California State University, Long Beach

Control of Hazardous Energy Program
Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Authority</td>
<td>3</td>
</tr>
<tr>
<td>2.0 Program Application</td>
<td>3</td>
</tr>
<tr>
<td>3.0 Definitions</td>
<td>4-7</td>
</tr>
<tr>
<td>4.0 Specific Program Requirements</td>
<td>8-15</td>
</tr>
<tr>
<td>5.0 Group Lockout/Tagout Procedures</td>
<td>16-21</td>
</tr>
<tr>
<td>6.0 University/Auxiliary Specific Requirements</td>
<td>22-23</td>
</tr>
<tr>
<td>7.0 Training and Communication</td>
<td>24-25</td>
</tr>
<tr>
<td>8.0 Periodic Procedures/Work Practice</td>
<td></td>
</tr>
<tr>
<td>Audits of Authorized Employees</td>
<td>26</td>
</tr>
<tr>
<td>9.0 Contractors and Outside</td>
<td></td>
</tr>
<tr>
<td>Service Representatives</td>
<td>27-33</td>
</tr>
<tr>
<td>10.0 Program Administration</td>
<td>34</td>
</tr>
<tr>
<td>11.0 References</td>
<td>34</td>
</tr>
<tr>
<td>12.0 Attachments</td>
<td>35-70</td>
</tr>
</tbody>
</table>
1. Authority

California State University, Long Beach is committed to providing a safe and healthy work environment for our employees, contractors, and visitors. The Control of Hazardous Energy Program is a critical component in providing this environmental. Commonly called Lockout/Tagout (LOTO), this program outlines the requirements to follow to safeguard personnel while performing service, installation or maintenance on machines and equipment as well as those employees, contractors, and visitors who may also be working in adjacent areas. Development and implementation of a Control of Hazardous Energy Program provides the framework for university, university auxiliary and contractor employees to follow when locking out or tagging out machinery and equipment. Industry experience has proven that failure to appropriately lock out or tag out machinery or equipment may result in serious and/or fatal accidents.

To that end, this program describes the minimum requirements that must be followed while working on machinery or equipment at the university's facilities (including university-occupied leased sites).

2. Application

The Control of Hazardous Energy Program applies to all university employees, contractors, service representatives, and visitors who function as an authorized or affected employee (see definitions in Section 3).

The term contractor is used throughout this program and applies to contractors, subcontractors, consultants, service representatives, and visitors. The program covers the tasks and activities associated with the servicing and maintenance of machines and equipment in which the unexpected startup or release of stored energy could cause harm to employees or contractors (Section 9).
3. Definitions

**Affected Employee** - An employee who performs the duties of their job in an area in which the hazardous energy control procedure is implemented and servicing or maintenance operations are performed. An affected employee becomes an "authorized" employee whenever he or she performs isolation, servicing, or maintenance functions on machines or equipment that must be locked or tagged (excluding the application of a red tag).

**Authorized Employee** - An employee who isolates machinery, equipment, or utilities for servicing or maintenance functions to be performed; or an employee who performs servicing or maintenance functions on such machinery, equipment, or utilities; or an employee who must maintain control of hazardous energies or hazardous energy control procedures when overseeing work activities by non-university personnel.


**Blank Flange** - A solid plate or cap (also called a "line blind" or "pancake") installed in a pipe, line, or duct to ensure its absolute closure and to prevent passage of any material.

**Bleed** - To release or dissipate residual energy in a machine or equipment so that all energy is reduced to a zero energy state.

**Blocking Device** - A device that physically restrains, secures, or prevents the failing or moving of machinery, equipment, or parts thereof.
**Capable of being locked out** - An energy-isolating device is considered capable of being locked out if it meets any of the following requirements:

- It is designed with a hasp to which a lock can be attached.
- It is designed with any other integral part through which a lock can be affixed.
- It has a locking mechanism built into it.

It can be locked without dismantling, rebuilding, or replacing the energy isolating device or permanently altering its energy control capability.

**Contractor** - A vendor performing work for the university under contract.

**Control of Hazardous Energy Program** - A program intended to prevent the unexpected energizing or the release of stored energy in machines or equipment. The program consists of hazardous energy control procedures, an employee training program, and periodic inspections.

**De-energize** - To remove, restrain, or secure energy either supplied to or stored in machinery or equipment.

**Energized** - Machines and equipment are energized when (1) connected to an energy source or (2) containing residual or stored energy.

**Energy Isolating Device** - Any mechanical device that physically prevents the transmission or release of energy. These include, but are not limited to, manually operated electrical circuit breakers, disconnect switches, line valves, and blocks.

**Energy Source** - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal energy, gravity, and radiation energy.
Group Lock Box - A box capable of being locked in order to secure keys being used for group lockout. It is secured with an individual lock by each authorized person assigned to the job task.

Hazardous Energy Control Procedure (LOTO procedure) - A written document that contains those items of information an authorized employee needs to know to safely control hazardous energy during servicing or maintenance of machines or equipment.

Lock - A device used to ensure the continuity of energy isolation. The lock must be a keyed lock designed for lockout/tagout application.

Lock out - To place a lockout device on an energy-isolating device in accordance with an established procedure, ensuring that the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lock out device - Any device that uses positive means such as a keyed lock to hold an energy-isolating device in a safe position, thereby preventing the energizing of machinery or equipment. When properly installed, a blank flange or bolted slip blind is considered equivalent to a lockout device.

Qualified Person - A person, designated by the employer, who by reason of experience or instruction has demonstrated familiarity with the operation to be performed and the hazards involved.

Qualified Electrical Worker (High voltage) - A person with a minimum of two years of electrical training and experience with high voltage circuits and equipment under the supervision of another qualified electrical worker (Title 8 Section 2300, 2700, 2714, & 2940c). A Qualified Electrical Worker must be able to distinguish exposed live parts, determine their nominal voltage, maintain
minimum approach distances, properly use energy isolation procedures and special precautionary techniques, and properly maintain and use PPE, insulating and shielding materials, insulated tools, grounding devices, and test instruments.

**Red Tag** - A red tag placed by an employee, manager/supervisor, or CSULB Safety and Risk Management prohibiting the use of tools or equipment because of the belief that the use of the tool or equipment will result in an accident or injury.

**Tag out** - To place a tagout device on an energy-isolating device in accordance with an established procedure to indicate that the energy-isolating device and the equipment being controlled may **not** be operated until the tagout device is removed.

**Tagout Device** - A university tag specifically designed for use in energy isolation. The tag is affixed with the tie wrap provided through the applicable department. Tags must include the person's name and employee number, department name, date applied, and the reason for the isolation. The tag shall indicate that the machine or equipment to which it is attached is not to be operated until the tagout device is removed in accordance with the applicable hazardous energy control procedure (LOTO procedure). All tags shall be written in clear print.
4. Requirements

4.1 Authorized Persons
Authorized persons must have a working knowledge of equipment and/or systems to which they are assigned work. Each authorized person must also be current in their training requirement as defined in the Training and Communication section of this document. Authorized persons who are not familiar with specific equipment or systems shall place their locks and tags on equipment with a knowledgeable person from their own shop or trade.

4.2 Acquiring Lockout and Tagout Devices
Authorized employees may obtain locks and devices from the Facilities Management Warehouse. The Warehouse stocks common lockout devices. If devices are needed that are not available at the Warehouse, employees shall contact their supervisor to obtain the proper lockout device before starting work.

4.3 Locks and Keys
Locks with keys shall be used for lockout. Combination locks shall not be used on university machines or equipment for lockout.

Each lock used for lockout shall have one key that is kept by the authorized employee assigned to the lock.

4.4 Lockout and Tagout Devices
The following requirements apply to all lockout and tagout devices:

- Lockout devices and tagout devices shall be singularly identified.
- Lockout and tagout devices shall be the only devices(s) used for controlling energy and shall not be used for other purposes.
- Lockout and tagout devices shall be durable.
- Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

- Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

- Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.

- Lockout and tagout devices shall be standardized within the university to meet regulatory requirements and contain the following criteria:
  - Color
  - Shape
  - Size
  - Print and format (applies to tagout devices.)

- Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

- Lockout devices and tagout devices shall indicate the identity of the employee applying the device(s).

- Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal.

- Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend as follows: “Do Not Operate.”
4.5 Lockout/Tagout Device Application and Removal

The primary tool for providing employee protection is the energy isolating device. This is the mechanism that prevents the transmission or release of energy and where the lock(s) or tag(s) are attached. There are two types of energy-isolating devices: those capable of being locked and those that are not. The device guards against the accidental startup or unexpected energizing of machines or equipment during servicing or maintenance.

This program has been implemented to provide full protection to all personnel working on machines and equipment. The authorized employees are required to apply LOTO devices to energy-isolating equipment to ensure their full protection while engaged in servicing and/or maintenance activities.

Removal of lockout/tagout devices and/or tags shall be accomplished using procedures detailed in section 4.5.8 and 4.5.8.1 of this document, and in Section 5, Group Lockout/Tagout Procedures.

4.5.1 Work Plans for Multiple Departments Performing Lockout/Tagout

When lockout requires more than one shop, trade, authorized college technician or other authorized university employee applying locks, a pre-job meeting shall be held to ensure all personnel understand:

- The specific equipment to be locked and tagged
- The location of each lockout/tagout location
- Each type of energy that requires isolation
- How to properly verify that each hazardous energy source has been de-energized
- The LOTO procedure and determine if it is accurate and consistent with the isolation/verification steps required in the field.

The meeting is documented using the LOTO procedure form (Attachment B), if required.
4.5.2 Lockable Energy-Isolating Equipment

If the energy-isolating equipment is lockable, the authorized employee shall use university-approved locks, lockout devices and tags to secure the machine or equipment in a "safe" or "off" position while involved in servicing or maintenance functions. All employees servicing machines and equipment shall lock the equipment in a "safe" position and shall not rely on another employee's locks. Each authorized employee shall verify that all hazardous energy has been eliminated or controlled before working on equipment.

4.5.3 Non-Lockable (Tag-Only) Energy Isolating Equipment

If the energy-isolating equipment is not lockable, the authorized employee(s) shall fasten a university-approved tag at the same point a lock would have been applied or as close as safely possible to that point. The authorized employee(s) shall then implement any available additional safety measure such as removing or isolating circuit switches; blocking controlling switches blinding, blocking, or bleeding piping; or removing valve handles. All employees servicing machines and equipment shall tag the equipment in a "safe" position and shall not work under another employee's tags. Each authorized employee shall verify that all hazardous energy has been eliminated or controlled and the LOTO procedure documents this circumstance before working on the equipment.

4.5.4 Equipment With Plugs (Cord and cap)

Lockout devices are not required for work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energizing or startup of the equipment is controlled by unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

Tagout devices are required to be used on cords with plugs during servicing and maintenance operations. Each authorized employee shall ensure that plug-type
equipment cannot be inadvertently plugged into an electrical source during servicing or maintenance.

Lockout devices for plugs are available from the Warehouse, if an authorized employee chooses to use them.

4.5.5 Lockout and Tagout Device Identification and Attachment

Whenever a lockout and/or tagout device is used, the tag must be completed so that the following information is readily identifiable:

- Authorized employee's first initial and last name
- Authorized employee's employee number.
- Department and/or college name
- Brief description of work to be performed

The tagout device shall be attached with a non-reusable, self-locking, and non-releasable nylon cable-tie capable of withstanding a minimum unlocking strength of 50 pounds.

A tag shall not be attached to the hasp of the lock in lieu of using a non-releasable nylon cable-tie capable of withstanding a minimum unlocking strength of 50 pounds.

Specific tagout requirements may be found in individual written LOTO procedures.

4.5.6 Hazardous Energy Control Procedures

The hazardous energy control procedure (aka LOTO Procedure) contains information that the authorized employee must know to safely control the hazardous energy during servicing or maintenance.

Written LOTO Procedures are available from Facilities Management (FM). The detailed information necessary to safely de-energize, verify and return to service each piece of equipment is identified in the procedures maintained by FM, including the preparation for shutdown and required notifications. Developing
and Verifying LOTO Procedures, Attachment A, should be referenced when any questions arise related to any part of the LOTO procedure.

No isolation shall be initiated or work performed unless a written LOTO procedure has been developed for all pieces of equipment related to a specific job and/or project.

The FM Engineering Shop is responsible for LOTO procedure development for process-related equipment within Central Plant and not exclusively electrical service related. The FM Electric Shop is responsible for developing non-process-related LOTO procedures. Approved Authorized employees (Qualified electrical workers – see definitions in Section 3). Colleges, other academic units and auxiliaries are responsible for developing LOTO procedures for required equipment and processes in their respective areas.

The written LOTO procedures (Appendix B) shall contain the following information:

- Preparer(s) and Employee number(s)
- Department name(s) and number(s)
- Date
- Work Order Number
- Project or Construction Project Name/Number (Circle)
- Equipment Identification Number
- Equipment Description
- Required Personnel
- Required Equipment (tags and locks)
- Types of Hazardous Energy (List all types)
- Notifications required before Isolation and after restoration
- Isolation/Verification/Restoration sequence (same table on form)
- Signoffs

As part of the field verification for each LOTO Procedure, any revisions must be documented in the field by an authorized employee, on the specific procedure
and issued to his/her supervisor at the completion of the job. The supervisor is responsible for ensuring any revised LOTO procedure is issued to CSULB Facilities Management for completion.

4.5.7 Notification and Job/Worksite Safety

Before any lockout/tagout device is removed from energy isolating equipment, affected employees shall be notified and the work area inspected to ensure all other employees, tools, and equipment have been moved to a safe location. Additionally, all safety devices and guards have been installed.

4.5.8 Lockout/Tagout Device Removal

The employee who applied the lock and tag device(s) shall be the only person authorized to remove the lockout/tagout device(s) from energy-isolating equipment.

When the employee is not available to remove his or her lockout/tagout device(s), the following procedure shall be followed if the lockout/ tagout devices must be removed:

1. The employee's supervisor shall make all reasonable efforts to contact the employee who applied the lockout/tagout devices and determine whether the employee is on site.

2. After verification by the employee's supervisor that the employee who applied the lockout/tagout device(s) is not available, the employee's Supervisor or Lead may remove the lockout/tagout device(s).

3. The authorized employee's Supervisor or Lead shall complete a Lockout/Tagout Device Removal Notification form (Attachment C) and ensure that the authorized employee is notified that his or her lockout/tagout device(s) were removed before the employee resumes field work.
4.5.8.1 Device/Tag Removal Standby and Emergency Situations

If an authorized employee must remove a lock and tag to avoid injury or death, environmental impact, or property damage, he or she may do so as follows:

1. Obtain verbal authorization from the same shop or trade supervisor.
2. The most senior department, college, or administrative supervisor shall confirm the authorization and document the authorization in the daily log.
3. The most senior department, college, or administrative supervisor shall complete the Lockout/Tagout Device Removal Notification form and ensure that the authorized employee is notified that his or her lockout/tagout device(s) was removed before the employee resumes field work.

4.6 Machine and Equipment Testing

In situations where testing and/or repositioning of machinery or equipment is required to accomplish servicing or maintenance objectives, authorized and affected employees shall follow all procedures set forth in this document for removal and application of all lockout/tagout devices.

4.7 Modified and New Equipment

Whenever replacement, major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment is installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.
5. **Group Lockout/Tagout Procedures**

Group LOTO procedures are an option when servicing and/or maintenance is performed by a crew, shop, or other group. Group procedures must afford employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. Group lockout/tagout:

- Reduces the number of locks and tags applied by authorized personnel.
- Reduces the amount of time required to apply and remove locks and tags.
- Complies with both Cal-OSHA and all other applicable requirements for hazardous energy control.

Provides safe working conditions for all authorized employees by developing methods to be used that will maintain both the integrity and security of the group lock and tag.

### 5.1 Initial Requirements

To ensure the integrity of the group lockout/tagout method, the following must occur before group lockout/tagout is implemented:

- Identify trade leaders for each trade who will be responsible for applying group locks.
- Provide the trade leaders with the devices necessary to perform proper group lockout/tagout.
- Train university personnel on the correct procedures to apply and remove locks and tags in a group lock and tag situation.

Ensure the LOTO procedure is reviewed, verified and signed by each trade leader.
5.2 Implementation of Group LOTO

Group LOTO will be implemented in any of the following situations:

- Three or more authorized personnel from one department are involved in the servicing and maintenance of equipment.

- More than one shop, trade, department, or college is involved in the isolation of and/or servicing and maintenance of equipment.

Three or more contractor personnel are involved in the construction, maintenance, or retrofitting of equipment.

5.3 Definitions Applicable to Group Lock and Tag

Authorized person - A person who performs servicing or maintenance work on machines or equipment while under the direction of a designated Trade Leader from his or her same trade/shop and protected by group locks and tagout devices applied by that Trade Leader.

Trade Leader - A designated authorized employee whose primary responsibility is to protect a specific number of same trade/shop employees working under a group lockout/tagout.

Electrical Maintenance Coordinator - A qualified electrical worker whose primary responsibility is to make the initial isolations on electrical tubs, feeder breakers, and MCC switchgear in preparation for maintenance and servicing work on electrical equipment related to plant process, maintenance buildings, laboratories and instructional/ administrative buildings.
5.4 Authorized Person Duties

Carry out work assignments in conjunction with Group LOTO procedures and informed instructions from Trade Leader and/or Electrical Maintenance Coordinator. If in doubt about any phase of the work assignment, ask questions before beginning assignment and ensure that the information provided is understood and accurate.

5.5 Trade Leader Duties

5.5.1 Application of Group Lockout/Tagout

1. Notify affected University and contract personnel in the immediate area where lockout/tagout is being performed for the servicing and maintenance of equipment.

2. Coordinate isolations and the application of lockout and tagout devices with other authorized personnel from different crafts.

3. Apply University-approved group locks and tagout devices to isolation devices identified in the LOTO procedure.

4. Verify that isolation devices used to control hazardous energy are working.

5. Inform other authorized same trade employees working under a group lockout/tagout of both the isolation and verification steps taken to ensure that the hazardous energy associated with equipment to be serviced has been controlled.

6. Secure the key for the group locks by placing it inside the group lock box and affixing his or her personal lock to the lock box.

7. Ensure that all authorized same craft employees working under the group lockout tagout have affixed their personal lock to the group lock box.

5.5.2 Removal of Group Lockout/Tagout

1. Ensure that all tools and equipment are removed from the work area after the servicing or maintenance work has been completed.
2. Notify the same Trade Leader if he or she must leave the work area prior to completion of the servicing or maintenance work.

3. Upon completion of the servicing or maintenance work, notify his or her same Trade Leader that the equipment, machinery, or utility is ready to be returned to service.

4. Maintain the integrity of the group lockout/tagout by removing his or her lock and tagout device from the group lock box, only after the Trade Leader(s) have removed their personal lock and tagout device from the group lock box.

5. Assist the same Trade Leader in notifying affected personnel in the area that the equipment, machinery, or utility is being placed back into service.

5.6 Electrical Maintenance Coordinator Duties
As required to ensure the safe work practices and worksite conditions of university employees (Trade Leaders and Authorized Employees), and consistent with the University Arc Flash training program.

5.7 Group Lockout/Tagout Shift Change/Overtime

The Trade Leader who initially applied group locks and tags for his or her same craft authorized employees shall be responsible for ensuring the safe transfer of those locks and tags while maintaining the integrity of the group lockout/tagout.

All oncoming shift/overtime and off-going shift authorized employees from the same craft who have been or will be performing the maintenance or servicing work must be at the location where the work is taking place before the exchange of both personnel and tags can take place.

Before removing his or her group locks, the off-going shift Trade Leader shall:

1. Notify all affected and authorized employees in the immediate area that the exchange of group locks is in progress.
2. Inspect the work area to ensure that all tools and nonessential items have been removed from the work site.

3. Ensure that all authorized oncoming shift/overtime and off-going shift employees are on site and accounted for.

4. With the oncoming shift Trade Leader present, verify that all the isolation devices are in the proper positions to both control and/or relieve hazardous energy associated with the equipment being serviced.

5. Ensure the oncoming shift Trade Leader and staff review and verify the LOTO procedure. Only the Trade Leader is required to sign the LOTO procedure.

5.8 Removal of Group Locks and Tags

1. In the presence of both the oncoming shift and off-going shift Trade Leaders, all off-going shift authorized employees shall remove their personal locks and tags from the group lockout box. When this has been completed, the off-going shift Trade Leader shall remove the key for the group locks from the group lock box.

2. To maintain the integrity of the group lockout/tagout, the overtime or oncoming shift Trade Leader shall apply his or her group locks and tagout devices to the isolation devices before the off-going shift Trade Leader can remove his or hers. The exception to this rule is the group lock box.

3. When the overtime or on-coming shift Trade Leader’s group locks have been applied to the isolation devices and the verification steps have been completed, the off-going shifts Trade Leader’s group locks and tagout devices may be removed.

4. The oncoming Trade Leader shall account for all his or her same craft authorized employees before the exchange of group lock can begin.

5. All same craft authorized off-going shift personnel shall be present at the group lock box before the removal of their personal lock from the group lock box can begin.
6. When the off-going shift authorized employees have removed their personal lock, the oncoming shift Trade Leader shall remove the key to his or her group locks from inside the group lock box.

7. Before the off-going shift Trade Leader can start removing his or her group locks and tagout devices, the overtime Trade Leader shall place the key for group locks inside the group lock box and then affix his or her personal lock to the outside of the group lock box.

8. All same craft authorized overtime personnel shall affix their personal locks to the outside of the group lock box. Once this step is completed, the off-going shift Trade Leader shall remove the group locks and tagout devices from the isolation devices.

5.9 Group Lockout/Tagout of Electrical Equipment Over 480 Volts.

1. The requesting party shall submit an Electrical Power Outage Request form to the FM Electrical Shop one week prior to the planned shutdown.

2. The Electric Shop Supervisor has the authority to approve or deny this request.

3. The requesting party must receive an approval notice from the Electric Shop before de-energizing electrical power over 480 volts.

4. Only Electricians (qualified electrical workers, high voltage) who are certified in maintaining high voltage equipment are qualified to act as authorized personnel during the de-energizing and energizing of electrical power in excess of 480 volts.

5. The Electrical Maintenance Coordinator shall be the first to apply locks and tagout devices and the last to remove them.

6. Under no circumstances shall unqualified University personnel be allowed to open or close electrical breakers in excess of 480 volts.
6.0 University/Auxiliary Specific Requirements

The University has established some industry and site-specific requirements to facilitate operational and maintenance functions in its facilities. Auxiliary organizations have also established specific requirements for their operations and maintenance functions. All of these site specific procedures will comply with applicable regulatory requirements, and the overarching requirements of the CSULB Injury and Illness Prevention Program.

6.1 Coordinating and Scheduling of Lockout/Tagout Activities

Coordinating and scheduling of lockout/tagout work activities among Facilities Management, Colleges and academic units, auxiliary organizations and Physical Planning/Construction Management offices shall take place.

6.2 Electrical Work

The university has established specific requirements for all electrical work on university equipment as described in the following. All university and/or auxiliary organization managers and employees are subject to these requirements.

6.2.1 Electrical Work – General

Facilities Management approved Electric Shop Electricians may turn electrical circuit breakers on and off and perform lock and tag operations on any de-energized circuit rated 480 volts and below.

All circuits rated above 480 volts shall be de-energized by authorized and certified Qualified Electrical Workers. This requirement applies to all university facilities including auxiliary organization employees and contractor work.

6.2.2 Electrical Work – Central Plant

For all repair and maintenance on machinery and equipment or utilities that involves Central Plant equipment and is to be completed by university employees, only authorized University qualified electrical workers shall first isolate the machinery or equipment that is to be worked on. Facilities Management and/or Contract personnel are required to verify that all hazardous energy has been eliminated or controlled prior to servicing or maintenance.
activities. Other Facilities Management trades personnel shall coordinate all maintenance activities with Central Plant operations personnel and Facilities Management Building Engineers before work starts.

6.2.2.1 Central Plant Confined Space Hazardous Energy Isolations

In confined spaces where isolations to Central Plant equipment or utilities are required to accomplish maintenance or construction work, authorized FM personnel shall make isolations either directly or in consultation with Central Plant/Building Engineering staff. These areas include, but are not limited to, confined spaces at Central Plant and heating and cooling loop service vaults. Authorized persons performing isolations shall ensure that Central Plant/Building Engineering personnel are notified prior to removal of lock and tag devices using the Hazardous Energy Control Operations Authorization for Lock and Tag form (Attachment C). Central Plant personnel are prohibited from entering closed electrical cabinets within the plant. **Group** lock and tag **shall** be utilized on electrical equipment in Central Plant.
7.0 Training and Communication

The scope and type of training for each type of employee are determined by the relationship of the employee’s job to the machine or equipment being locked or tagged out and the degree of knowledge relevant to the hazardous energy that the employee must possess. Training is required for all authorized and affected university and auxiliary employees. Training curricula will be developed and delivered by CSULB Safety and Risk Management. External training curricula must be approved by Safety and Risk Management prior to delivery. Documentation of training is as stipulated in sub-section 7.3.

7.1 Authorized Employee Training

All authorized university and auxiliary employees will receive the initial Hazardous Energy Control course. A refresher Hazardous Energy Control course will be provided annually for those employees whose job duties require them to continue to perform the duties of an authorized employee. Initial training will include the following topics:

- Recognition of hazardous energy sources
- The type and magnitude of energy at the university
- Methods for isolation and control of the energy
- Lockout/tagout procedures
- The difference between lockout and tagout
- Application of Red Tags
- Limitations of tags as energy control devices
- The requirements of this program
- The requirements of Title 8, Section 3314, Cleaning, Repairing, Servicing and Adjusting Prime Movers, Machinery and Equipment.
EHS will conduct annual hazardous energy control refresher training. Refresher training will be conducted at least annually or when there are observed changes and/or deficiencies are in the program.

7.2 Affected Employee Training

The affected employees (all other employees) will be provided training during safety meetings. The topics will include the purpose, function, and restrictions of the Control of Hazardous Energy Program.

Affected employees will be trained on their responsibilities under the program. The employees will be able to recognize when an energy-isolating device is being used and the importance of not attempting to start up or use equipment that has been locked or tagged out.

7.3 Records of Training

Authorized employee training records include employee name, instructor name, training date, and test score. The records for affected employees include the employee's name, safety meeting date, and instructor. Employee training records shall be maintained by the department who administered the training. The records shall be kept for the duration of applicable employee's tenure with the university or auxiliary organization, and in compliance with institutional records retention requirements.
8.0 Periodic Procedures/Work Practice Audits of Authorized Employees

Annual audits of authorized employees will be conducted to ensure that they are implementing LOTO procedures properly and that they are familiar with their responsibilities under those procedures. The periodic audits are intended to identify and correct any deviations observed.

An independent authorized employee will perform the audits. The work of all authorized employees will be audited by another authorized employee each calendar year. The audits will be documented and the records will be issued and maintained by EHS. The Control of Hazardous Energy Periodic Inspection form will be used to document this activity (see Attachments D).
9.0 Contractors and Outside Service Representatives

This program requires that contractors and outside service representatives be informed of the LOTO procedures implemented at university facilities, auxiliary organization facilities and job sites. Contractors and service representatives must provide the university copies of their Hazardous Energy Control program. These procedures must be at least as protective of the “guest” employees as the university procedures are for university employees. EHS shall make this determination.

After the university and the outside employer inform each other of their respective LOTO procedures, each employer shall ensure that their employees understand and comply with all restrictions and/or prohibitions set forth in this document.

The general contractor is responsible for presenting and explaining the university’s Hazardous Energy Control program to its authorized employees and the authorized employees of any subcontractors. The university is responsible for informing its authorized and affected employees of the requirements within the contractors program.

University personnel shall be the first to place a lock and tag, at each isolation point as detailed in the LOTO procedure, before the contractor starts work and the last to remove the lock and tag when the contractor completes work. If the work is being performed on auxiliary equipment, authorized auxiliary employees, in consultation with University Facilities Management authorized employees will be the first to place a lock and tag and the last to remove those devices. Under no circumstance shall a contractor lock and tag be on equipment without being accompanied by a university or auxiliary organization lock and tag.
9.1 Contractor Responsibilities

The contractor shall:

1. Provide a list of names to the Project Manager/Construction Manager/Inspector of Record or other authorized personnel who will be responsible for applying and removing its lockout and tagout devices. Only contractor authorized personnel shall apply and remove lockout and tagout devices.

2. When requested, immediately provide the most recent Control of Hazardous Energy training records for those individuals listed.

3. Provide a copy of written Hazardous Energy Control Program to the Project Manager/Construction Manager/Inspector of Record before the start of work involving control of hazardous energy.

4. The Project Manager/Construction Manager/Inspector of Record shall submit a copy to EHS for review.

5. Comply with the University Control of Hazardous Energy Program.

6. Do not place a lock or tag on equipment until after the equipment has been de-energized, locked and tagged by University personnel.

9.2 University (Host Employer) Responsibilities

CSULB EHS shall:

1. Upon request from contractor(s), provide copies of the University's Hazardous Energy Control Program.

2. In coordination with Facilities Management and Physical Planning/Construction Management, as applicable, conduct safety meetings to inform contractors of their obligations under the University's Hazardous Energy Control Program.
3. Develop a procedure to ensure University authorized and affected employees understand the contractor’s hazardous energy control policies and procedures.

University Staff and/or Administrators shall ensure that, as required the following actions take place:

1. The department, Physical Planning/Construction Management or Facilities Management administrator responsible for having a contract issued to a contractor is responsible for ensuring that the contractor is complying with the requirements detailed in this program.

2. Ensure the contractor has appropriate locking (key only)/blocking devices and tags as required by this program and are detailed in the LOTO procedure.

3. Ensure that all contractor lockout/tagout operations are coordinated with Facilities Management Electrical Shop and, if required, the affected academic department staff.

4. Advise EHS of contractor problems encountered during implementation of the written LOTO procedure. Stop work until resolved.

5. Stop work activities on those portions of a job that pose an imminent threat to health, property or the environment and/or the requirements of this program are not being met.

9.3 Pre-Work Notifications

Work shall not begin until University Facilities Management and/or other affected personnel approve the shutdown or isolation. The following steps shall be performed before the start of work:

1. Upon written request from the Contractor, the Project Manager/Construction Manager/Inspector of Record shall submit a Shutdown/Isolation Request form (Appendix C) to Facilities Management.
2. Timeframes for shutdowns and/or isolation shall be considered and coordinated in advance. A minimum of one week is required, except in emergency situations.

9.4 Prohibition of Release of Energized Equipment to Contractors

The university (or auxiliary organization) shall not release any piece of equipment or process to any Contractor that is energized except as defined below:

- **Exception 1**: Equipment that is cord and plug may be unplugged by the contractor provided that this is the only source of hazardous energy and the contractor’s authorized employee is made aware that the equipment is energized.

- **Exception 2**: Equipment that will be tested by the Contractor as part of the routine servicing of the equipment may be energized provided that the contractor’s authorized employee is made aware that the equipment is energized.

Each piece of equipment that is to be de-energized and released to a contractor for repair, servicing, maintenance, or construction shall have a written LOTO procedure that includes the steps to follow to ensure that equipment will be de-energized and to verify that hazardous energy has been released. The procedure shall be developed by Facilities Management.

If specific situations warrant, Safety and Risk Management, Construction Management, Facilities Management, the appropriate auxiliary organization and the contractor shall all have input into development of the LOTO procedure.

Isolating and de-energizing of equipment may begin prior to the contractor’s arrival on site. The Contractor, in the presence of an authorized university employee, shall verify that all hazardous energy has been released from the process or equipment before the contractor starts work. Each subcontractor shall also verify that hazardous energy has been released before starting work.
All authorized persons shall sign off on the LOTO procedure that they have verified that hazardous energy has been released from the equipment before the start of work. The signature is an acknowledgment by all authorized parties that all steps in the LOTO procedure have been completed and all hazardous energies have been controlled.

9.5 Required Hazardous Energy Control Equipment

The Contractor shall provide identifiable keyed locks, blocking devices and tagout devices, as applicable, to all authorized personnel. An authorized university representative must approve this equipment prior to use on the project.

9.6 Application of Lockout and Tagout Devices (Contractors)

The Contractor’s authorized personnel shall:

1. Coordinate all lockout/tagout activities with the university Construction Management site inspector, who will in turn coordinate the application of contractor locks and lockout and tagout devices with Facilities Management staff.
2. Have an approved locking, blocking and tagging equipment, as applicable, for each hazardous energy control/isolation point.
3. Review and sign the LOTO procedure with an authorized university representative.
4. Do not manipulate isolation devices on process equipment.
5. Apply locks and tags only under the direction of a (CSULB) Facilities Management Manager, Lead Building Engineer, Electrician, or college/academic unit qualified electrical worker.
6. Apply lock to isolation devices that are lockable.
7. Whenever a lockout and/or tagout device is used, the tag must be completed so that the following is clearly readable (specific tag requirements are detailed in the LOTO procedure):
   - Authorized employee’s first initial and last name
• Authorized employee’s company name
• Date
• Brief description of work to be performed

8. Abide by group LOTO procedures, if applicable, as required by this program.

9.7 Notification and Job Site Safety

Before any lockout/tagout device is removed from energy isolating equipment, affected employees shall be notified and the work area shall be inspected to ensure all other employees, tools, and equipment have been moved to a safe location and all safety devices and guards have been installed. The contractor shall designate the person to make the notifications and identify this person to the Construction Management Inspector of Record overseeing the work.

9.8 Removal of Lockout/Tagout Devices (Contractor)

The Contractor’s authorized personnel shall:

1. Remove only locks and lockout/tagout devices applied by contractor personnel.
2. Not energize any equipment unless in the presence of the university Construction Management Inspector of Record.
3. Provide an emergency callout person who has the authority to remove locks and tagout devices applied by contractor coworkers.

The university Construction Management Inspector of Record is responsible for notifying all personnel who have placed a lock and tag on the equipment.

9.9 Machine and Equipment Testing

In situations where testing and/or repositioning of machinery or equipment is required to accomplish servicing or maintenance objectives, authorized and affected employees shall follow all procedures set forth in this document for application and removal of all lockout/tagout devices.
9.10 Modified and New Equipment

Whenever replacement, major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment is installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

9.11 Group Lockout/Tagout Procedure (Contractor)

To ensure the integrity of the group lockout/tagout method, the contractor shall ensure the following are completed before group lockout/tagout is implemented:

- Identify crew leaders for each trade (contractor) who will be responsible for applying group locks and tags. A crew leader may exist for each contractor or subcontractor.

- Ensure the crew leaders with the devices necessary to perform proper group lockout/tagout.

- Review and sign the LOTO Procedure with an authorized university representative.

9.12 Training and Communication

The university will communicate the requirements of its Hazardous Energy Control Program to the general contractor at the start of a job (during the pre-construction meeting). The general contractor is responsible for informing all of its subcontractors of these requirements. Each contractor is responsible for ensuring all of its employees are trained in accordance with Cal-OSHA requirements. Training is required for all authorized and affected employees.

The University considers all hazardous energy control procedure infractions to be an imminent hazard, and work affected by the infraction is subject to immediate stoppage.
10. Program Administration

This Hazardous Energy Control Program shall be evaluated annually to ensure that it is effective in providing adequate protection from the release of hazardous energy during maintenance activities. The following steps shall be followed to conduct this program review:

1. CSULB Safety and Risk Management shall review the most recent Control of Hazardous Energy Program and proposed changes to State and Federal Regulations and national consensus standards and recommend changes to the university’s Control of Hazardous Energy Program as required.

2. CSULB Safety and Risk Management shall have 30 days to make minor program changes and 60 days in the case of major program revisions.

Control of Hazardous Energy Program reviews shall start by May of each calendar year.

11. References

- CSULB Injury and Illness Prevention Program
- Title 8, California Code of Regulations, Section 3314, Cleaning, Repairing, Servicing and Adjusting Prime Movers, Machinery and Equipment
- ANSI Z244.1-1982 (R1993) Lock Out/Tag Out of Energy Sources, Safety Requirements for the Control of Hazardous Energy
- University Arc Flash Study and Procedures
12. Attachments

**Attachment A**, Lockout/Tagout Procedure (LOTO Procedures) Form

**Attachment B**, Hazardous Energy Control Operations – Authorization for Lockout/Tagout

**Attachment C**, Lockout/Tagout Device Removal Notification Form

**Attachment D**, CSULB Hazardous Energy Control Periodic Inspection Form

**Attachment E**, Facilities Management Arc Flash Protection Program References

**Attachment F**, CSULB Hazardous Energy Controls Tailgate Safety Briefing Form

**Attachment G** Flame Resistant Clothing Requirements
Attachment A

Lockout/Tagout Procedure (LOTO Procedures) Form
**California State University, Long Beach**

**LOCKOUT/TAGOUT PROCEDURE DEVELOPMENT FORM**

<table>
<thead>
<tr>
<th>Preparer &amp; Employee #:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Order Number:</td>
<td>FM Project or Construction: (Circle)</td>
</tr>
<tr>
<td></td>
<td>Project #:</td>
</tr>
<tr>
<td>Equipment Identification Number:</td>
<td>Equipment Description:</td>
</tr>
<tr>
<td>Required Personnel:</td>
<td>Notifications:</td>
</tr>
</tbody>
</table>

**Location:**

**GENERAL PROCEDURE**

1. List steps required to de-energize, lock, and tag equipment, including verification steps.
2. All parties shall sign that they have verified hazardous energy removal while implementing this procedure.

<table>
<thead>
<tr>
<th>Required Personnel &amp; Equipment</th>
<th># of Personnel</th>
<th># of Locks</th>
<th># of Tags</th>
<th>Locking Devices/Hasps</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM Electric Shop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FM Engineer’s Shop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FM Central Plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FM Plumbing Shop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The number of tags and lock may vary when group locks are used. The number of locks and tags represents the minimum needed by each person on the job.

**TYPES OF HAZARDOUS ENERGY**

- Electrical (HAZ1)
- Thermal (HAZ10)
- Mechanical (HAZ2)
- Chemical (List Chemical)
- Hydraulic (HAZ6)
- Gravity (HAZ7)
- Pneumatic (HAZ8)
- Radiation (HAZ9)
**PERSONAL PROTECTIVE EQUIPMENT**
Use appropriate PPE for the area per SOPs, safety requirements, and after fully consulting the NFPA 70E PPE Table 130.2 (Attachment D)

**NOTIFICATIONS**
Notify all affected personnel of this shutdown and LOTO procedure.

**ISOLATION / VERIFICATION**
Verify all applicable processes/equipment are off line; Isolate, Lock, Tag and Verify the following equipment in the order listed. **In the last column enter the restoration sequence (REST.) if other than in reverse order of the isolation sequence:**

<table>
<thead>
<tr>
<th>Seq.</th>
<th>Isolation / Verification Description</th>
<th>Device Number</th>
<th>Device Description</th>
<th>Location</th>
<th>Lock</th>
<th>Rest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SIGNOFFS:** Keep this Signoff Page with the Work Order Package. If additional isolation/verification steps are required, use the additional sheets. **Sign this sheet, initial and date each additional sheet.**

I agree that hazardous energy has been controlled from the above mentioned equipment and I have placed locks and tags on the equipment and verified that no hazardous energy exists.

FM Electric Shop Representative: __________________________ Date: __________

FM Engineer’s Shop Representative: ________________________ Date: __________

FM Central Plant Representative: __________________________ Date: __________

FM Plumbing Shop Representative: _________________________ Date: __________

College Representative: _________________________________ Date: __________
Revisions to this procedure: If any problems are found while performing this procedure, mark up a copy of the procedure and give it to your supervisor.

Supervisor: Return marked up copy to EHS appropriate administrators.

Comments:
Attachment B

Hazardous Energy Control Operations – Authorization for Lockout/Tagout
Attachment B-2: Hazardous Energy Control Operations Authorization for Lock and Tag

California State University, Long Beach
Hazardous Energy Control Authorization for Isolation
On Central Plant Equipment and Utilities
This Form Shall Only Be Used For Isolation in Central Plant Equipment/Heating And Cooling
Loop Vaults And Related Work That Occurs In Confined Spaces
(A CSULB Confined Space Entry Permit must be issued concurrently)

In the event a hazardous energy isolation must be performed by qualified non-Facilities Management personnel, the appropriate Facilities Management administrator or qualified supervisors must approve the isolation and the placement and/or removal of lock(s) and tag(s) on Central Plant and associate utility equipment. No other University employee, or contract personnel engaged by the University shall apply or remove locks or tags from University Central Plant and related utilities without the written approval of the appropriate University administrator. Qualifies University personnel must witness the isolation to the extent possible.

HEC-CSULB 080229, the University’s Control of Hazardous Energy Program, outlines the process that must be followed for lock and/or tag application and removal. This completed form serves as authorized employee notification and Facilities Management Appropriate Administrator approval to apply or remove locks and tags.

☐ Central Plant  ☐ Utility Vault (Identification Number ________)

Authorized Employee Name: __________________________________________

Department: ___________________________________________________________

Job or Task Location: ____________________________________________________

Equipment to be serviced/maintained/repaired/replaced and specific locations where lock/tagout devices will be applied: __________________________

_____________________________________________________________________

Number of isolation points: _____________________________________________

Estimated length of work (hours/minutes/days): __________________________

Facilities Management Administrator Approval for Lock and Tag Application:

____________________________________   Date: ________________

Name/Position

Central Plant/FM Qualified Employee Observing Isolation: _______________________

To Be Completed After Required Isolation Work Complete:

Facilities Management Administrator Approval for Lock/Tag Removal:

______________________________________    Date: ________

Name/Position

V. 1.1
8/11/2015
Attachment C

Lockout/Tagout Device Removal Notification Form
Attachment C: Example of Lockout/Tagout Device Removal Notification Form

CALIFORNIA STATE UNIVERSITY, LONG BEACH
LOCKOUT/TAGOUT DEVICE REMOVAL NOTIFICATION

In the event a lock or tag must be removed and the employee who applied the lock and/or tag is not available, the employee must be notified of the removal of the lock and/or tag upon his or her return to work. The university’s SER-SP-105, Control of Hazardous Energy Program, outlines the process that must be followed for lock and tag removal. This completed form serves as employee notification and must be given to the employee before he or she returns to work.

☐ ________________________________  ☐ Central Plant

Specify equipment location

_____ Verification that the authorized employee is not on site.
(Initial)

Authorized Employee Name: ________________________________

Job Classification: ________________________________

Shift  ☐ Day  ☐ Night

Date the device was removed: ________________________________

Equipment or location device was removed from: ________________________________

Reason the device was removed: ________________________________

___________________________________________

Supervisor/SPO/Lead: ________________________________  Date: ______________

C: Original  Safety & Risk Management
Yellow   FM Lockout/Tagout Device Removal Notification Notebook
Pink     Authorized Employee

V. 1.1  8/11/2015
Attachment D

CSULB Hazardous Energy Control Periodic Inspection Form
CSULB Hazardous Energy Control Program – Periodic Inspection Form

Equipment Identification (PM) Number: _________________________________

Building and Room: ___________________________

Inspector: ____________________________ Shop (Department): __________

<table>
<thead>
<tr>
<th>Authorized Employees Performing Lockout/Tagout:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee Name</td>
</tr>
<tr>
<td>_____________________</td>
</tr>
<tr>
<td>_____________________</td>
</tr>
<tr>
<td>_____________________</td>
</tr>
<tr>
<td>_____________________</td>
</tr>
<tr>
<td>_____________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of Work Process:</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____________________________</td>
</tr>
<tr>
<td>_____________________________</td>
</tr>
<tr>
<td>_____________________________</td>
</tr>
<tr>
<td>_____________________________</td>
</tr>
<tr>
<td>_____________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation of Lockout/Tagout Application:</th>
</tr>
</thead>
<tbody>
<tr>
<td>____________________________</td>
</tr>
<tr>
<td>____________________________</td>
</tr>
<tr>
<td>____________________________</td>
</tr>
<tr>
<td>____________________________</td>
</tr>
<tr>
<td>____________________________</td>
</tr>
</tbody>
</table>

(continue overleaf if required)

<table>
<thead>
<tr>
<th>Corrective Measures Recommended:</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______________________________</td>
</tr>
<tr>
<td>_______________________________</td>
</tr>
<tr>
<td>_______________________________</td>
</tr>
<tr>
<td>_______________________________</td>
</tr>
</tbody>
</table>

_______________________________________  _______________________
Inspector      Date

V. 1.1
8/11/2015
Attachment E

Excerpts – CSULB Facilities Management
Arc Flash Protection Policy
5.0 SAFE WORK PRACTICES

5.1 Live Part Work Policy

5.1.1 General Policies

It is the general policy that NO maintenance or construction/installation work is to be performed on any conductors and/or exposed circuit parts at 50 volts and above while they are energized. If a decision is made to work on exposed energized parts at 50 volts and above, then an Energized Electrical Work Permit is required before the start of this work. This permit shall be signed by the location manager or his or her designee.

The preferred work environment is to de-energize the line or equipment before a person works on or near them. The employee shall create an electrically safe work condition before start of work unless the employer can demonstrate that de-energizing introduces increased hazards or is infeasible.

Examples of increased or additional hazards include, but are not limited to, interrupting life support equipment, deactivation of emergency alarm systems, and shut down of hazardous location ventilation equipment.

Examples of work performed due to infeasibility include performing diagnostics and testing (i.e., start-up, troubleshooting, phasing) of electrical circuits that can only be performed with the circuits energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

Energized Electrical Work Permit - If exposed live parts at 50 volts and above are not placed in an electrically safe work condition (i.e. for reasons of increased or additional hazards or infeasibility), work to be performed is considered energized electrical work and shall be performed by written permit only.

Note: Energized parts that operate at less than 50 volts are not required to be de-energized to satisfy an “electrically safe work condition.” However, consideration should be given to the capacity of the source, any overcurrent protection between the energy source and the worker, and whether the work task related to the source operating at less than 50 volts increases exposure to electrical burns or to explosion from an electric arc.
The energized electrical work permit shall include, but not be limited to, the following items:

- Description of circuit and equipment to be worked on and their location
- Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage
- Detailed job description procedure to be used in performing the work
- Description of the safe work practices to be employed
- Results of the shock hazard analysis
- Determination of the shock protection boundaries
- Results of the arc flash hazard analysis
- Determination of the arc flash protection boundary
- Necessary personal protective equipment to safely perform the assigned task
- Means employed to restrict the access of unqualified persons from the work area
- Evidence of completion of a job briefing including a discussion of any job related hazards
- Signatures of electrically qualified person(s) performing the task
- Approval signatures from the following:
  - Electric Shop Supervisor or his or her designee
  - Manager, Engineering/Electrical Services
  - Asst. Director, Engineering Services

Energized Electrical Work Permits are to be reviewed and retained by CSULB Facilities Management once the work is completed.

See Annex G for a sample of an energized electrical work permit.

Exemptions to requiring an Energized Electrical Work Permit - Work performed on or near live parts by qualified persons related to tasks such as testing, troubleshooting, voltage measurements, etc., shall be permitted to be performed without an energized electrical work permit, provided
appropriate safe work practices and personal protective equipment in accordance with this document are provided and used.

An Electrical Hazard Analysis is required before working on or near exposed energized parts. Based on the results of the hazard risk analysis, a minimum of two people may be required for the task.

5.1.2 Exceptions to General Policies

All exceptions, other than the ones listed below, should be approved by the location manager or his or her designee and require a written documented plan.

- A qualified employee may perform the following tasks:
  - Use non-contact (proximity) meters or other high voltage detectors.
  - Attach grounds.
  - Perform voltage phasing.
  - Take voltage readings.
  - Use Live line tools for switching operations.

- Electrical servicing activities (maintenance trouble shooting and diagnostic testing) that require electrical equipment to be energized require the worker to take special precautions while he or she is performing these activities. Activities covered by this practice may include:
  - Voltage phasing.
  - Preventive maintenance observations and meter checks.
  - System component adjustment.
  - Voltage readings.
  - Troubleshooting.
  - Re-setting device overloads.

When these activities are performed and will place the worker in close proximity to exposed live parts, appropriate personal protective equipment (PPE) shall be utilized. Such PPE in addition to the minimum basic requirements for electrical personnel may include:
- Arc-rated face shields or arc flash suite hood.
- Insulating gloves with leather protectors.
- Arc-rated flame resistant clothing or arc flash suit.

The location management is responsible for approving the PPE selection for such activities.

5.2 Working On or Near Energized Equipment

5.2.1 General Policy

Electrical conductors and equipment shall be considered energized unless they have been put into an electrically safe work condition (i.e. isolated, locked out or tagged out, tested for the absence of voltage, and grounded as required in this document). The nominal voltage of conductors and equipment shall be determined before work is performed on or near energized parts.

Consider all circuits energized until a voltage test positively verifies them as de-energized. It is mandatory that the employee test for the absence of voltage before touching exposed conductor or circuit part within the defined boundary of the work area.

Only qualified employees may work on or near, or in an area of exposed live parts operating at 50 volts or more. Where repair work (see definition of “Working On”) is taking place inside the limited approach boundary and a shock hazard exists, a minimum of two qualified workers shall be required for this work.

5.2.2 Working Near Exposed Live Parts

Before beginning any construction work or maintenance work that requires activities, other than the exceptions outlined in section 5.1.2, that will place the worker(s) in close proximity to exposed live parts, the area of work shall be isolated and insulated. Supervision shall be notified if isolation and insulation is used in lieu of de-energizing.

Barriers required to prevent qualified persons from contacting exposed live parts should be placed no closer to the exposed live part than the restricted approach boundary. While the barrier is being installed, the worker should not cross the restricted approach boundary or the equipment should be placed in an electrically safe work condition while the barrier is being installed.

To cross the prohibited approach boundary and enter the prohibited space is considered the same as making contact with the live parts. Any work on
exposed live parts shall utilize the procedures defined under “working inside the prohibited approach boundary” (see Annex B).

While working within reach of exposed live parts, the employee shall remove all jewelry and similar conductive apparel if such articles may inadvertently contact the exposed live parts. It is highly recommended that electricians and technicians remove all conductive apparel and jewelry prior to entering the plant, production, or maintenance areas.

A hazard/risk evaluation procedure should be used before work is started on or near exposed live parts operating at 50 volts or more, or where an electrical hazard exists. For an example of such a procedure see Annex F of NFPA 70E-2004.

A shock hazard analysis should be performed to determine the voltage to which personnel will be exposed, the boundary requirements, and the PPE necessary to minimize the possibility of an electrical shock.

An arc flash hazard analysis is recommended before a person approaches exposed live parts that have not been placed in an electrically safe work condition in order to protect personnel from the possibility of being injured by an arc flash. The purpose of the arc flash analysis is to determine the arc flash protection boundary and the necessary PPE equipment for use while working within the arc flash protection boundary.

Load-rated switches, circuit breakers, or other devices specifically designed to operate under load shall be used for the opening, reversing, or closing of circuits under load conditions.

All test equipment shall be assessed and approved by the Safety Awareness Team.

All tools and/or handling equipment that might make contact with exposed live parts shall be insulated and of approved design.

Employees shall not enter spaces containing exposed live parts unless illumination is provided that enables the employees to perform the work safely.

Employees shall not reach blindly into areas that might contain exposed live parts where an electrical hazard exists.

Employees shall not knowingly be permitted to work in areas containing exposed live parts operating at 50 volts or more or other electrical hazards while their alertness is recognizably impaired due to illness, fatigue, or other reasons.
5.2.3 Reclosing Circuits After Protective Device Operation

After a circuit is de-energized by a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses is prohibited.

When it is determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment is not required before the circuit is reenergized. However, only one reset of the overcurrent device is allowed without further troubleshooting by a qualified person.

5.2.4 Electrical Hazards

Two primary hazards to consider when working on or near energized equipment are:

- Shock Hazard
- Arc Flash Hazard

Examples of activities, which have the risk of creating an electrical arc flash are listed below:

- Performing switching on switchgear or motor starters.
- Installing or removing circuit breakers or motor starter contactors with the switchgear bus energized.
- Installing or removing combination circuit breaker and motor starter cubicles, commonly referred to as “buckets”.
- Working on motor control centers with open doors (unless the power components at 480 or 600 volts are well guarded).
- Installing or removing safety grounds.
- Moving parts connected to energized wires.
- Taking voltage measurements.
- Working on exposed live parts.
5.2.5 Arc Flash Hazard Analysis, Arc Flash Protection Boundary, PPE

An arc flash hazard analysis is required before a person approaches any exposed electrical conductor or circuit part that has not been placed in an electrically safe work condition.

An arc flash hazard analysis shall be performed in order to protect personnel from the possibility of being injured by an arc flash. The analysis shall determine the arc flash protection boundary and the PPE that people shall wear within the arc flash protection boundary.

As an alternative, the PPE requirements located Annex C shall be permitted to be used in lieu of a detailed arc flash hazard analysis.

Note: See Annex D of this document for sample calculations of an arc flash protection boundary.

5.2.6 Shock Protection Boundaries - Approach Boundaries

The shock protection boundaries are identified as the Limited, Restricted, and Prohibited Approach Boundaries. These boundaries are fixed distances from exposed live parts based on voltage. The approach boundaries are listed in Annex A (Figure A-2 & Table A-2) and Annex B of this document.

Observing a safe approach distance from an exposed live part is an effective means of maintaining electrical safety. The potential for an electrical incident increases as the distance between a person and an exposed live part decreases. The safe approach distance to an exposed live part varies depending on the person’s status:

Safe Approach Distance:

“Unqualified” persons are not permitted to cross the limited approach boundary unless they are wearing appropriate PPE and are continuously escorted by a qualified person. Under no circumstance is the unqualified person(s) permitted to cross the restricted approach boundary.

“Authorized” persons, who are specifically trained for a task, may work inside the limited approach boundary but should never be allowed to work as close to exposed live parts as the restricted approach boundary.

“Qualified” persons may work up to the restricted approach boundary. If a person is working near the restricted approach boundary for an extended period of time, it is recommended that special precautions such as insulating and barricading be used.

To cross the restricted approach boundary and enter the restricted space, the qualified person shall:
• Perform a risk assessment of the hazards involved.

• Use personal protective equipment appropriate for working on exposed live parts, and rated for the voltage and energy level involved.

• Be certain that no part of the body enters the prohibited space.

• Minimize the risk due to inadvertent movement by keeping as much of the body out of the restricted space as possible, using only protected body parts in the space as necessary to accomplish the work.

Crossing the prohibited approach boundary and entering the prohibited space is considered the same as making contact with the exposed live part. Only “Qualified” people are permitted to work on exposed live parts. To cross the prohibited approach boundary and enter the prohibited space, the qualified person shall:

• Have specified training to work on exposed live parts.

• Have an energized electrical work permit.

• Perform a risk analysis.

• Use personal protective equipment appropriate for working on exposed live parts, and rated for the voltage and energy level involved.

Note: The above items must be approved by management

5.2.7 Safety Procedures for Climbing Structures

Fall Prevention/Protection - Fall prevention/protection shall be used anytime an employee is working 6 feet or more above the ground. Consult and follow the CSULB Fall Protection Program.

Prior to working at elevation, employees shall establish a safe work zone around the elevated work area sufficient to accommodate assisting employees working at ground level. The perimeter zone demarcation shall be sufficient to prohibit breaching by unqualified employees or pedestrians."

The following safety precautions shall be followed when raising or lowering Material/Equipment:

• All small equipment and tools to be used aloft shall be raised and lowered by means of a handline, a canvas bucket, or other suitable container.

• Employees working overhead shall take precautions to prevent tools or materials from dropping and falling.
• Employees on the ground shall stay clear of overhead work to reduce the potential of being struck by falling objects.

• All employees on the ground and exposed to falling objects within the established work zone in proximity to employees working at elevation shall wear head protection (hard hats) compliant with ANSI Z89.1-1997.

5.3 Equipment/Line Status

5.3.1 Basic Rule

Electrical equipment and lines shall be considered energized until they have been put into an electrically safe work condition (i.e. isolated, tested, locked out and/or tagged out, and grounded if necessary in accordance with established practices).

5.3.2 Creating an Electrical Safe Work Condition

The following steps are required to achieve an electrically safe work condition:

• Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.

• After properly interrupting the load current, open the disconnecting device(s) for each source.

• Where it is possible, visually verify that all the blades of the disconnecting devices are fully open or that drawout type circuit breakers are withdrawn to the fully disconnected position.

• Apply lockout/tagout devices in accordance with a documented and established policy.

• Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Before and after each test, determine that the voltage detector is operating satisfactorily.

• Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them.

• Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized
conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

- Establish the boundary of the work area (work zone).

### 5.3.3 Testing and Verification Techniques for Isolation

Consider all circuits energized until a voltage test positively verifies them as de-energized. Use the “Test Before Touch” concept.

Recognize that once no voltage is verified, voltage can reappear on a de-energized system. For example:

- Backfeeds from voltage transformers or control power transformers.
- Undocumented alternate sources.
- Missed lockouts.
- Equipment not operating at the time of test.
- Lightning.
- Induced voltage.
- Energized line contacting a de-energized line.
- Insulation failure.

The following testing and verification techniques are recommended when testing for the absence of voltage:

- Check for absence of voltage on molded-case circuit breakers (600 volts and less) since they cannot be visually verified.

⚠️ **Caution.** Test for voltage both phase-to-phase and phase-to-ground.

- Purchase panel boards (600 volts and less) pre-equipped with locking devices and use these devices for lock out.
- Remove fuses from low-voltage switches that have covered blades, if applicable, after verifying there is no voltage.
- Withdraw draw-out circuit breakers to the farthest position in the cubicle (with the line and load stabs disconnected) and completely remove the circuit breaker if a ground-and-test device will be applied.
- Open isolation disconnects on circuit breakers within open-air switchyards. Remove any fuses for additional isolation.
• Do not rely on control circuit isolation for lock out purposes. Provide primary circuit isolation on circuit breakers and motor starters (i.e., withdraw, or “rack out,” circuit breakers or open disconnect switches).

Testing procedure for the absence of voltage should include the following:

• What voltage detector will be used and what will be done to verify proper operation of the voltage detector before and after testing for the absence of voltage.

• A requirement to define the boundary of the work area.

• A requirement to test before touching every exposed conductor or circuit part within the defined boundary of the work area.

• A requirement to retest for the absence of voltage when circuit conditions change or when the job location has been left unattended.

• Where there is no accessible exposed point to take a voltage measurement, planning considerations must include alternate methods of verification (example: use of a non-contact voltage tester).

### 5.3.4 Reenergizing Lines and Equipment

Prior to re-energizing the lines or equipment, the following steps shall be taken:

• Remove all protective grounds.

*Caution. Grounds left on equipment when re-energized present a short circuit hazard. A positive method of control shall be used to assure removal before re-energizing (tags, leaving doors or covers open, leaving the ground cables clearly visible, use of magnetic ground signs, etc.)*

• Remove all protective safety locks and tags from points of disconnection.

• Release all associated electrical clearances.

• Ensure that all affected employees are clear of the lines and equipment covered under the lockout and/or electrical clearance and that they understand that the lines and equipment are being returned to service.

• Re-energize lines and equipment following the facility’s procedures.
5.3.5 Switching Procedures for Power Systems

A written switching order is required before any switching can be performed on the high voltage distribution power system (this does not include switching of individual motors). The switching order shall be written by a qualified person and reviewed by at least one other qualified person. Both people shall sign and date the switching order before it may be used.

Before the start of any switching, a job briefing shall be held by the person in charge of the switching order. All employees that will be involved in the switching shall attend the job briefing. As a minimum the following items shall be reviewed:

- Reason switching is being performed.
- Review one line drawing and/or power system status board to assure that all involved understand what will occur.
- Discuss each step of the switching order.
- Make job assignments to all involved (who will do what).
- Discuss safety issues and required PPE.
- Review the following (if required).
  - Electrical clearance requirements and/or Lockout/tagout issues.
  - Location of safety grounds – to be installed or removed and by who.
  - Other issues (such as operational limitations).

During switching the switching order shall be followed in the order that it is written (step 1, 2, 3, etc.). Each switching step shall be checked off when completed. It is recommended that the time the switching step is completed be recorded. The following switching procedures and information items are recommended:

- The person receiving a switching command should repeat the switching command and have it confirmed by the person issuing the order before executing the command.

- If switching commands are given by radio, a unique switching channel should be used. Cross talk on the radio during switching could cause a switching error.
• When the switching is complete the status of the power system should be documented. Use of a status board or pin board is one method of accomplishing this issue.

• Information on abnormalities of the power system should be documented in order to inform off shift personnel who may be involved in responding to power system problems. It is recommended that this information be posted near a power system status board or pin board.

• It is recommended that open electrical clearances (or parts of the power system under lockout/tagout), the location of any safety grounds, and other power system safety issues be posted near the power system status board or pin board.

• A second person should stand clear and be a safety observer for the person doing the switching. The safety observer should ensure that each step the switch operator is about to perform is correct.

5.3.6 Switching Procedures for Low Voltage Systems

A written switching order is generally not required for low voltage systems. However, while low voltages do not typically require the formalized procedures and written switching instructions required for high voltage systems, a disciplined, through-through procedure should be followed.

If the work to be done is extensive and complex, a formal written switching order should be followed.

5.4 Job Briefings (Tailgate Safety Briefing)

5.4.1 General Requirements

The person-in-charge shall conduct a job briefing with all personnel involved in the work before starting each Job.

At least one job briefing shall be conducted before the start of each shift. Additional job briefings shall be held if changes occur during the course of the work that could affect personnel safety.

The job briefing shall cover at least the following subjects:

• Hazards associated with the job.

• Work procedures involved.

• Special precautions.

• Energy source controls.
• Personal protective equipment requirements.

• Work Zones (Barricades).

During the job briefing, each person involved should be able to answer the following questions before start of work:

• Do I thoroughly understand the job?

• Do I thoroughly understand my role and everyone else’s role in the job?

• Am I aware of all the hazards I may possibly encounter?

• Am I knowledgeable about all safety rules and required personal protective equipment applicable to this job?

• Do I have safeguards in place to protect me from unexpected events?

5.4.2 Repetitive or Similar Tasks

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

A more extensive discussion shall be conducted:

• If the work is complicated or particularly hazardous, or

• If the employee (qualified or unqualified) cannot be expected to recognize and avoid the hazards involved in the job.

A person working alone shall plan their work as though a briefing is required.

Note: See Job Briefing Checklist (Tailgate Safety Briefing) in Attachment F
### CSULB Facilities Management Hazardous Energy Work Tailgate Safety Briefing

<table>
<thead>
<tr>
<th>Identify</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the hazards?</td>
<td>Potential for arc flash</td>
</tr>
<tr>
<td>What voltage levels are involved?</td>
<td>Unusual work conditions</td>
</tr>
<tr>
<td>What skills are required?</td>
<td>Is this a multiple-person job?</td>
</tr>
<tr>
<td>“Foreign” voltage source present?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ask</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Can the equipment be de-energized?</td>
<td>Is a “standby person” required?</td>
</tr>
<tr>
<td>Are there possible backfeeds of the circuits to be worked on?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Job plans</td>
<td>Safety procedures</td>
</tr>
<tr>
<td>One lines and vendor prints</td>
<td>Vendor information</td>
</tr>
<tr>
<td>Status board</td>
<td>For up-to-date information on plant and vendor resources</td>
</tr>
<tr>
<td>Individuals familiar with facility?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Know</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the job?</td>
<td></td>
</tr>
<tr>
<td>Who is in charge?</td>
<td></td>
</tr>
<tr>
<td>Who else needs to know? … Communicate!</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Think</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>About the extra event … What if?</td>
<td>Use the right tools and equipment, including PPE</td>
</tr>
<tr>
<td>Lock - Tag – Test – Try</td>
<td>Install barriers and barricades</td>
</tr>
<tr>
<td>Test for voltage – FIRST</td>
<td>What else …?</td>
</tr>
<tr>
<td>Install and remove grounds</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prepare for an emergency</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standby person CPR trained?</td>
<td>What is the exact work location?</td>
</tr>
<tr>
<td>Telephone location?</td>
<td>How is the equipment shut off in an emergency?</td>
</tr>
<tr>
<td>Fire alarm locations?</td>
<td>Where is the emergency equipment?</td>
</tr>
<tr>
<td>Confined space rescue available if required?</td>
<td>Is the required emergency equipment available?</td>
</tr>
<tr>
<td>Emergency phone numbers?</td>
<td>Radio communications available?</td>
</tr>
<tr>
<td>Appropriate Fire Extinguisher?</td>
<td></td>
</tr>
</tbody>
</table>
## CSULB Hazardous Energy Controls Tailgate Briefing

### Roster

<table>
<thead>
<tr>
<th>Job or W/O</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Signature</th>
<th>Employer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V. 1.1
8/11/2015
Attachment G

Flame Resistant Clothing Requirements
Attachment G - Flame Resistant Clothing Recommendations Including NFPA 70E-2007 Table 130.7(C)(9)(a) Hazard/Risk Category Classifications (Extracted from NFPA 70E and the Facilities Management Arc Flash Protection Program)

From NFPA 70E:

(C) Personal Protective Equipment.

(1) General. When an employee is working within the Flash Protection Boundary he/she shall wear protective clothing and other personal protective equipment in accordance with 130.3.

(2) Movement and Visibility. When flame-resistant (FR) clothing is worn to protect an employee, it shall cover all ignitable clothing and shall allow for movement and visibility.

(3) Head, Face, Neck, and Chin Protection. Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with live parts or from flying objects resulting from electrical explosion. Employees shall wear nonconductive protective equipment for the face, neck, and chin whenever there is a danger of injury from exposure to electric arcs or flashes or from flying objects resulting from electrical explosion.

FPN: See 130.7(C)(13)(b) for arc flash protective requirements.

(4) Eye Protection. Employees shall wear protective equipment for the eyes whenever there is danger of injury from electric arcs, flashes, or from flying objects resulting from electrical explosion.

(5) Body Protection. Employees shall wear FR clothing wherever there is possible exposure to an electric arc flash above the threshold incident-energy level for a second-degree burn, 5 J/cm² (1.2 cal/cm²).

Exception: For incident-energy exposures 8.36 J/cm² (2 cal/cm²) and below, employees may wear non-melting clothing described in Hazard/Risk Category 0 in Table 130.7(C)(11).

(6) Hand and Arm Protection. Employees shall wear rubber insulating gloves where there is danger of hand and arm injury from electric shock due to contact with live parts. Hand and arm protection shall be worn where there is possible exposure to arc flash burn. The apparel described in 130.7(C)(13)(c) shall be required for protection of hands from burns. Arm protection shall be accomplished by apparel described in 130.7(C)(5).

(7) Foot and Leg Protection. Where insulated footwear is used as protection against step and touch potential, dielectric overshoes shall be required. Insulated soles shall not be used as primary electrical protection.

(8) Standards for Personal Protective Equipment. Personal protective equipment shall conform to the standards given in Table 130.7(C)(8).

(9) Selection of Personal Protective Equipment.
(a) When Required for Various Tasks. When selected in lieu of the flash hazard analysis of 130.3(A), Table 130.7(C)(9)(a) shall be used to determine the hazard/risk category for a task. The assumed short-circuit current capacities and fault clearing times for various tasks are listed in the text and notes to Table 130.7(C)(9)(a). For tasks not listed, or for power systems with greater than the assumed short-circuit current capacity or with longer than the assumed fault clearing times, a flash hazard analysis shall be required in accordance with 130.3.

FPN No. 1: Both larger and smaller available short-circuit currents could result in higher available arc-flash energies. If the available short-circuit current increases without a decrease in the opening time of the overcurrent protective device, the arc-flash energy will increase. If the available short-circuit current decreases, resulting in a longer opening time for the overcurrent protective device, arc-flash energies could also increase.

FPN No. 2: Energized parts that operate at less than 50 volts are not required to be de-energized to satisfy an “electrically safe work condition.” Consideration should be given to the capacity of the source, any overcurrent protection between the energy source and the worker, and whether the work task related to the source operating at less than 50 volts increases exposure to electrical burns or to explosion from an electric arc.

**Arc Flash Hazard Analysis** *(From Facilities Management Arc Flash Protection Program)*

An arc flash hazard analysis shall be done before a person approaches any exposed electrical conductor or circuit part that has not been placed in an electrically safe work condition.

The arc flash protection boundary shall be utilized to initiate the need for personal protective equipment. Refer to chapter 1, section 130.3 and Annex D of NFPA 70E-2004 for formulas and other information needed to establish the arc flash protection boundary. Chapter 1, section 130.7 and Annex H in NFPA 70E also contain information and recommendations that address personal protective equipment required for personnel to cross inside the arc flash protection boundary.

Flame Resistant (FR) Clothing and Personal Protective Equipment (PPE) shall be used by the employee based upon the incident energy exposure associated with the specific task. As an alternative, the PPE requirements outlined chapter 1, section 130.7 of NFPA 70E may be used.

For systems which are 600 volts and below, the arc flash protection boundary shall be 4.0 feet, based on the product of clearing times of 6 cycles (0.1 seconds) and the available bolted fault current of 50 kA or any combination not to exceed 300kA cycles (5000 ampere seconds). For clearing times and bolted fault currents other than 300 kA cycles, or under engineering supervision, the arc flash protection boundary may...
alternatively be calculated using information and formulas outlined in NFPA 70E-2004 section 130.3(A).

At voltage levels above 600 volts, the arc flash protection boundary is the distance at which the incident energy level equals 1.2 cal/cm². For situations where fault clearing time is 0.1 second (or faster), the arc flash protection boundary is the distance at which the incident energy level equals 1.5 cal/cm².

Existing knowledge about arc flash exposure at voltage levels above 600 volts is limited. Other methods of calculating such exposure exist and may be used. Commercial and shareware programs are available for calculating these values. It is important to investigate the limitations of any programs to be used. It should be noted that all present methods of calculating incident energy at higher voltage levels have limitations.

Equations for calculating the incident energy produced by a three phase arc on systems rated 600 volts and below for an “Arc in Open Air” \(E_{ma}\) and an “Arc in a Cubic Box” \(E_{mb}\) (arc flashes emanating from within switchgear, motor control centers, or other electrical equipment enclosures) may be calculated by using the formulas derived in the IEEE paper by R.L. Doughty, T.E. Neal, and H. L. Floyd, “Predicting Incident Energy to Better Manage the Electric Arc Hazard on 600 Volt Power Distribution Systems,” IEEE Sept 30, 1998.

NOTE: See Annex D for Sample Calculation of the Arc Flash Protection Boundary \(D_c\), Arc in Open Air \(E_{ma}\), and Arc in Cubic Box \(E_{mb}\) (formulas hold for current range from 16 kA to 50 kA only).

V. 1.1
8/11/2015
### Table 130.7(C)(9)(a) Hazard/Risk Category Classifications From NFPA 70E-2007

<table>
<thead>
<tr>
<th>Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)</th>
<th>Hazard/ Risk Category</th>
<th>V-rated Gloves</th>
<th>V-rated Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panelboards Rated 240V and Below—Notes 1 and 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker (CB) or fused switch operation with covers on</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CB or fused switch operation with covers off</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Remove/install CBs or fused switches</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>Panelboards Rated &gt; 240V and Up To 600 V (with molded case or insulated case circuit breakers) — Notes 1 and 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CB or fused switch operation with covers on</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CB or fused switch operation with covers off</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>600 V Class Motor Control Centers (MCCs) — Notes 2 (except as indicated) and 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CB or fused switch or starter operation with enclosure doors closed</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Reading a panel meter while operating a meter switch</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CB or fused switch or starter operation with enclosure doors open</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts 120 V or below, exposed</td>
<td>0</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts &gt;120 V, exposed</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Insertion or removal of individual starter “buckets” from MCC</td>
<td>3</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Application of safety grounds, after voltage test</td>
<td>2</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>600 V Class Switchgear (with power circuit breakers or fused switches) — Notes 5 and 6</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CB or fused switch operation with enclosure doors closed</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Reading a panel meter while operating a meter switch</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CB or fused switch operation with enclosure doors open</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts 120 V or below, exposed</td>
<td>0</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts &gt;120 V, exposed</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Insertion or removal (racking) of CBs from cubicles, doors open</td>
<td>3</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Insertion or removal (racking) of CBs from cubicles, doors closed</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Application of safety grounds, after voltage test</td>
<td>2</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>3</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Other 600 V Class (277 V through 600 V, nominal) Equipment — Note 3</td>
<td>Hazard/ Risk Category</td>
<td>V-rated Gloves</td>
<td>V-rated Tools</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>---------------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Lighting or small power transformers (600 V, maximum)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>2*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>1*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>2*</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Application of safety grounds, after voltage test</td>
<td>2*</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Revenue meters (kW-hour, at primary voltage and current)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Insertion or removal</td>
<td>2*</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Cable trough or tray cover removal or installation</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Miscellaneous equipment cover removal or installation</td>
<td>1</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>2*</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Application of safety grounds, after voltage test</td>
<td>2*</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>NEMA E2 (fused contactor) Motor Starters, 2.3 kV Through 7.2 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contactor operation with enclosure doors closed</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Reading a panel meter while operating a meter switch</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Contactor operation with enclosure doors open</td>
<td>2*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts 120 V or below, exposed</td>
<td>0</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts &gt;120 V, exposed</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Insertion or removal (racking) of starters from cubicles, doors open</td>
<td>3</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Insertion or removal (racking) of starters from cubicles, doors closed</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Application of safety grounds, after voltage test</td>
<td>3</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>4</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>3</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metal Clad Switchgear, 1 kV and Above</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CB or fused switch operation with enclosure doors closed</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Reading a panel meter while operating a meter switch</td>
<td>0</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CB or fused switch operation with enclosure doors open</td>
<td>4</td>
<td>N</td>
<td>YN</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts 120 V or below, exposed</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Work on control circuits with energized parts &gt;120 V, exposed</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Insertion or removal (racking) of CBs from cubicles, doors open</td>
<td>4</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Insertion or removal (racking) of CBs from cubicles, doors closed</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Application of safety grounds, after voltage test</td>
<td>4</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>4</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>3</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening voltage transformer or control power transformer compartments</td>
<td>4</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Other Equipment 1 kV and Above</td>
<td>Hazard/Risk Category</td>
<td>V-rated Gloves</td>
<td>V-rated Tools</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Metal clad load interrupter switches, fused or unfused</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Switch operation, doors closed</td>
<td>2</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Work on energized parts, including voltage testing</td>
<td>4</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized parts)</td>
<td>4</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized parts)</td>
<td>3</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Outdoor disconnect switch operation (hookstick operated)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Outdoor disconnect switch operation (gang-operated, from grade)</td>
<td>2</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Insulated cable examination, in manhole or other confined space</td>
<td>4</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Insulated cable examination, in open area</td>
<td>2</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Note:
V-rated Gloves are gloves rated and tested for the maximum line-to-line voltage upon which work will be done.
V-rated Tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done.
2* means that a double-layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 requirements of Table 130.7(C)(10).
Y = yes (required)
N = no (not required)
Notes:
1. 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
2. 65 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
3. For < 10 kA short circuit current available, the hazard/risk category required may be reduced by one number.
4. 65 kA short circuit current available, 0.33 second (20 cycle) fault clearing time.
5. 65 kA short circuit current available, up to 1.0 second (60 cycle) fault clearing time.
6. For < 25 kA short circuit current available, the hazard/risk category required may be reduced by one number.