ELECTRICAL SAFETY, INSTALLATIONS, AND EQUIPMENT PROCEDURE

V:2023.1

Electrical Safety, Installations, and Equipment Procedure

January 2023

A. Policy

All electrical work will be conducted in a manner consistent with existing regulations and with good standard practices. This section establishes standards for electrical operations.

Because electrical work has the potential for personnel electrocution and the potential hazard of catastrophic property damage, extreme caution must be exercised when working with electricity and electrical equipment. Electrical equipment can also cause fire because of its potential as an ignition source for causing fire or explosion.

Fire is frequently caused by short circuits, overheating equipment and failure of current limiters, thermal sensors, and other safety devices. Explosions may occur when flammable liquids, gases, and dusts are exposed to ignition sources generated by electrical equipment.

B. Requirements

1. Electrical installations and utilization equipment will be in accordance with the current edition of the National Electrical Code, National Fire Protection Association (NFPA 70); American National Standards Institute (ANSI) Standard C1. This code will also apply to every replacement, installation, or utilization equipment.
2. Equipment or facilities designed, fabricated for, and intended for use by Company personnel will be procured to meet the requirements of the National Electric Code.
3. Frames of all electrical equipment, regardless of voltage shall be grounded.
4. Exposed non-current carrying metal parts of electrical equipment that may become energized under abnormal conditions shall be grounded in accordance with the National Electrical Code.
5. Wires shall be covered wherever they are joined, such as: outlets, switches, junction boxes, etc.
6. Parts of electrical equipment which in ordinary operation produce arcs, sparks, etc., shall not be operated or used in explosive atmospheres or in close proximity to combustible materials.
7. Equipment connected by flexible extension cords shall be grounded either by a 3-wire cord or by a separate ground wire (except double insulated equipment).
8. Ground fault circuit interrupters (GFCI) shall be used on all 120-volt, single-phase, 15- and 20-ampere receptacle outlets at job sites when the receptacles are not a part of the permanent wiring of the building or structure. Receptacles on a two wire, single-phase portable or vehicle-mounted generator rated not more than 5-kilowatts, where the circuit conductors of the generator are insulated from the generator frame and all or the grounded surfaces, need not be protected with GFCI’s.

9. Unqualified Workers:

    a. "Work on energized equipment or near enough to them for employees to be exposed to any hazard they present." Only qualified persons may work on electric circuit parts or equipment that have not been de-energized under the procedures of paragraph (b) of this section. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special

precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

b. "Overhead lines." If work is to be performed near overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be provided before work is started. If the lines are to be de-energized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

(i). When an unqualified person is working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object they may contact cannot come closer to any unguarded, energized overhead line than the following distances:

- For voltages to ground 50kV or below - 10 feet (305 cm);
- For voltages to ground over 50kV - 10 feet (305 cm) plus 4 inches (10 cm) for every 10kV over 50kV.

(ii). When an unqualified person is working on the ground in the vicinity of overhead lines, the person may not bring any conductive object closer to unguarded, energized overhead lines than:

- For voltages to ground 50kV or below - 10 feet (305 cm);
- For voltages to ground over 50kV - 10 feet (305 cm) plus 4 inches (10 cm) for every 10kV over 50kV.

10. “Vehicular and mechanical equipment.”

a. Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 ft. (305 cm) is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10kV over that voltage. However, under any of the following conditions, the clearance may be reduced:

(i). If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. (122 cm). If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10 kV over that voltage.

(ii). If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

(iii). If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance (between the un-insulated portion of the aerial lift and the power line) may be reduced to the distance given below:

Voltage range (phase to phase)	Minimum approach distance
300V and less	Avoid Contact
Over 300V, not over 750V	1 ft. 0 in. (30.5 cm).
Over 750V, not over 2kV	1 ft. 6 in. (46 cm).
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm).
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm).
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm).
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm).
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm).

b. Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless:

(i). The employee is using protective equipment rated for the voltage; or

(ii). The equipment is located so that no un-insulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the line than permitted.

c. If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

11. “Illumination.”

a. Employees may not enter spaces containing exposed energized parts unless illumination is provided that enables the employees to perform the work safely.
b. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees may not perform tasks near exposed energized parts. Employees may not reach blindly into areas which may contain energized parts.

12. “Confined spaces where electrical hazards may exist.”

a. When an employee works in a confined or enclosed space that contains exposed energized parts, the IPS*ITCS will provide, and the employee shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

13. “Conductive materials and equipment.”

a. Conductive materials and equipment that are in contact with any part of an employee's body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, the employer shall institute work practices (such as the use of insulation, guarding, and material handling techniques), which will minimize the hazard.

14. “Portable ladders.”

a. Portable ladders shall have nonconductive siderails if they are used where the employee or the ladder could contact exposed energized parts.

15. “Conductive Apparel”

a. Conductive articles of jewelry and clothing (such a watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.

16. “Inspections”

a. Supervisors will ensure that work areas are inspected for possible electrical hazards.

b. Sufficient workspace shall be provided and maintained around electric equipment to permit safe operations and maintenance of such equipment.

C. Responsibilities

a. Supervisors

(i). All work hazards must be anticipated, and all safeguards utilized.

(ii). Ensures that all employees are properly trained and instructed in the safe operation of electrical equipment and aware of all hazards associated with the use of these electrical devices.

(iii). Initiates any necessary administrative action required to enforce safety practices.

(iv). Requests assistance from Company Management regarding equipment operation which require unique safety practice instructions.

b. Employees

(i). Follows the Company’s electrical safety policies and procedures and instructions of responsible Supervisors and the Safety and Health Manager.

(ii). Brings to the attention of the supervisor and/or Health and Safety Branch potential hazardous situations such as discrepancies between instruction, procedures, policies and manual, faulty equipment, misapplication of device, etc.

(iii). Electrical equipment known to be malfunctioning must be repaired or replaced before use. The repair must be initiated as soon as possible after the malfunction is noted.

c. Safety and Health Manager

(i). Assists supervisors in defining hazardous operations, designating safe practices, and selecting proper application of devices.

(ii). When necessary, obtains from the principal supervisor, standard operating procedure for electrical equipment and devices in use.

(iii). In coordination with Company Management and other supervisors, reviews and approves standard operating procedures.

(iv). Evaluates potential electrical hazards during facility inspections to ensure compliance with existing Company policy and other safety guidelines.

(v). Requests support from Company Management on hardware and equipment testing, tagging out of unserviceable equipment, and taking corrective action where necessary.

D. Electrical Safety Practices

The following practices are to be followed by all employees:

a. Individual

(i). The user is responsible for obtaining necessary tools and safety equipment from the designated storage area, checking it for discrepancies, returning it to storage in good condition and identifying any faulty equipment to his/her supervisor. It shall be the Supervisor's immediate responsibility to replace any faulty safety equipment and notify the Safety and Health Manager.

(ii). Eye protection is required during any electronic or electrical hardware repair, installation and/or open front operation.

(iii). Electrical safety shoes, long sleeve non-polyester, low flammability shirts and insulating gloves will be worn when operating or testing 600 volt or higher equipment.

(iv). Protective apron will be worn over polyester or other highly flammable clothing during soldering operations.

b. Laboratory Requirements

(i). All electrical and electronic laboratory equipment must be inspected for electrical hazards before using.

(ii). All electrical equipment must be grounded through power cords, frame grounding and/or grounding through wiring in conduit system.

NOTE: Some power tools and instruments are now double insulated and do not require or need three pronged plugs. Contact the Safety and Health Manager where the discrepancy or hazard exists.

(iii). Laboratory equipment will be kept clear of electrical panel boards with the following clearances: 36 inches for 120/208 volts and 42 inches for 277/480 volts and up to 600-volt equipment.

(iv). Operation of panel board circuit breakers by laboratory personnel is prohibited except in case of personal emergency, contact the Safety and Health Manager for operation.

(v). Switching devices which are tagged or locked shall not be operated until tag is removed by issuer.

(vi). When work is to be performed on electrical equipment, care must be taken to make sure the electrical source is turned off, rendered inoperative, tagged and locked. (Re: Lock out/Tag out). Working on live parts of 50 volts or more shall not be done except in an emergency and with proper procedure and/or qualified “Buddy” with appropriate safety equipment.

(vii). Extension cords are intended only for temporary use with portable appliances, tools, and similar equipment that are not normally used at one specific location. Extension cords are not to be used as a substitute for fixed wiring. FEB will install receptacles when needed for new equipment.

c. Emergency Procedures:

In the event of a medical emergency (shock etc.) contact a member of Management, contact local Emergency Rescue Units (911), and direct Emergency Rescue Units to the scene. If there is a person nearby who has received First Aid/CPR training, they should be contacted immediately to give assistance.

d. Emergency Removal or Tag and Lock:
In the event of an emergency in which the person responsible for removing the tag and lock cannot be located, the General Foreman may remove the device in the presence of a member of the Health and Safety Branch. Details for removal are given in the Lock out/Tag out Policy

e. Hazards:
The extreme hazard of electrical equipment is the potential for personnel electrocution from contacting energized systems. Electrical equipment can also cause catastrophic property damage because of its potential as an ignition source for causing fire or explosion.

E. Control of Hazardous Energy (Lock-Out/Tag-Out):

The procedures specified in this section comply with the requirements for the isolation or control of hazardous energy sources set forth in the OSHA standard (29 CFR 1910.147 – proposed). The accidental release of energy during maintenance work can and frequently does cause severe injuries, amputations, and death. Energy can be present in the form of electricity, potential energy (due to gravity) stored in elevated masses, chemical corrosivity, chemical toxicity, or pressure.

The only exceptions (allowed by OSHA to these requirements) are those situations involving “hot tap” operations. For this exception to be valid, Company personnel involved must demonstrate that the continuity of services is essential, that shutdown of the energy source is impractical, and that documented (written) procedures and special equipment have been implemented that will provide proven effective protection. These procedures apply to all maintenance or installation operations conducted on Company premises.

a. Tag-out Devices

Tags affixed to energy isolating devices are warning devices that do not provide the physical restraint on those devices that a lock would provide. Any tag so attached to an energy isolating device must not be removed without authorization of the person attaching it, and it must never be bypassed, ignored, or otherwise defeated. Tags must be legible and understandable to be effective. Tags must be made of materials which will withstand environmental conditions encountered in the workplace. When utilized, tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use. Tag-out devices must be substantial enough to prevent inadvertent or accidental removal.

Tag-out devices must warn against hazardous conditions if the machine or equipment is energized and must include appropriate warnings such as:

•DO NOT START

•DO NOT ENERGIZE

•DO NOT OPEN

•DO NOT OPERATE

•DO NOT CLOSE

b. Lock-out Devices

Lock-out devices and practices vary by nature and function. Several effective lock-out devices and practices are listed as follows:

(i). Padlocks. Key operated padlocks are recommended and should be assigned individually.

(ii). Multiple lock adapters will enable more than one worker to place their own padlock on the isolating device to guarantee that the machine or equipment will remain deactivated until each and every employee completes their own task, and only then will the last padlock be removed.

(iii). Chains or other commercially available devices should be used to prevent valves from being opened or, in some cases, closed. The principle of multiple lock adapters still applies even when chains or other devices are used on operations requiring more than one employee.

c. Procedures

(i). General

If energy-isolating devices are not capable of being locked out, they must be modified so that they are capable of being locked out whenever major replacement, repair, renovation, or modification of the machine or equipment takes place. Whenever new machines or equipment are installed, energy-isolating devices for such machines or equipment must be designed to accept a lock-out device.

If an isolating device cannot be locked out for any reason, then additional steps must be taken to assure full employee protection such as removing fuses, blocking switches, blanking off lines, etc.

If the machine or equipment is not capable of being locked out, a tag-out procedure must be documented and utilized. The tag-out procedure must provide full employee protection equivalent to a lock-out system. For full employee protection, when a tag-out device is used on an energy-isolating device, the device must be attached at the same location that the lock-out device would have been attached and must demonstrate that the tag-out device will provide a level of safety that is equivalent to that of a lock-out system.

(ii). Plug/Cord and Hose-Connected Type Equipment

When servicing or installing plug/cord or hose connected electrical, pneumatic, or hydraulically powered equipment, the cord or hose shall be disconnected from the equipment to be worked on, prior to starting the work. A tag warning against reconnecting the plug or hose shall be affixed to the plug or hose end.

Any stored energy (e.g., capacitor voltage, hydraulic pressure) shall be safely released prior to the start of maintenance or installation work.

(iii). Electrically Powered Equipment

Electrically powered equipment shall be de-energized, and their source of electricity manually disconnected from them prior to the removal of protective covers or the start of other maintenance or installation work. It is important to recognize that locking and tagging on/off switches is often not sufficient to prevent accidental start up or prevent voltage from being present in the equipment. If the equipment is not wired properly (i.e., the polarity is reversed) or the switch is of the single pole type, voltage can be present even if the operating switch is in the off position. For these reasons, manual disconnects must be placed in the off position and/or the equipment's power fuses removed from the motor control center.

The lock-out/tag-out procedure is as follows:

- Each person working on the circuit or piece of equipment shall place a padlock and warning tag on the electrical isolation device (e.g., disconnect switch).
- Each person working on the circuit or piece of equipment shall attempt to energize or start the piece of equipment prior to starting work. Each on/off switch capable of energizing the equipment must be "tried."
- If the try step reveals that the equipment is capable of being energized, the proper disconnects must be located and locked out and the try step repeated.
- As each person completes their task, they shall remove their padlock and tag from the energy-isolating device.
- All protective covers or panels shall be securely re-attached prior to energizing the equipment after work is completed. In the event that protective covers must be removed to make adjustments on energized equipment, appropriate guards must be constructed and attached in such a manner as to prevent employee contact with live circuitry capable of causing human injury. Such guards must be of durable construction, adequate to prevent injurious contact, and remain in place at all times that the equipment is energized.

Chemical and/or Pressurized Lines:

Prior to working on any pressurized line or a line containing a toxic, flammable, reactive, or corrosive material, the following procedure must be implemented:

(i). The line to be serviced must have two block valves upstream of the work area or device to be serviced or installed, placed in the closed position and tagged. The bleed valve (between the two block valves) shall be opened and tagged so that leakage of the valve upstream would be readily obvious. The line shall be depressurized or drained in a safe manner. Lines shall be broken in such a manner as to release pressure away from the employee. All solids or liquids drained shall be safely collected. This procedure is called “double block and bleed.”

(ii). If it is possible for pressure or line material to enter the work area from more than one direction, the line in each direction of travel shall be “double blocked and bled” as described above.

(iii). In the event that “double block and bleed” procedures are infeasible (i.e., the line is not provided with adequate valving), alternative measures shall be implemented. One alternate measure is to place a solid “blind” in a flange located between the available upstream valve and the work area. If blinds are used they shall be sufficiently corrosion and pressure-resistant to ensure that if the valve leaks, the blind will stop the material or pressure from reaching the work area.

Stored Mechanical Energy

In situations where equipment to be worked on has stored mechanical energy (e.g., in a flywheel or drop hammer), the stored energy must be released or blocked in a safe manner before starting maintenance or installation work. Effective blocking practices may include the installation of safety blocks or adequate supports. Under no circumstances will “bumper jacks” or “scissor jacks” be considered to be adequate blocks.

F. Training

The purpose in providing training to employees is to ensure that they understand the purpose and function of the lock-out/tag-out program and procedures, and that they have the knowledge and skills required for the safe application, usage, and removal of energy controls.

1. Personnel who work around electrical equipment but who do not perform a primary duty of electrical system installation or maintenance will be briefed by their supervisor on the hazards of electricity and the proper precautions to observe.

2. Each authorized employee who will use a lock-out/tag-out procedure must 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 isolation and control.

3. Employees must be retrained whenever there is a change in their job assignment; a change in machines, equipment, or processes that present a new hazard; or when there is a change in the lock-out/tag-out procedures.

Revision History

Rev	Rev Date	Rev By	Approved By	Description
1.0	1.3.2022	Shayne Torrans	Shayne Torrans	Initial Procedure Document
1.1	12.20.2022	Shayne Torrans	Shayne Torrans	Format Revision

Approvals:

Procedure Owner

_____ _____
Print Name Date

_____
Signature

Competency Assessment

No.	Questionnaire	C/NYC
Q1		
A1		
Q2		
A2		
Q3		
A3		
Q4		
A4		
Q5		
A5		

Enclosed Attachments	
Risk Assessment	☑
Environmental Aspect and Impact	☑
Training and Competency	☑
Measure and Evaluation Tools	☑

Competency Checklist

To be filled out by Trainer and signed by Employee, Assessor and Supervisor before being returned to the HSEQT Manager for recording purposes.

Procedure	Competency	Date	Competent YES / NO	Employee Signature

(Please tick appropriate box)

This employee is competent in performing the job. ☐

This employee has not attained the competency level. ☐ *

* *If the employee has not attained all competency levels, the General Manager must assess the action to be taken, provide an extension of training or alternative action as listed below.*

Alternate action to be taken: _____

Signed By

Employee: _____ Date: _____

Trainer: _____ Date: _____

Assessor: _____ Date: _____

Regional Manager: _____ Date: _____

Environmental Aspects and Impacts

Identified Environmental Aspects and Impacts

The following table is a summary of the likely environmental aspects and impacts that may be identified during site inspections. The significance of each impact needs to be assessed using the Risk Assessment Model.

Activity	Aspect	Impact
Purchasing & Administrative Work	Consumption of goods	Conservation of natural resources
	Consumption of energy (eg. Electrical equipment and facilities)	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of waste (eg. Paper)	Consumption of space for waste disposal; Habitat loss
Climate Control	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of noise	Disturbance to community; Habitat loss
Cleaning of – offices / vehicles	Storage, use and release of chemicals	Contamination of air, water or soil; Risk to human health
Transport (Fleet vehicles / staff travel)	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Loss of habitat at all stages of generation; Light pollution
	Consumption of goods (eg. Oil)	Consumption of natural resources; Generation of waste; Habitat loss; Biodiversity impacts
	Generation of waste (eg. Oil)	Consumption of space for waste disposal; Potential contamination of water or soil; Habitat loss
	Exhaust emission	Release of greenhouse gases and atmospheric pollution
	Use of dangerous goods (eg. Batteries)	Potential contamination of air, water or soil; Risk to human health
	Generation of noise	Disturbance to community; Habitat degradation
Operations		

Risk Assessment

Risk Assessment // insert name here					
Step No: Logical sequence	**Sequence of Basic Job Steps documented in the Procedure, Work Instruction and project plans. Break down Job into steps.** Each step should be logical and accomplish a major task.	**Potential Safety & Environmental Hazards/Impacts at the site of the Job** Identify the actual and potential health and safety hazards and the environmental impacts associated with each step of the job.	**Risk Rating** Refer to the risk matrix or HSEQT.PRO. Risk Mgt	**Recommended Corrective Action or Procedure** ***Determine the corrective actions necessary to reduce the risk to as low as reasonably practical (ALARP) refer to HSEQ.PRO.Risk Mgt. The risk must be rediced or controlled to ALARP before work commences.*** Document who is responsible for implementing the controls to manage each hazard identified.	**Risk Rating** refer to the risk matrix or HSEQT.PRO.Risk Mgt
1.					
2.					
3.					
4.					
5.					

Audit

Process: insert// **Procedure**: Insert //	Date:	Audited by:
	Location of Audit:	Area Mgr/Supervisor:

Item	Question	Evidence Sited	Comments	Conformance Score 0,3,5
1.				
2.				
3.				
4.				
5.				
6.				
7.				

AUDITOR'S SIGNATURE: SAFETY REP'S SIGNATURE:	CONFORMANCE SCORE: / 25 CONFORMANCE %:	0 – Non-Conformance 3 – Continuous Improvement Opportunity 5 – Total Conformance