ELECTRICAL SAFETY PROCEDURE (ESP)

FOR QUALIFIED ELECTRICAL WORKERS

CEHS-PC-S02
**REVISION HISTORY**

The ESP will be reviewed and revised annually by the EHS Director. Additional revisions may be completed if the incident or accident indicates deficiencies in the program or new hazards, which must be addressed immediately.

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1.0 PURPOSE

1.1 This procedure guides Colby College’s safe work practices for all electrical maintenance and installation work as completed by electrically qualified employees. Specifically, the ESP will define safe work practices, training requirements, and live electrical work requirements.

1.2 The ESP is intended to protect employees against electricity-related hazards. These hazards include electrical shock and burns; arc flash burns; arc-blast impacts; falls; and other potential electrical safety hazards. Working on equipment in a de-energized state is required unless de-energizing introduces an increased hazard or is infeasible (e.g. voltage testing to troubleshoot).

1.3 To ensure that Colby complies with the requirements of Occupational Safety and Health Administration (OSHA) Regulations including 29 CFR 1910 Subpart S, Electrical and the requirements of NFPA 70E, Standard for Electrical Safety in the Workplace.

2.0 SCOPE

2.1 This program applies to all Colby employees and contractors when engaged in activities covered by the procedure.

2.2 The Procedure has been established to ensure the safety of employees who may work on or near electrical equipment of 600 volts or less.

2.3 The ESP requirements apply to all equipment, research/experimental apparatus, or facility that has electrical energy as a source of power and/or utility distribution.

3.0 REFERENCE DOCUMENTS

3.1 OSHA, 1910 Subpart S - Electrical Requirements
3.2 OSHA, 1910.147 - The control of hazardous energy (lockout/tagout).
3.3 NFPA 70E (2015)
3.4 Colby College Energy Control Program, CEHS-SPR-S01 (lockout/tagout)
3.5 Identifying Underground Services, CEHS-SPC-26
3.6 Electrical Hazard Assessment (Appendix A)
3.7 Energized Work Permit (Appendix B)
4.0 RESPONSIBILITIES

4.1 Responsibilities for oversight and implementation of Colby College’s ESP are assigned below. Identified personnel may designate tasks assigned to them to a qualified employee, as appropriate.

4.2 Environmental, Health, and Safety (EHS) Director
   4.2.1 Assist Facilities in implementing the provisions of this program.
   4.2.2 Periodically review and update this written program.
   4.2.3 Provide or coordinate general training for qualified employees on the content of this program.
   4.2.4 Evaluate overall effectiveness of the electrical safety program on a periodic basis.
   4.2.5 Assist in hazard assessments and risk control evaluations.

4.3 Director of Operations and Maintenance
   4.3.1 Review and act as final approval for all energized work permits.
   4.3.2 Assist in hazard assessments and risk control evaluations.

4.4 Supervisor of Mechanical and Electrical Services
   4.4.1 Responsible for the implementation of the electrical safety program for all Facilities employees.
   4.4.2 Determines when Facilities employees meet the requirements to be considered “qualified.”
   4.4.3 Ensure qualified employees comply with all provisions of the electrical safety program.
   4.4.4 Ensure qualified employees receive training appropriate for their assigned electrical tasks and maintain documentation of such training.
   4.4.5 Provide task and trade-specific training.
   4.4.6 Ensure employees are provided with and use appropriate protective equipment.
   4.4.7 Conduct initial review and approval of energized work permits.
   4.4.8 Take lead on assisting employees on hazard assessments and risk control evaluations.

4.5 Qualified Employees
   4.5.1 Follow the work practices described in this document, including the use of appropriate protective equipment and tools.
   4.5.2 Attend all training required relative to this program.
   4.5.3 Immediately report any concerns related to electrical safety to supervision.
5.0 DEFINITIONS

5.1 **Arc rating**: The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to “breaking open” or at the onset of a second-degree skin burn. This rating is assigned to electrical protective clothing and is normally expressed in calories per square centimeter (cal/cm²).

5.2 **Electrically safe work condition**: A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with Colby Hazardous Energy Control Program, tested to ensure the absence of voltage, and grounded if determined necessary.

5.3 **Energized**: Electrically connected to or having a source of voltage.

5.4 **Exposed (as applied to live parts)**: Capable of being inadvertently touched or suitably guarded, isolated, or insulated.

5.5 **Flash hazard analysis**: A study investigating a worker’s potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices along with appropriate levels of PPE.

5.6 **Flash protection boundary**: An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.

5.7 **Flash suit**: A complete FR clothing and equipment system that covers the entire body, except for the hands and feet. (Such a suit typically includes pants, jacket, and a “bee-keeper” style hood fitted with a face shield).

5.8 **FR apparel**: Flame-resistant apparel; describes a broad category of clothing designed to protect employees from electrical arc events during completion of energized tasks.

5.9 **Incident energy**: The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per square centimeter (cal/cm²).

5.10 **Limited approach boundary**: An approach limit at a distance from an exposed live part within which a shock hazard exists.

5.11 **Live parts**: Energized conductive components.
5.12 **Prohibited approach boundary:** An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live part.

5.13 **PPE:** An acronym for “Personal Protective Equipment”.

5.14 **Qualified person:** One who has skills and knowledge related to the construction and operation of the electrical equipment and installation and has received training on the hazards involved.

5.15 **Restricted approach boundary:** An approach limit at a distance from an exposed live part within which there is an increased risk of shock (due to electrical arc-over combined with inadvertent movement) for personnel working in close proximity to the live part.

5.16 **Unqualified person:** Any person who does not meet the definition of a qualified person.

5.17 **Working near (live parts):** Any activity within a Limited Approach Boundary.

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

6.0 **GENERAL ELECTRICAL SAFETY PRINCIPLES**

6.1 Electricity is dangerous when used without proper training, knowledge and planning. The electrical safety principles listed below provides general universal guidance for using electricity safely before you start any job.

6.1.1 The most important principle of electrical safety is to assume all electric circuits are energized unless each involved worker ensures they are not. Every circuit and conductor must be tested every time work is done on it.

6.1.2 Obtain Training: To ensure every employee receives the appropriate training to make them qualified electrical workers for the job they are expected to perform.

6.1.3 Plan Every Job: If a job requires working on live circuits (the energized condition), the qualified employees must have or develop a written systematic plan for doing the work. Discuss the hazards and procedures with supervision before starting each job.

6.1.4 Identify Hazards: Conduct hazard analysis for the job and identify steps that could create electric shock or arc-flash hazards.
6.1.5 Minimize Hazards: De-energize equipment unless it introduces a greater hazard. Insulate or isolate exposed live parts to avoid contact. Use appropriate PPE and electrically safe tools.

6.1.6 Anticipate Problems and plan for the worst-case scenario.

7.0 IDENTIFYING ELECTRICAL HAZARDS

7.1 Electricity-related hazards include electric shock and burns, arc-flash burns, arc-blast impacts, and falls.

7.1.1 Electric Shock and Burns: An electric shock occurs when electric current passes through your body. This can happen when you touch an energized part. If the electric current passes across the chest or head, you can be killed. At high voltages, severe burns can result.

7.1.2 Arc-Flash Burns: An electric arc flash can occur if a conductive object gets too close to a high-amp current source or by equipment failure (for instance, while opening or closing disconnects). The arc can heat the air to temperatures as high as 35,000° F, and vaporize metal in the equipment. The arc flash can cause severe skin burns by direct heat exposure and by igniting clothing.

7.1.3 Arc-Blast Impacts: The heating of the air and vaporization of metal creates a pressure wave that can damage hearing and cause memory loss (from concussion) and other injuries. Flying metal parts are also a hazard.

7.1.4 Falls: Electric shocks and arc blasts can cause falls, especially from ladders or unguarded scaffolding.

7.2 Before any work can take place, including testing and troubleshooting, an electrical hazard assessment must be done. A Hazard Assessment for Electrical Work form can be found in Appendix A. The hazard assessment includes identifying the following:

7.2.1 Shock, arc flash, and arc blast hazards

7.2.2 Non-electrical hazards (e.g. falls, confined space, chemical, biological, radiation, and environmental hazards)

7.2.3 Means of mitigating hazards through engineering controls, administrative controls, and PPE

7.2.4 If an Energized Electrical Work Permit is required

7.3 Identified hazards must be adequately controlled to reduce risks. Utilize the risk control hierarchy of methods in the following order:

1. Elimination
2. Substitution
3. Engineering controls
4. Awareness (training)
5. Administrative controls
6. Personal protective equipment (PPE)

7.4 The EHS Director, Director of Operations and Maintenance, and Supervisor of Mechanical and Electrical Services will assist the qualified employees in completing this process.

7.5 Identification of underground utilities and electrical lines will be completed following the requirements of Colby procedure, Identifying Underground Services, CEHS-SPC-26.

8.0 IDENTIFYING ARC FLASH HAZARDS

8.1 Third party arc flash hazard analysis (study) are to be completed at Colby during all major electrical system upgrades or renovations; and for all new electrical system installations. Arc flash hazard analysis will be done under the supervision of an experienced licensed electrical engineer.

8.2 For systems of 600 volts or less where an arc flash analysis has not been performed, NFPA 70E Hazard/Risk Category Classification tables [130.7(C)(15)(a) and 130.7(C)(15)(b)] will provide arc flash boundary distance, determine the hazard/risk category; voltage rated (V-rated) gloves use; and V-rated tools use. Table use can only be used provided the equipment meets the maximum short circuit current and fault clearing time criteria.

8.3 For other fault currents and clearing times greater than those listed in the NFPA 70E tables, an arc flash analysis must be performed to determine necessary controls.

8.4 When complete, the arc flash study will identify equipment that has a greater potential for arc flash as well as help ensure the safety of qualified electrical workers who frequently use hazard/risk category PPE.

9.0 ELECTRICAL PROTECTIVE EQUIPMENT

9.1 Colby will provide any electrical protective equipment required by this program for all employees working in areas where there are potential electrical hazards.

9.2 Electrical protective equipment must meet the criteria established by the American Society of Testing and Materials (ASTM) and by the America National Standards Institute (ANSI).
9.2.1 Equipment shall include rated arc flash apparel, eye protection, head protection, hand protection, hearing protection, insulated footwear, and face shields where necessary.

9.2.2 PPE must be maintained in a safe, reliable condition and be inspected by the qualified wearer for damage before use and immediately following any incident that can reasonably be suspected of having caused damage.

9.2.3 Protective equipment that becomes damaged or contaminated with grease, oil flammable liquids, or combustible liquids shall not be used.

9.2.4 Electrical tools and protective equipment must be specifically approved, rated, and tested for the levels of voltage of which an employee may be exposed.

9.3 Personal Protective Equipment (PPE) shall be worn whenever qualified workers are inside the Arc Flash Boundary of energized equipment or Restricted Approach Boundary of exposed energized parts (using the greater of the two distances).

9.3.1 The required PPE can be determined from the incident energy value listed on the equipment’s arc flash label if present. If an arc flash analysis has not been done, then Hazard/Risk Category Classification and PPE tables in NFPA 70E should be consulted. Copies of Approach Boundary, Hazard/Risk Category Classification and Protective Clothing/PPE tables are available from the EHS Director.

9.3.2 The following list the minimum PPE required for electrical tasks. PPE must be donned prior to starting work.

- Eye protection whenever there is a danger of injury from electric arcs, flashes, or from flying objects resulting from an electrical explosion
- Nonconductive head protection (rated hard hat) whenever there is a danger of head injury from electric shock or burns due to contact with live parts or from flying objects resulting from an electrical explosion
- Rubber insulated gloves where there is a danger of hand or arm contact with live parts or possible exposure to arc flash burn
- Voltage rated gloves with leather protectors when using electrical testing meters on exposed energized electrical conductor or circuit parts 50 volts and above
Dielectric overshoes when insulated footwear as protection against step and touch potential. Insulated soles shall not be used as primary electrical protection.

Protective shields, barriers, or insulating materials must be used to protect each employee from shock, burns, or other electrical injuries while that person is working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur. Face shields without arc rating shall not be used for electrical work. Safety glasses or goggles must always be worn underneath face shields. Additional illumination may be needed when using tinted face shields as protection during electrical work.

Arc Rated Apparel & Under layers worn to protect an employee must cover potentially exposed areas as completely as possible, cover all ignitable clothing, and allow for movement and visibility. Arc-resistant shirtsleeves must be fastened at the wrist and arc-resistant shirts or jackets must be closed at the neck. Arc-rated garments worn as outer layers over arc-rated apparel (i.e. jackets or rainwear) must also be made from arc-rated material. Arc-Rated flash suits must permit easy and rapid removal by the user. Follow the garment manufacturer’s instructions arc-resistant apparel care and maintenance in order to maintain protective properties.

Non-melting, flammable garments (e.g. cotton, wool, rayon, silk, or blends) may be used as under layers beneath arc-resistant apparel; however, arc-resistant undergarments are recommended. Melting fibers such as acetate, nylon, polyester, polypropylene, and spandex is not permitted in fabric under layers next to skin; however, an incidental amount of elastic on non-melting fabric underwear or socks is permitted.

9.4 Employees must use insulated tools and handling equipment rated for the voltages encountered when working inside the Limited Approach Boundary and Restricted Approach Boundary near exposed energized circuits, conductors, or parts.

9.5 Insulating rubber equipment such as gloves, sleeves, blankets, and matting must be stored in an area protected from light, temperature extremes, excessive humidity, ozone, and other substances and conditions that may
cause damage. In addition to being tested according to the schedule supplied by the manufacturer, rubber insulated equipment must be

- Inspected for damage before each day’s use
- Air tested (gloves) before each use
- Inspected immediately following any incident that could have caused damage
- Dielectrically tested within 6 months of first use or 1 year of purchase if not used (rubber gloves used without the leather protectors must be removed from service until dielectrically tested)
- Rubber insulated equipment found to have defects that might affect its insulating properties must be removed from service until testing indicates that it is acceptable for continued use. Do not attempt to repair defective rubber insulated equipment.

10.0 ELECTRICAL WORK ZONES IN OCCUPIED AREAS

10.1 Electrical work zones must always be secured to prevent access by unqualified individuals for their safety and the safety of the qualified personnel. Often, electrical work is performed in areas where the general public could be exposed to the hazards. The steps listed below shall be followed to reduce the hazards to unqualified people.

10.1.1 Barricades shall be used in conjunction with safety signs to prevent or limit access to work areas containing live parts. Barricades must be of sturdy construction and discourage access. Barricades shall be placed no closer than the Limited Approach Boundary.

10.1.2 If signs and barricades do not provide sufficient protection, an attendant will be assigned to warn and protect pedestrians. The primary duty of the attendant shall be to keep an unqualified person out of the work area where an electrical hazard exists. The attendant shall remain in the area as long as there is a potential exposure to electrical hazards.

10.1.3 If any area accessible to unqualified people are left unattended, the area must be returned to an electrically safe condition (ex. Panelboard covers replaced). Barricades and signs are not an acceptable safeguard.
11.0 WORKING ON DE-ENERGIZED EQUIPMENT

11.1 All electrical work must be done on de-energized equipment unless specifically authorized under the conditions listed in Sections 13-14.

11.2 Before any service, maintenance or installation work, all equipment must be completely locked out and in an electrically safe condition following Colby’s Energy Control Program (Reference 3.4) and train employees in the program.

11.3 Conductors that have been de-energized, but not locked or tagged out shall be treated as energized and the appropriate safety related protocols shall be used.

11.4 NFPA 70E lists six steps to ensure for electrically safe work conditions. Always follow these steps.

- Identify all sources of power to the equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
- Remove the load current, and then open the disconnecting devices for each power source.
- Where possible, visually verify that blades of disconnecting devices are fully open or that drawout-type circuit breakers are fully withdrawn.
- Assuming the conductors are live, test each phase conductor or circuit part with an adequately rated voltage detector to verify that the equipment is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Check the voltage detector before and after each test to ensure it is working.
- Properly ground all possible sources of induced voltage and stored electric energy (such as, capacitors) before touching. If conductors or circuit parts that are being de-energized could contact other exposed conductors or circuit parts, apply ground-connecting devices rated for the available fault current.
- Apply lockout/tagout devices in accordance with Colby’s protocol.

12.0 OTHER PRECAUTIONS WHEN WORKING DE-ENERGIZED

12.1 When working on de-energized parts but are still inside the arc flash protection boundary for nearby energized exposed parts:

12.1.1 If the parts cannot be de-energized, barriers (e.g. insulated blankets) must be used to protect against accidental contact or PPE must be worn.
12.1.2 Employees shall not reach blindly into areas that might contain exposed live parts.

12.1.3 Employees shall not enter spaces containing energized parts unless illumination is provided that allows the work to be performed safely.

12.1.4 Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed live parts.

12.1.5 Conductive materials, tools, and equipment that are in contact with any part of an employee’s body shall not be handled inside the Limited Approach Boundary. If this is not possible, they shall be handled in a manner that prevents accidental contact with live parts. Such materials and equipment include, but are not limited to, long conductive objects such as ducts, pipes, tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, and chains.

12.1.6 When an employee works in a confined space or enclosed spaces (such as a manhole or vault) that contains exposed live parts, the employee shall use protective shields, barriers or insulating materials as necessary to avoid contact with these parts. Doors, hinged panels, and the like shall be secured to prevent them from swinging into employees.

13.0 WORKING ON ENERGIZED EQUIPMENT

13.1 As a general safety principle, energized electrical conductors and circuit (live) parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works (on or near) within the Limited Approach Boundary of those conductors or parts. The exception requires the employer to demonstrate that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

13.2 Energized electrical conductors and circuit (live) parts that operate at less than 50 volts to ground need not be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

13.3 Examples of increased or additional hazards include, but are not limited to:
13.4 Colby will provide training and a written standard operating procedures (SOPs) tasks where work on or near live circuits may be frequently required. When working on live circuits an employee is inside the prohibited approach boundary and actually touching energized parts with tools. When working near live circuits, an employee inside the restricted approach boundary is close enough to energized parts to pose a risk, even though other parts are de-energized. Common tasks include:

- Opening electric equipment doors for inspection
- Opening and closing disconnects and breakers
- Taking voltage measurements
- Racking breakers on and off the bus
- Removing panels and dead fronts

13.5 All worker on energized equipment requires at a minimum two qualified employees

14.0 ENERGIZED ELECTRICAL WORK PERMITS

14.1 Work on live parts is considered energized electrical work. With the exception of testing with a meter, live work requires an Energized Electrical Work Permit (example in Appendix B) prior to starting. The intent of the permit is to ensure that all appropriate safety precautions are taken prior to performing energized electrical work. Note, proximity testers will only be utilized to test for the presence of live voltage. Proximity testers shall never be used for verification that a circuit has been de-energized.

14.2 The permit must be originated by both qualified electrical workers and submitted to the Supervisor of Mechanic Trades and Director of Operations for review and signature. The signed permit must be posted in an appropriate and obvious location where the energized work is taking place for the duration of the task. After the energized electrical work has been completed, send a copy of the completed work permit to the EHS Director.

14.3 Understanding and properly managing approach boundaries is critical to controlling the risk of energized electrical work. NFPA 70E defines four
(4) boundaries for electrical work. Three (3) boundaries are approach distances related to shock hazards and the fourth boundary is related to arc flash protection.

14.3.1 **Limited Approach Boundary** - Within the limited approach boundary, unqualified persons should not be inside the boundary unless escorted by a qualified person and informed of potential safety hazards.

14.3.2 **Restricted Approach Boundary** - Within the restricted approach boundary, only qualified persons with proper PPE and tools may cross. Inside this boundary, accidental movement can put a part of the body or conductive tools in contact with live parts or inside the prohibited approach boundary. To cross the restricted approach boundary, the qualified person must:

- Perform hazard identification and risk assessment.
- Have an approved energized work permit when performing work beyond meter testing.
- Use PPE rated for working near exposed energized parts and rated for the voltage and energy level involved.
- Ensure that no part of the body enters the prohibited space.
- Minimize risks from unintended movement by keeping as much of the body as possible out of the restricted space (body parts in the restricted space should be protected).

14.3.3 **Prohibited Approach Boundary** - Within the prohibited approach boundary, body parts may not cross the prohibited approach boundary, only insulated tools and testing equipment. Approaching any closer is comparable to making direct contact with an exposed energized electrical conductor or circuit part. The qualified person must:

- Have specified training to work on exposed energized electrical conductor or circuit part.
- Have an energized work permit with proper written work procedures and justifying the need to work that close.
- Perform hazard identification and risk assessment.
- Have (2) and (3) approved by the appropriate supervisor.
- Use PPE appropriate for working near exposed energized parts and rated for the voltage and energy level involved.
14.3.4 **Arc Flash Protection Boundary** - Within the arc flash protection boundary, protective equipment and measures are required. The qualified person must:

- Perform hazard identification and risk assessment.
- Use PPE appropriate for working near exposed energized parts and rated for the voltage and energy level involved.
- A qualified person can use the arc flash analysis label to determine the arc flash hazard if an arc flash analysis has been performed. If an Arc Flash Analysis has not been performed, they must use NFPA 70E tables. Table 130.7(C)(15)(a) and/or Table 130.7(C)(15)(b) must be used to determine the hazard/risk category. Table 130.7(C)(16) must be used to choose the appropriate clothing and PPE.

For systems of 600 volts and less where an arc flash analysis has not been performed NFPA 70E Table 130.4(C)(a) and/or Table 130.4(C)(b) will provide arc flash boundary distance, provided it meets the maximum short circuit current and fault clearing time criteria in the tables.

*Note: For copies of NFPA 70E tables contact the EHS Director or Mechanical Trades Supervisor.*

15.0 **Temporary Wiring**

15.1 Temporary electrical power and lighting installations of 600 volts or less, including flexible cords, extension cords, and cables may only be used during and for renovation, maintenance, repair, or experimental work. Temporary wiring used for decorative lighting, special events, and similar purposes may not exceed 90 days. Temporary wiring shall be removed immediately following completion of the project or the purpose for which the wiring was installed. The following additional requirements apply:

15.2 **Grounding and Electrical Connections**

15.2.1 Ground-fault protection (i.e. GFCIs) must be on all temporary-wiring circuits, including extension cords, used for construction or maintenance activities. In addition, equipment and tools connected by cord and plug must be grounded unless they are listed or labeled as “double insulated” tools and appliances.

15.2.2 Receptacles must be of the grounding type unless installed in a complete metallic raceway. Each branch circuit must contain a
15.2.3 Feeders must originate in an approved distribution center, such as a panel board rated for the voltages and currents the system is expected to carry. Branch circuits must originate in an approved power outlet or panel board and suitable disconnecting switches must be installed to permit the disconnection of all ungrounded conductors of each temporary circuit. Neither bare conductors nor earth returns may be used for the wiring of any temporary circuit.

15.3 Temporary Flexible cords and Cables

15.3.1 Flexible cords and cables must be of a listed type and rated for the location and intended use. They may only be used for pendants, wiring of fixtures, connection of portable lamps or appliances, elevators, hoists, connection of stationary equipment where frequently interchanged, prevention of transmission of noise or vibration, data processing cables, or where needed to permit maintenance or repair.

15.3.2 They may not be used as a substitute for the fixed wiring where run through holes in walls, ceilings, or floors; where run through doorways, windows, or similar openings; where attached to building surfaces; or where concealed behind building walls, ceilings, or floors. They must be protected from accidental damage when they pass through doorways or other pinch points. Avoid sharp corners and projections.

16.0 TRAINING

16.1 Electrical safe work practices training is required for anyone working near energized, or potentially energized electrical circuits of fifty (50) or more volts to ground to become Qualified Electrical Worker. Training shall be provided when an employee is initially assigned to the job and prior to performing energized electrical work. Trained personnel must demonstrate a working knowledge of the National Electrical Code.

16.2 Initial training must cover avoiding electrical hazards associated with work inside shock approach and arc flash boundaries of exposed energized parts. The following items are to be included in the training of Qualified Electrical Workers:

- Universal electrical safety practices and procedures for doing energized electrical work.
Electrical Safety Procedure
Colby College

16.4 Mandatory retraining (or refresher) training is required a minimum of every three (3) years or when conditions change. The interval between retraining shall not exceed 42 months. In addition, an employee must receive additional training (or retraining) when any of the following conditions are met:

- Supervision or annual inspections indicate that the employee is not complying with the established safety-related work practices.
- Safety-related work practices not normally used during regular job duties are employed.
- New technology, new types of equipment, or changes in procedures require using safety-related work practices that differ from those normally used.

17.0 RECORDKEEPING

17.1 This written program will be available for review upon request by any employee during work hours. It is located in the EHS Directors’ office.

17.2 Current training records will be maintained at a minimum until retraining is completed.
Appendix A: Hazard Assessment Form

This form should be filled out prior to any electrical work inside the Limited Approach or Arc Flash Boundaries. This includes testing and trouble shooting. Fill out sections 1-6 using information from Job/Work Order, arc flash label and/or NFPA 70E Approach Boundary, Hazard/Risk Category, and PPE tables. The qualified employees performing the work shall sign and date the Hazard Assessment form.
COLBY COLLEGE
Electrical Safety Program

Hazard Assessment for Electrical Work

Job/Work Order Number: ____________________________________________
Job Location/Circuit/Equipment: ______________________________________
Description of Work to be Performed: __________________________________

1. Will this job or task require exposure to energized electrical conductors or circuit parts and/or work within an arc flash boundary (this includes testing)?  □ Yes  □ No

2. Shock Hazard Analysis:
   Voltage (V) Level Phase to Phase
   □ Less than 120 V  □ 120 V  □ 208 V  □ 240 V  □ 277 V
   □ 480 V  □ Greater than 600 V  □ Single Phase  □ 3 Phase

   Approach Boundaries
   Limited: __________ inches  Restricted: ___ inches  Prohibited: ___ inches

3. Arc Flash Hazard:
   Has an arc flash analysis been performed on this equipment?  □ Yes  □ No
   • If "Yes", what is:
     o The Hazard Risk Category for the task? _________________
     o The Arc Flash Boundary? _________ Inches
     o Incident Energy at Working Distance? _____cal/cm²
   • If "No", using the NFPA 70E Hazard/Risk Category Table, what is:
     o The Hazard Risk Category for the task? _________________
     o The Arc Flash Boundary? _________ Inches

4. Can equipment be de-energized, locked and tagged out prior to task (other than testing/troubleshooting)?  □ Yes  □ No

IF YOU ANSWERED "No" TO QUESTION 4, COMPLETE THE ENERGIZED ELECTRICAL WORK PERMIT

5. Non-Electrical Hazards:
   □ Falls  □ Chemical Exposure  □ Traffic in Public Areas
   □ Falling Objects  □ Biological Exposure  □ Obstructed Egress
   □ Lack of Lighting  □ Radiation Exposure  □ Heavy or Repetitive Lifting
   □ Wet or Damp Area  □ Extreme Temperature  □ Repetitive Motions
   □ Confined Space  □ Noise  □ Other: _________________

Colby College
5500 Mayflower Hill,
Waterville, ME 04901
6. What personal protective equipment (PPE) and safety measures will be used (check all that are applicable)?

<table>
<thead>
<tr>
<th>Body</th>
<th>□ Arc-Rated or Cotton, Long Sleeve Shirt &amp; Long Pants or Coveralls □ Arc-Rated Flash Suit Jacket and Pants □ Arc-Rated Rainwear or Jacket □ Arc-Rated Fall Protection Harness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye, Face, and Head</td>
<td>□ Safety Glasses □ Arc-Rated Hardhat □ Arc-Rated Flash Hood □ Safety Goggles □ Arc-Rated Balaclava □ Hearing Protection (Ear Canal Inserts) □ Arc-Rated Face Shield □ Hardhat Liner</td>
</tr>
<tr>
<td>Hands and Arms</td>
<td>□ Heavy Duty Leather Gloves □ Rubber Insulating Gloves Only □ Rubber Insulating Gloves with Leather Protectors □ Rubber Sleeves</td>
</tr>
<tr>
<td>Foot</td>
<td>□ Closed Toe Shoes □ Leather Work Shoes</td>
</tr>
<tr>
<td>Respiratory</td>
<td>□ Dust Mask □ Air Filtering Respirator</td>
</tr>
<tr>
<td>Tools</td>
<td>□ Insulated Tools □ Meter □ Rubber Blankets</td>
</tr>
<tr>
<td>Safety Measures</td>
<td>□ Barricades with Signs □ Attendant</td>
</tr>
<tr>
<td>Other</td>
<td>□</td>
</tr>
</tbody>
</table>

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Employee Name (Print)          Employee Signature          Date

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Employee Name (Print)          Employee Signature          Date

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Colby College  
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Appendix B: Energized Electrical Work Permit
ENERGIZED ELECTRICAL WORK PERMIT

Part I: (Can be completed by the requesters, supervisors or workers performing the task)
1) Description of circuit/equipment /job location:____________________________________________________________

2) Description of work to be done:________________________________________________________________________

3) Justification of why circuit/equipment cannot be de-energized or the work deferred until a scheduled outage:
_______________________________________________________________________________________________________

Requester (print):________________________________________Date:_______________________________
Job Start (time/date):_________________________________Job End (time/date):__________________________

Part II: (Must be completed by the electrically qualified persons doing the work)
1) Detailed job description procedure to be used in performing the above work (use additional paper as needed):

2) Description of the safe work practices to be employed:

3) Results of shock risk assessment:
   a. Voltage exposed:___________________________________________________________
   b. Limited approach boundary:_______________________________________________
   c. Restricted approach boundary:_____________________________________________
   d. Necessary protective equipment to perform work (include PPE):__________________

4) Results of arc flash risk assessment
   a. Available incident energy at the working distance or arc flash PPE category:____________
   b. Necessary arc flash personal and other protective equipment to safely perform the assigned task (see also the hazard assessment):___________________________________________________________
   c. Arc flash boundary:_________________________________________________________

5) Means employed to restrict the access of unqualified persons from the work area:

6) Job briefing / discussion of any job-related hazards and controls: (date/time)____________

7) Name of Qualified Worker (entering restricted approach boundary):______________________

8) Name of Second Qualified Worker:__________________________________________________
   a. Second Worker CPR trained:____Yes _____No (do not work)
Make a diagram of the worksite showing electrical equipment with approximated approach boundaries and barricades:

Part III: Agree to comply with condition of the Permit and Approval(s) to perform the work while electrically energized:

________________________________________________________________________
Qualified Worker __________________________ Date

________________________________________________________________________
Qualified Worker __________________________ Date

________________________________________________________________________
Supervisor of Mechanical and Electrical Services __________________________ Date

________________________________________________________________________
Director of Operations and Maintenance __________________________ Date

By signed above all parties agree that compliance with the permit will ensure that the work can be done safely

Note: Once work is complete, forward this form or a copy to the EHS Director with the completed hazard assessment form