



Low/High Voltage Electrical Program

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Table of Contents

- Low Voltage Electrical Safety Program*** _____ **5**
- Responsibilities*** _____ **5**
 - Safety Manager Responsibilities** _____ **5**
 - Supervisors Responsibilities** _____ **5**
 - Employees** _____ **5**
- Program Components*** _____ **6**
 - General Precautions for All Employees** _____ **6**
 - Prevention of Electrical Shock** _____ **7**
 - Localized Electrical Outage** _____ **7**
 - Supervisors/Employees** _____ **7**
 - Reporting Requirements** _____ **7**
 - Damaged or Defective Electrical Equipment _____ **7**
 - Training Requirements** _____ **8**
- Emergency Response*** _____ **8**
- Personal Protective Equipment Is Required*** _____ **8**
 - Personal Protective Equipment Types** _____ **9**
 - Low Voltage Gloves _____ **9**
 - Rubber Protective Blankets _____ **9**
 - Head, Eye and Face Protection _____ **9**
 - Flash Burn Equipment _____ **9**
 - Body Protection _____ **9**
 - Hot sticks _____ **9**
 - Personal grounds _____ **9**
 - Examples of Situations Requiring PPE _____ **10**
 - Tools and Personal Protective Equipment (PPE) _____ **10**
- High Voltage Electrical Program*** _____ **10**
 - Responsibilities** _____ **11**
 - Supervisors Responsibilities _____ **11**
 - Safety Manager Responsibilities _____ **11**
 - Qualified Electrical Worker Responsibilities _____ **11**
 - De-Energized Electrical Work** _____ **11**
 - Energized Electrical Work** _____ **12**
 - Operating Procedures** _____ **12**
 - Observers** _____ **12**
 - Precautions about Arcing and Flashes** _____ **12**
 - Workspace Clearances** _____ **13**

Special Requirements	13
High Voltage	13
Work Practices	13
Voltage Detection	13
Vehicles/Equipment	13
Clearances	13
Tools and Probe	14
Overhead Voltage Lines	14
Hazardous Locations	14
Wet or Damp Locations	14
Working on Life Safety Systems	15
Protection from Life Safety Systems	15
Energized Electrical Work for Life Safety Systems	15
De-Energized Electrical Work for Life Safety Systems	15
Overriding Safety Interlocks	15
Equipment Inspection and Calibration	16
Reporting Requirements	16
Training Requirements and Competency Assessment	16
Employee Training	16
Qualified High Voltage Electrical Worker	16
Emergency Response	17
Personal Protective Equipment	17
Personal Protective Equipment Types	17
Low Voltage and High Voltage Gloves	18
Rubber Protective Blankets	18
Head, Eye and Face Protection	18
Flash Burn Equipment	18
Body Protection	18
Hot sticks	18
Personal grounds	18
Examples of Situations Requiring PPE	18
Tools and Personal Protective Equipment (PPE)	19
<i>Protection Against Arc Flash</i>	<i>19</i>
Exposure to under 600 volts:	20
Exposure to over 600 volts:	20
<i>Training</i>	<i>21</i>
Retraining	21
<i>Host Notification</i>	<i>21</i>
<i>Qualified – Unqualified</i>	<i>21</i>
<i>Work Practices</i>	<i>22</i>
<i>Hazard Analysis</i>	<i>22</i>
<i>Testing</i>	<i>22</i>

Energized Conductors _____ 23

Illumination _____ 23

Low Voltage Electrical Safety Program

This section applies to all work operations involving electrical systems of 600 volts or less where employees may be exposed to live parts and/or those parts that have been de-energized. The normal scope of our work does not include electrical work on low voltage and we do not do high voltage work.

The purpose of this section is to prevent injuries and accidents and protect employees from low voltage electrical hazards. "Low Voltage" is defined by Cal/OSHA as work performed directly on or in proximity of systems of 600 volts, nominal, or less. Specific safety procedures for preventing electric shock or other injuries resulting from direct/indirect electrical contact to employees working on or near energized or de-energized parts/lines will be developed and implemented as required.

This program applies to all work operations involving electrical systems of 600 volts or less where employees may be exposed to live parts and/or those parts that have been de-energized. Any work on energized equipment may be done only after it has been determined that this type of work must be performed with the equipment energized. All electrical equipment will be treated as energized and all barriers or covers will be re-installed if applicable.

Responsibilities

The goal of the electrical safety program is to ensure that all employees understand the hazards associated with electric energy and are capable of performing the necessary steps to protect themselves and their coworkers.

Safety Manager Responsibilities

- Hazard identification
- Reporting/correcting safety hazards
- Provide assistance in identifying electrical safety issues
- Provide electrical safety training
- Review electrical equipment safe operating procedures as necessary
- Ensure that all authorized or qualified persons have received appropriate levels of training
- Ensure appropriate Personal Protective Equipment is provided to authorized or qualified employees who work with electrical equipment

Supervisors Responsibilities

- Ensure employees are trained, qualified, and authorized to work on electrical equipment
- Correct identified safety hazards
- Ensure that all authorized or qualified persons have received appropriate levels of training
- Conduct periodic hazard analysis of work areas
- Ensure appropriate Personal Protective Equipment is provided to authorized or qualified employee who work with electrical equipment

Employees

- Are aware of electrical safety issues
- Comply with safe operating procedures when working with electrical equipment
- Attend appropriate safety training.
- Report safety concerns

Program Components

Most employees use electric powered equipment and systems. Whether in an office, field or shop, electricity is used continuously, usually without incident.

Voltages as low as 12 volts can be dangerous and when working with or around electrical equipment, one may inadvertently become part of an electrical circuit. Only trained and authorized or qualified individuals should do any repair or work on electrical equipment and always follow our Lockout/Tagout Program.

General Precautions for All Employees

- Never work on “hot” or energized equipment unless it is necessary to conduct equipment troubleshooting
- Use extension cords only as temporary power sources.
- Do not connect too many pieces of equipment to the same circuit or outlet as the circuit or outlet could become overloaded.
- Be sure that ground-fault circuit interrupters (GFCI) are used in high-risk areas such as wet locations (GFCI's are designed to shut off electrical power within as little as 1/40 of a second).
- Plug strips, such as those used on computers, should be plugged directly into outlets and not into extension cords or other plug strips.
- Inspect all equipment before use for defects or damage.
- All cords that are worn, frayed, abraded, corroded or otherwise damaged must be replaced.
- Grasp the plug to remove it from a socket - never pull the cord.
- Keep all cords away from heat, oil and sharp edges.
- Always follow the manufacturer's instructions for use and maintenance of all electrical tools and appliances.
- Keep equipment operating instructions on file.
- Never touch an electrical appliance and plumbing at the same time.
- Always unplug electrical appliances before attempting any repair or maintenance.
- All electrical devices must be properly grounded with approved three wire plugs unless they are "double insulated". Grounding provides a safe path for electricity to the ground, preventing leakage of current in circuits or equipment.
- All electrical equipment used should be UL or FM approved.
- Keep cords out of the way of foot traffic so they don't become tripping hazards or become damaged by traffic.
- Never use electrical equipment in wet areas or run cords across wet floors.
- Ensure energized parts of electrical equipment operating at 50 volts or more are guarded against accidental contact.
- Only properly trained employees should work on electrical equipment.
- Know how to respond to emergencies such as electric shock incidents or fires.
- When adequate natural illumination or permanent artificial illumination cannot be made available to secure the safety of employees, suitable portable lights shall be provided.
- Employees may not enter spaces containing exposed energized parts unless illumination is provided that enables the employees to work safely.

Prevention of Electrical Shock

- Suitable protective equipment or devices shall be provided and used on or near energized equipment for the protection of employees where there is a recognized hazard of electrical shock or burns.
- Work shall not be performed on exposed energized parts of equipment or systems until the following conditions are met:
 - Responsible supervisor or site lead person has determined that the work is to be performed while the equipment or systems are energized.
 - Involved personnel have received instructions on the work techniques and hazards involved in working on energized equipment.
 - Suitable personal protective equipment and safeguards (i.e., approved insulated gloves or insulated tools) are provided and used.

Localized Electrical Outage

- All employees should immediately report electric outages to dispatch.
- If possible, identify the equipment or the cause of the failure and remove it from service.
- Report this information to your supervisor upon his/her arrival.

Supervisors/Employees

- **NEVER** work with electricity greater than 600 volts without specific permission, training and written procedures. Notify your supervisor immediately if you have any questions.
- Be able to recognize electrical safety hazards in your work area.
- Ensure that all authorized or qualified persons have received appropriate training in order to operate or repair equipment.
- Keep equipment in good working order to help prevent electrical accidents.
- Maintain a three-foot clearance around electrical panels.
- Electrically operated equipment must be de-energized before work may commence.
- Always follow lockout/tag-out procedures when working on electrical equipment (Lockout/Tag-out Program) and wear appropriate Personal Protective Equipment (PPE) such as safety glasses, rated rubber gloves, rated rubber sleeves, insulated boots, or face shield.
- Never override safety devices such as electrical interlocks.
- Remove all rings, key chains or other metal objects when working around electricity.
- Wear appropriate personal protective equipment, such as eye protection or insulated gloves, as needed.
- Never use metal ladders when working near energized wiring.
- Damp or wet environments may be dangerous when working with electricity.
- Never plug in cords that are wet or touch electrical equipment with wet hands.
- Employees working with lasers, performing hardware or software testing, or other activities that do not require direct contact with electrical components, should be aware of electrical safety issues and be alert to the possibility of other employees conducting energized work in the area.

Reporting Requirements

Damaged or Defective Electrical Equipment

Report malfunctioning equipment or devices to your supervisor or the site owner's representative.

Typical issues include:

- Damaged cords, plugs or outlets;

- o Receiving a shock when touching the equipment; and
- o Arcing, sparking, smoking, or otherwise malfunctioning equipment.

Any electrical equipment not operating properly should be:

- o Taken out of service immediately.
- o Tagged or labeled as “Do Not Use”.
- o Reported to the appropriate department or individual for repair.

Do not attempt to repair any electrical equipment yourself unless you are properly trained and authorized to do so. If safety issues persist, please notify your supervisor.

Training Requirements

Training Requirement	Target Employees	Frequency
Basic Electrical Safety Awareness	All field employees	At time of employment and periodically thereafter as part of the UCI Core Safety Training Program and the Laboratory Core Safety Training Program
Advanced Electrical Safety	Employees who work directly with electrical systems from 50 to 600 volts, Qualified or Authorized Persons	Annually
Lock Out/Tag Out	Employees who work directly with electrical systems from 50 to 600 volts, Qualified or Authorized Persons	Annually

Specific training may also be required for specific workplace activities or equipment. Notify your supervisor if you have any questions.

Emergency Response

In case of an emergency, our employees must contact their supervisor and dial 911 from an internal or external telephone.

Personal Protective Equipment Is Required

When working where there is a hazard of electrical contact or flash burn proper personal protective equipment will be used. In all cases personal grounds will be applied before work on any de-energized electrical equipment. Conductive items of jewelry or clothing shall not be worn unless they are rendered non-conductive by covering, wrapping or other insulating means.

Personal Protective Equipment Types

One or more of the following types of personal protective equipment will be used when our employees are exposed to electrical hazards:

- Low voltage gloves
- Rubber protective blankets
- Head, eye and face protection
- Flash burn equipment
- Body protection
- Hot sticks
- Personal grounds

Low Voltage Gloves

These are used when checking for voltage prior to starting work, changing fuses in safety switches and where the possibility of electrical contact exists. All gloves shall be inspected prior to each use. Rubber gloves shall also be “air tested”.

Rubber Protective Blankets

Rubber blankets can be used to insulate workers from exposed electrical parts. Rubber blankets are considered additional protection from incidental contact with live electrical parts and circuits. This means that rubber blankets cannot be used as the sole source of protection and that rubber gloves and protective clothing must be worn when rubber blankets are in use.

Head, Eye and Face Protection

- Shall be used when working near exposed, overhead energized lines and equipment.
- Shall be used when working near exposed energized conductors and parts in switchgear and motor control centers.
- Shall be used when exposed to a possible electrical shock, arc or blast.
- Shall be used when exposed to falling objects.

Face shields made of polycarbonate material are more appropriate for use in situations with relatively low radiation exposure. Safety glasses and goggles provide lesser protection but, in low-risk tasks, may be justified if the task involves substantial physical work in combination with good visual requirements. Eye protection (safety glasses or goggles) shall always be worn under face shields or hoods.

Flash Burn Equipment

- Flash burn equipment shall be worn when there is a risk of arc flash burns.

Body Protection

- Employees shall wear clothing resistant to flash flame whenever there is a risk of an electric flash.

Hot sticks

- Employees shall use hot sticks when operating disconnects, applying personal grounds, taking voltage readings and when working on energized equipment.

Personal grounds

- Employees shall ground all de-energized electrical equipment prior to commencing work. Personal grounds are not to be removed until all work is complete and all personnel are clear of the equipment.

- All aerial work platforms shall be grounded when in use.

Examples of Situations Requiring PPE

- Testing for voltage on switchgear buses and other electrical equipment prior to starting work.
- Working near exposed energized lines, buses and electrical equipment.
- Applying personal grounds.

Tools and Personal Protective Equipment (PPE)

- The electrical tools and protective equipment must be specifically approved, rated, and tested for the levels of voltage of which an employee may be exposed.
- Electrical Protective Equipment must be selected to meet the criteria established by the American Society of Testing and Materials (ASTM) and by the American National Standards Institute (ANSI).
- Insulating equipment made of materials other than rubber shall provide electrical and mechanical protection at least equal to that of rubber equipment.
- PPE must be maintained in a safe, reliable condition and be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage.
- Employees must use insulated tools and handling equipment that are rated for the voltages to be encountered when working near exposed energized conductors or circuit. Tools and handling equipment should be replaced if the insulating capability is decreased due to damage. Protective gloves must be used when employees are working with exposed electrical parts above fifty (50) volts.
- Fuse handling equipment (insulated for circuit voltage) must be used to remove or install fuses when the fuse terminals are energized. Ropes and hand lines used near exposed energized parts must be non-conductive.
- Protective shields, barriers or insulating materials must be used to protect each employee from shock, burns, or other electrical injuries while that person is working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.

High Voltage Electrical Program

The purpose of this section is to establish minimum standards to prevent hazardous electrical exposures to personnel and ensure compliance with regulatory requirements applicable to electrical systems. Working on the equipment in a de-energized state is required unless de-energizing introduces an increased hazard or is infeasible. The normal scope of our work does not include electrical work low or high voltage.

This section is designed to help ensure that energized high voltage electrical work is performed safely by authorized employees, who are trained and provided with the appropriate safe work procedures, protective equipment and other controls. The section is intended to ensure the employees are protected against electrical shock, burns and other potential electrical safety hazards as well as comply with regulatory requirements.

Only a Qualified High Voltage Electrical Worker is allowed to work on energized conductors or equipment connected to energized high-voltage systems. With the exception of replacing fuses, operating switches, or other operations that do not require the employee to contact energized high voltage conductors

or energized parts of equipment, clearing trouble or emergencies involving hazard to life or property, no such employee shall be assigned to work alone.

Responsibilities

Supervisors Responsibilities

Supervisors of persons performing electrical work must be knowledgeable about the work to be performed and the hazards involved in determining who is qualified to perform the work.

Supervisors or site lead person is responsible for:

Determining which employees are Qualified High Voltage Electrical Workers and are allowed to work on energized systems. This process involves “certification” of the individual by another Qualified High Voltage Electrical Worker based upon observation of their safe work practices, knowledge level and familiarity with the tools and equipment for performing energized electrical work on high voltage systems, and documentation of the required two years of training and experience.

Safety Manager Responsibilities

Our company safety manager is responsible for:

- Performing program implementation review on an annual basis on all electrical work including lockout/tagout procedures for specific equipment, and high voltage switching procedures written by the supervisor or their high voltage electrical contractors.

Qualified Electrical Worker Responsibilities

Qualified High Voltage Electrical Workers who perform energized electrical work on equipment or systems operating at greater than 600 volts must be able to:

- Understand how to use special tools and special work procedures for greater than 600 volts;
- Know the clearance requirements for high voltage equipment, barrier and barricading requirements;
- Understand special hazards associated with high voltage equipment;
- Understand special procedures and tools for extracting personnel from energized circuits and providing rescue and resuscitation, and;
- Understand the workspace and guarding specified in the Cal/OSHA standard.

Additionally, all Qualified High Voltage Electrical Workers must also have the skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment and to determine the nominal voltage of exposed live parts. Qualified employees must assess the tasks to be performed and note whether the work can be performed with the equipment in the de-energized state, as described below. The equipment manual, as well as personnel who are experienced with the equipment, shall be consulted for assistance in making these determinations. When work on equipment must be performed while energized, qualified employees must follow the procedures for energized electrical work as described in this program.

De-Energized Electrical Work

Electrical systems must be worked on in the de-energized state, whenever feasible, following the work practices described in our Lockout/Tagout Program. Energized electrical work should only be performed in situations where utilizing Control of Hazardous Energy practices increases the hazard(s) to the employee and/or equipment or it is not feasible (e.g., performing metering and testing).

Energized Electrical Work

In no case shall any employee approach within 10 feet of any energized high voltage device.

Energized electrical work is acceptable for tasks which can only be performed with the equipment energized or when the use of de-energized electrical work procedures presents a greater hazard. Cal/OSHA has defined such work as repair, maintenance, troubleshooting, or testing on electrical circuits, components, or systems while energized (i.e., live). No other activities shall be performed while energized.

Due to the degree of electrical hazards associated with this type of work, the procedures, equipment, and other controls described in this section must be used when performing energized electrical work. Our energized electrical work practices and procedure shall incorporate all other applicable provisions of Cal/OSHA regulations covering work in confined or enclosed workspaces, workspace illumination, alerting techniques, and personal protective equipment requirements.

Operating Procedures

Only Qualified High Voltage Electrical Workers shall work on energized conductors or equipment connected to energized high voltage systems. They shall observe the minimum approach clearances as stated in table 3940.2 of the Cal OSHA regulations.

Observers

During the time that work is being performed on any exposed conductors or exposed parts of equipment connected to high voltage systems, a Qualified High Voltage Electrical Worker, or an employee in training, must be in close proximity at each work location to:

- Act primarily as an observer for the purpose of preventing an accident
- Render immediate assistance in the event of an accident.
- All safe work practices must be followed while performing energized electrical work.

Precautions about Arcing and Flashes

Employees must wear protective equipment for the eyes or face wherever there is a potential danger of electric arcs, flashes or flying objects resulting from electric explosion. This should include polycarbonate safety glasses with side shields and a full-face shield. The following scenarios are examples of situations with the potential for arcs:

- Working with a metal or conductive tool near a live electrical contact point with voltages above 600 volts;
- Accidentally making contact across two live electrical contact points with a metal or conductive tool; and
- Utilizing conductive materials or tools to connect a circuit in place of properly rated fuses or circuit breakers.

Precautions to prevent arcs or flashes include the following:

- Keep covers over live electrical contact points closed;
- Avoid using metal or conductive tools around live electrical contact points, when possible;
- Avoid pointing or placing metal tools near live electrical contact points in equipment with voltages above 600 volts;
- Verify the voltages present when working near live electrical contact points;

- Utilize test fixture boxes while performing adjustments, calibrations, or function tests of energized parts; and
- Use properly rated fuses for the capacity of the line or protection needed for the equipment in question.

Workspace Clearances

Clearances and access distances for energized electrical work must comply with Cal/OSHA regulations. At least one entrance not less than 24 inches wide and six (6) and a half (1/2) feet high must be provided to give safe access to the working space around energized electrical equipment. When un-insulated energized parts are located adjacent to such entrance, they must be guarded.

The area in the immediate vicinity of the workspace must be surveyed and all potential hazards such as ladders, stacked boxes, ceiling tiles, or doors that may fall or swing into the workspace must be secured to prevent interference with the work being performed.

Portable ladders shall have non-conductive side rails. A clear escape path must be maintained from the workspace to an exit from the area.

Special Requirements

High Voltage

Work on systems greater than 600 volts must be performed using de-energized electrical work practices, whenever possible. Energized electrical work on greater than 600-volt electrical systems must only be performed by a Qualified Electrical Worker. The following work practices are required, in addition to the requirements described above, for energized electrical work.

Work Practices

Work on greater than 600 volts must be performed following the same requirements as described above under Operating Procedures, including the use of permits, Qualified High Voltage Electrical Workers, tools, PPE, and safety observers.

Voltage Detection

The operating voltage of equipment and conductors must be determined before performing any energized electrical work on high voltage systems. This should be performed using a calibrated and working high voltage probe designed for high voltage circuits at the level of voltage to be encountered.

Vehicles/Equipment

Vehicles or equipment with obstructed views to the rear will have a spotter or reverse signal alarm audible above the surrounding noise level. The spotter shall observe approach distances and provide the driver/operator a timely warning if the distances are compromised.

Clearances

Workspace clearances for vehicles and mechanized equipment are as follows:

General Clearances Required from Energized Overhead High-Voltage Conductors

Nominal Voltage (Phase to Phase)	Minimum Required Clearance (Feet)
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600..... 50,000	6
over 50,000..... 345,000	10
over 345,000..... 750,000	16
over 750,000... 1,000,000	20

General Clearances required from energized overhead high voltage conductors boom-type lifting or hoisting equipment clearances required from energized overhead high-voltage lines

Nominal voltage (Phase to Phase)	Minimum Required Clearance (Feet)
600..... 50,000	10
over 50,000..... 75,000	11
over 75,000..... 125,000	13
over 125,000.....175,000	15
over 175,000.....250,000	17
over 250,000.....370,000	21
over 370,000.....550,000	27
over 550,000.....1,000,000	42

The safe approach distances for vehicles/equipment, load limits/ratings and clearances to overhead lines must be adhered to. For additional clearances check with your supervisor and our safety manager. Please verify that all warning signs are in place alerting to overhead power lines.

Tools and Probe

- Insulating gloves and blankets shall be visually inspected before each use, electrically re-tested in accordance with ASTM standards (every six (6) months for gloves and sleeves and every twelve (12) months for blankets). Gloves and blankets shall be marked with either the date tested or with the date the next test is due. Whenever rubber gloves are used, they must be protected by outer canvas or leather gloves. Insulating protective equipment found to be defective or damaged must be immediately removed from use tagged or labeled as “Do Not Use”.

When not in use, protective equipment must be stored in suitable containers and stored away from direct sunlight, steam pipes, sources of excessive heat, and protected from physical damage.

Overhead Voltage Lines

Special requirements are required for work on overhead voltage lines. In general, this work should only be performed by personnel (e.g., outside vendors) who are experienced in this type of electrical work and have the appropriate tools including hoists and fall protection. When working on overhead lines if clearance distances cannot be provided all lines must be de-energized and grounded prior to any work being performed.

We do not allow our employees to climb or perform work on poles or towers, string or rung lines, or work with live line bare hand work. When this work is being performed our employees are not to be in the area.

Hazardous Locations

Wet or Damp Locations

Work in wet or damp work locations (i.e., areas surrounded or near water or other liquids) should not be performed unless it is absolutely critical.

Electrical work should be postponed until the liquid can be cleaned up. If the work cannot be avoided, the supervisor or site lead person responsible for the task, prior to performing the work must grant approval.

Every attempt should be made to provide an insulated workspace if the work must be performed. The following special precautions must be incorporated while performing work in damp locations:

- Only use electrical cords that have Ground Fault Circuit Interrupters (GFCIs);
- Place a dry barrier over any wet or damp work surface;
- Remove standing water before beginning work. Work is prohibited in areas where there is standing water;
- Do not use electrical extension cords in wet or damp locations; and
- Keep electrical cords away from standing water.

Working on Life Safety Systems

Protection from Life Safety Systems

Life safety systems (e.g., emergency lighting) are intended to provide safety features additional to the safety features of the equipment being serviced, therefore, de-energized procedures should not be used.

Examples:

- Work on alarm systems, which would require deactivation of the system in order to perform de-energized electrical work;
- Work on ventilation systems for hazardous locations, which would require shutting off the ventilation systems in order to perform de-energized electrical work; and
- Work on illumination systems, which would create a safety hazard if they were turned off in order to perform de-energized electrical work.

Energized Electrical Work for Life Safety Systems

Work on life safety systems should be performed using energized electrical work practices or preferably, during off hours when the life safety systems can be taken out of service to ensure the life safety protection provided by these systems is maintained. Specific procedures need to be developed to work on these systems safely.

De-Energized Electrical Work for Life Safety Systems

When work requires that a life safety system be de-energized, SAFETY approval is required prior to work being performed.

Additional safeguards such as a fire watch, notification of security, and an Emergency Response Technician are also required if a life safety system is to be de-energized.

Overriding Safety Interlocks

Overriding safety interlocks are often required when performing metering, in emergency situations, or when troubleshooting equipment with the power on (i.e., energized electrical work). The following safe work practices shall be followed:

- Overriding safety interlocks shall only be performed by Qualified High Voltage Electrical Workers who are experienced with the equipment being serviced and understand the consequences of overriding the interlocks (NOTE: Interlocks must not be used as the sole means of de-energizing equipment);

- Work areas must be marked with labels, tags, or barriers when such work is being performed;
- All safety interlocks should be restored after the work has been completed; and
- Positive confirmation should be made to verify that each interlock functions as intended.

Equipment Inspection and Calibration

All electrical test and mechanical equipment must be inspected for damage before use. The equipment must not be used if it is damaged or if its functionality is questionable. Equipment must be handled in a manner that will not damage the equipment. Prior to each use, electrical test equipment, such as voltmeters, mechanical critical and rotating equipment must be inspected to be functional. This is accomplished by testing the voltmeter on a known voltage to verify correct readings. After metering or testing is completed, the voltmeter should again be tested on a known voltage to verify functionality of the voltmeter.

Electrical test equipment should be calibrated yearly, at a minimum. If there is any doubt as to the equipment's calibration, the equipment should be recalibrated.

Reporting Requirements

We shall make all energized electrical work practices and procedures available to all affected employees and to all Cal/OSHA and Department of Labor officials upon request.

Training Requirements and Competency Assessment

Training Requirement,	Target Audience	Frequency
Class Title		
Core Safety Training	All Employees	At time of employment & periodically thereafter
Advanced Electrical Safety and Lockout/Tagout Training	Employees who work directly with electrical systems from 50 to 600 volts, Authorized Lockout/Tagout Persons	Annually
High Voltage and Hazardous Electrical Safety Training	Employees who work with, or in the proximity of, electrical equipment or systems over 600 volts, Qualified High Voltage Electrical Worker	Annually

Employee Training

All employees involved with work on or around energized, or potentially energized electrical circuitry of fifty (50) volts to ground or greater, shall be trained in energized electrical safe work practices and procedures every three years.

Qualified High Voltage Electrical Worker

Employees will receive training in avoiding the electrical hazards associated with working on or near exposed energized parts prior to performing energized electrical work. Such training will be provided

when the employee is initially assigned to the job and refresher training will be provided every three years or when conditions change.

The following items are to be included in the training of Qualified High Voltage Electrical Workers:

- Our control of hazardous energy and Lockout/Tagout Training Program including safe work practices required to safely de-energize electrical equipment.
- Universal safety procedures.
- Skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- Perform on-the-job training with a skilled technician.
- Skills and techniques necessary to determine the nominal voltage of exposed live parts.
- Clearance distances corresponding to the voltage of exposed live parts.
- Selection and use of personal protective equipment, tools, insulating and shielding materials and equipment for working on or near energized parts.
- Selection and use of proper work practices for working on or near energized parts.
- Qualified High Voltage Electrical Workers must also be trained in recognizing signs and symptoms of electric shock, heart fibrillation, electric burns, and proper first aid protocols for these conditions. They must have the following training:
 - Basic Cardiopulmonary Resuscitation (CPR);
 - Automatic External Defibrillator (AED); and
 - Contacting emergency personnel.

Only Qualified High Voltage Electrical Workers are permitted to perform energized electrical work on equipment or systems operating at greater than 600 volts. Such employees are qualified persons, who by reason of a minimum of two years of training and experience with high-voltage circuits and equipment, have demonstrated by performance familiarity with the work to be performed and the hazards involved.

Emergency Response

In case of an emergency, our employees must contact their supervisor and dial 911 from an internal or external telephone.

Personal Protective Equipment

When working where there is a hazard of electrical contact, flash burn or equipment contact with energized lines all employees will be protected from the hazards and proper personal protective equipment will be used. In all cases personal grounds will be applied before work on any de-energized electrical equipment. Conductive items of jewelry or clothing shall not be worn unless they are rendered non-conductive by covering, wrapping or other insulating means.

Personal Protective Equipment Types

One or more of the following types of personal protective equipment will be used when our employees are exposed to electrical hazards:

- Low voltage and high voltage gloves
- Rubber protective blankets
- Head, eye and face protection
- Body protection
- Hot sticks
- Personal grounds

- Flash burn equipment

Low Voltage and High Voltage Gloves

These are used when checking for voltage prior to starting work, changing fuses in safety switches and where the possibility of electrical contact exists. All gloves shall be inspected prior to each use. Rubber gloves shall also be “air tested”.

Rubber Protective Blankets

Rubber blankets can be used to insulate workers from exposed electrical parts. Rubber blankets are considered additional protection from incidental contact with live electrical parts and circuits. This means that rubber blankets cannot be used as the sole source of protection and that rubber gloves and protective clothing must be worn when rubber blankets are in use.

Head, Eye and Face Protection

- Shall be used when working near exposed, overhead energized lines and equipment.
- Shall be used when working near exposed energized conductors and parts in switchgear and motor control centers.
- Shall be used when exposed to a possible electrical shock, arc or blast.
- Shall be used when exposed to falling objects.

Face shields made of polycarbonate material are more appropriate for use in situations with relatively low radiation exposure. Safety glasses and goggles provide lesser protection but, in low-risk tasks, may be justified if the task involves substantial physical work in combination with good visual requirements. Eye protection (safety glasses or goggles) shall always be worn under face shields or hoods.

Flash Burn Equipment

- Flash burn equipment shall be worn when there is a risk of arc flash burns.
- Removing or installing high voltage circuit breakers from switchgear cubicles.
- Checking high voltage switchgear buses de-energized prior to starting work.

Body Protection

- Employees shall wear clothing resistant to flash flame whenever there is a risk of an electric flash.

Hot sticks

- Employees shall use hot sticks when operating disconnects, applying personal grounds, taking voltage readings and when working on energized equipment.

Personal grounds

- Employees shall ground all de-energized electrical equipment prior to commencing work. Personal grounds are not to be removed until all work is complete and all personnel are clear of the equipment.
- All aerial work platforms shall be grounded when in use.

Examples of Situations Requiring PPE

- Removing or installing high voltage circuit breakers from switchgear cubicles.
- Working near exposed energized lines, buses and electrical equipment.

- Cleaning high voltage switchgear and motor control centers.
- Testing for voltage on switchgear buses and other electrical equipment prior to starting work.
- Removing and installing high voltage circuit breakers.
- Applying personal grounds.

Tools and Personal Protective Equipment (PPE)

- The electrical tools and protective equipment must be specifically approved, rated, and tested for the levels of voltage of which an employee may be exposed.
- Electrical Protective Equipment must be selected to meet the criteria established by the American Society of Testing and Materials (ASTM) and by the American National Standards Institute (ANSI).
- Insulating equipment made of materials other than rubber shall provide electrical and mechanical protection at least equal to that of rubber equipment.
- PPE must be maintained in a safe, reliable condition and be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage.
- Employees must use insulated tools and handling equipment that are rated for the voltages to be encountered when working near exposed energized conductors or circuit. Tools and handling equipment should be replaced if the insulating capability is decreased due to damage. Protective gloves must be used when employees are working with exposed electrical parts above fifty (50) volts.
- Fuse handling equipment (insulated for circuit voltage) must be used to remove or install fuses when the fuse terminals are energized. Ropes and hand lines used near exposed energized parts must be non-conductive.
- Protective shields, barriers or insulating materials must be used to protect each employee from shock, burns, or other electrical injuries while that person is working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.

Protection Against Arc Flash

An arc flash is a “dangerous condition associated with the release of energy caused by an electric arc.” An arc flash is an explosion causing severe burns, injuries and/or death depending on the severity.

Most workers realize that electrical shock is potentially life threatening, but many do not understand that wearing clothing that is not flame resistant can result in severe harm or death if it is ignited in an electrical arc flash.

While it is our policy that employees insure an outside agency/company de-energize the power source before performing any work on the system. Our employees are not authorized to work on energized lines/equipment unless approved by our safety manager and their supervisor. If the work must be performed and employees may be exposed to the energy source, we need to protect the worker from a potential arc flash that is always possible due to the presence of a power source. The means of proper PPE and levels of protection are simplified with the use of fire-resistant garments that meet the hazard risks.

Keep in mind that the use of these suits, are only needed when you are being exposed to energy, or you are attempting to tie-in or are making contact with the power source. Once the potential for an arc flash is

either removed or isolated, and the worker is protected, the protective suit is no longer needed (i.e., the panel cover is back on).

Our employees are not authorized to work on any electrical equipment over 600 volts unless the power source has been eliminated by others or have received training as a qualified electrical worker.

It is our policy that all employees have safe access to electrical equipment if within the scope of our work. All employees must use the following PPE in order to protect themselves against Arc Flash occurrences. All PPE will be inspected prior to use and will meet the requirements outlined in the ANSI table 130.7(C) (14).

Exposure to under 600 volts:

- Nomex full body jump suit
- Properly rated gloves
- Dielectric hard hat
- Full amber face shield
- Dielectric booties to slip over work boots

Examples of work performed at this level: (examples not intended to be all inclusive of every type of work)

- Removing any panel covers or barriers of energized equipment to perform investigative functions or inspections.
- Working in a panel with the line side energized and the panel cover removed.
- Installing a breaker into an energized electrical panel.
- Pulling cables or wiring into energized panels.
- Pulling or installing fuses into energized parts.

Safety signs, tags, barricades and attendants will meet the ANSI Z Table 130.7(F). Barricades if required for use will be used with safety signage and never used as standalone and will not increase the potential for employee injuries.

Exposure to over 600 volts:

- The level of protection for 600 volts and above will be a full body 40cal. High Voltage Suit complete with a full Head Hood, Dielectric booties, and properly ratted High Voltage gloves.

Examples: Work performed at this level: (examples not intended to be all inclusive of every type of work)

- Removing any gear covers or barriers of energized equipment to perform investigative functions or inspections.
- Installing protective blankets or insulating devices on Buss work (i.e., rubbering up) in an active High Voltage Substation.
- Racking in a breaker into an energized electrical cabinet.
- Pulling cables or wiring into energized switchgear.
- Pulling or installing cut-outs on a utility pole.

Contact your supervisor to obtain an arc flash protection kit which will have all of the above-mentioned PPE. Check the kits before use to ensure that all of the high voltage PPE has a current inspection certification. Do not use if it has expired!

Training

Employees shall be trained in safety-related work practices and procedural requirements as necessary to provide protection from the electrical hazards associated with their respective jobs. Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury. Documentation shall be made when the employee demonstrates proficiency, be maintained for the duration of the employee's employment, and contain each employee's name and date of training.

Retraining

An employee shall receive additional training under any of the following conditions:

- If the supervision or annual inspections indicate that the employee is not complying with the safety-related work practices
- If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those that the employee would normally use
- If he or she must employ safety-related work practices that are not normally used during his or her regular job duties

Retraining should be conducted within three years.

Host Notification

We shall advise the host employer of:

- Any unique hazards presented by our work,
- Any unanticipated hazards found during our work that the host employer did not mention, and
- The measures we took to correct any hazards reported by the host employer to prevent such hazards from recurring in the future.

Qualified – Unqualified

Unqualified persons shall not be permitted to enter spaces that are required to be accessible to qualified employees only, unless the electric conductors and equipment involved are in an electrically safe work condition

Qualified personnel permitted to work within the Limited Approach Boundary of exposed energized electrical conductors and circuit parts operating at 50 volts or more shall, at a minimum, be additionally trained in all the following:

- The skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts.

- Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring within the limited approach boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.
- The approach distances specified in Table 130.2 C and the corresponding voltages to which the qualified person will be exposed.
- The decision-making process necessary to determine the degree and
- extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

Work Practices

Our safety related work practices for working within the Limited Approach Boundary are the following:

- Conduct daily evaluations and safety inspections through the shifts.
- Anticipating unexpected events and conduct a job hazard analysis.
- All electrical parts are considered live until zero energy is verified.
- Work permits shall be utilized and posted on site (i.e., lockout/tagout & hot work).
- Electrical flash arc hazard analysis will be conducted, and the appropriate personal protective equipment identified.

Hazard Analysis

Hazard Analysis should contain event severity, frequency, probability and avoidance to determine the level of safe practices employed. A hazard/risk evaluation shall be completed before work is started within the Limited Approach Boundary of energized electrical conductors and circuit parts operating at 50 volts or more or where an electrical hazard exists.

START

- Gather task information and determine task limits
- Document task/hazard pairs
- Estimate risk factors for each task/hazard pair
- Assign safety measures for each task/hazard pair

Is risk acceptable?

- **NO** Re-evaluate task/hazard
- **YES** Document results

A job briefing should be held before starting each job and include all employees involved. The briefing should cover hazards associated with the job, work procedures involved, special precautions, energy source controls, and PPE requirements

Testing

Test instruments, equipment, and their accessories shall meet the requirements of ANSI/ISA-61010-1-Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1 General Requirements, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 Volts and below. When test instruments are

used for the testing for the absence of voltage on conductors or circuit parts operating at 50 volts or more, the operation of the test instrument shall be verified before and after an absence of voltage test is performed.

All insulating PPE, tools and equipment used for electrical work must be inspected before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection.

Such tests include:

- Blankets-before first issue/every 12 months thereafter,
- Gloves-before first issue and every 6 months
- Sleeves before first issue and every 12 months. Covers and Line hose shall be testing if insulating value is suspect

Our safety manager will track all test dates and upcoming tests dates if we perform any high voltage electrical work. Any insulated equipment not properly tested or in question shall be removed from service.

Energized Conductors

Work on energized electrical conductors or circuit parts that are not placed in an electrically safe working condition, shall be considered energized electrical work and shall be performed by written permit only.

Illumination

Employees shall not enter spaces containing electrical hazards unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform any task within the Limited Approach Boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.