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CALIFORNIA STATE UNIVERSITY
EAST BAY

Electrical Safety Program
Version 0

This Electrical Safety Program is hereby approved by:

Robert Andrews	Facilities Director	9-3-12
Signature	Title	Date
Donna Placzek	Director , EHS	9-20-12
Signature	Title	Date

1.0 Purpose

The Electrical Safety Program is developed in accordance with Federal OSHA and Cal OSHA Standards (29 CFR 1910 Subpart S; CCR, Title 8, Sections 2299-2974, *Low Voltage, Electrical Safety Orders*) and NFPA 70E, *Standard for Electrical Safety in the Workplace, 2012 Edition,* and applicable SOPs and Standard Work Practices.

The purposes of this program are to define standard work practices and procedures to be followed when performing work on electrical equipment, and to provide employees with a consistent system to perform electrical work correctly and safely.

2.0 Scope

This program applies to all CSUEB employees who might be exposed to electrical hazards during normal work assignments. Work assignments may include the repair, servicing, or installation of equipment and electrical or HVAC systems and components.

3.0 Responsibilities

3.1 Electrical Safety Team

1. Develop CSUEB specific electrical safety procedures.

2. Review the Electrical Safety Program periodically and update the Program as needed.

3. Review implementation of the Program and verify compliance.

4. Assist with incident investigations involving electrical work as needed.

3.2 Managers

1. Implement and enforce this Program as it pertains to their areas.

2. Identify employees in their areas covered by the scope of this program.

3. Ensure all procedures are understood and followed by employees in their department.

4. Enforce safe work procedures in their areas.

5. Verify employees have the appropriate Personal Protective Equipment (PPE) and tools to perform the work.

6. Report any electrical incident, near miss, shock, or injury to the Worker's Compensation Coordinator and EHS.

7. Lead incident investigations involving electrical work and their employees.

8. Review Energized Electrical Work Permit to ensure the work can be safely done while energized and all necessary safety precautions are in place.

9. Approve Energized Electrical Work Permit.

10. Conduct annual field audits to ensure the requirements and procedures in this Program are being followed and take appropriate actions to address any deficiencies observed.

11. Work with EHS as needed to carry out the above responsibilities.

3.3 Supervisors

1. Support Manager in their department in carrying out the responsibilities described in Section 3.2

2. Identify electrical hazards in their work areas.

3. Complete and submit an Energized Electrical Work Permit to the department manager for approval prior to starting energized work (except where exempt under the Program).

4. Report any electrical incident, near miss, shock, or injury to their manager, the Worker's Compensation Coordinator, and EHS.

3.4 Employees

1. Maintain a high level of awareness of electrical hazards and safe work practices.

2. Perform only work for which they are trained and experienced.

3. Report any electrical incident, near miss, shock, injury, and observed hazards to their supervisor.

4. Understand and follow the procedures and practices developed under this Program.

5. Follow applicable safe work practices and procedures relevant to their work.

6. Inspect test equipment, tools and PPE before use.

7. Use appropriate PPE.

8. Contact their supervisor or manager if they are unclear on a procedure.

9. Complete and submit an Energized Electrical Work Permit to the department Manager for approval prior to starting energized work (except where exempt under the Program).

3.5 Environmental Health and Safety

1. Lead and facilitate Electrical Safety Team meetings for periodic program review.

2. Work with departmental managers as needed in carrying out the responsibilities described in Section 3.2.

3. Review and approve Energized Electrical Work Permit.

4. Distribute and send out electrical/rubber insulating gloves for electrical testing.

5. Maintain training records.

4.0 Training, Skills and Experience Requirements

4.1 General Training Requirements for Unqualified Employees

1. *Unqualified* personnel are employees who have not received specific training to perform a given task or those who are not qualified personnel as defined in Section 4.2. This includes:

   a. Employees who do not perform electrical work, but who work in areas with exposed circuits and face a risk of injury from this exposure.
   b. Authorized and affected employees in the Hazardous Energy Control Program (Lockout/Tagout Program) who are not trained qualified personnel are considered unqualified employees.

2. All unqualified employees shall receive electrical safety/awareness training as appropriate for their job tasks. The training includes the following topics:

   - Hazards associated with electricity
   - Effects of electricity on the body
   - Specific safety-related practices to prevent shock or other electricity-related injury

3. Staff in the plumbing department does not perform electrical work, but may on occasion lockout/tagout a motor for repair. In addition to the training topics described in Section 2 above, they shall receive training in proper lockout/tagout methods and procedures.

    a. They shall contact the University electricians for all electrical-related work.

4.2 General Training Requirements for Qualified Employees

1. Only qualified personnel can work on electrical equipment or systems. An employee is qualified to perform only specific electrical work for which he/she has training and experience.

2. Qualified personnel are employees "who by reason of experience or instruction has demonstrated familiarity with the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved."

3. The department management will evaluate and assess the training and experience of new employees to determine their qualifications.

4. Qualified employees will be trained and must be familiar with the following practices and techniques:
    a. Safety-related work practices to protect from electrical hazards associated with respective tasks or equipment, including arc flash and shock hazards and protection; use of precautionary techniques; and selection, use and inspection of insulating tool and shielding materials, and personnel protective equipment (PPE).
    b. Selection, use, inspection and limitation of test equipment, including how to select an appropriate voltage detector and verify for absence of voltage.
    c. Skills and techniques necessary to distinguish exposed parts from other parts of electrical equipment.
    d. Skills and techniques necessary to determine the nominal voltage of exposed parts, clearance distances, and corresponding voltages to which the qualified person will be exposed.
    e. Procedures for performing the jobs safely and properly.
    f. Methods of releasing victims from contact with exposed energized conductors or circuits.
    g. Procedure for safe lockout/tagout of electrical circuits and equipment.
    h. CSUEB Procedures for performing energized work.
    i. Approach distances/boundaries.
    j. Job planning.
    k. First aid and CPR.

4.3 Training Requirements for Job Functions

In addition to the general training requirements described in Section 4.2, qualified employees shall receive additional training based upon their job assignments or functions. The training shall be classroom or on-the-job skills development, with focuses on safety-related practices that pertain to the employee's job assignments.

4.3.1 *Facilities Maintenance Worker II*

1. Classroom training or experience in the following areas:
   - Basic industrial electricity
   - Circuit breakers and fuses
   - Electrical lighting
   - Meter types, safety and proper usage

2. On-the-job experience:
   - Reset breakers
   - Replace lamps/ballasts
   - Replace fuses

4.3.2 *Maintenance Mechanic*

Employees must have the training, skills, and experience to independently diagnose, troubleshoot, install and repair *de-energized* circuits or electrical systems ≤ 480V, pertaining to HVAC, plumbing, and other building equipment.

1. Classroom training or experience in the following areas:
   - Basic industrial electricity and troubleshooting (AC/DC voltage and current, transformer and motor operation, troubleshooting electrical circuits)
   - Relays, contactors, timers, and motor starters
   - Low voltage electrical safety
   - Meter types, safety and proper usage
   - Electrical lighting
   - Electrical diagrams
   - Operation and construction of HVAC and other mechanical equipment.

2. On-the-job experience:
   - Test, reset and replace circuit breakers
   - Replace lamps and ballasts
   - Replace igniters/starters
   - Install and replace motors
   - Test and replace fuses, light switches, receptacles, and motion sensors
   - Test and replace contactors
   - Replace wiring, switches, instruments, controllers, and other control devices on a locked out circuit.

4.3.3 *Building Services Engineer, Refrigeration Mechanic and Control Specialist*

Employees must have the training, skills, and experience to independently diagnose, troubleshoot, install and repair for non-hazardous locations electrical systems ≤ 480V, pertaining to HVAC and refrigeration equipment/system.

1. Classroom training or experience in the following areas:
   - Operation, design and construction of HVAC and/or refrigeration equipment/system
   - Low voltage electrical safety
   - Meter types, safety and proper usage
   - Single-phase and 3-phase voltages and distribution systems
   - Operation, maintenance and troubleshooting of VFDs
   - Troubleshooting electrical control circuits
   - Electrical diagrams

2. On-the-job experience:
   - Reset breakers
   - Reset heaters
   - Troubleshoot, calibrate and repair 3-phase motors, VFDs, process controllers, and other control devices
   - Replace motors

4.3.4 *Electrician*

Employees must have the training, skills, and experience to diagnose, troubleshoot, and repair electrical systems up to 600V.

1. Classroom training or experience in the following areas:
   - National Electric Code
   - Low voltage electrical safety
   - Safe switching practices
   - Meter types, safety and proper usage
   - Single-phase and 3-phase voltages and distribution systems
   - Motor circuit component sizing
   - Electrical diagrams
   - Grounding
   - Motors theory and application
   - Electrical lighting

2. On-the-job experience:
   - Troubleshoot, repair and replace VFDs
   - Troubleshoot, repair and replace 3-phase motors, motor starter contactors, process controllers, and other control devices and panels

- Install bus switches and motor control center (MCC) buckets

4.4 Training Documentation and Certification

1. When an employee completes off-site training, he/she must submit a copy of the course completion certification to EHS and his/her department.

2. Records of training conducted onsite or by the department will be maintained by the department. A copy of the training outline or course content and the attendance rosters will be submitted to EHS.

3. Training documentations will be maintained by the employee's department and EHS for the duration of the employee's employment.

4.5 Retraining

An employee shall receive additional training or refresher training:

1. When there is new technology, new types of equipment or changes in procedures that necessitate additional training.

2. When he/she must employ safety-related work practices that are not normally used during regular job duties.

3. When there is reason to believe the employee needs to be retrained, such as after a near missed accident or non-compliance with safety work practices.

4. The manager will determine through regular supervision or annual inspections whether an employee needs refresher training in a particular area.

5. Refresher training will be completed at least every 3 years.

6. CPR/AED and First Aid training will be completed as per the American Heart Association and Red Cross requirements.

5.0 Electrical Work Practices and Procedures

5.1 Hazard Control

1. Whenever feasible, electrical system must be worked in the de-energized state. The equipment/system shall be de-energized and lockout/tagout as described in CSUEB's Hazardous Energy Control (Lockout/Tagout) Program.

2. Electrical conductors or circuits shall be considered energized until tested and proven otherwise.

5.2 Energized Work

1. Exposed electrical conductors or circuit parts, operating at 50 volts and higher, shall be de-energized before performing work on or within the Limited Approach Boundary, unless it can be shown that de-energizing creates additional hazards, or is not feasible due to design or operational limitations.

2. Energized electrical work shall be performed only under an *approved written work permit*. The permit serves as a checklist to help ensure hazards are considered and mitigations are in place. Prior to starting the work, the employee shall evaluate the hazards associated with the task involved and submit the permit to the appropriate manager for approval.
   a. Exception to work permit: Work that involves testing, measurement and troubleshooting activities are permitted to be performed without an energized work permit. Appropriate personal and other protective equipment for shock and arc hazards shall be used.

3. Energized Electrical Work Permit (see Appendix B).
   a. The requester shall provide a description of the circuit or equipment, the work to be done and justification for why the work cannot be performed de-energized.
   b. The qualified person who will perform the work must provide a description of how the work will be done, the safe work practices to be employed, results of the shock hazard analysis and shock protection boundaries, results of the arc flash hazard analysis and arc flash protection boundary, personal protective equipment to be used, means for excluding unqualified persons from the work area, and evidence of completing a job briefing.
   c. The responsible Manager, Electrically Knowledgeable Person, and EHS must agree and approve that the work must be performed while the equipment or system is energized and that the work can be safely done in the energized state.

4. Employees must use suitable protection against both electrical shock and arc flash/blast in the form of insulated tools and equipment and PPE (arc-rated clothing, gloves, blankets, mats, etc).

5.3 Personal Protective Equipment and Arc Flash/Shock Protection

1. Whenever feasible, work on electrical system must be performed in the de-energized state. Proper PPE shall be worn and safe work

methods for energized work shall be followed until it is proven that the system is de-energized.

2. When work needs to be performed within the Arc Flash Protection Boundary, employees shall wear the appropriate arc flash PPE.
   a. Arc flash PPE is required for testing, troubleshooting and voltage measuring.
   b. Arc flash PPE shall consists of arc-rated (FR) clothing and/or clothing made of untreated natural fibers, safety glasses, hard hat with arc-rated face shield and liner, rubber insulating gloves with leather protector, arc blast rated earplugs, and all leather safety shoes.
   c. Selection of PPE shall be based upon Emerson Arc Flash Study and NFPA 70E Table 130.7(C)(16) (see Appendix A1).
   d. Arc-rated (FR) clothing shall cover potentially exposed parts of the body as completely as possible and all flammable garments underneath. Shirt sleeves shall be fastened at the wrists and shirts and jackets shall be closed at the neck.
   e. Safety glasses or safety goggles shall be worn underneath the face shield or arc flash suit hood.
   f. An arc-rated balaclava (head sock) shall be worn with an arc-rated face shield when the back of the head is within the arc flash protection boundary or for Hazardous Risk Category 2 (HRC 2) work. An arc flash suit hood can be worn in lieu of a balaclava. An arc-rated hood shall be worn when the anticipated incident energy exceeds 12 cal/cm^2.
   g. Meltable fibers such as acetate, nylon, polyester, and spandex are not permitted as underlayers.
   h. Layering of arc-rated clothing can be used such that the arc rating for the total clothing system meets the minimum arc rating requirement for each Hazard/Risk Category. Garments that are not arc rated shall not be permitted to be used to increase the arc rating of a garment or clothing system.
   i. Garments worn over arc-rated (FR) clothing such as jackets shall also be made from arc-rated (FR) material (exception: jacket or outerwear is removed before crossing the arc flash protection boundary).
   j. Protective clothing and other protective items that become contaminated with grease, oil, or flammable/combustible materials shall not be used.
   k. For applications where the incident energy exceeds $40cal/cm^2$, work shall not be performed in the energized state. Arc flash PPE protects the employee from thermal energy and will not provide protection from the concussive (kinetic) energy generated during an arc blast/flash.

3. When no data is available from the Arc Flash Study for a specific equipment or electrical system, Table 130.7(C)(15)(a),

Table130.7(C)(15(b), and Table 130.7(C)(16) in NFPA 70E, 2012 edition may be used (see Appendix A1 and A3).

a. For tasks not listed or for systems with greater maximum short-circuit current capacity or longer fault clearing time, an incident energy analysis is required.

4. Shock hazard

a. The shock protection boundaries (Limited, Restricted, and Prohibited Approach Boundary) are applicable in situation where approaching personnel are exposed to energized electrical conductors or circuits. The shock protection boundaries and arc flash boundary are independent of each other.

b. The shock protection boundaries for a specific equipment or system shall be based upon Emerson Arc Flash Study. When no data is available for the shock protection boundaries for an equipment/electrical system, follow Table 130.4(C)(a) or Table 130.4(C)(b) in NFPA 70E, 2012 edition (see Appendix A2).

c. Unqualified personnel are not permitted to enter or cross the Limited Approach Boundary, unless the equipment or electrical system has been de-energized and locked out as described in CSUEB's Hazardous Energy (Lockout/Tagout) Program.

d. Where there is a need for an unqualified person to cross the Limited Approach Boundary, he/she must be continuously escorted through the area by a qualified person. The qualified personnel must advise him/her of the potential hazards. Appropriate arc-rated PPE or other protective equipment shall be worn when crossing the arc flash protection boundary.

e. An unqualified person shall not be permitted to enter or cross the Restricted Approach Boundary under any circumstances.

f. To cross the Restricted Approach Boundary, qualified personnel must wear PPE for protection from shock. Exceptions:

(1) The qualified person is insulated or guarded from the live parts operating at 50 volts or more (insulating gloves or insulating gloves and sleeves are considered insulation only with regard to the energized parts upon which work is being performed), and no uninsulated part of the qualified person's body crosses the Prohibited Approach Boundary.

(2) The live part operating at 50 volts or more is insulated from the qualified person and from any other conductive object at a different potential.

(3) The qualified person is insulated from any other conductive object as during live-line bare-hand work (e.g., use of insulating blankets, insulating mats, insulating ladders).

g. Shock Protection PPE shall consist of rubber insulating gloves with leather protectors. The gloves shall be rated for the voltage in which the gloves will be exposed.
h. Leather protectors/gloves shall not be worn alone to provide shock protection.
i. Where finger dexterity is needed to manipulate small equipment and parts requires the use of rubber insulating gloves without leather protectors, extra care must be taken by the user to prevent puncture, abrasion or other damages to the gloves.
j. Bare-hand contact is permitted only under approval of an Energized Electrical Work Permit. No bare-hand contact is to be made with exposed energized electrical conductors or circuits above 250 volts to ground.
k. To assure the continued integrity, rubber insulating gloves must be inspected on their inside and outside surfaces and a pinhole leak test must be performed before each use.
l. Crossing the Prohibited Approach Boundary is considered the same as making contact with exposed energized conductors or circuits. The same safe work practices shall be followed.

5. Conductive articles of jewelry and clothing such as watches, rings, key chains, necklaces, metal headgear, and metal frame glasses shall not be worn.

5.4 Standby Person

1. The employee will work with the manager to evaluate the hazards associated with the task involved and determine whether a standby person is required for the task.

2. A standby person is required when repairing or working on energized parts at or exceeding 600 volts.

3. The standby person duties are to provide and summon assistance during an emergency and warn unauthorized or unqualified personnel from approaching the area.

4. The standby person cannot perform any other activity that might divert his/her attention from the person performing the energized work.

5. The standby person shall be a qualified employee and shall be knowledgeable in the emergency procedures for the task involved and methods to release the victim from contact with exposed live parts.

6. Since the standby person might need to cross the restricted/prohibited approach boundary and/or Flash Protection

Boundary to provide immediate assistance, he/she shall wear the same PPE as the employee performing the work.

5.5 Emergency Plan

1. Employees shall evaluate the hazards associated with the work involved and, if necessary, work with their supervisor and/or manager to develop an appropriate emergency response plan.

2. The following are general procedures to be followed in the event of an incident:
   b. In an event of a shock, determine whether the person is "hung up" on a live circuit. Always assume that the circuit is energized, and never attempt to remove the person from the live circuit with bare hands.
   c. If possible and safe to do so, de-energize the circuit by shutting off the power.
   d. Use an insulated device to pull the person free from the circuit (do not use device such as rope, dry wood, etc. in a high voltage system).
   e. Immediately call UPD and ask them to summon for medical assistance.
   f. Notify manager and EHS of the incident.

5.6 Alerting Techniques and Barricades

1. Appropriate alerting techniques shall be used to warn and protect personnel from hazards that could cause injury from electric shock, burns, or failure of electrical equipment parts.

2. Use safety signs, safety symbols, or accident prevention tags to warn personnel from electrical hazards that might endanger them or where necessary to warn employees about electrical hazards (i.e. danger or caution sign affixed to the equipment).

3. Barricades shall be used in conjunction with safety signs where necessary to prevent or limit access to work areas with uninsulated energized conductors or circuit parts (i.e. posting sign at door entrance warning unqualified personnel to keep out).
   a. If an employee is working alone or there is no standby person, signs and barricades must be used to warn unqualified personnel of the hazards and from entering the area.
   b. Appropriate warning signs and/or barricades must be placed where vehicle and pedestrian traffic may pass adjacent to the working area.

4. Where barricades are used, it shall not be placed closer than the Limited Approach boundary. Do not use conductive barricades where they might cause an electrical contact hazard.

5. If signs and barricades do not provide sufficient warning and protection from electrical hazards, station an attendant outside the Limited Approach boundary to keep other personnel from the area.

5.7 Insulated Tools, Test Instruments and Equipment

1. Employees shall use insulated tools and equipment when working inside the Limited Approach Boundary if the tools and/or equipment might contact or accidentally contact exposed energized conductors or parts.

2. Insulated tools, test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors must be visually inspected for external defects and damages before the equipment is used.

3. If there is a defect or evidence of damage that might expose an employee to injury or which may prevent the tool or equipment from performing properly, the defective or damaged item shall be removed from service, and shall not be used until necessary repairs and tests have been made.

4. Test instruments and equipment and accessories must be rated for the circuits and equipment to which they will be connected and must be designed for the environment in which they will be exposed and used.

5. Never use a multi-meter unless it contains the fuse protection recommended by the manufacturer.

6. When test instruments are used to test for absence of voltage on conductors or circuits operating at 50 volts or greater, the instrument’s operation must be verified before and after the test.

7. Insulated or nonconductive tools and equipment shall be stored, handled, maintained, and operated as per the manufacturer’s instructions.

8. If there is any doubt regarding the insulating integrity of a tool or equipment, replace the tool or have it tested.

9. Employees shall not use insulated live-line tools, test instruments or equipment on exposed energized parts unless they have been trained or instructed in their proper use.

5.8 Job Briefing

1. The employee in charge shall conduct a job briefing with all involved employees prior to start of work. Additional briefings shall be done if there are changes during the course of the work that might affect personnel safety.

2. The briefing shall include the following topics: hazards associated with the job, work procedures involved, special precautions and safeguards, energy control sources, PPE, and work zones.

3. A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably expected to recognize and avoid the hazards involved with the task.

4. An employee working alone shall plan the work as if a job briefing is to be done.

5.9 General Safe Work Practices

1. Ensure that employees performing electrical work are qualified.

2. Plan and analyze each step of the work to be performed for potential hazards, hazard mitigation, proper PPE, and appropriate tools. Refer to system drawings when available and perform system walk downs.

3. Wear appropriate PPE for the task involved.

4. Use properly rated test equipment and verify its condition and operation before and after use.

5. Operate electrical equipment in accordance with the manufacturer's recommendations. The safety instructions and operating procedures for all equipment must be followed.

6. Maintain good housekeeping and cleanliness.

7. Know and practice applicable emergency response procedures.

8. If there is no sufficient lighting or a clear view of the work, do not enter or reach blindly into areas that may contain energized parts.

9. Limit access of unauthorized personnel into areas around electrical switchgear, panel boards, or load centers.

10. Limit access of unauthorized personnel to areas where exposed energized parts are present.

11. Use portable ladders with non-conductive side rails where energized parts are exposed.

12. For tasks in confined space, proper procedures for working in confined space as described in CSUEB’s Confine Space Program must be followed. Use protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with

exposed energized parts. Secure doors, hinged panels, and the like to prevent from swinging into an employee and causing the employee to contact exposed energized parts.

13. Over-current protection of circuits and conductors may not be modified, beyond that allowed per OSHA 1910.304(e), the installation safety requirements for over-current protection.

5.10 Working at Heights

1. When work is performed in locations containing uninsulated energized overhead lines that are not guarded, precautions shall be taken to prevent employees from contacting these lines. If contact with the overhead line is possible, the lines shall be de-energized and visibly grounded at the point of the work or properly guarded.

2. When an unqualified person is working near overhead lines, whether on the ground or in an elevated position (i.e. aerial lift), ensure that the employee and the longest conductive object he or she may contact maintain the following minimum distances from any unguarded, energized overhead line:
   a. For voltages to ground 50kV below – 10 ft
   b. For voltages over 50kV – 10 ft plus 4” for every additional 10kV.
   c. Objects that are not insulated for the voltage involved shall be considered conductive.

6. Where a vehicle or aerial lift is elevated near energized overhead lines, if the aerial lift is insulated for the voltage involved and the task is being performed by a qualified person, the clearance may be reduced to the restricted approach boundary, provided appropriate procedures are followed.
   a. Employees standing on the ground shall not contact the equipment unless the employee is wearing protective equipment rated for the voltage involved or the minimum distance described in 5.10(2) is maintained.

5.11 Routine Opening and Closing of Circuits

1. Routine energizing and de-energizing of circuits must be performed with devices designed specifically to be the disconnecting means (load-rated switches, circuit breakers, or other devices specifically designed for the task).

2. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections shall not be used for such purposes, except in an emergency.

5.12 Reclosing Circuits after Protective Device Operation

1. After a circuit is de-energized by a circuit protective device, do not manually reenergize the circuit until it has been determined that the equipment and circuit can be safely energized.

2. When it can be determined from the design of the circuit and over-current protective devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment is not required before reenergizing the circuit.

3. The repetitive manual closing of circuit breakers or reenergizing circuits through replaced fuses is prohibited.

5.13 Ground Fault Circuit Interrupter

1. To ensure that a GFCI is operating properly, test it regularly and according to the manufacturer’s instructions.

2. In construction areas, use either GFCI or an assured grounding program (see OSHA regulations, 1926.404).

5.14 Electric Cords

1. Inspect cords regularly. Do not use if there are signs of stretching, insulation damage, and kinking.

2. Keep cords and cables clean and free from kinks. Kinking can damage both the cord's insulation and the internal wire.

3. Never carry a tool by its cord.

4. Portable electrical equipment must either be double insulated or have a third wire (equipment) ground prong.

5. When using tools that require a third wire ground, use only three-wire extension cords with three-pronged grounding plugs and three-hole electrical outlets. Never cut off the grounding plug from a cord.

6. Pulling on electric cords can damage the cord insulation and cause electric sparks. Always remove the cord at the plug.

7. Extension cords may present a tripping hazard. Make sure that cords are not located in walking paths or that a non-trip cover is placed over the cords.

8. Always use the correct extension cord for the job. An undersized cord can cause a drop in tool power and overheating. Check the manufacturer's recommendations for the wire gauge (or thickness) and length of the cord based on the application.

9. Portable electrical equipment and flexible cords used in highly conductive work locations (such as those in water or other conductive liquids), or in job locations where employees are likely to contact water or conductive liquids, must be approved for those locations.

10. Hands and feet must be dry when plugging and unplugging flexible cords and cord-and plug-connected equipment, whenever energized equipment is involved. Use an insulated tool at a safe distance to unplug equipment in wet areas.

5.15 Use of Portable Electric Equipment

1. Handle portable equipment in a manner that will not cause damage.

2. Do not raise and lower the equipment using the flexible electrical cord.

3. Do not fasten the flexible electrical cord with staples or handle in a manner that could damage the outer jacket or insulation.

4. Before use, visually inspect the portable cord and plug-connected equipment and flexible cord sets (extension cords) for external defects (i.e. loose parts, deformed and missing pins, or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket).

5. Remove defective equipment from service until repairs and tests necessary to render the equipment safe have been made.

6. Use a flexible cord with an equipment-grounding conductor with grounding type equipment.

7. Do not connect or alter attachment plugs and receptacles in a manner that prevents proper continuity of the equipment-grounding conductor at the point where plugs attach to receptacles. Do not alter these devices to allow the grounding pole of a plug to be inserted into slots intended for connection to the current-carrying conductors.

8. Do not use adapters that interrupt the continuity of the equipment grounding connection.

9. Use insulating protective equipment to handle energized plug and receptacle connections if the condition of the connection could provide a conducting path to the hand (e.g., if a cord connector is wet).

10. Properly secure locking type connectors after connection.

5.16 Underground Utilities

1. Before digging, view appropriate maps and drawings to identify locations of underground utilities.

2. If it is possible that electrical lines or equipment might be contacted, a hazard analysis shall be performed to determine appropriate safe work practices to be followed during excavation.

6.0 Contractors

1. Contractors or outside personnel are required to perform their work in compliance with CSUEB's safe work practices and procedures, as well as with federal, state, and local regulations.

2. Contractors failing to adhere to applicable safe work practices and standards will be asked to terminate their work until their program is brought into compliance.

3. The (University) Project Manager shall provide the contractors with applicable information in this Program and to contact EHS for any questions regarding the policies and procedures outlined in this Program.

4. The Project Manager shall inform the contractors of any known hazards that are related to the work involved and any information that the contractors might need to perform the work safely.

5. The contractors shall inform the University of any hazards presented by the work involved and any unanticipated hazards found during the work.

6. The contractors shall ensure that their employees or sub-contract employees follow applicable safe work practices and procedures, received all applicable training, and are qualified to perform the work.

7. Work on electrical system shall be done in the de-energized state and Lockout/Tagout as per Cal/OSHA Hazardous Energy Control Program, unless it can be demonstrated that de-energizing creates additional hazards, or is not feasible due to design or operational limitations.

8. Prior to performing energized work, the contractor must assess the hazards associated with the task involved and ensure all safety precautions are in place. An Energized Electrical Work Permit must be completed and approved by the appropriate (contracted) personnel. The University Project Manager will be notified and provided a copy of the energized work permit prior to start of work.

9. An emergency plan and standby person are required for energized work. The standby person shall be certified in first aid and CPR.

7.0 Document History

Document Revision	Date	Prepared by:	Approved by:	Comment
New – Version 0		Lyanh Luu	Donna.Placzek Robert Andrews	Meets NFPA 70E 2012 requirements

Appendix A-NFPA 70E Tables

A1: Table 130.7(C)(16) Protective Clothing and PPE

Hazard/Risk Category	Protective Clothing & PPE
Hazard/Risk Category 0 Protective Clothing, Nonmelting or Untreated Natural Fiber Protective Equipment	Shirt (long sleeve) Pants (long) Safety glasses or safety goggles (SR) Hearing protection(ear canal inserts) Heavy duty leather gloves (Note 2)
Hazard/Risk Category 1 Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm^2 Protective Equipment	Arc-rated long-sleeve shirt and pants or arc-rated coverall (Note 4) Arc-rated face shield or arc flash suit hood (Note 5) Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves (Note 2) Leather work shoes
Hazard/Risk Category 2 Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm^2 Protective Equipment	Arc-rated long-sleeve shirt and pants or arc-rated coverall (Note 4) Arc-rated face shield with arc-rated balaclava or arc flash suit hood (Note 5) Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves (Note 2) Leather work shoes
Hazard/Risk Category 3 Arc-Rated Clothing, Minimum Arc Rating of 25 cal/cm^2 Protective Equipment	Arc-rated long-sleeve shirt (Note 6) Arc-rated pants (Note 6) Arc-rated coverall (Note 6) Arc-rated arc flash suit hood (Note 6) Arc-rated arc flash suit (Note 7) Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes

Hazard/Risk Category	Protective Clothing & PPE
Hazard/Risk Category 4 Arc-Rated Clothing, Minimum Arc Rating of 40 cal/cm^2	Arc-rated long-sleeve shirt (Note 6) Arc-rated pants (Note 6) Arc-rated coverall (Note 6) Arc-rated arc flash suit hood (Note 6) Arc-rated arc flash suit
Protective Equipment	Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes

SR= Selection required

*The table above is taken from NFPA 70E Table 130.7(c)(16), 2012 Edition.
*The notes below are modified from NFPA 70E Table 130.7(C)(10), 2009 Edition, for clarification.

Notes:

1. Arc rating for a garment or system of garments is expressed in cal/cm^2.
2. Rubber insulating gloves shall be worn in conjunction with leather protectors.
3. Arc-rated coverall can be worn in lieu of arc-rated (FR) shirt and pants.
4. The clothing worn underneath must be made of nonmelting or natural fiber (i.e. cotton, wool, rayon, silk, or blends of these materials).
5. A face shield with a minimum arc rating of 4 for Hazard/Risk Category 1 or a minimum arc rating of 8 for Hazard/Risk Category 2. Alternatively, an arc-rated arc flash suit hood can be worn. Safety glasses or safety goggles and a hard hat are required in addition to the face shield or hood.
6. An alternate is to wear an arc-rated flash suit with a minimum arc rating of 25 for Hazard/Risk Category (HRC) 3 and a minimum arc rating of 40 for Hazard/Risk Category 4. Clothing worn underneath must be made from arc-rated material or nonmelting fiber. Layering of arc-rated clothing can be used such that the arc rating for the total clothing system meets the minimum arc rating requirement for each Hazard/Risk Category. Garments that are not arc rated shall not be permitted to be used to increase the arc rating of a garment or clothing system.
7. An alternate is to use a total arc-rated (FR) clothing system and hood.

A2: Approach Boundaries for Shock Protection

Table 130.4(C)(a) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for **Alternating-Current Systems** (All dimensions are distance from energized electrical conductor or circuit part to employee.)

(1)	(2)	(3)	(4)	(5)
	Limited Approach Boundary[b]		Restricted Approach Boundary[b]; Includes Inadvertent Movement Adder	
Nominal System Voltage Range, Phase to Phase[a]	Exposed Movable Conductor[c]	Exposed Fixed Circuit Part		Prohibited Approach Boundary[b]
<50 V	Not specified	Not specified	Not specified	Not specified
50 V–300 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact	Avoid contact
301 V–750 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)	25 mm (0 ft 1 in.)
751 V–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)	0.2 m (0 ft 7 in.)
15.1 kV–36 kV	3.0 m (10 ft 0 in.)	1.8 m (6 ft 0 in.)	0.8 m (2 ft 7 in.)	0.3 m (0 ft 10 in.)
36.1 kV–46 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)	0.4 m (1 ft 5 in.)
46.1 kV–72.5 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 3 in.)	0.1 m (2 ft 2 in.)
72.6 kV–121 kV	3.3 m (10 ft 8 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 4 in.)	0.8 m (2 ft 9 in.)
138 kV–145 kV	3.4 m (11 ft 0 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)	1.0 m (3 ft 4 in.)

[a] For single-phase systems, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.

Table 130.4(C)(b) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for **Direct-Current Voltage Systems**

(1)	(2)	(3)	(4)	(5)
	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder	
Nominal Potential Difference	Exposed Movable Conductor[b]	Exposed Fixed Circuit Part		Prohibited Approach Boundary
<100 V	Not specified	Not specified	Not specified	Not specified
100 V–300 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact	Avoid contact
301 V–1 kV	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)	25 mm (0 ft 1 in.)
1.1 kV–5 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.5 m (1 ft 5 in.)	0.1 m (0 ft 4 in.)
5 kV–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)	0.2 m (0 ft 7 in.)
15.1 kV–45 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)	0.4 m (1 ft 5 in.)
45.1 kV– 75 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 2 in.)	0.7 m (2 ft 1 in.)
75.1 kV–150 kV	3.3 m (10 ft 8 in.)	3.0 m (10 ft 0 in.)	1.2 m (4 ft 0 in.)	1.0 m (3 ft 2 in.)
150.1 kV–250 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.6 m (5 ft 3 in.)	1.5 m (5 ft 0 in.)
250.1 kV–500 kV	6.0 m (20 ft 0 in.)	6.0 m (20 ft 0 in.)	3.5 m (11 ft 6 in.)	3.3 m (10 ft 10 in.)
500.1 kV–800 kV	8.0 m (26 ft 0 in.)	8.0 m (26 ft 0 in.)	5.0 m (16 ft 5 in.)	5.0 m (16 ft 5 in.)

[a] All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.
[b] This terms describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

A3: Hazard/Risk Category Classifications

Table 130.7(C)(15)(a): Hazard/Risk Category Classifications for Alternating Current Equipment

Table 130.7(C)(15)(a) Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools-Alternating Current Equipment (Formerly Table 130.7(C)(9)

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
Panelboards or other equipment rated 240 V and below Parameters: Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 19 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	0	N	N
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	1	Y	Y
Panelboards or other equipment rated > 240 V and up to 600 V Parameters: Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 30 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	1	N	N
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	1	Y	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Remove/install CBs or fused switches	2	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	2	Y	Y
600 V class motor control centers (MCCs) Parameters: Maximum of 65 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 53 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	1	N	N

(continues)

Table 130.7(C)(15)(a) *Continued*

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
CB or fused switch or starter operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2	Y	Y
Application of temporary protective grounding equipment, after voltage test	2	Y	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the motor control center	2	Y	Y
600 V class motor control centers (MCCs) Parameters: Maximum of 42 kA short circuit current available; maximum of 0.33 sec (20 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 165 in.			
Insertion or removal of individual starter "buckets" from MCC	4	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
600 V class switchgear (with power circuit breakers or fused switches) and 600 V class switchboards Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.5 sec (30 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 233 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	2	N	N
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2	Y	Y

Table 130.7(C)(15)(a) *Continued*

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
Insertion or removal (racking) of CBs from cubicles, doors open or closed	4	N	N
Application of temporary protective grounding equipment after voltage test	2	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	2	N	N
Other 600 V class (277 V through 600 V, nominal) equipment Parameters: Maximum of 65 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance (except as indicated) Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 53 in.			
Lighting or small power transformers (600 V, maximum)			
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	2	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Application of temporary protective grounding equipment, after voltage test	2	Y	N
Revenue meters (kW-hour, at primary voltage and current)—insertion or removal	2	Y	N
Cable trough or tray cover removal or installation	1	N	N
Miscellaneous equipment cover removal or installation	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Application of temporary protective grounding equipment, after voltage test	2	Y	N
Insertion or removal of plug-in devices into or from busways	2	Y	N
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.2 sec (12 cycle) fault clearing time; minimum 36 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 422 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	3	N	N
Contactor operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
Contactor operation with enclosure doors open	2	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	4	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	3	Y	Y

Table 130.7(C)(15)(b): Hazard/Risk Category Classifications for Direct Current Equipment

Table 130.7(C)(15)(b) Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools — Direct Current Equipment

Tasks Performed on Energized Equipment	Hazard/Risk Category[a]	Rubber Insulating Gloves[b]	Insulated and Insulating Hand Tools
Storage batteries, direct-current switchboards and other direct-current supply sources >100 V <250 V			
Parameters: Voltage: 250 V Maximum arc duration and working distance: 2 sec @ 18 in.			
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥1 kA and <4 kA Potential arc flash boundary using above parameters at 4 kA: 36 in.	1	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥4 kA and <7 kA Potential arc flash boundary using above parameters at 7 kA: 48 in.	2	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥7 kA and <15 kA Potential arc flash boundary using above parameters at 15 kA: 72 in.	3	Y	Y
Storage batteries, direct-current switchboards and other direct-current supply sources ≥250 V ≤600 V Parameters: Voltage: 600 V Maximum arc duration and working distance: 2 sec @ 18 in.			
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥1 kA and <1.5 kA Potential arc flash boundary using above parameters at 1.5 kA: 36 in.	1	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥1.5 kA and <3 kA Potential arc flash boundary using above parameters at 3 kA: 48 in.	2	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥3 kA and <7 kA Potential arc flash boundary using above parameters at 7 kA: 72 in.	3	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥7 kA and <10 kA Potential arc flash boundary using above parameters at 10 kA: 96 in.	4	Y	Y

Y: Yes (required).

[a]If acid exposure is possible, the clothing is required to be protected from acid and arc rated to the hazard according to ASTM F 1891 or equivalent and evaluated by ASTM F 1296 for acid protection.

[b]In clean rooms or other electrical installations, that do not permit leather protectors for arc flash exposure, ASTM F 496 is required to be followed for use of rubber insulating gloves without leather protectors, and the rubber gloves chosen are required to be arc rated to the potential exposure level of the hazard/risk category.

Appendix B - Electrical Procedures & Forms

B1: Safe Switching Practices

1. Obtain authorization.
2. Review one-line diagram to identify all equipment affected by the operation.
3. Identify the immediate blast zone.
4. Notify all affected employees.
5. Clear work area.
6. Clear and keep others out of the switching area.
7. Make sure standby person is out of the immediate blast zone.
8. Make sure panel covers and doors are secured.
9. Inspect and put on required protective equipment.
10. Have the standby person put on the required PPE.
11. Perform switching operation. If the device cannot be operated remotely, stand off to the side that offers the most protection from an anticipated blast.
12. Verify that all locks and tags have been removed and it's safe to re-energize the circuit.
13. Re-energize circuit.
14. Notify affected employees that work is complete.

B2. Electrical Procedures:
Energized Ballast Replacement

Note: Work on energized equipment requires a signed Energized Electrical Work Permit.

Brief description of work:
Replacement-in-kind of an energized 120 or 277 volt ballast

List of tools and equipment:

- Caution tape
- Safety-insulated tools
- Fiberglass ladder
- All leather safety shoes
- Class “0” gloves w/ leather protector
- Safety glasses
- Arc-rated face shield
- Arc-rated (FR) clothing

Emergency procedures and contact:

Procedures:
Follow this step-by-step outline of work, including safety preparations, work outline, and removal of temporary safety barriers or tags:

1. Evaluate why work must be done on an energized circuit.
2. Complete and submit Energized Electrical Work Permit. Obtain necessary approval.
3. Clear working area.
4. Put on safety glasses and arc-rated face shield.
5. Inspect and put on PPE specified in Permit.
6. Open fixture and remove lamps.
7. Place lamps in a safe spot.
8. Open ballast compartment.
9. Test for “live.”
10. First, cut hot wire using insulated cutters and safe-off hot lead.
11. Second, cut neutral wire using insulated cutters and safe-off.
12. Cut remaining ballast leads.
13. Remove old ballast.
14. Install new ballast.
15. Make up ballast leads in the reverse order that they were disconnected.
16. Replace ballast cover avoiding pinched wires.
17. Replace lamps.
18. Close fixture.

B3. Electrical Procedures:
Energized Panel Work

Note: Work on energized equipment requires a signed Energized Electrical Work Permit.

Brief description of work:
Repair or construction work in energized panel between 50 volts and 600 volts

List of tools and equipment:

- Caution tape
- Electrical tape
- Tie wraps
- Electrical safety blanket (1000 volt)
- Non-metallic blanket clamps
- Safety-insulated tools
- Arc-rated (FR) clothing
- Class “0” gloves w/ leather protector
- Arc-rated face shield
- Safety glasses
- All leather safety shoes
- Fire extinguisher (carbon dioxide)

Emergency procedures and contact:

Procedures:
Follow this step-by-step outline of work, including safety preparations, work outline, and removal of temporary safety barriers or tags:

1. Complete and submit Energized Electrical Work Permit. Obtain necessary approvals.
2. Notify affected employees of planned work.
3. Identify escape route.
4. Establish safe work area.
5. Install caution tape barrier around panel allowing working clearance.
6. Remove conductive jewelry.
7. Inspect and put on PPE specified in the permit.
8. Have standby person put on PPE.
9. Remove panel cover (remove from safe work area).
10. Remove dead front (remove from safe work area).
11. Inspect panel interior for bus/ground areas that could be shorted during the work.
12. Cover electrically exposed area with electrical safety blanket.
13. Perform work using insulated tools.
14. Test the work for proper performance.
15. Remove safety blanket.
16. Re-install panel, dead front, and cover.
17. Remove barricades.
18. Update wiring diagram/documentation.
19. Notify affected employees that work is complete.

B4. Electrical Procedures:
Voltage, Current, and Phase Measurements

Brief description of work:
Voltage, current, or phase measurement on equipment between 50 volts and 600 volts

List of tools and equipment:

- Multi-meter
- Fiberglass ladder
- Amp clamps
- Floor mat (nonconductive barrier)
- Electric shields
- Safety-insulated tools
- Arc-rated face shield
- Class “0” gloves w/ leather protector
- Safety glasses
- All leather safety shoes
- Arc-rated (FR) clothing

Emergency procedures and contact:

Procedures:
Follow this step-by-step outline of work, including safety preparations, work outline, and removal of temporary safety barriers or tags:

1. Notify affected employees of planned work.
2. Test meter on known live circuit.
3. Clear working area.
4. Inspect and put on appropriate PPE.
5. Identify location for voltage measurement.
6. Place insulating mat.
7. Open enclosure in a safe manner.
8. Evaluate whether shielding should be placed over live circuits not being measured.
9. Properly set up meter for the voltage or amperage you are going to measure (be you sure are on the correct scale and in correct sockets).
10. Inspect meter lead and probes to make sure insulation is not compromised.
11. Take and record measurements.
12. Close enclosure.
13. Notify affected employees that work is complete.

B5. Energized Electrical Work Permit

PART I: JOB SCOPE (to be completed by the requester):

Work Order Number _____

1) Description of circuit/equipment/job location: _____
_____

2) Description of work to be done: _____
_____

3) Why can the circuit/equipment not be de-energized or the work deferred until the next scheduled outage?: _____
_____
_____

Requester's Name & Title _____ Date: _____

PART II: HAZARD ANALYSIS (to be completed by the electrically qualified persons <u>doing</u> the work):

Check when Completed

1) Detailed job description procedure to be used in performing the above described work: _____ ☐
_____

2) Description of the Safe Work Practices to be employed: _____ ☐
_____

3) Is a Standby person required? ☐ Yes ☐ No

4) Results of the Shock Hazard Analysis:_____ ☐
Limited Approach Boundary_____ Restricted Approach Boundary_____
Prohibited Approach Boundary_____

5) Necessary personal and other shock protective equipment to safely perform the assigned task:_____ ☐
_____

6) Results of Arc Flash Hazard Analysis: ☐
Incident Energy _____ Hazard/Risk Category_____
Arc Flash Boundary _____

7) Necessary arc flash personal and other protective equipment to safely perform the assigned task:_____ ☐
_____

8) Means employed to restrict the access of unqualified persons from the work area: _____ ☐
_____

9) Evidence of completion of a Job Briefing including discussion of any job-specific hazards: _____ ☐
_____

10) Do you agree the above described work can be done safely? ☐ Yes ☐ No If no, return to requester.

_____ _____
Electrically Qualified Person Date

PART III: APPROVAL(s)* (to perform the work while electrically energized):

Note: Exposed electrical conductors or circuit parts, operating at 50 volts and higher, shall be de-energized before performing work on or near, unless it can be shown that de-energizing creates additional hazards, or is not feasible due to design or operational limitations. Exception: Work by a qualified employee that involves testing, measurement and troubleshooting activities.

Manager's Name	Manager's Signature	Date
EHS	EHS Signature	Date
Electrically Knowledgeable Person	Electrically Knowledgeable Person's Signature	Date

Note: Once the work is complete, forward a copy of this form to EHS

B6. Electrical Safety Program
Field Work Audit

Date_____ **Inspector's Name_____**

Employee's Name_____ **Job Title_____**

Location_____

Process Involved_____

		Yes	No	N/A
1.) Is the work being performed energized?				
2.) Can the work be performed in the de-energized state?				
3.) Does the work require an Energized Electrical Work Permit? (Except for testing, measurement, and troubleshooting, electrical work permit is required for energized work.)				
4.) Is there an approved written electrical work permit?				
5.) Is proper PPE worn for arc flash and shock protection? (PPE is required for energized work, including testing, measurement, and troubleshooting. Electrical conductors and circuits must be treated as energized until tested and proven otherwise.)				
6.) Is the PPE in good conditions, free of flammable or combustible materials, and inspected prior to usage?				
7.) Jewelry and conductive materials such as rings, key chains, and metal frame glasses and clothing made from meltable fibers such as polyester and nylon are not worn.				
8.) Does the task require insulated hand tools/equipment?				
9.) Are insulated hands/equipment being used?				
10.) Test instruments and equipment are designed and properly rated for the circuits, equipment and environment they are being used?				
11.) Are tools/equipment used in good conditions and inspected prior to usage?				
12.) Is access restricted? Are there measures in place (signs, barricades, attendant, etc) to protect other personnel from coming in contact with energized parts?				
13.) Employee had analyzed the work and mitigated potential hazards?				
14.) Are other elements of the electrical work permit such as job briefing implemented?				
15.) Are safe work practices being followed?				

Comments:

Forward completed copy to EHS