Lock-Out/Tag-Out

Purpose, Applicability, and Scope

Purpose – This program defines responsibilities and establishes procedures for the lockout/tagout of energy isolating devices whenever maintenance or servicing is done on machines or equipment. These procedures must be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could occur.

Applicability – This program shall apply to all SUNY Potsdam staff who perform construction or maintenance work on campus.

Scope – This procedure covers the servicing and maintenance of machines and equipment in which the unexpected energization or startup of the machines or equipment, or release of stored energy, could harm employees. This procedure establishes minimum performance requirements for the control of such hazardous energy.

This program applies to the operation of equipment on the SUNY Potsdam campus by both employees of the University and contractors working on its behalf. It encompasses maintenance, grounds, heating plant, garage areas, the art department, and any additional area where in order to work safely on a piece of equipment we have a need to control the accidental release of energy.

Supervisors and employees are encouraged to contact Environmental Health & Safety at X2596 any time for consultation or training assistance.

Definitions and Abbreviations

Abbreviations

EHS – Environmental Health & Safety

OSHA - Occupational Safety and Health Administration

PESH – Public Employee Safety & Health Bureau

PPE – Personal Protective Equipment

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References

1. OSHA 29 CFR 1910.147 "The Control of Hazardous Energy" – Appendix A
2. OSHA 29 CFR 1910.333 "Selection and Use of Work Practices"

Definitions

AFFECTED EMPLOYEE – An employee who actually locks/tags machines or equipment in order to perform servicing or maintenance. Examples of Authorized employees are: electricians, plumbers, energy facility operators, etc. Authorized employees must be trained in the recognition of hazardous energy sources, the type and magnitude of energy sources in their work area, and the procedures that are used for energy isolating and control.

AUTHORIZED EMPLOYEE – An affected employee is not qualified to lock/tagout a piece of equipment but uses/operates a machine or piece of equipment which made need maintenance or servicing. An affected employee can also be a person who works in/around an area where equipment may be locked/tagged out. Examples of an affected employee are: housekeeping staff, grounds staff, roofers, office employees, etc.

ENERGY SOURCE – Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy. Energy sources are what makes the piece of equipment or machinery run, move or operate. Equipment may have a single energy source or may have many different sources of energy.

ENERGIZED – Machines and equipment are energized when they are connected to an energy source, or they contain residual or stored energy. An example of stored energy could be a steam line. Even though you may have isolated a section of steam line by closing valves, pressure will remain in the line until it is properly bled-off.

ENERGY ISOLATING DEVICE – A mechanical device that physically prevents the transmission or release of energy. Examples of energy-isolating devices include a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices

LOCKOUT – The placement of a lockout device on an energy-isolating device which ensures that equipment being controlled cannot be operated until the lockout device is removed.

LOCKOUT DEVICE – Examples include locks, chains, blank flanges and bolted slip blinds. Lock out devices are used to hold an energy-isolating device in a safe position and to prevent the start-up of machinery or equipment. Whenever possible a lockout device must be used along with a tagout device. An example of this is when you lockout an electrical disconnect,

you must attach the warning tag to the lock shackle and then attach both the lock and tag to the disconnect. Never remove a lockout that does not belong to you.

TAGOUT DEVICE - A tag and a nylon tie that is securely fastened to an energy-isolating device to indicate that the machine cannot be operated until the tagout device is removed. A tag alone will only serve as a warning device - people can easily remove tags, putting you at risk. Never remove a tagout that does not belong to you.

Roles and Responsibilities

Supervisors shall:

- Ensure that all direct report employees under their supervisor are properly trained on this program and operate in compliance with it at all times when working around hazardous sources of energy.
- Shall annually evaluate all work areas that your operational area maintains and review all isolation procedures for equipment specific to those areas.
- Ensure that only employees properly trained for the task at hand are assigned.
- Shall ensure that all employees have the needed PPE as well as all materials necessary to perform isolation tasks for each piece of equipment they are required to maintain.

Employees shall:

- Verify that a PPE Hazard Assessment has been performed for the task assigned.
- Be sure to utilize all PPE provided to you.
- Immediately report to EHS when asked to perform a task without training or proper PPE.
- Work in a safe and responsible manner in full compliance with this program
- Only AUTHORIZED EMPLOYEES may lockout or tagout equipment. An AFFECTED EMPLOYEE must be informed by an AUTHORIZED EMPLOYEE when this program is in effect and the anticipated return to service time for the impacted equipment.

Outside Contractors shall:

- Must submit their lockout/tagout procedures to the Office of Environmental Health & Safety for review before any work may start.
- In instances where there is a conflict between SUNY Potsdam policy and an outside contractor’s procedure the more restrictive of the measures shall apply.

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EHS shall:

- Be available for consultation on any job tasking requiring the use of this program.
- Annually review the program in conjunction with department heads for accuracy and update as necessary.
- Facilitate training for all employees assigned to tasks involving the isolation of harmful energy.

Program Activities

General Procedure:

- **Preparation for shutdown:** Before an authorized or affected employee turns off a machine or equipment, the authorized employee must have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.
- **Machine or equipment shutdown:** The machine or equipment must be turned off or shut down using the procedures established to avoid any additional hazards to employees as a result of the machine or equipment stoppage.
- **Machine or equipment isolation**: All energy-isolating devices that are needed to control the machine's energy source must be located. These devices may include: valves and disconnects which isolate the machine or equipment from its energy source(s).
- **Lockout or tagout device application:** Locks and tags must be attached to each energy-isolating device by authorized employees. Locks must be attached in a manner that will hold the energy isolating devices in a "safe" or "off" position. Where tagout devices are used, the tag should be attached in a manner that will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited. If the tag can not be affixed directly to the energy isolating device, the tag must be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.
- **Stored energy:** After the energy-isolating device has been locked out or tagged out, all potentially hazardous stored or residual energy must be relieved, disconnected, restrained, and otherwise rendered safe.
- **Verification of isolation:** Before any work begins on machines or equipment that have been locked out or tagged out, an authorized employee must verify that the machine or equipment has been properly isolated and de-energized. Depending on the specific piece of equipment you are servicing or maintaining, there may be one source of energy to lockout/tagout, or there could be many sources of energy that must be isolated before beginning maintenance activities.

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Machine Testing Procedure:

Another situation concerning the use of locks and tag that is commonly encountered is the need to remove a lockout devices to test a piece of equipment, jog the machine, etc.

In some circumstances, employees need to temporarily restore energy to a machine or piece of equipment during servicing or maintenance to test and /or reposition the machine or piece of equipment. Lockout or tagout devices may be removed temporarily in order to perform these tasks.

Sequence of Action

- STEP #1: The machine or equipment must be cleared of tools and materials.
- STEP #2: Employees must be removed from the machine or equipment area.
- STEP #3: All lockout or tagout devices may then be removed.
- STEP #4: Authorized employees may then proceed to energize and test or position the equipment or machinery.
- STEP #5: You must make sure you are not exposed to any hazardous energy while testing the equipment. Additional protective measures must be taken to keep yourself safe: insulated tools, guards, personal protective equipment, etc.
- 6. Following testing or positioning, all systems must be de-energized and energy control measures reapplied to continue the servicing and /or maintenance.

Group Lockout Devices:

Another issue concerning multiple employee lock/tagout is the situation where a piece of equipment has many isolating devices that must be locked/tagged before maintenance can be performed.

An example of this would be a large boiler with a total of ten valves and disconnects that must be isolated before servicing. In this case the maintenance employees have two options:

- they could each place a lock on each of the ten lockout/tagout locations. This option may be difficult, because each mechanic would have to posses ten locks and tags and the process of locking/tagging all isolating devices may be cumbersome.
- One supervisory employee could lockout/tagout the entire boiler. This supervisor would then place all keys to his locks inside a metal "lockout box". All other mechanic working on the boiler would then place a single lock and tag on the metal lockout box that holds the supervisors keys.

Example: multiple employees conducting lockout/tagout on the same piece of equipment using a lockout box.

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Procedure:

- STEP #1: One (1) Authorized Employee will place all the required locks/tags on the equipment/machinery being repaired or serviced. Locks and tags will be placed on the equipment by following a written procedure developed for the particular piece of equipment.
- STEP #2: All keys are then placed into a lock box by the one (1) authorized employee.
- STEP #3: A multi-lock hasp is then placed on the lock box and all other employees performing maintenance/service on the piece of equipment lockout/tagout the box of keys.
- STEP #4: If maintenance/service of the equipment will occur on different shift and with different mechanics, the mechanics on the leaving shift will meet with the mechanics on the incoming shift to change out locks. A new Authorized Employee will be designated for the new shift and will be responsible for the locks, tags and keys that are directly on the equipment.
- STEP #5: Once a mechanic has completed their work on the locked out piece of equipment, they will remove their lock and tag form the group lockout box.
- STEP #6: Once all mechanics have removed their locks and tags from the group lockout box, the authorized employee that placed the locks on the piece of equipment will be able to access his/her key and can proceed to unlock the entire piece of equipment.

Restoring Equipment to Service:

This procedure must be used during shift or personnel changes to ensure the continuity of lockout/tagout protection, for individual and group lockout/tagout.

- The on-coming authorized employee must exchange lockout/tagout devices with the off-going authorized employee.
- Re-testing must be done to ensure the de-energized state of the equipment.
- Employees must discuss the status of maintenance or servicing and any notification of start-up or testing to be performed.

Written Procedures for Lockout-Tagout:

Departments must develop written procedures for the lockout/tagout of each piece of equipment or machine under their control. A model written procedure is attached to this program (Appendix C). However, specific written procedures for a particular machine or piece of equipment are not required if all of the following elements exist:

- The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shutdown which could endanger employees.
- The machine or equipment has a single energy source which can be readily identified and isolated.
- The isolation and locking out of that energy source must completely de-energize and deactivate the machine or equipment.
- The machine or equipment is isolated from that energy source and locked out during servicing or maintenance.
- A single lockout device must achieve a locked-out condition
- The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance.
- The servicing or maintenance does not create hazards for other employees.
- The department, in utilizing this exception, has had no accidents involving the unexpected activation or re-energization of the machine or equipment during servicing or maintenance.

IMPORTANT: IF THE EQUIPMENT YOU ARE ASSIGNED TO WORK ON REQUIRES THE CONTROL OF ENERGY AND DOES NOT HAVE A WRITTEN PROCEDURE YOU MUST CONSULT WITH ENVIRONMENTAL HEALTH AND SAFETY BEFORE ANY WORK TAKES PLACE. EHS WILL DETERMINE WHETHER THE SPECIFICS OF THE WORK ARE EXEMPTED FROM THIS REQUIREMENT OR WILL HALT THE WORK UNTIL A PROCEDURE IS IN PLACE.

Restoring Equipment to Service:

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps must be taken by the authorized employee who applied the lockout/tagout device. If that employee is not available and the lockout/tagout device must be removed, follow the procedure outline in Section XII (Alternate Procedure for Lockout/Tagout Device Removal).

- Check the machine or equipment and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.
- Check the work area to ensure that all employees have been safely positioned or removed from the area.
- Verify that the controls are in neutral.
- Remove the lockout/tagout devices and reenergize the machine or equipment.
- Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

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Note: The removal of some forms of blocking may require reenergization of the machine before safe removal.

Reporting:

Although there are no record-keeping requirements set by the Standard, all LOTO information should be kept with the Project Manager/Supervisor and be available for review when requested.

Annual Review:

Each year an authorized employee, who is not involved in the procedure being inspected, must conduct an inspection of the lockout/tagout procedure. The inspection procedure must include the following elements.

- Where lockout is used, a discussion of the authorized employee's responsibility under the lockout/tagout program with the inspector.
- Where tagout is used, a discussion of the authorized employee's responsibility under the lockout/tagout program and the limitations of the tagout system with the inspector.
- If deficiencies are noted during the inspection, corrective actions and retraining of employees, as necessary, must be done immediately.

Training:

The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees. The training shall include the following:

- Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.
- Each affected employee shall be instructed in the purpose and use of the energy control procedure.
- The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.

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When tagout systems are used, employees shall also be trained in the following limitations of tags:

- Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.
- When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.
- Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
- Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Employee retraining: Additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures. The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

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APPENDIX A
29 CFR 1910.333 (b)

August 7, 2022

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1910.333(b)
"Working on or near exposed deenergized parts."

1910.333(b)(1)
"Application." This paragraph applies to work on exposed deenergized parts or near enough to them to expose the employee to any electrical hazard they present. Conductors and parts of electric equipment that have been deenergized but have not been locked out or tagged in accordance with paragraph (b) of this section shall be treated as energized parts, and paragraph (c) of this section applies to work on or near them.

1910.333(b)(2)
"Lockout and Tagging." While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both in accordance with the requirements of this paragraph. The requirements shall be followed in the order in which they are presented (i.e., paragraph (b)(2)(i) first, then paragraph (b)(2)(ii), etc.).

Note 1: As used in this section, fixed equipment refers to equipment fastened in place or connected by permanent wiring methods.

Note 2: Lockout and tagging procedures that comply with paragraphs (c) through (f) of 1910.147 will also be deemed to comply with paragraph (b)(2) of this section provided that:

[1] The procedures address the electrical safety hazards covered by this Subpart; and

[2] The procedures also incorporate the requirements of paragraphs (b)(2)(iii)(D) and (b)(2)(iv)(B) of this section.

1910.333(b)(2)(i)
"Procedures." The employer shall maintain a written copy of the procedures outlined in paragraph (b)(2) and shall make it available for inspection by employees and by the Assistant Secretary of Labor and his or her authorized representatives.

Note: The written procedures may be in the form of a copy of paragraph (b) of this section.

1910.333(b)(2)(ii)
"Deenergizing equipment."

1910.333(b)(2)(ii)(A)
Safe procedures for deenergizing circuits and equipment shall be determined before circuits or equipment are deenergized.

1910.333(b)(2)(ii)(B)
The circuits and equipment to be worked on shall be disconnected from all electric energy sources. Control circuit devices, such as push buttons, selector switches, and interlocks, may not be used as the sole means for deenergizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for lockout and tagging procedures.

1910.333(b)(2)(ii)(C)
Stored electric energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electric energy might endanger personnel.

Note: If the capacitors or associated equipment are handled in meeting this requirement, they shall be treated as energized.

1910.333(b)(2)(ii)(D)
Stored non-electrical energy in devices that could reenergize electric circuit parts shall be blocked or relieved to the extent that the circuit parts could not be accidentally energized by the device.

1910.333(b)(2)(iii)
"Application of locks and tags."

1910.333(b)(2)(iii)(A)
A lock and a tag shall be placed on each disconnecting means used to deenergize circuits and equipment on which work is to be performed, except as provided in paragraphs (b)(2)(iii)(C) and (b)(2)(iii)(E) of this section. The lock shall be attached so as to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.

1910.333(b)(2)(iii)(B)
Each tag shall contain a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag.

1910.333(b)(2)(iii)(C)
If a lock cannot be applied, or if the employer can demonstrate that tagging procedures will provide a level of safety equivalent to that obtained by the use of a lock, a tag may be used without a lock.

1910.333(b)(2)(iii)(D)
A tag used without a lock, as permitted by paragraph (b)(2)(iii)(C) of this section, shall be supplemented by at least one additional safety measure that provides a level of safety equivalent to that obtained by use of a lock. Examples of additional safety measures include the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device.

1910.333(b)(2)(iii)(E)
A lock may be placed without a tag only under the following conditions:

- 1910.333(b)(2)(iii)(E)(1) Only one circuit or piece of equipment is deenergized, and
- 1910.333(b)(2)(iii)(E)(2) The lockout period does not extend beyond the work shift, and
- 1910.333(b)(2)(iii)(E)(3) Employees exposed to the hazards associated with reenergizing the circuit or equipment are familiar with this procedure.

1910.333(b)(2)(iv)
Verification of deenergized condition. The requirements of this paragraph shall be met before any circuits or equipment can be considered and worked as deenergized.

1910.333(b)(2)(iv)(A)
A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be restarted.

1910.333(b)(2)(iv)(B)
A qualified person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and shall verify that the circuit elements and equipment parts are deenergized. The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage backfeed even though specific parts of the circuit have been deenergized and presumed to be safe. If the circuit to be tested is

over 600 volts, nominal, the test equipment shall be checked for proper operation immediately after this test.

1910.333(b)(2)(v)
"Reenergizing equipment." These requirements shall be met, in the order given, before circuits or equipment are reenergized, even temporarily.

1910.333(b)(2)(v)(A)
A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.

1910.333(b)(2)(v)(B)
Employees exposed to the hazards associated with reenergizing the circuit or equipment shall be warned to stay clear of circuits and equipment.

1910.333(b)(2)(v)(C)
Each lock and tag shall be removed by the employee who applied it or under his or her direct supervision. However, if this employee is absent from the workplace, then the lock or tag may be removed by a qualified person designated to perform this task provided that:

- 1910.333(b)(2)(v)(C)(1) The employer ensures that the employee who applied the lock or tag is not available at the workplace, and
- 1910.333(b)(2)(v)(C)(2) The employer ensures that the employee is aware that the lock or tag has been removed before he or she resumes work at that workplace.
- 1910.333(b)(2)(v)(D) There shall be a visual determination that all employees are clear of the circuits and equipment.

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APPENDIX B
Electrical Safety

August 7, 2022

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Electrical Shock Hazards

The major hazards associated with electricity are electrical shock, fire and arc flash. Electrical shock occurs when the body becomes part of the electric circuit, either when an individual comes in contact with both wires of an electrical circuit, one wire of an energized circuit and the ground, or a metallic part that has become energized by contact with an electrical conductor.

The severity and effects of an electrical shock depend on a number of factors, such as the pathway through the body, the amount of current, the length of time of the exposure, and whether the skin is wet or dry. Water is a great conductor of electricity, allowing current to flow more easily in wet conditions and through wet skin.

The effect of the shock may range from a slight tingle to severe burns to cardiac arrest. The chart below shows the general relationship between the degree of injury and amount of current for a 60-cycle hand-to-foot path of one second's duration of shock. While reading this chart, keep in mind that most electrical circuits can provide, under normal conditions, up to 20,000 milliamperes of current flow.

Current	**Reaction**
1 Milliampere	Perception level
5 Milliamperes	Slight shock felt; not painful but disturbing
6-30 Milliamperes	Painful shock; “let-go” range
50-150 Milliamperes	Extreme pain, respiratory arrest, severe muscular contraction
1000-4,300 Milliamperes	Ventricular fibrillation
10,000+ Milliamperes	Cardiac arrest, severe burns and probable death

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In addition to the electrical shock hazards, sparks from electrical equipment can serve as an ignition source for flammable or explosive vapors.

Arc Flash

A hazardous arc flash can occur in any electrical device, regardless of voltage, in which the energy is high enough to sustain an arc. Potential places where this can happen include:

- Panel boards and switchboards
- Motor control centers
- Metal clad switch gear
- Transformers
- Motor starters and drive cabinets
- Fused disconnects
- Any place that can have equipment failure

In an arc flash incident, an enormous amount of concentrated radiant energy explodes outward from electrical equipment. The explosion creates pressure waves that can damage a person's hearing, a high-intensity flash that can damage their eyesight and a superheated ball of gas that can severely burn a worker's body and melt metal.

Only qualified workers who have been trained in the avoidance of electrical hazards are permitted to work on or near exposed energized parts. Safety related work practices are employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contact when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices must be consistent with the nature and extent of the associated electrical hazards.

Qualified Personnel vs. Unqualified Personnel

For the purposes of electrical safety related work practices, there are two types of employees in the work place that may come in contact with electrical equipment on a jobsite: qualified and unqualified. A Qualified employee is defined as a worker who

- Has been trained to avoid electrical hazards when working on or near exposed energized parts.
- Is familiar with the safety related work practices as required by OSHA standards.
- Is able to distinguish exposed live parts of electrical equipment.
- Is knowledgeable of the skills and techniques used to determine the nominal voltages of exposed parts and components.

An Unqualified employee is defined as a worker who has little or no training regarding electrical hazards. Even though unqualified persons should not be exposed to energized parts,

they should be provided with information and training necessary to perform their job in a safe manner and understand the following:

- Be familiar with any electrical hazards in the workplace.
- Understand procedures to follow and to protect themselves when they work around electricity.
- Understand which tasks that can only be performed by qualified workers (e.g. maintenance and repairs).
- Know when and how to report electrical problems.
- Know what to do in the event of emergency involving electricity.
- Know how to inspect electrical tools and equipment before use to make sure insulation and wiring are in good condition.

Live parts to which an employee may be exposed must be de-energized before the employee works on or near them unless de-energizing the parts introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. Examples of increased or additional hazards include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or removal of illumination for an area. Live parts that operate at less than 50 volts to ground need not be de-energized if there are no increased exposures to electrical burns or to explosions due to electric arcs

Working On or Near Energized Circuits

Live parts to which an employee may be exposed must be de-energized before the employee works on or near them unless de-energizing the parts introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. Examples of increased or additional hazards include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or removal of illumination for an area. Live parts that operate at less than 50 volts to ground need not be de-energized if there are no increased exposures to electrical burns or to explosions due to electric arcs.

De-energized Parts

When employees work on de-energized parts or near enough to them to expose the employees to any electrical hazard they present, the following safety related work practices must be followed:

- Treat as energized any conductors and parts of electrical equipment that have been de-energized, but have not been properly locked out or tagged.
- While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out or tagged or

both. In addition, electrical hazards must be controlled; a qualified person must test the circuit to verify de-energization from all voltage sources.

- Safe procedures for de-energizing circuits and equipment must be determined before circuits or equipment are de-energized. All electric energy sources must be disconnected. Control circuit devices, such as push buttons, electric switches, and interlocks must not be used as the sole means of de-energizing circuits or equipment. Interlocks must not be used as a substitute for lockout and tagging procedures.

Energized Parts

Employees are considered working on or near exposed energized parts when working on exposed live parts either by direct contact or contact be means of tools or materials or when working near enough to energized parts to be exposed to any hazard they present.

Overhead Lines

When work is to be performed near overhead lines, the lines must be de-energized and grounded, or other protective measures taken before the work is started. Such protective measures, such as guarding, isolating or insulating, shall prevent the qualified person performing the work from contacting the lines with any part of their body or indirectly through conductive material, tools, or equipment.

Employees working in an elevated location near overhead lines are not allowed to come closer or to handle the conductive objects which may contact or come closer to any unguarded, energized overhead line than **15 feet.**

Employees working on the ground in the vicinity of overhead lines are not allowed to bring a conductive object or any insulated object which does not have the proper insulating rating closer to unguarded, energized overhead lines that the distance specified above.

Qualified persons working in the vicinity of overhead lines, whether in an elevated position or on the ground, are not allowed to approach or take any conductive object without an approved insulating handle closer to exposed energized parts than **15 feet.**, the person is insulated from the energized part by using the proper gloves, with sleeves if necessary, rated for the voltage involved, or b.) The energized part is insulated from all the person, or c.) The person is insulated from all conductive objects at the potential different from the energized part.

Use of Protective Equipment

Employees working in areas where there are potential electrical hazards must be provided with and use electrical protective equipment appropriate for the parts of the body to be protected and the work performed. Protective equipment must be maintained in a safe, reliable condition and be periodically inspected or tested as required by 29 CFR 1910.137, Electrical Protective Devices. Where the insulating capability of protective equipment is subject to damage during

use, the insulating material must be protected by covering with leather or other appropriate materials. Nonconductive head protection must be worn wherever there is danger of head injury from electrical shock or burns due to contact with exposed energized parts. Protective equipment for the eyes must be worn where there is danger of eye and/or face injury from electric arcs and flashes or flying objects resulting from electrical.

General Protective Equipment and Tools

Insulated tools and handling equipment must be used by employees working near exposed energized conductors or circuit parts if the tools and/or equipment may make contact with the conductors or parts. The insulating material of tools and equipment must be protected where it is subject to damage. Fuse handling equipment, insulated for the circuit voltage, must be used to remove or install fuses when the fuse terminals are energized. All ropes and hand lines used near exposed energized parts must be nonconductive. Protective shields, protective barriers, or insulating material must be used to protect employees from shock, burns, or other electrical related injuries while employees are working near exposed energized parts which might be contacted or where dangerous electric heating or arcing might occur. When normal enclosed live parts are exposed for maintenance or repair, the parts must be guarded to protect unqualified persons from contact with the live parts.

Alerting Techniques

Alerting techniques must be used to warn and protect employees from electrical shock hazards, burns, or failure of electric equipment parts. Safety signs, safety symbols, or accident prevention tags must be used where necessary to warn employees about electrical hazards which may endanger them. Barricades should be used in conjunction with safety signs where necessary to prevent or limit employee access to work areas exposing employees to un-insulated energized conductors or circuit parts. Conductive barricades must not be used where they might cause an electrical contact hazard. An attendant should be stationed to warn and protect employees where signs and barricades do not provide sufficient warning and protection.

Arc Flash Personal Protective Equipment

This Personal Protective Equipment provides protection after an arc flash incident has occurred and should be viewed as the last line of protection. Selection of the appropriate PPE for the task to be performed is based upon hazard categories found in ***NFPA 70E – 2020,*** which should appear on labeled electrical panels and equipment.

The following table is provided as a quick reference. Workers must ensure that they have reviewed all appropriate safety requirements before work begins.

Lock-Out/Tag-Out

Personal Protective Equipment Requirements for Arc Flash Protection

Category	Energy Level	PPE Requirements
0	⩽2 cal/cm²	Non-melting or untreated natural fiber
1	4 cal/cm²	Fire Resistant (FR) shirt and pants
2	8 cal/cm²	Fire Resistant shirt and pants, cotton underwear
3	25 cal/cm²	Two layers Fire Resistant clothing, cotton underwear
4	40 cal/cm²	Fire Resistant shirt and pants, multilayer flash suit, cotton underwear.

Face protection includes face shield and/or safety glasses. Hand protection includes leather over rubber for arc flash protection. Leather work boots above 4 cal/cm².

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APPENDIX C
Equipment Specific Lockout Procedure Template

Specific Lockout Procedure for:

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Lock-Out/Tag-Out

(Identification of machine or equipment)

Authorized employees must perform lockout/tagout in accordance with this procedure for this particular machine or equipment and must initial each step as completed. Affected employees, upon observing a machine or piece of equipment that is locked or tagged out to perform servicing or maintenance shall not attempt to start, energize, or use that machine or equipment.

Sequence of Lockout

(1) _____ Notify all affected employees that servicing or maintenance is required on this machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.

Names/Job Titles	How to Notify

(2) _____ The authorized employee shall identify the type and magnitude of the energy that the machine or equipment utilizes, shall understand the hazards of the energy, and shall know the methods to control the energy.

Energy Type & Magnitude	Hazard	Method to Control Energy

Lock-Out/Tag-Out

(3) _____ If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).

Type of Operating Control	Location

(4) _____ De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).

Energy Isolation Device Type	Location

(5) _____ Lock out the energy isolating device(s) with assigned individual lock(s).

(6) _____ Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.

Types of Stored Energy	Method to Dissipate or Restrain

(7) _____ Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating

the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

Caution: Return operating control(s) to neutral or "off" position after verifying the isolation of the equipment.

Note: A qualified person must verify through the use of test equipment that all electrical circuit parts to which employees could be exposed during service or maintenance are de-energized. This test must also determine if any energized condition exist due to inadvertently induced voltage or unrelated voltage feedback even in circuits that have been de-energized and presumed safe. If the circuit to be tested is over 600 volts, the test equipment must be checked for proper operation before and immediately after the test.

(8) _____ The machine or equipment is now locked out.

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APPENDIX D
Equipment Specific Lockout Procedures

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Lock-Out/Tag-Out

Record of Revision

Date	Description	Person Authorizing
December 1, 2014	New Procedure	Calvin Smith
April 7, 2022	Complete Program Rewrite	Patrick O'Brien
August 7, 2022	Updated NFPA 70 Reference	Patrick O'Brien