

# DuPage County Environmental, Safety, Health & Property Loss Control Program

## Electrical Safety for Qualified Staff & Contractors

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### Purpose:

This policy establishes the minimum requirements for the inspection, installation, maintenance and repairs of electrical systems and equipment and is not intended to cover all electrical safety requirements. Utilization of the current standard of the National Fire Protection Associations Standard 70E (Electrical Safety in the Workplace) should be referred to for a more comprehensive description of DuPage County's electrical safety requirements.

This policy is for both our employees and contractors to assist in guarding against electrical hazards that could cause injury or property damage.

Electrical contractors must follow this rule unless they can demonstrate that they follow procedures that provide equivalent safety, and then only the County's Electrical Manager / Supervisor can authorize them to proceed accordingly.

### Policy:

- Only properly trained, authorized and qualified persons are allowed to perform work on or near energized electrical equipment and conductors, and only in accordance with the current edition of NFPA 70E Electrical Safety in the Workplace.
- Electrical equipment shall be systematically inspected per DPC Electrical Preventative Maintenance Program (EPMP), and shall be maintained in safe condition.
- Current electrical diagrams and specific procedures for installation, testing, and repair of electrical equipment and systems shall be used as tools to identify the electrical hazards and develop a plan to eliminate or control those hazards.
- Work shall only be done on or near energized conductors when it has been demonstrated that it is infeasible to perform the work when the equipment and/or conductors are de-energized, and then only when an Energized Work permit has been granted that documents appropriate safe work practices issued by the County's Electrical Manager /Designee. ( Exhibit 1)
- Mandatory pre-work safety meeting is required with electrical contractors. The meeting must be documented. This meeting is to delineate responsibilities for the work, explain any dangerous areas in the vicinity of their work they should avoid, assure the contractor's employees are qualified for the tasks to be performed, explain they are to notify our project manager of any unanticipated hazards found during their work, how known hazards will be mitigated and to provide them a copy of this procedure.

### Definitions:

**Arc Flash Hazard:** A dangerous condition associated with the possible release of energy caused by an electric shock.

**Arc Flash Hazard Analysis:** A study investigating a worker's potential exposure to arc flash energy, conducted for the purpose of injury prevention and determination of safe work practices, arc flash boundary, and the appropriate levels of personal protective equipment (PPE).

**Arc Flash Suit:** A complete arc-rated clothing and equipment system that covers the entire body, except for the hands and feet.

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**Arc Rating:** The value attributed to materials that describe their performance to exposure to electrical arc discharge.

**Balaclava (Sock Hood):** An arc-rated hood that protects the neck and head except for the facial area of the eyes and nose.

**Barricade:** A physical obstruction such as tapes, cones intended to provide a warning about and to limit access to a hazardous area such as identifying a Limited Approach Boundary.

**Boundary-Arc Flash:** When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

**Boundary-Limited Approach:** An approach distance from an exposed energized electrical conductor or circuit part within which a hazard exists. Defines the approach limit for unqualified staff and to eliminate the risk of contact with an exposed energized electrical conductor.

**Boundary-Prohibited Approach:** An approach limit at a distance from an exposed energized electrical conductor or circuit part within which work is considered the same as making contact with the electrical conductor or circuit part.

**Boundary-Restricted Approach:** An approach limit from and exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

**Qualified Person:** One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved.

- Employees are categorized as “qualified” or “unqualified” by OSHA, based on their training. Qualified persons have demonstrated skills and operation of electrical equipment and has received trained to avoid electrical hazards of working on or near energized parts. Qualified persons must be capable of working safely on energized circuits, as determined by their electrical knowledge and skills ascertained by the County’s Electrical Manager / Designee.

### General Safety Procedures:

- If a person’s work on or near energized equipment involves either direct contact or potential indirect contact by means of tools or materials with energized circuits or conductors, that person must be a “qualified person” in accordance with OSHA requirements.
- Inspect and evaluate electrical systems and equipment before beginning work.
- Maintain the integrity of the insulation and enclosure of energized parts of electrical equipment.
- Plan every job and document first-time procedures.
- De-energize the system or equipment prior to performing work.
- Use appropriate electrical protective equipment, safety equipment, and clothing, as specified in electrical safe work practices and procedures section of this policy.

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- Ensure that electrical protective equipment is dielectrically tested in accordance with OSHA requirements contained in 29 CFR 1910.137
- Rubber Insulation Equipment Maximum Test Intervals:
  - i) Blankets—before first issue and every 12 months thereafter.
  - ii) Covers—if insulating value is suspect.
  - iii) Gloves—before first issue and every 6 months thereafter.
  - iv) Line hose---If insulating value is suspect.
  - v) Sleeves—before first issue and every 12 months thereafter.
- Only insulated tools with the Underwriter's Laboratories square- in-square UL mark are to be used within the vicinity of a Prohibited Approach Boundary.
- Use the appropriate insulated tools for the rated voltages on which they are to be used.
- Selection of Personal Protective Equipment is to be determined by Hazard / Risk Category following NFPA 70E's 2012ed Table 130.7 (C) (15) (a). See Exhibit 2 for description based on Hazard / Risk Category.
- **Qualified persons are familiar with:**
  - Skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;
  - Skills and techniques necessary to determine the nominal voltage of exposed live parts;
  - Selection of the correct level of Personal Protective Equipment for each electrical hazard category;
  - Minimum approach distances corresponding to the voltages to which they will be exposed;
  - Proper use of special precautionary techniques, insulating and shielding materials, and insulated tools;
  - The installation, construction and/or operation of apparatus or equipment and the associated electrical hazards involved;
  - Other electrical safe work practices that are necessary for safety as found in NFPA 70E standard in addition to OSHA rules.
- It is likely that an individual may be considered “qualified” with regard to certain equipment (i.e. low voltage electrical equipment), but “unqualified” with regard to other equipment (i.e. high voltage electrical equipment).

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- An employee who is being trained on the job who has demonstrated an ability to perform certain duties safely at his/her level of training, and who is under the direct supervision of a qualified person, is considered a qualified person for the performance of those specific duties.

#### Limitations on Unqualified Persons:

- Unqualified persons are only allowed to work on de-energized electrical equipment after it has been locked out and tagged in accordance with the County's Lock out Tag out (LOTO) policy. (**Exception:** the changing of light bulbs and shutting off and resetting 277v circuit breakers is permitted.
- Unqualified persons are not allowed to perform testing work on electric circuits or equipment.
- Unqualified persons are not allowed to approach conductors or equipment closer than the limited approach boundary.
- Unqualified persons are not allowed to cross the arc flash protection boundary unless they are wearing appropriate personal protective clothing and are under the close supervision of a qualified person.

#### Responsibilities:

- The Director of Public Works (Program Administrator) has overall responsibility for implementing this procedure; however, supervisors and managers are responsible for cooperating with the Chief Electrical Manager to ensure that specific procedures are developed when necessary, and to ensure that employees are trained in accordance with program requirements.
- The Electrical Manager is responsible for ensuring that electrical equipment is frequently and systematically inspected and maintained in safe condition.
- The Electrical Manager is responsible for determining who are "electrically qualified" as well as the electrical tasks that qualification is granted for. Such qualification must be documented annually and retained in employee's Human Resources training file. ( Exhibit 3)
- All Managers & Supervisors shall ensure that adequate electrical protective equipment and safety equipment are readily available for use when and where they are needed and that only authorized employees use them as outlined in this policy.
- The Electrical Manager / Supervisor are the only ones who can approve permits for authorized employees to de-energize primary voltage lines or equipment or to perform work on or near energized conductors, when de-energization is infeasible, provided that the permit request has been properly completed.
- Employees shall conscientiously and consistently comply with electrical safe work practices and procedures.

#### Electrical Safety Program Controls:

- The design and installation of electrical equipment shall conform to National Electrical Code requirements.
- Our program includes a Risk Assessment which identifies the process to be used by the employee before work is started and consists of:

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1. Identify hazards
2. Assess risks
3. Implement risk control according to hierarchy of methods as specified in ANSI/AIHA Z10 American National Std. for Occupational Health and Safety Management as follows:
  - Elimination
  - Substitution
  - Engineering Controls
  - Awareness
  - Administrative Controls
  - PPE usage
  - Note the risk assessment may include identifying when a second person could be required and the training and equipment and PPE that person should have.
- Defective electrical equipment or electrical protective equipment shall not be used.
- All energized parts inside buildings shall be insulated or covered or guarded by location, except during maintenance or repairs by qualified persons following approved electrical safe work practices.
- Every electrical conductor or circuit part is considered energized until proven otherwise.
- No bare-hand contact is to be made with exposed energized electrical conductors or circuit parts above 50 volts to ground.
- De-energizing an electrical conductor or circuit part and making it safe to work on is in itself a potentially hazardous task.
- Electrical safety procedures as tools to identify hazards and controls include:
  - Purpose of task;
  - Qualifications and minimum number of employees;
  - Hazardous nature and extent of the task;
  - Limits of approach are determined, and clearly marked;
  - Safe work practices to be utilized;
  - Personal protective equipment involved;

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- Correct Insulating materials and tools involved;
- Special precautionary techniques;
- Electrical diagrams;
- Equipment details;
- Sketches or pictures of unique features;
- Reference data.

#### **Electrical Equipment Inspections:**

A qualified electrician shall perform safety inspections of electrical systems and equipment based on the EPMP. A circuit analyzer shall be used to randomly test a representative number of electrical receptacles per the EPMP in order to detect and correct common wiring problems. The current version of the National Electrical Code shall be used as the criteria for identifying and correcting deficiencies. The location and description of each deficiency that is found shall be documented.

The Electrical Manager is responsible for ensuring that prompt corrective action is taken to repair or replace items that are identified as deficiencies during safety inspections. The date each item was corrected or the date of a follow-up inspection to ensure the item was corrected shall be noted on each inspection report.

#### **Construction Activities:**

DuPage County requires 100% ground fault circuit protection on temporary electric services and all portable electrical power tools for ensuring electrical safety during construction activities. If this is not done, the general contractor will be responsible for implementing an OSHA recognized “assured” equipment grounding conductor program, which will apply to all contractors and subcontractors on the project site.

#### **Limits of Approach for Qualified Personnel:**

Observing a safe approach distance from exposed energized electrical conductors or circuit parts is an effective means of maintaining electrical safety. As the distance between a person and the exposed energized conductors or circuit parts decreases, the potential for an electrical accident increases.

**Barricades** are intended to act as a warning, and should enclose the area containing the electrical hazard. If tape issued the tape must have a Red background and Danger Do Not Enter in Black lettering.

#### **Rules for Application of Approach Limits:**

- Appropriate arc rated clothing and helmet with face shield are required whenever the flash protection boundary is to be crossed.
- Only a person who is qualified to perform the job or task is allowed to cross the limited approach boundary, and only when there is adequate illumination.

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- When a qualified person is working in the vicinity of overhead lines that have not been de-energized, he/she shall not approach any exposed energized conductor or circuit part that has not been placed into an electrically safe work condition (de-energized and effectively grounded), or take any conductive object without an approved insulating handle that is rated for the voltage involved, any closer than the restricted approach boundary, unless:
  - The qualified person is insulated or guarded from the energized conductors or circuit parts and no unguarded part of the person's body enters the prohibited space; or
  - The energized conductor or circuit part is insulated or guarded from the qualified person and any other conductive object at a different electric potential; or
  - The qualified person is isolated, insulated or guarded from all conductive objects at a different electrical potential than the energized part.
- An Energized Work Permit that specifies personal protective equipment and the work plan is required and must be approved by the Electrical Safety Program Administrator whenever a qualified employee must cross the restricted approach boundary and enter the restricted space in order to do the work. In addition:
  - No part of the body shall enter the prohibited space.
  - The risk due to inadvertent movement shall be minimized by keeping as much of the body out of the restricted space as possible, using only protected body parts in the space as necessary to accomplish the work.
- There must be a written risk analysis/justification and electrical safety procedure for the work when the prohibited approach boundary must be crossed. In addition, the following requirements apply:
  - The qualified employee must have completed training required to work on energized conductors or circuits.
  - There must be an Energized Work Permit that specifies personal protective equipment and the work plan, which must be approved by the Electrical Manager / Supervisor.
  - Where de-energizing is required the Lock out Tag out (LOTO) procedure must be followed. Where arrangements are made to use protective measures such as guarding, isolating or insulating, employees shall be prevented from contacting lines or conductors directly with any part of their body or indirectly through conductive materials, tools or equipment.

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#### *Arc Flash Protection Boundary:*

Boundary shall be determined by either an Electrical Engineer or using the current edition of NFPA's 70E tables or calculation formula's.

#### **Energized Work Permit Procedure:**

**An Energized Work Permit is NOT required for work involving less than 50 volts.**

- An Energized Work Permit (Exhibit 1) must be requested at least 24 hours in advance for all non-emergency work that involves de-energizing primary voltage lines and equipment or work on or near energized conductors.
  - The qualified person in charge of the work must complete the information requested in the Energized Work Permit, and submit it for approval to the Electrical Manager / Supv.
  - The Electrical Manager / Supv. will review the form and approve it after ascertaining that all necessary precautions have been included in the work plan.
- Work must be done in accordance with the approved work plan shown on the Energized Work Permit. The person in charge shall certify this when he/she signs and returns the form to the Electrical Manager / Supv. Upon completion of the job. The permit must be returned to them promptly after work is completed and in no case later than the end of the work shift.
- An Energized Work Permit is not transferable and shall not be valid for longer than one work shift. Only the qualified persons named on the permit are allowed to do the work. If crew members will change or the work will extend past the end of a shift, a new permit must be requested and approved before work may continue.
- For purposes of interpreting the level of personal protective equipment that is specified on an Energized Work Permit



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#### **Qualified Personnel Emergency Response Training:**

Employees exposed to shock hazards must be trained in methods of safe release of victims from contact with exposed energized electrical conductors or circuit parts. Refresher Training shall occur annually.

1. First Aid, Emergency Response and Resuscitation:
  - (a) Employees responsible for responding to medical emergencies including Qualified Electricians shall maintain certification for cardiopulmonary resuscitation (CPR).
  - (b) Employees responsible for responding to medical emergencies including Qualified Electricians shall maintain certification for use of automated defibrillators (AED).
  - (c) Documentation of training shall be maintained and verified annually.
2. Contact Release:
  - a) All Qualified Personnel must be trained on how to safely “release” a victim from contact with an electrical circuit.

#### **General Electric Pre-job Safety Briefing:**

- Before starting each job, the qualified employee in charge shall conduct a job briefing with the employees involved. The briefing shall cover:
  - The hazards associated with the job;
  - Work procedures and special precautions;
  - Energy source controls; and
  - Personal protective equipment requirements.
- If the work or operations to be performed during the workday or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of the day or shift. Additional job briefings shall be held if significant changes that might affect the safety of the employees occur during the course of the work.

#### **Training Prior to Assignment & As Needed:**

- Managers or supervisors shall ensure that authorized employees have the necessary knowledge and skills to safely perform electrical inspection, maintenance and repair work and to meet requirements for qualified persons outlined in this policy.

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- An employee shall receive additional training whenever it is determined through normal supervision, an incident investigation or periodic inspection that an employee is not adhering to safety rules. This re-training must be documented and sent to HR for their personnel file.
- All affected employees shall be trained when new technology, new types of equipment or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use.
- Refresher training must be provided prior to performing non-routine tasks that are performed less than once a year.
- Safe work practices shall be reviewed during unit / department meetings held throughout the year.
- The Electrical Manager or qualified instructor shall certify that employee training has been accomplished and is being kept up-to-date.
- Classroom training will be conducted by the Risk Management Coordinator or his/her designee using lecture, discussion, videotape or computer-based training or any combination thereof.
- The training of qualified employees shall include the following topics:
  - Explanation of OSHA regulations pertaining to design, maintenance and repair of electrical systems and equipment;
  - This policy for Electrically Qualified employees & contractors;
  - An approved curriculum on general electrical safety and lockout/tag out techniques.
  - Employees who are authorized to perform energized work shall be trained in First Aid, CPR and rescue techniques.
  - The Risk Management Coordinator and Electrical Manager are responsible for keeping up-to-date concerning OSHA regulations on the subject of the control of electrical safety.
- The Risk Management Coordinator in consultation with the Electrical Manager is responsible for approving training curricula and instructors.

#### **Training of Non-Employees:**

- Contractors must be advised of the County's electrical safety program and procedures, as well as specific lockout-tagout requirements for machinery or equipment they will be working on.
- Contractors are specifically required by contract to provide all of their own safety equipment and tools.
- Contractors should be required to provide documentation of electrical safety and lockout-tag out training, upon request.

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#### Program Review:

- The Electrical Manager / designee shall confirm that each “qualified” employee is complying with the safety-related work practices through regular supervision and through documented observations conducted on a minimum of an annual basis. (Exhibit 2)
- The Electrical Manager is responsible for determining whether or not training was administered as required according to this program. If deficiencies are found, they must be noted in memo form to the department head and must be corrected by administration of testing and training conducted by the Electrical Manager / Designee for the employee within 30 days.
- The written program and the effectiveness of implementation will be reviewed annually by the Electrical Safety Program Administrator, with assistance from the Public Works / Facilities Management Safety Committee, if needed.
  - Spot checks will be done to verify whether or not electrical protective equipment is being supplied, used and cared for properly. Deficiencies shall be noted and corrective action shall be taken in a timely manner.
  - The following shall also be reviewed, as they relate to the Electrical Safety Program, and the results shall be recorded for Safety & Health Program Updates :
    1. Results of electrical safety inspections and audits for the past year;
    2. Employee electrical hazard reports and electrical safety suggestions for the past year;
    3. Electrical Incident investigations and Job Safety Analysis reports for the past year;
    4. Electrical Safety presentations for the past year;
- A copy of the report reviewing the effectiveness of the written program and any correspondence regarding correction of training deficiencies will be submitted to the Safety Program Administrator, who will also route copies to the Risk Management Coordinator.
- If the annual review indicates that changes, additions or improvements to the program are needed, the Risk Management Coordinator will be responsible for coordinating the implementation of action items, and documenting their completion.

#### Recordkeeping:

- Specific operating procedures for electrical systems and equipment that involve additional or different steps than the general procedures outlined in this written program in shall be kept readily available and shall be updated as necessary.
  - A copy of each additional specific operating procedure shall be included with this program as an attachment.

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- The Human Resource Dept. shall keep a permanent file of all training records pertaining to this program.
- The Electrical Manager shall keep copies of all canceled Energized Work Permits for two years past the end of the year to which they relate.

#### References:

- OSHA 29 CFR 1910.137
- OSHA 29 CFR 1910.333-335
- OSHA 29 CFR 1910.269
- Electrical and Electronic Engineers 1584-Guide for Performing Arc Hazard Calculations
- NFPA 70E current edition
- National Electric Code current edition