

**California State University,  
Bakersfield  
Electrical Safety Program**



CALIFORNIA STATE UNIVERSITY  
**BAKERSFIELD**  
Safety and Risk Management

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# California State University, Bakersfield

## Electrical Safety Program

### 1.0 PURPOSE

California State University, Bakersfield makes every effort to provide a safe and healthy environment for employees and students. CSUB has developed this Electrical Safety Program in compliance with applicable regulations set forth by Cal/OSHA electrical safety orders, telecommunication safety orders, lockout/tagout and the National Fire Protection Association 70 and 70E standards.

Only CSUB Facility Management can authorize work on electrical equipment.

To protect employees, students, and the public from electrical hazards, it is CSUB's policy that all electrical circuits, cables, wires, or equipment operating at 50 volts or above will be considered energized until proven de-energized by approved test instruments. Live parts will be de-energized before an employee works on or near them unless one of the following conditions applies:

A. De-energizing introduces additional or increased hazards.

Examples of additional or increased hazards would include deactivation of emergency alarm systems or shutdown of hazardous location ventilation systems.

B. De-energizing is not possible due to equipment design or operational limitations.

Examples of this situation would include testing and troubleshooting of electrical circuits that can only be performed with the circuit energized.

C. Live parts that are operating at less than 50 volts to ground, and there is no increased exposure to electrical burns or to explosion due to electrical arcs.

When live parts are not placed in an electrically safe condition, the work practices described in this document shall be utilized. Live parts are to be de-energized in accordance with the Hazardous Energy Control Program (Lockout/Tagout).

### 2.0 SCOPE

This program is applicable to all work at CSU involving electrical systems six-hundred (600) volts or less where employees may be exposed to live parts and/or those parts that have been de-energized. It is possible that some laboratories or

areas under Facilities Operations such as mechanical rooms may require employees to work with equipment in the range between one-hundred twenty and six-hundred (120 – 600) volts. However most other University employees work in areas where the voltages of appliances and equipment are at one hundred twenty (120) volts or less.

This program authorizes only campus Facilities Management personnel or a qualified and authorized contractor perform electrical work. The program is established to:

- A. Ensure the safety of authorized personnel who work on or near electrical systems;
- B. Ensure that all personnel understand and comply with electrical safety standards;
- C. Ensure that personnel follow uniform safe work practices during the completion of electrical work;
- D. Ensure an electrical hazard assessment is completed prior to performing energized electrical work;
- E. Ensure the proper labeling of and restricted access to energized electrical equipment.

### 3.0 REFERENCES

Title 8, CCR, §2299 Low Voltage Electrical

Safety Title 8, CCR, §2320 Work Procedures

Title 8, CCR, §2710 High Voltage Electrical Safety

Title 8, CCR, §8600 – 8618 Telecommunication Safety

Orders Title 8, CCR, §3314 Control of Hazardous Energy

National Electrical Code

National Fire Protection Association 70 and 70E, Standard for Electrical Safety in the Workplace

Occupational Safety and Health Administration, 29 CFR 1910 Subpart S, Electrical, 1990.

Occupational Safety and Health Administration, 29 CFR 1910.147, Control of Hazardous Energy, 1989.

## 4.0 DEFINITIONS

AED Automated External Deliberator is a device that enables a CPR-trained individual to perform defibrillation in order to save an injured employee Arc Rating The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to “breaking open” or at the onset of a second-degree skin burn. This rating (APTV, Arc Protective Thermal Value) is assigned to electrical protective clothing and is normally expressed in calories per square centimeter (cal/cm<sup>2</sup>)

Authorized Workers Only persons specifically authorized by Facilities Management may install, modify, repair, or work on electrical conductors and equipment in or on CSUB facilities.

Authorization is hereby granted to employees in the following classifications, on the condition that the employee has documented training and demonstrated knowledge of electrical safety and the national electric code. □ Electrician (all)

- HVAC Engineers
- Maintenance Mechanic
- Metal Worker

Any non-University personnel performing work on electrical conductors and equipment must be a licensed electrical contractor, or an employee of such, holding a license issued by the State of California or recognized as a qualified Journeyman electrician by the Department of Industrial relations, or under the direction of such. In addition, any work must be done under an approved contract issued by Procurement and administered by Facilities Management.

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 power cord from the electrical outlet (providing plug and cord are in the immediate control of the employee working on the equipment).
- Operation and lockout of a mechanical disconnecting means to disconnect the equipment from the source of supply. The campus lockout procedure must be followed and may ONLY be performed by personnel trained and certified in hazardous energy control procedures.

**Bonding** Permanent joining of metallic parts to form an electrically conductive path that ensures electrical continuity, and the capacity to conduct safely, any current likely to be imposed

**Circuit Breaker** A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined over current without damage to itself when properly applied within its rating

**Conductive** Suitable for carrying electric current

**Current** Term referring to electric flow; it is current that can result in electric shock

**As related to electrical safety,** electrical devices and/or equipment that are disconnected from all energy sources including direct electrical connectors, stored electric energy such as capacitors, and stored nonelectrical energy in devices that could re-energize electric circuit part

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

**Electrically Safe Work Condition** A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with CSUB policy, tested to ensure the absence of voltage, and grounded if determined necessary

**Electrician** A person designated by the employer who has been trained in and is familiar with "safety-related work practices," safety procedures, first aid and CPR, emergency procedures, recognizing work hazards, personal protective equipment, and insulating tools and equipment operating below 600 volts. This person has demonstrated familiarity with the operation to be performed and the hazards involved.

**Energized**

Electrically connected to or having a source of voltage (aka "live")

**Exposed** (as applied to live parts) Capable of being inadvertently touched or not suitably guarded, isolated, or insulated

**Equipment** A general term including material, fittings, devices, appliances, luminaries (fixtures), apparatus, and the like used as a part of, or in connection with, an electrical

installation

**Flash Hazard** A dangerous condition associated with the release of energy caused by an electric arc

**Flash Hazard Analysis** A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices along with appropriate levels of PPE

**Flash Protection Boundary** An approach limit set at a fixed distance from exposed live parts within four feet which is the minimum default boundary in the absence of calculated flash values, a person could receive a second-degree burn (1.2 cal / cm) if an electrical arc flash were to occur

**Flash Suit / Smock Kit** FR clothing and equipment system that covers potentially exposed area of the body, except for the hands and feet. (Such a system may include pants, jacket, and a "bee- keeper" style hood fitted with a face shield)

**FR Apparel** Flame-resistant apparel; describes a broad category of clothing designed to protect employees from electrical arc events during completion of energized tasks. (FR typically refers to "resistant" which is an inherent quality as opposed to flame retardant which imparts a chemical coating to a fabric, protection which may diminish over time.)

**Ground Fault Circuit Interrupter (GFCI)** A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within established period of time. GFCI provides additional protection from shock by deactivating current to equipment when a change in electricity is sensed.

**Grounding Practice** whereby electrical equipment is intentionally and securely bonded to the ground, creating a safe, conductive path for electricity

**High Voltage** A sustained voltage of more than 600 volts (See Voltage)

**Incident Energy** The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per square centimeter (cal/cm<sup>2</sup>).

**Limited Approach Boundary** An approach limit set at a fixed distance from an exposed live part within which a shock hazard exists

**Live Parts** Energized conductive components or parts that have been energized, (aka "live" parts), are assumed to be live, until verified to be free of energy



Low Voltage Low-Voltage Electrical Safety Orders apply to all electrical equipment of 600 volts or less and to work performed in proximity to such electrical systems in all places of employment in the State of California (Labor Code Section 6303). This does not apply to conductors and equipment in vehicles, operating at less than 50 volts or to their ignition system, unless otherwise specified.

Outlet A point on the wiring system at which current is taken to connect electrically operated devices

Prohibited Approach Boundary An approach limit set at a distance from an exposed live part within which work is considered the same as making contact with the live part. Personal Protective Equipment is required when performing this type of work.

PPE An acronym for "Personal Protective Equipment" that refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury by blunt impacts, electrical hazards, heat, chemicals, and infection

Qualified Person (aka qualified electrician) One who: □ Has the skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training on the hazards involved. □ Is familiar with the proper use of special precautionary techniques, personal protective equipment, including arc-flash, insulating and shielding materials, and insulated tools and test equipment □ Can distinguish exposed energized parts from other parts of electrical equipment; and, has skills that have been verified by a knowledgeable supervisor.

Resistance The ease with which electricity flows through a given material (conductor). Every material has a different resistance, which may change with conditions. Resistance is included in basic electrical calculations of voltage and current ( $V = I \times R$ ).

Restricted Approach Boundary An approach limit at a distance from an exposed live part within which there is an increased risk of shock (due to electrical arc-over combined with inadvertent movement) for personnel working near the live part. Only trained personnel are allowed within this boundary.

**Service Connection (Drop)** The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served

**Unqualified Person** Any person who does not meet the definition of a qualified person

**Voltage** Units of electric potential or potential difference assigned to a circuit or system. The greatest root-mean-square (rms) effective difference of potential between any two conductors of the circuit concerned.

**Voltage to Ground** In grounded circuits the voltage between the given conductor and that point or conductor of the circuit which is grounded; in ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit

**UL** Abbreviation for Underwriters Laboratory, an independent product safety testing and certification organization

**Working Near (live parts)** Any activity within a Limited Approach Boundary (i.e. within area where shock is possible)

**Working On (live parts)** Coming in contact with live parts via tools, probes, test equipment, hands, feet, or other body parts regardless of the level of PPE worn.

## 5.0 ELECTRICAL OUTAGES

Employees should report electrical outages to Facilities Management immediately at extension 2211 (661-6542211) before 4:30pm, and University Police Dispatch at extension 2111 (661-654- 2111) after 4:30pm, on holidays and weekends.

Any work on electrical service for the campus, including construction, renovation, demolition, maintenance and repair work, requires notification of CSUB Facilities Management. CSUB Facilities Management ensures continuity of electrical service to the campus and is responsible for scheduling and performing/facilitating power shutdowns for the campus in concert with overall Facilities Management.

## 6.0 RESPONSIBILITIES

The goal of this electrical safety program is to ensure all employees understand the hazards associated with electric energy and can perform the necessary steps to protect themselves and any co-workers in the area. Responsibilities include hazard identification regarding electrical equipment as set forth below, reporting and correcting any observed or perceived electrical safety hazards and training.

## 6.1 CSUB Employees Will:

- A. Remember that only properly trained employees are permitted to perform maintenance and repair activities on electrical equipment. Unless you were hired to work on electrical equipment and possess appropriate training, do not perform maintenance and repair;
- B. Not reset a circuit breaker that has tripped to the off position. Contact Facilities Management at extension 2211 and ask for assistance;
- C. Not work on energized or "hot" equipment without completing an Energized Electrical Work Permit and hazard analysis;
- D. Wear clothing as specified in Section 7 when working with electric energy;
- E. Not enter an area that has been secured to prevent access (taped-off with yellow or red tape.);
- F. Comply with safe work practices (see Safe Work Practices, Appendix C);
- G. Attend and participate in safety training;
- H. Report damaged equipment and immediate electrical safety concerns to Facility Management through the TMA work request system (<http://facman1.csub.edu/>).

## 6.2 CSUB Supervisors/Managers Will:

- A. Ensure employees are trained, qualified and authorized to work on electrical equipment where required to do so as an employee's job duties dictate;
- B. Respond to reports of electrical safety concerns from employees or students, in conjunction with Facilities Management and Safety & Risk Management;
- C. Contract and schedule outside contractors through Procurement and Facilities Management when electrical systems are affected or modified;

### 6.3 Facilities Management Will:

- A. Ensure that authorized departmental employees meet the definition of qualified person as defined above;
- B. Ensure the appropriate levels of training and annual performance evaluations are performed for each qualified person performing electrical work;
- C. Ensure electrical conductors are labeled according to current best practices and at minimum according to NEC 110.16;
- D. Provide appropriate personal protective equipment to authorized qualified employees who work with electrical equipment;
- E. Stop work activities involving electrical service and equipment when the work presents a threat to the health and safety of persons, property, or the environment;
- F. Ensure that a flash hazard analysis is developed and reviewed prior to authorizing energized electrical work.

### 6.4 Safety & Risk Management Will:

- A. Provide assistance in identifying, assessing, and labeling electrical hazards;
- B. Facilitate scheduling and identifying appropriate electrical safety training for employees;
- C. Collaborate with the Facilities Management and assist Supervisors/Managers on matters of electrical safety;
- D. Stop work activities involving electrical service or equipment on campus when the work presents a threat to the health or safety of persons, property, or the environment, whether contractors or staff/faculty are performing the work;
- E. Review and update this program when necessary. Affected employees will have the opportunity to provide input in order to improve the functionality of the program at any time through safety committee meetings and through established IIPP processes.

### 6.5 Outside Contractors Will:

- A. Adhere to the provisions of California OSHA, the NEC and NFPA 70 and 70E while performing repair of electrical equipment or any other electrical work while on campus by specifications included in the contract with the University;

- B. Comply with CSUB's Electrical Safety Program and the Lockout /Tag Out Program or submit for approval by S&RM an equivalent or more stringent ESP;
- C. Be informed of the prohibition of working on energized electrical equipment;
- D. Provide C-10 Electrical Qualifications for electrical work to be performed at CSUB.

## 7.0 CLOTHING

All campus electricians, and anyone assigned to electrical work, are prohibited from wearing:

- A. Garments having synthetic fiber content greater than 15% when working on energized electrical components. Natural fibers such as cotton or wool are recommended.
- B. Conductive articles of clothing (such as rivets, brads, and large metal buckles) and jewelry. Hair must be restrained in a non-metallic clip or rubber band.

When performing tasks in which a potential electrical hazard is identified, the campus will provide FR clothing appropriate from the following:

- A. Fire Resistive Work Shirt – 7 oz., with a minimum “arc thermal performance exposure value” (APTV), of 8, and an arc rating of 8.2.
- B. Fire Resistive Work Pant – 9 oz., with a minimum APTV of 8, and an arc rating of 11.1.
- C. 1,000 Volt Rubber Gloves (listed, rated and tested), and leather keepers.
- D. A face-shield / hat / chin-cup device – with a minimum APTV of 10, tested to ASTM F2178 specifications.
- E. Smock Suit/Flash Gear Set (all inclusive) with APTV of 28 or 40.

## 8.0 INSULATED HAND TOOLS

Insulated hand tools complying with ASTM F 1505, Standard Specification for Insulated and Insulating Hand Tools, shall be used where contact of the tool with live conductors or parts is possible. Insulated hand tools shall be marked with the manufacturer’s name or trademark, the double triangle symbol, the year of manufacture, and the electrical working limit for alternating current (usually 1000 volts).

- A. Insulated tools shall be rated for the voltages on which they are used.

B. Insulated tools shall be used for the purpose for which they were designed and constructed.

C. Insulated tools are only to be used up to the voltage rating for which they have been tested and certified.

D. Insulated tools shall be properly stored away from sources of heat to minimize the risk of damage to the insulation.

E. Insulated tools shall be visually inspected before each use. If there is evidence of insulation cracking or contamination of potentially conductive material, the tool shall be examined by a supervisor and electrically tested if necessary. If deemed unserviceable or unsafe, it shall be destroyed.

F. Double-ended tools are not permitted; these may be insulating tools, but are not insulated tools.

G. Fuse holder handling equipment insulated for the circuit voltage shall be used to remove or install a fuse when the fuse terminals are energized.

H. Insulated tools such as hot sticks shall be dielectrically tested to ensure nonconductive integrity every 24 months.

## 9.0 ELECTRICAL SAFETY PROCEDURES

Except for emergency repairs to the extent necessary to safeguard the general public, at least two qualified persons shall be present during installation, removal or repair of lines that are energized from 480 to 600 volts, and until a system operating at 480 to 600 volts has been verified as being de-energized.

Employees working on electrical equipment should develop standard procedures, also called a flash hazard analysis, that include:

A. Purpose of the task/job

B. Order of task performance and potential hazards (including arc flash/blast) involved with each task

C. Safe work practices to be employed

D. Personal Protective Equipment to be used

E. Special insulating materials and tools to be used

F. Any special precautions or techniques needed

G. If applicable, electrical diagrams

H. Requisite training, such as electrical qualification or CPR/First Aid

## 10.0 GENERAL REQUIREMENTS, ELECTRICAL COMPONENTS

A. Electrical equipment must have durable markings or labels which indicate the manufacturer's name or trademark; and the voltage, current, or wattage rating

B. Live parts must be guarded, enclosed, or located in a room accessible only to authorized employees. Rooms with 600 volts or more shall be kept locked.

C. Access to electrical equipment must be maintained to accommodate servicing and repair. Areas in front of disconnects, circuit breaker panels, motor control centers, control panels, etc. shall have a front clear space of at least three feet.

D.

Electrical disconnects and circuit breakers will be labeled to indicate their purpose.

E. Unused openings in cabinets and junction boxes shall be closed.

F. Equipment must be labeled for use in hazardous areas. Intrinsically safe electrical equipment is to be used in locations where flammable gases, vapors, dusts, and other easily ignitable materials are present.

G. When protection devices activate, the cause must be determined and corrected before the equipment is re-energized. When there is evidence that electric equipment could fail, protect from hazards associated with the impending failure of the equipment.

H. Protection devices must not be modified or circumvented to prevent their normal operation.

I. Proper disconnecting means designed for the purpose of energizing and de-energizing electrical power to equipment is required.

J. The space in back or on top of switchboards, transformers, electrical conduit, and other electrical components is to be kept free of debris and cannot be used for storage.

K. General illumination lamps or bench lighting located less than seven feet from walking or working surfaces must be covered or protected from physical damage.

## 11.0 WORK ON ELECTRICAL SYSTEMS: ENERGIZED PARTS

Live parts to which an employee may be exposed will be de-energized, using the approved Lockout/Tagout Procedures. Work on energized equipment at CSUB is prohibited, with the following exceptions:

A. Work is performed on or near live parts by qualified persons while

utilizing safe work practices and personal protective equipment AND with the following considerations:

- B. Tasks are related to testing, trouble-shooting, voltage measuring, and other systems analysis that necessitates the system remain energized;
- C. The live parts operate at less than 50 volts to ground and there is no increased exposure to electrical burns or arc.
- D. De-energizing introduces additional or increased hazards (such as critical fume hood systems the remove flammable or toxic vapors)
- E. De-energizing is not possible due to equipment design or operational limitations.
- F. Prior to work being performed on energized equipment, a signed Energized Electrical Work Permit (Appendix A) must be obtained from the Facilities Management Supervisor, or his designee. A copy of the permit should be forwarded to S&RM prior to work beginning. It is recommended that a call be made ahead to verify the availability of an AED.

11.1 For all energized work, the following is required:

1. An Energized Electrical Work Permit has been issued and applies to the work being done.
2. Area must be demarcated to secure access to only personnel trained to be in the area.
3. If signs and barricades do not provide sufficient access restriction, then an attendant will be assigned to warn and protect pedestrians. The attendant's duty is to keep unqualified persons out of the work area.
4. When working within the Approach and Prohibited Approach Boundaries, and live parts are exposed, personal protective equipment must be worn and must cover all exposed areas of the body.
5. PPE shall include clothing meeting ASTM standards with a 11 and 40 calorie FPV for below 240 and above 240 volts, respectively. FR clothing will be inspected before each use. Damaged clothing will not be used. Clothing contaminated with grease, oil, flammable liquids, or combustible liquids shall not be used.
6. Arc flash protection will cover all exposed parts of the body including eyes, head, face, ears, hand, feet, and skin of all limbs.



7. Rated (and tested according to mandated interval) insulated gloves meeting ASTM standards must be worn for voltages in excess of 250 volts to ground.

8. Rubber insulating gloves must be inspected for damage before use. An air test must be performed before each use. Rubber gloves shall be protected by an outer leather glove (ATPV > 140 cal / cm<sup>2</sup>) when subject to damage during use. Rubber gloves shall be dielectrically tested every 6 months if out of the package, and every 12 months if in the original packaging. Rubber gloves must be stored in an area protected from light and temperature extremes. Rubber insulating gloves shall be marked with the ASTM seal indicating the insulating certification, and date of testing.

#### 12.0 SPECIALIZED CONTROLS AND PRACTICES: ELECTRICAL WORKERS

9. Every electrical conductor or circuit part is considered energized until proven otherwise by field verification.

10. De-energizing an electrical conductor or circuit part and making it safe to work on is in itself a potentially hazardous task.

11. Wear personal protective equipment specified for a particular job. (Attachment B.)

12. Utilize insulating tools designed for work with electrical service.

13. Use only fiberglass (non-metal ladders) around electrical panels or work areas.

14. Sufficient working clearance around energized equipment (minimum of 3 feet) should be confirmed prior to starting work.

### 13.0 HAZARDOUS ENERGY CONTROL (LOCKOUT/TAGOUT)

CSUB shall adhere to the provisions of CSUB IIPP Lockout/Tagout Program which complies with CalOSHA 8CCR 2320.1, 2527.1, 2530.4, 3314, Hazardous Energy Control Program.

The following requirements recap basic principles of the Hazardous Energy Control Program:

- A. Circuits and equipment to be worked on will be disconnected by the worker from electric energy sources
- B. Stored electrical energy will be safely released prior to the work.
- C. Stored non-electrical energy (hydraulic or pneumatic) in devices that could reenergize electric circuit parts must be locked or relieved so that circuit parts cannot be accidentally reenergized by the device
- D. A lock and tag must be placed on each disconnecting means used to de-energize circuits and equipment on which work is to be done
- E. Push-button control switches shall not be used as the sole means of lockout
- F. Positioning the handles of a disconnect switch to the "off" position shall not be used as the sole means of lockout
- G. Identify stored energy devices as part of the lockout/tagout

process The de-energized condition will be verified as follows:

1. Equipment operating controls will be manually and remotely activated to ensure it cannot be restarted.
2. Use test equipment to ensure de-energized.
3. Test equipment must be inspected for defects or damage before verifying equipment is deenergized. Test on live equipment before and after the verification on de-energized equipment.

Re-energizing Equipment can only be done once a visual inspection is done to verify that electrical jumpers, shorts, grounds, and other devices have been removed before energizing. Persons shall be notified of the reenergizing of the circuit so they can stay clear and for removal of locks and tags.

#### 14.0 EXCAVATION AND TRENCHING

Excavation and trenching work will be preceded by verification of zero energy before work and before conduit removal. Conduct source checks for energy near the work, and not just at known energy sources.

- A. Review of the most current drawings and information will be used to locate utilities prior to excavation and trenching work
- B. Electrical wiring will be traced prior to initiating cutting
- C. Hand excavate near the expected location of the utility
- D. Permits are required when excavation and trenching work is to be done near energized lines
- E. Excavation and trenching work will only be done within a specified area with established boundaries
- F. Manual excavation and trenching near power lines shall be accomplished with, at minimum, the following equipment features:
  - 1. Utility locator survey technology (or locator service, [www.nulca.org](http://www.nulca.org), or [www.commongroundalliance.com](http://www.commongroundalliance.com))
  - 2. Double-insulated electrical tools that have insulated handles
  - 3. Drill-stop equipment when performing core drilling
  - 4. GFCI's with power tools
  - 5. Electrically-rated protective gloves and footwear

#### 15.0 RECORD KEEPING

Testing records shall be kept for a minimum of two years.

#### 16.0 TESTING EQUIPMENT

Voltage Testing Equipment is considered safety equipment for purposes of confirming the presence or absence of electricity.

- A. Voltage test equipment shall be maintained in good condition.
- B. Voltage testing equipment shall be used and maintained per manufacturer's recommendations.
- C. Voltage testing equipment shall have Underwriters Laboratories (UL), Factory

D. Mutual Corporation (FMC), Intertek ETL Semco, (ETL) or Institute of Electrical and Electronic Engineers, Inc. (IEEE) approval. Voltage testing equipment shall be used only by qualified, trained personnel.

E. Test instruments/equipment shall be rated for the circuits and equipment to which they are connected and shall be suitable for the environment in which they are to be used

#### 17.0 TRAINING AND CERTIFICATION

Electrical Safety training modules are included in New Employee Safety Orientation Training, and in other safety training programs such as Laboratory Safety and Lockout/Tagout. This includes generalized safety training topics on electrical hazards for employees who are not qualified persons under NFPA 70E and not expected to perform maintenance and repair on electrical equipment.

Safety training for employees who perform work on electrical service and equipment shall be provided. It is the responsibility of the employing department to facilitate the appropriate training for their employees to safely perform their duties. Training topics should include:

A. Understanding specific hazards associated with electrical energy.

B. Safety-related work practices and procedural requirements as necessary to provide protection from electrical hazards.

C. Identify and understand the relationship between electrical hazards and possible injury.

D. Emergency procedures and methods of release of victims from contact with exposed energized conductors or circuit parts.

E. A knowledgeable supervisor must certify every three years, that a qualified person has been observed and that his or her performance is consistent with electrical safe practices and this electrical safety program.

1. Follow the manufacturer's instructions for use, maintenance and repair of electrical equipment. Keep manufacturer instructions on file for reference.
2. Inspect electrical equipment for damage or defects prior to use.
3. Replace electrical cords that are worn, frayed or otherwise damaged.
4. Take equipment that is damaged or not operating properly out of service by placing a tag or sign that says "DO NOT USE - DEFECTIVE". Report to your supervisor for repair and or replacement.
5. Insure that extension cords are not in continuous use for a period of longer than thirty (30) days. CSUB FM or S&RM reserves the right to remove any extension cord deemed by them to be unsafe.
6. Insure that multiple power outlets (surge protectors) are plugged directly into outlets. Extension cords shall not be plugged into another extension cord or another multiple power outlet.
7. Plug all items with high amperage demands, such as refrigerators and microwaves, directly into a wall socket.
8. Utilize ground fault circuit interrupters (GFCI) in wet areas.
9. Handle plugs on electrical cords by grabbing the plug itself – never pull the electrical cord as a means to remove it.
10. Keep cords away from heat, oil and sharp edges.
11. Insure all electrical equipment is either Underwriters Laboratories (UL) or Factory Mutual listed.
12. Insure electrical cords are placed in a manner such that they do not become a trip hazard. Do not run cords under rugs or floors.
13. Insure that a clear space of at least 36 inches be maintained in front of electric equipment such as electrical breaker panels. This space shall not be used for storage.

#### 18.0 PORTABLE ELECTRICAL EQUIPMENT

1. All portable electrical equipment must be handled only in accordance with the manufacturer's instructions.
2. All portable electrical equipment with a cord and plug must have either a grounding post or a double insulated casing.
3. Double-insulated power tool protection is only good when the appliance is dry. Double- insulated power tools should only be used in wet and damp locations with

proper ground fault circuit interrupter (GFCI) protection.

4. Portable electrical equipment/tools with a cord and plug used in wet or damp areas must be either connected to a GFCI protected outlet or utilize a portable GFCI device.

5. Portable electrical equipment and cords must be visually inspected before each use for:

- Loose parts
- Deformed and missing pins
- Damaged outer jacket or insulation
- Possible internal damage

6. Defective equipment must be taken out of service and tagged to prevent reuse until repaired.

7. Only portable electrical equipment approved by the manufacturer for such applications is permitted to be used in wet locations.

#### 19.0 EXTENSION CORDS

1. All extension cords must be of the proper size and rating for the equipment in use. Only UL- listed equipment or components are used.

2. For outdoor work, use cords marked "W-A" or "W."

3. Remove electrical loads before connecting or disconnecting cord sets.

4. Never overload a cord set. If the cord is warm or hot to the touch, stop using and evaluate the potential equipment problem.

5. Do not drape cords over hot surfaces such as steam lines, space heaters, or radiators.

6. Do not run extension cords through standing water, wet floors, or other wet areas.

7. When cords are used outdoors, ensure the cord is listed and marked for outdoor use.

8. All extension cords must have an equipment grounding conductor. The grounding post on a three prong plug must never be removed to make it fit into a two-plug wall socket. Cords with missing or cutoff ground prongs must be removed from service. A standard plug adapter may be used and the ground properly attached.

9. Flexible electric cords must not be used to lift and lower the equipment they are attached to.

10. New or repaired extension cords should be tested before they are put into use.

11. Make a visual inspection of the extension cord each time the cord is used. Cords with cracked or worn insulation or damaged ends must be removed from service immediately.

12. Cords should be free of splices or taps. There should be no exposed wires, cut insulation, or loose connections at the plug or receptacle ends.

13. When cords must cross passageways or doors, protect the cords, provide warnings, and only use temporarily or for emergencies. Do not run cords through exit doorways, hazardous areas, or smoke or fire barriers.

14. Flexible cords and extension cords are not authorized as a substitute for fixed wiring. They must not be:

- Attached to building or structural surfaces
- Concealed behind walls, ceilings, or floors
- Run through windows, doors, other openings/holes, or around sharp corners or projections



APPENDIX A: ENERGIZED ELECTRICAL WORK PERMIT

Electrical Qualified Person(s) Name:		Date	
Work site location: /building & room number)		Work order/project no.:	
Planned start date/time:		Planned end date/time:	
Description of the work to be performed:			
Justification for the live work request:	<input type="checkbox"/> Shut down is infeasible due to design or operational limitations (specify)		
	Shut down creates an increased/additional hazard (specify):		
<b>Hazard Analysis /to be completed by the electrically qualified persons doing the work.)</b>			
Shock Analysis/Approach Boundaries: Limited approach boundary- Restricted approach boundary- Prohibited approach boundary-	<input checked="" type="checkbox"/> Work will be conducted within this boundary. <input type="checkbox"/> Work will be conducted within this boundary.		
Results of the flash hazard analysis:	The flash protection boundary is <b>4 ft 0 in</b> for systems that are <input checked="" type="checkbox"/> based on the product of clearing times of 6 cycles combination not exceeding 300 kA cycles (500 ampere seconds). (0.1 second) and the available bolted fault current of 50 kA or less.		
Hazard/risk category for the task: ATP rating (in cal/cm <sup>2</sup> ) for FR clothing:	<input type="checkbox"/> 01 02 03 04 (from Table 130.7(C)(9)(A) & (11)) <input type="checkbox"/> NIA (Cat 0) 04 (Cat 1) 08 (Cat 2) 025 (Cat 3) 040 (Cat 4)		
<input type="checkbox"/> Voltage-rated tools <input type="checkbox"/> Voltage-rated gloves <input type="checkbox"/> Safety glasses <input type="checkbox"/> Hearing protection <input type="checkbox"/> Leather work shoes <input type="checkbox"/> Hard hat	<input type="checkbox"/> Short-sleeve shirt (nat fiber) <input type="checkbox"/> Long-sleeve shirt (nat fiber) <input type="checkbox"/> Long-sleeve FR shirt (ATPV) <input type="checkbox"/> FR coveralls (ATPV) <input type="checkbox"/> FR jacket/rainwear (ATPV)	<input checked="" type="checkbox"/> Multi-layer FR flash suit jacket <input type="checkbox"/> Multi-layer FR flash suit pants (ATPV) <input type="checkbox"/> Arc-rated face shield (ATPV) <input type="checkbox"/> Flash shield hood (ATPV) (From Table 130.7(C)(10))	
access of unqualified persons from the work area:	<input type="checkbox"/> Signs/tags <input type="checkbox"/> Barricades <input type="checkbox"/> Attendants		
Has a documented job briefing with detailed procedures been conducted?	<input type="checkbox"/> Yes, see attached <input type="checkbox"/> No		
Proposed energized electrical work has been reviewed by:	Electrically Qualified Person(s)	Date:	
	Supervisor:	Date:	
	Request for energized electrical work granted? <input type="checkbox"/> Yes <input type="checkbox"/> No		
<b>SEND A COPY OF THIS PERMIT TO SAFETY AND RISK MANAGEMENT AT ADM37 FOR RECORDKEEPING AND PROGRAM REVIEW</b>			



