

Proof of Training

Print name: _____ Signature: _____ Date: _____

Electrical Safety

Purpose

The purpose of this policy is to establish safe work practices that are intended to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits which are or may be energized and to comply with the OSHA Regulations and NFPA 70e.

Scope

This policy will apply to all work performed by employees and subcontractors including, but not limited to the following activities: construction, installation, demolition, remodeling, relocation, refurbishment, testing, and servicing or maintenance of equipment or machines and at other times working on or near electrical systems. This policy applies to both Qualified persons and Unqualified persons (See the definitions below) who are working on, near, or with the electrical equipment, tools or installations.

Responsibilities

Management (Board of Directors and Project Managers)

Management is responsible for ensuring that the materials (e.g., tools, equipment, personal protective equipment) and other resources (i.e., worker training materials) required to fully implement and maintain this program are readily available where and when they are required. Additionally, management will monitor the effectiveness of the program, provide technical assistance as needed, and review the program bi-annually.

Program Manager

Dave Simpson is responsible for the development, documentation, training and administration of the program. This position carries the responsibility of insuring this program is adhered to and that proper reporting is executed.

Supervisors (Superintendents and Foreman)

Supervisors are responsible for ensuring that a task specific job hazard analysis (JHA), also known as a safe work plan, is developed. The JHA will select, implement and document the appropriate site-specific control measures as defined within this policy. Supervisors will direct the work in a manner that ensures the risk to workers is minimized, adequately controlled and that practices defined by this policy will be followed. Supervisors are responsible for ensuring Unger Construction employees and subcontractors are following expectations. Supervisors will be held accountable for enforcing the requirements of this program. Undesirable behavior will not resolve itself, therefore supervisors must be directly involved

with modifying behaviors inconsistent with program expectations. Supervisors will be held accountable for enforcing Unger Construction's disciplinary program.

Workers (Employees and Subcontractors)

Unger Construction has high expectations and requires safety excellence for each employee, crew, project and for our entire company. Workers are required to follow the minimum procedures outlined in this program. Workers are responsible for knowing the hazards and the control measures established in the JHA. Workers are responsible for using the assigned PPE in an effective and safe manner. Workers are responsible for stopping unsafe acts and correcting unsafe conditions on the spot as soon as they are discovered. Any deviations from this program must be immediately brought to the attention of your supervisor. Workers that choose to conduct themselves in a manner that is inconsistent with these expectations will be held accountable for those decisions and may incur disciplinary actions.

Job Hazard Assessment (Safe Work Plan)

Unger Construction utilizes JHA's as our means of hazard assessment and establishing a safe work plan. JHA's are performed by supervisors and/or workers. Our library of hazard assessments is maintained on the "S" drive. Before beginning a new task refer to the JHA library, generally speaking all scopes of our work are covered. For situations that have not yet been covered select one that is substantially similar and use it as a baseline. JHA's on the "S" drive are organized by work area and job description. JHA's include strategies for elimination, substitution, engineering and administrative controls. After applying all appropriate reduction and elimination technique, the remaining hazards will be analyzed and the proper PPE to reduce the hazards will be selected. PPE will be identified for hazards that are in the process of being reduced or eliminated and/or when hazard-reduction efforts are not 100% effective in eliminating the hazards.

For complex or moderate to high hazard tasks, tasks where an additional level of safety planning is needed, the safety director will perform the JHA with the supervisor and workers.

Introduction

The electrical safety program at Unger Construction is closely linked to the following programs; High Voltage Electrical Safety, NFPA 70e, Control of Hazardous Energies (CoHE) also known as lock out tag out. These programs are intertwined and directly coupled to each other in fact much of the information is the same. In order to perform work on electrical systems you must have demonstrated competency with NFPA 70e and Control of Hazardous Energies. Our high voltage electrical safety program is very restrictive. Authorization to work on or near high voltage electrical systems is issued on a very limited basis.

Definitions

Authorized/Qualified person means a person permitted to work on or near exposed energized parts who has been trained in and familiar with: The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment, The skills and techniques necessary to determine the nominal voltage of exposed live parts, The knowledge, skills and techniques to work safely on energized circuits, The proper use of special precautionary techniques, personal protective equipment, Insulating and shielding materials, and insulated tools, The clearance distances for work performed near overhead

lines that are specified in the OSHA standard and the corresponding voltages to which the person will be exposed.

Unqualified Person - means a person with little or no training in avoiding the electrical hazards of working on or near exposed energized parts.

On or near means close enough to exposed line parts (by either personal contact or contact by tools or materials) for an employee to be exposed to any hazard they present.

Training

Appropriate training will be provided for those employees who face a risk of electric shock in the form of classroom and/or on the job instruction. Each employee required to be trained will become familiar with the safe work practices required by this policy and the OSHA Electrical Standard that pertain to his/her respective job assignment(s).

Authorized/Qualified persons (i.e. those persons permitted to work on or near exposed energized parts) will, at a minimum, be trained in the following: The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment, The skills and techniques necessary to determine the nominal voltage of exposed parts, The clearance distances and the corresponding voltages to which the authorized/qualified person will be exposed.

Proof of training is available on the "S" drive. The training data base can be sorted by employee name or by subject. This ensures supervisors and employees are able to confirm they have the necessary training and if they don't which employees do. Employees that need training should contact their project manager or superintendent to make arrangements for them to be trained.

Retraining

The need for retraining will be indicated when: An employee's work habits or knowledge indicate a lack of necessary understanding, motivation or skills. New equipment is installed that requires new or different PPE, Changes in the workplace make previous training obsolete, Changes in the types of PPE to be used make previous training obsolete or Upon a supervisor request.

General Requirements

Only authorized/qualified workers are allowed to work on or near electrical systems. Appropriate safe work practices will be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment/circuits that are or may be energized. Those specific work practices will be consistent with the nature and extent of the associated electrical hazards. Live parts that operate at less than 50 volts to ground need not be de-energized as long as there will be no increased exposure to electrical burns or to explosion due to electric arcs. For all other electrical systems our preferred method to perform work is in the de-energized and locked out state as identified in our Control of Hazardous Energies program. Live parts to which an employee may be exposed will be de-energized before any employee works on or near them, unless de-energizing will introduce additional or increased hazards or is not feasible due to equipment design or operational limitations (See below for examples).

1. 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.
2. Examples of work that may be performed on or near energized circuit parts because of infeasibility due to equipment design or operational limitations include testing of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

Confirming Zero Hazardous Energies

Whenever any employee is exposed to contact with parts of fixed electric equipment or circuits that have been de-energized, the circuits energizing the parts will be properly locked out per our Control of Hazardous Energies program.

Safe procedures for de-energizing circuits and equipment will be determined before circuits or equipment are de-energized. The circuits and equipment to be worked on will 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 de-energizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for lockout procedures.

Stored electrical energy that might endanger personnel will be released before starting work. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electric energy might endanger personnel.

No work will be performed on or near de-energized live parts, circuits or equipment until their de-energized condition has been verified. Verification of the de-energized condition will be made as follows: An authorized/qualified person will operate the equipment operating controls or otherwise verify that the equipment cannot be restarted, An authorized/ qualified person will use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and will verify that the circuit elements and equipment parts are de-energized, The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage back feed even though specific parts of the circuit have been de-energized and presumed to be safe. There will be a visual determination that all employees are clear of the circuits and equipment.

Re-energizing

Before any circuit or equipment is reenergized (even temporarily) the following requirements will be met in the order listed: An authorized/ qualified person will 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. Employees exposed to the hazards associated with reenergizing the circuit or equipment will be warned to stay clear of circuits and equipment,

Each lock will be removed by the employee who applied. If that employee is absent from the workplace, then the lock may be removed by following the Abandoned Lock Removal Process.

Work on or Near Exposed Energized Parts

In those cases where the exposed live parts are not de-energized, either because of increased or additional hazards or because of infeasibility due to equipment design or operational limitations, other safety-related work practices must be used to protect employees who may be exposed to the electrical hazards involved. Work shall not be performed on exposed energized parts of equipment or systems until the following conditions are met 1) Supervision has determined that the work must be performed with the equipment or system energized 2) Involved personnel have received instructions on the work techniques and hazards involved in working on energized equipment 3) Proper personal protective equipment has been selected, inspected and approved for use.

The work practices used must protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object or when employees are near enough to be exposed to any hazard they present.

Only an authorized/qualified person may work on electric circuit parts or equipment that, has not been de-energized. These employees must be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

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

Whenever an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized parts, he/she must be provided with, and he will use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with those parts. Doors, hinged panels, and the like that are present in any confined or enclosed space will be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

Conductive materials and equipment that are in contact with any part of an employee's body will be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts.

Only wooden ladders or ladders with nonconductive side rails are allowed in areas where the employee or the ladder could contact exposed energized parts.

Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, keychains, 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.

Conductive tools or equipment such as measuring tapes, fish tapes or other such devices cannot be used in or around potentially energized electrical systems. Even if those systems are believed to be de-energized. Non-conductive versions of these tools shall be used.

Where live parts present an electrical contact hazard, employees may not perform housekeeping duties at such close distances to the parts that there is a possibility of contact, unless adequate safeguards

(such as insulating equipment or tools) are provided. Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions) may not be used in proximity to energized parts unless appropriate procedures are followed that will prevent electrical contact.

Only an authorized/ qualified person following the requirements of the procedures set forth in this section of the policy may defeat an electrical safety interlock and then only temporarily while he or she is working on the equipment. The interlock system will be returned to its operable condition when such work is completed.

Working Near Overhead Power Lines

Areas where overhead power lines exist require special site orientations, safe work practices, signage and barricades to prevent accidental contact. Signs and barricades shall be placed at every level that a worker is expected to perform work. For example ground level and upon scaffolding or other elevated surfaces.

Whenever an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, appropriate work practices (such as the use of insulation, guarding and material handling techniques) shall be instituted which will minimize the hazard.

Whenever an unqualified employee 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 the distances given below. For voltages normally encountered with overhead power lines, objects which do not have an identified insulating rating for the voltage involved shall be considered to be conductive.

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

Whenever work is to be performed near overhead lines, the lines will be de-energized and grounded, or other protective measures will be provided before work is started. When overhead lines are to be de-energized, arrangements to de-energize and ground them will be made with the organization that operates or controls the electrical circuits involved. When protective measures are provided such as guarding, isolating, or insulating, those precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment. Only an authorized/qualified employee will be permitted to install insulating devices on overhead power transmission or distribution lines.

Whenever an unqualified employee is working in elevated positions near overhead lines, the location will be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances: For voltages to ground 50kV or below - 10ft. (305cm), For voltages to ground over 50kV - 10 ft. (305cm) plus 4 inches (10 cm) for every 10kV over 50kV.

Minimum Approach Distances

<u>Voltage Range (phase to phase)</u>	<u>Minimum Approach Distance</u>
300V and less	Avoid Contact
Over 300V, not over 750 V	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)

Corded Tools and Extension Cords

Corded tools and extension cords shall be inspected before each use. The inspection shall look for defects or damage to the mechanical restraints, caps, connectors, damaged or missing conductors, insulation that is damaged, frayed stressed or nicked. Suspect tools or cords shall be taken out of service (red tagged) or immediately repaired by an authorized/qualified individual. Subcontractors shall submit their corded tools and extension cords to Unger Construction for inspection when they first mobilize on the job site. Extension cords shall be heavy-duty construction grade

Unger Construction does not utilize an assured grounding program preferring instead to follow a 100% ground fault circuit interruption (GFCI) program. All corded tools and extension cords must be connected to a GFCI. GFCI's themselves must be inspected and tested monthly. Units that fail the test shall be destroyed and discarded.

Extension cords which cross a normal travel path must be covered with rubber threshold cover plates or other non-conductive means of protection. Extension cords shall not be routed through doorways, panels or covers without some means of protecting the cord from damage.

Portable Electric Equipment

All cord- and plug- connected electric equipment, flexible cord sets (extension cords), and portable electric equipment will be handled in a manner that will not cause damage. Flexible electric cords connected to equipment may not be used for raising or lowering the equipment. Flexible cords may not be fastened with staples or otherwise hung in such a fashion as could damage the outer jacket or insulation.

Portable cord- and plug- connected equipment and flexible cord sets (extension cords) shall be visually inspected before use and missing pins, or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket). However, cord- and plug- connected equipment and flexible cord sets (extension cords) which remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item will be removed from service, and no employee may use it until necessary repair and tests have been made to render the equipment safe.

Whenever an attachment plug is to be connected to a receptacle (including any on a cord set), the relationship of the plug and receptacle contacts will first be checked to ensure that they are of proper mating configurations.

A flexible cord used with grounding-type equipment will contain an equipment grounding conductor.

Plugs and receptacles may not be connected or altered in a manner that would prevent proper continuity of the equipment grounding conductor. Additionally, those devices may not be altered to allow the grounding pole of a plug to be inserted into slots intended for connection to the current carrying conductors. Adapters that interrupt the continuity of the equipment grounding connection may not be used.

Portable electric equipment and flexible cords used in highly conductive work locations (such as those inundated with water or other conductive liquids), or in job locations where employees are likely to contact water or conductive liquids require protective via ground fault circuit interrupters.

Switching and Circuit Protection Devices

Only proper load rated switches, circuit breakers, or other devices specifically designed as disconnecting means will be used for the opening or closing of circuits under load conditions.

After a circuit is de-energized by a circuit protective device, the circuit may not be manually re-energized until it has been determined that the equipment and circuit can be safely energized.

However, when it can be determined from the design of the circuit and the overcurrent devices involved that the automatic operating of a device was caused by an over load connected equipment is needed before the circuit is reenergized.

Repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses is prohibited.

Overcurrent protection of circuits may not be modified, even on a temporary basis.

Test Instruments and Equipment

Only an authorized/ qualified person may perform testing work on electric circuits or equipment. Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors will be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item will be removed from service, and no employee may use the item until necessary repairs and tests to render the equipment safe have been made.

Test instruments and equipment and their accessories will be rated for the circuits and equipment to which they will be connected and will be designed for the environment in which they will be used.

Flammable or Ignitable Materials

In those situations where flammable materials are present only occasionally, electric equipment capable of igniting them will not be used, unless measures are taken to prevent hazardous conditions from

developing. Flammable materials include, but are not limited to: flammable gases, vapors, or liquids; combustible dust and ignitable fibers. In those situations where flammable vapors, liquids or gases, or combustible dusts or fibers are (or may be) present on a regular basis, the electrical installation requirements contained in OSHA regulations regarding hazardous locations must be observed.

Alerting or Area Control and Isolation

Alerting techniques will be used to warn and protect employees from hazards which could cause injury due to electric shock, burns, or failure of electric equipment parts as follows:

1. **Safety Signs and Tags:** Safety signs, safety symbols, or accident prevention tags will be used where necessary to warn employees about electrical hazards which may endanger them.
2. **Barricades:** Barricades will be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing employees to uninsulated energized conductors or circuit parts. Conductive barricades may not be used where they might cause an electrical contact hazard.
3. **Attendants:** If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant will be stationed to warn and protect employees.

Personal Protection Safeguards

Employees working in areas where there are potential electrical hazards will be provided with, and will use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed. This equipment may include rubber protective equipment such as insulating gloves, blankets, hoods, line hose, sleeves, and matting for use around electric apparatus.

Protective equipment will be maintained in a safe, reliable condition and will be periodically inspected and/or tested. If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected. For example, an outer covering of leather can be used for the protection of rubber insulating material.

Employees will wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts. Employees will wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

When working near exposed energized conductors or circuit parts, each employee will use insulated tools or handling equipment if the tools or handling equipment might make contact with such conductors or parts. If the insulating capability of insulated tools or handling equipment is subject to damage, the insulating material will be protected.

Fuse handling equipment, insulated for the circuit voltage, will be used to remove or install fuses when the fuse terminals are energized. Ropes and hand lines used near exposed energized parts shall be nonconductive.

Protective shields, protective barriers, or insulating materials will be used to protect each employee from shock, burns, or other electrically related injuries while that employee is working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur.

When normally enclosed live parts are exposed for maintenance or repair, they will be guarded to protect unqualified persons from contact with their live parts.

Preparation and Planning

An approved Job Hazard Analysis (JHA), Standard Operating Procedure (SOP), Energized Electrical Work (EEW) Permit is required for all electrical system activities.

Pre-work Discussion

Before starting the tasks a pre-work discussion will take place between the Authorized/Qualified Electrical Workers and Unger Constructions superintendent. The discussion will ensure the workers understand; how to use special tools and special work procedures for electrical systems that operate on less than 600 volts; know the clearance requirements for electrical equipment, barrier and barricading requirements; the hazards associated with electrical equipment, procedures and tools for extracting personnel from energized circuits and providing rescue and resuscitation.

During the time that work is being performed on any exposed conductors or exposed parts of equipment connected to electrical systems, an authorized/qualified Electrical Worker, or an employee in training, "the observer" must be in close proximity. The primary role of the observer is a second set of eyes to help prevent an accident and to render immediate assistance in the event of an accident. The observer must be provided with and use personal protective equipment (PPE) that is appropriate for the specific work to be performed. Review the tables in NFPA 70e.

Pre-work Inspection

The electrical tools and protective equipment must be specifically approved, rated, and tested for the levels of voltage of which an employee may be exposed. Tools, PPE and insulating equipment must be inspected per Unger Constructions Electrical Safety Program before work can begin. Protective shields, barricades to isolate unauthorized employees or pedestrians from entering the work area and work space clearances as specified in NFPA 70e shall be inspected. Additionally, the inspection will ensure clear escape path from the work space to a safe exit point.

Test Equipment Inspection

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

Overriding Safety Interlocks

Overriding safety interlocks are often required when performing metering, in emergency situations, or when troubleshooting equipment with the power on (i.e., energized electrical work). The following safe work practices shall be followed: Overriding safety interlocks shall only be performed by An authorized/qualified Electrical Workers who are experienced with the equipment being serviced and understand the consequences of overriding the interlocks (NOTE: Interlocks must not be used as the sole means of de-energizing equipment); Work areas must be marked with labels, tags, or barriers when such work is being performed; All safety interlocks should be restored after the work has been completed; and Positive confirmation should be made to verify that each interlock functions as intended.

Emergency Response

In case of an emergency, contact your supervisor and Unger Construction's superintendent or foreman. They will activate the emergency response team and call for external emergency services.

Performing the Work

The work shall be performed per the approved Job Hazard Analysis (JHA), Standard Operating Procedure (SOP) and Energized Electrical Work (EEW) Permit. Changes in conditions or changes in plan will require work stoppage and approval of the alternate means and methods by Unger Construction and the clients' representatives. It is likely that the work will be stopped the workers asked to back out and return the systems to normal conditions such that the work approval team can have the appropriate time to review the proposal and evaluate collateral impacts of the change.

Unattended Operations

No exposed live electrical equipment shall be left unattended unless properly barricaded as outlined in NFPA 70E.