular contractions, inability to let go, ventricular fibrillation, tissue burns, and death.

Task Supervisor or Employee-in-Charge (Person-in-Charge) – A CAL POLY qualified person in charge of completing an electrical task and the safety of assigned personnel. (This is not to be confused with the management supervisor who might be an unqualified person.)

Task Qualified Person – An employee who receives safety and knowledge training to perform a specific electrical task and who demonstrates the ability to perform all duties safely shall be a task qualified person for that specific task only. A Job Safety Plan (JSP) shall be written by a qualified person for all tasks performed by task qualified persons.

Task Observer – If employees will be present in the test area during testing, a test observer as designated by the Task Supervisor shall be present. The test observer shall be capable of implementing the immediate de-energizing of test circuits for safety purposes if required.

Unqualified Person – A person who is not a qualified person.

Utilization Equipment – Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

Working Distance – The distance between a person's face and chest area and a prospective arc source.
Note 1: Incident energy increases as the distance from the arc source decreases.

Working On (energized electrical conductor 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 conductors, or circuit parts with approved test equipment that does not require making any physical change to the electrical equipment, conductors, or circuit parts. Repair is any physical alteration of electrical equipment, conductors, or circuit parts (such as making or tightening connections, removing, or replacing components, etc.).

Record Keeping Requirements

Under Revision

References

If no jurisdictional requirements are applicable, the standards below will supplement the program.

ASTM D120 titled "Specification for Rubber

Insulating Gloves." ASTM D178 titled "Specification

for Rubber Insulating Matting." ASTM D1048 titled

"Specification for Rubber Insulating Blankets."

ASTM F479 titled "Specification for In-Service Care of Insulating Blankets."

ASTM F496 titled "Specification for In-Service Care of Insulating Gloves and Sleeves."

ASTM F855 titled "Specifications for Temporary Protective Grounds to Be Used on De-energized Electric.
Power Lines and Equipment."
OSHA 1910.269 - Appendix E - Protection from Flames and Electric Arcs.

NETA World – Summer 2019 – High Voltage Arc Flash Assessment and Applications

– Part 1, Page 48 NETA Word – Fall 2019 - High Voltage Arc Flash Assessment and

Applications – Part 2, Page 58 IEEE/ANSI C2 – Current edition titled "National

Electrical Safety Code®"

NFPA 70 – Current edition titled "National Electrical Code®"

NFPA 70B – Current edition titled "Recommended Practice for Electrical Equipment

Maintenance®”
NFPA 70E – Current edition titled “Standard for Electrical Safety in the Workplaces

Any ASTM or other standards you have used to base your program on.

Program History

Issued by: Melonee Cruse

Next review date: 2026

Revision	Approval Date	Summary of change
1.0	MM/YYYY	
2.0	MM/YY	

Attachments

Attachment A – LOTO Observation Form (sample)

Attachment B - Energized Electrical Work Permit (Sample)