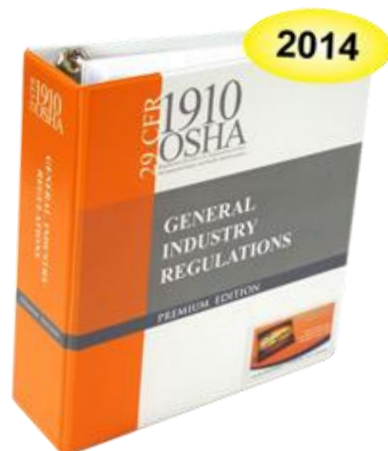
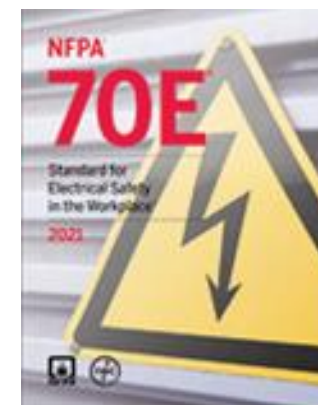


# Electrical Safety: Best Practices



General Industry Standard



Standard for Electrical Safety in the Workplace

*Presenter Marty Redman*

# Electrical Safety: Best Practices



When working with Electricity , you must protect yourself against the three hazards associated with electricity.

***1. Shock***

***2. Arc-flash***

***3. Arc-blast***



# Electrical Safety: Best Practices



## *Shock Hazard*

- ❑ A source of possible injury or damage to health associated with current through the body caused by contact or approach to exposed energized electrical conductors or circuit parts.
- ❑ Injury and damage to health resulting from shock is dependent on the magnitude of the electrical current, the power source frequency and the path and time duration of current through the body.
- ❑ The physiological reaction ranges from perception, muscular contractions, inability to let go, ventricular fibrillation, tissue burns, and death.

**“Energized parts that operate at less than 50 volts are not required to be de-energized to satisfy an ‘electrically safe work condition.’”**

... source : NFPA 70E

# Electrical Safety: Best Practices



## *Arc-flash Hazard*

- ❑ A source of possible injury or damage to health associated with the release of energy caused by an electric arc.
- ❑ The likelihood of occurrence of an arc flash incident increases when energized electrical conductors of circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc.
- ❑ An arc flash incident is not likely to occur under normal operating conditions when enclosed energized equipment has been properly installed and maintained

# Electrical Safety: Best Practices



## *Arc-blast Hazard*

- The tremendous temperatures of the arc cause the explosive expansion of both the surrounding air and the metal in the arc path.
- Copper expands by a factor of 67,000 times when it turns from a solid to a vapor causing high pressures, sound and shrapnel.
- The pressure can knock a worker off ladders, rupturing eardrums, and collapsing lungs.
- The material from the blast and molten metal are expelled away from the arc fast enough for shrapnel to completely penetrate the human body.



# Electrical Safety: Best Practices



## 8 steps for Verifying an Electrical Circuit is De-energized

1. Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
2. After properly interrupting the load current, open the disconnecting device(s) for each source.
3. Whenever possible, visually verify that all blades of the disconnected devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.
4. Release stored electrical energy.

# Electrical Safety: Best Practices



## 8 steps for Verifying an Electrical Circuit is De-energized

5. Release or block stored mechanical energy.
6. Apply lockout/tagout devices in accordance with a documented and established procedure.
7. Use an adequately rated portable test instrument to test each phase conductor or circuit part to verify it is de-energized, test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the test instrument is operating satisfactorily, through verification on any know voltage source.
8. Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply temporary protective grounding equipment.

# Electrical Safety: Best Practices



## Establishing Electrically Safe Work Conditions - LOTO

1. Employee Involvement. Each person who could be exposed directly or indirectly to a source of electrical energy shall be involved in the lockout/tagout procedure. It is the employer responsibility to provide the equipment necessary to execute lockout/tagout procedures
2. Training. It is the employer responsibility to provide lockout/tagout training to workers in accordance with 110.6(B)
3. Retraining. It is the employer's responsibility if the procedures are revised, at intervals not to exceed 3 years, or when supervision or annual inspections indicate that the employee is not complying with the lockout/tagout procedures.
4. Training Documentation. The employer shall document that each employee has received the training required by 110.6(B). The documentation shall be made when the employee demonstrates proficiency in the work practices involved. The documentation shall contain the content of the training, each employee's name, and the dates of the training.



# Electrical Safety: Best Practices



## Establishing Electrically Safe Work Conditions - LOTO

5. Planning. The procedure shall require planning, including the requirements of 120.4(A) (1) through 120.4(B) (14). Locating sources, Exposed Persons, Person in Charge, Simple lockout/tagout procedure, complex lockout/tagout procedures.
6. Control of Energy. The procedure shall identify elements of control. De-energizing equipment (shutdown) the procedure establish the person who performs the switching and where and how to de-energize the load. Stored Energy and the procedure shall include requirements for releasing stored electric or mechanical energy that endanger personnel.
7. Identification. The lockout/tagout device shall be unique and readily identifiable as a lockout/tagout procedure.
8. Voltage. Shall be identified using testing procedure to establish the following, test instrument to be used, required PPE, to set up boundary of the electrically safe work condition, and a Qualified person to take the reading.

# Electrical Safety: Best Practices



## Establishing Electrically Safe Work Conditions - LOTO

9. Coordination. The procedure shall establish how coordination is accomplished with other jobs or tasks in progress, including related jobs or tasks at remote locations as well as the person responsible for coordination.



# Electrical Safety: Best Practices



## Lockout/tagout Training for Employees

- ❑ The lockout/tagout program and procedures required by Article 120 shall be audited by qualified person at intervals not to exceed 1 year.
- ❑ The audit shall cover at least one lockout/tagout in progress.
- ❑ The audit shall be designed to identify and correct deficiencies in the following.
  - the lockout/tagout program and procedures
  - The lockout/tagout training
  - Worker execution of the lockout/tagout procedure
- ❑ Documentation. The audits required by 110.5(M) shall be documented.
- ❑ OSHA required training. Any employee that is require to lockout equipment to de-energized or block the follow of energy is required to be trained to become an Authorized person to place a lock on equipment.



***Thank you for your time today!***



***If you would like to learn more about Electrical Safety,  
TPC Training can help!***

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Phone: (847) 808-4000

***Remember we should never stop learning!***