



How Does NFPA 70E Standard Apply To Your Business

NECA Convention 2024
San Diego, CA






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- NFPA NEC Technical Committee Member, (Since 2008)
- NFPA 70E Technical Committee Member, (2018, 2021 Revision Cycles)




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NFPA 70E®, Standard for Electrical Safety in the Workplace

- NFPA 70E is a Consensus Standard – *What does that mean?*
- How should the Standard be used?
 - Under oversight of a competent professional
 - Using independent judgment
 - Determining the exercise of “reasonable care.”

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Safety and Shared Responsibilities

- **Employers** have responsibilities to the **employee!**
(safety programs/policies that are developed and implemented for employee protections)
- **Employees** have a responsibility to **themselves!**
(employees should be aware of the risks)
- **Employees** have responsibilities to their **families!**
(they are expected to know the safety rules and comply, there are family members waiting for you at home!)
- **Employees** have responsibilities to their **employers!**
(employees must follow the safety rules, regulations and requirements for the organization they work for).

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OSHA, DOE and NFPA 70E® The Relationship

OSHA: 29 CFR 1910 and 29 CFR 1926,
DOE: 10 CFR 851 Regulations

- Promulgates the rules and regulations according to the Code of Federal Regulations.
- Rulemaking process can take many years to fruition.
- Is the **“SHALL”**

NFPA 70E® Standards are:

- Developed through “Consensus.”
- Revised every three years to be current with latest technology and recognized Best Practices.
- Is the **“HOW”** to comply with OSHA and DOE.



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Where to apply NFPA 70E® “...where an electrical hazard exists...”

- The practices promoted in NFPA 70E cover all circumstances where the concept of “...**where an electrical hazard exists...**”
- Only **qualified persons** shall perform tasks such as testing, troubleshooting, and voltage measuring on electrical equipment **where an electrical hazard exists.**

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First – General Policies

What general policies does your company have in place?

- Attendance
- Driving and Vehicle use
- Substance Abuse
- Personal Cell Phone
- Incident and Accident Reporting
- Harassment Policies – Discrimination, Sexual Harassment
- Workplace Violence
- Others????????????

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What are Policies? Why do we need them?

- Understand compliance requirements
- Provide guidelines for creating a safe work environment
- Effectively communicate policies to employees and customers
- Express company commitment to safety and the rules
- Establish written *Policies*

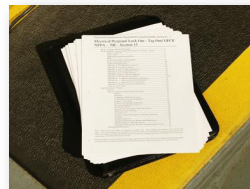


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What are Policies? Why do we need them?

- Policies are clear, simple statements on how a company conducts:
 - Services
 - Actions
 - Business
- Reflect values, approaches and commitments
- Helps to create a safety culture that all employees can foster



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Developing Effective Policies

- Include key stakeholders (management, employees and customers)
- Organize by brainstorming or small work group discussions
- Identify policies needed (compare)
- Templates available



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Developing Effective Policies

- Similar organizations
- Regulations & Consensus Standards
- Develop an overarching policy and specific ones as needed
- Identify and include unique elements of the company



Courtesy of NFPA®

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Developing Effective Policies

- Draft, refine and write the policies.
- Include at least the following information:
 - Title (name, version number, dates, and who authorized it)
 - Purpose statement (why the policy exists and its objectives)
 - Description/Responsibilities (one or two sections outlining the details of the policy and what each needs to do)

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Developing Effective Policies

- Have policies approved and endorsed by leadership (i.e., Board, President or CEO).
- Promote policies, look for feedback and refine the company policies as needed.
- Ensure all employees sign off on policies when hired and any changes made to a policy.

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Employer and Employee Responsibilities

- Shared Responsibilities of all parties
 - **Employers**, Employee, Host/Owner or Representative, etc.
- The employer must:
 - (1) establish, document, and implement the safety-related work practices and procedures required by this standard and
 - (2) provide employees with training in the employer's safety related work practices and procedures

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Employer and Employee Responsibilities

- Shared Responsibilities of all parties
 - Employers, **Employees**, Host/Owner or Representative, etc.
- The employee must comply with the safety-related work practices and procedures provided by the employer
- Owners, Clients, GC's etc.
 - Are they well informed with respect to electrical safe work practices?
 - Do they understand the hazards, potential for equipment damage and downtime?
 - Do they understand the potential for injury, death and 3rd party civil suits?

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Employer and Employee Responsibilities

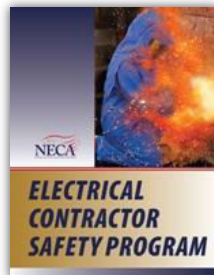
- Company Electrical Safety Commitment
- Safety Programs, Policies, Procedures
 - NECA Standing Policy 19, Safety and Health
 - Safety Orientation for employees
 - Company policy on energized work (justified)
 - Other company NFPA 70E-related policies

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NFPA 70E, Article 100 Definitions

- **Electrical Safety Program.** A documented system consisting of electrical safety *principles, policies, procedures, and processes* that *directs activities appropriate for the risk* associated with electrical hazards.

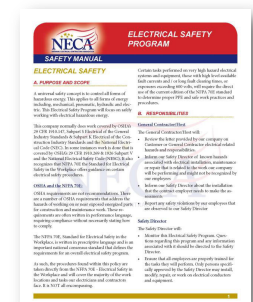


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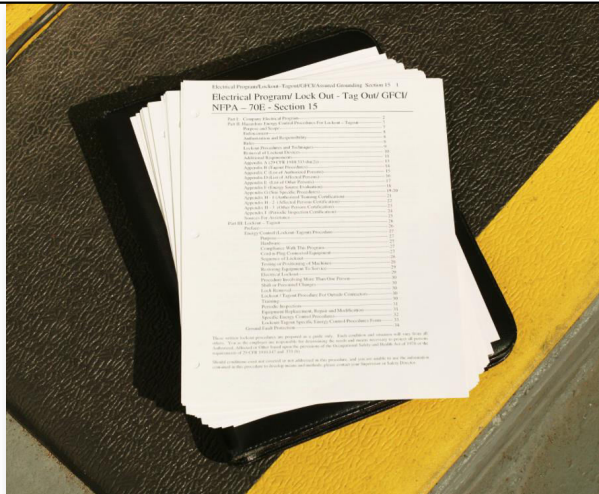
The Electrical Safety Program must include:

- Qualifications and Qualified Workers
- Inspection
- Condition of Maintenance
- Awareness and Self-Discipline
- **Policies, Programs and Procedures**
- Risk Assessment Procedures
- Job Safety Planning and Job Briefing
- Incident Investigations
- Auditing and Training



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Systems Approach to Electrical Safety

• NECA Standing Policy #19 Safety and Health

“...To that end, NECA commits to achieving zero harm in the workplace. Contractors must strictly adhere to observing the hierarchy of controls, especially the elimination of the hazards including performing all work in a de-energized capacity wherever possible.”

“NECA is committed to providing focused support of essential mental health services and programs in addition to active support and promotion of suicide prevention programs.”

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Annex E: Electrical Safety Program

E.2 Typical Electrical Safety Program Controls.

Electrical safety program controls can include, but are not limited to, the following:

- (1) The employer develops programs and procedures, including training, and the employees apply them.
- (2) Employees are to be trained to be qualified for working in an environment influenced by the presence of electrical energy.
- (3) Procedures are to be used to identify the electrical hazards and to develop job safety plans to eliminate those hazards or to control the associated risk for those hazards that cannot be eliminated.
- (4) Every electrical conductor or circuit part is considered energized until proved otherwise.
- (5) De-energizing an electrical conductor or circuit part and making it safe to work on is, in itself, a potentially hazardous task.
- (6) Tasks to be performed within the limited approach boundary or arc flash boundary of exposed energized electrical conductors and circuit parts are to be identified and categorized.
- (7) Precautions appropriate to the working environment are to be determined and taken.
- (8) A logical approach is to be used to determine the associated risk of each task.

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Annex E: Electrical Safety Program

E.3 Typical Electrical Safety Program Procedures.

Electrical safety program procedures can include, but are not limited to determination and assessment of the following:

- (1) Purpose of task
- (2) Qualifications and number of employees to be involved
- (3) Identification of hazards and assessment of risks of the task
- (4) Limits of approach
- (5) Safe work practices to be used
- (6) Personal protective equipment (PPE) involved
- (7) Insulating materials and tools involved
- (8) Special precautionary techniques
- (9) Electrical single-line diagrams
- (10) Equipment details
- (11) Sketches or photographs of unique features
- (12) Reference data

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Assessing the Condition of Maintenance (Excerpts) – NFPA 70E® Informative Annex (S)

- **Introduction** – Electrical Safety Programs must contain requirements that consider the condition of maintenance of electrical equipment and systems.
- **Assess the Risk** – Safe work practices should be employed when gathering information used to assess the condition of maintenance of electrical equipment.
- **Visual Inspection** – A Visual inspection of the equipment might be used to verify that it is installed in a professional and skillful manner in accordance with applicable industry codes and standards and the manufacturer's instructions.
- **Periodic Testing and Inspection** – Periodic testing and detailed inspections are used to help workers determine the condition of the equipment at the time of the test.
- **Permanently Installed Monitoring** – Continuous monitoring of specific equipment conditions can be performed using an uninterrupted method of data collection.
- **Predictive Techniques** – Predictive techniques monitor conditions in equipment using sensors and analyze and interpret the data using analytical methods and algorithms.
- **Maintenance History** – The maintenance history of electrical equipment is an important factor to consider when assessing if the equipment has been properly maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards.
- **Labels** – Labels, decals, or other markings might be placed on the exterior enclosure or surface of the electrical equipment or device to communicate the condition of maintenance as of the last assessment.
- **Digital and other Electronic Methods** – Digital technology is used as a method of storing and sharing maintenance related information.
- **NFPA 70B® Standard for Electrical Equipment Maintenance**– NFPA 70B provides a means to establish and maintain an acceptable condition of maintenance of electrical equipment and systems to address safety and reliability. (See NFPA 70B® for additional information!)

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NFPA 70E® Company Policy

Purpose:

- Ensures management and employees perform electrical work in a safe, healthful and productive manner and identify and clarify company requirements and expectations for electrical work to be performed in accordance with the current edition of NFPA 70E®.



Description:

- All electrical work shall be performed by qualified persons in accordance with company policies and procedures

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NFPA 70E® Company Policy

- The company intends to follow all:
 - applicable requirements found in OSHA regulations,
 - consensus standards such as NFPA 70E®
 - best practices as identified within the electrical industry.
- All persons performing energized electrical work shall be provided:
 - initial training,
 - evaluations,
 - proper Personal Protective Equipment (PPE) and
 - other training required to successfully complete task including specialized or refresher

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NFPA 70E® Company Policy Responsibilities - Employer

- Employer will:
 - provide a practical safe working area for employees relative to the hazards arising from the use of electricity
 - provide all the training required by NFPA 70E and OSHA regulations



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NFPA 70E® Company Policy: Responsibilities – Employer

- Employer will (continued):
 - Provide specific Personal Protective Equipment, (PPE) to personnel exposed to electrical hazards and ensure that it is in acceptable condition and being worn by all workers when necessary.
 - Create rules and policies with employee involvement that affect workers and ensure compliance. (See SHP Guidelines)
 - Determine who is qualified to perform justified energized work



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NFPA 70E® Company Policy: Responsibilities - Employees

- Employees will (continued):
 - Abide by all rules and regulations created and provided for their protection.
 - Wear all required PPE provided by the employer.
 - Be familiar with and implement all safe work practices developed and implemented for their own safety.
 - Take responsibility for their own actions and strive to keep the workplace free from any additional hazards.
 - Communicate any hazards encountered on the job

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Customer Communications

- Convey company policies and commitment to all customers:
 - To follow all applicable NFPA 70E® and OSHA regulations
 - To support the contractor's commitment to providing a safe work environment for employees including establishing an electrically safe working condition
 - To ensure any employer, contractor and worker that performs work on their facility be provided with all known information necessary to stay safe.
 - To make known any specific hazards that may be present in the workplace that could affect a worker.

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Qualified Person Policy

Purpose:

- A qualified person shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method.

Description:

- The qualified person shall be familiar with:
 - the proper use of the special precautionary techniques,
 - personal protective equipment, including arc-flash, insulating and shielding materials and insulated tools and test equipment.

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Qualified Person Policy

Remember:

- A person shall be considered qualified on equipment, installation, systems and tasks which they have training and experience and methods and may be unqualified for other equipment, installation, systems and tasks
- Employers have the responsibility to assign qualified persons for job tasks including performing justified energized work.

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Qualified Person Policy

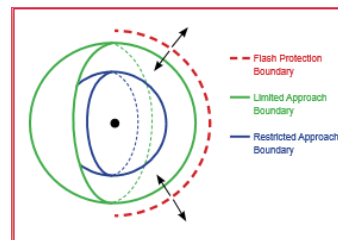
- Qualified person(s) permitted to work within the Limited Approach Boundary (see NFPA 70E®) of exposed live parts operating at 50 volts or more shall, at a minimum, be additionally trained in all of the following:
 - Skills and techniques to distinguish exposed energized parts
 - Skills and techniques necessary to determine nominal voltage (see definitions section) of exposed live parts.

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Qualified Person Policy (continued)

- Approach boundaries, distances and corresponding voltages
- Decision-making process necessary to:
 - perform job safety planning
 - identify electrical hazards
 - assess the associated risk
 - select the appropriate risk control method



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Energized Electrical Work Policy

Purpose:

Prohibit energized electrical work unless justified, signed off on by an authorized management representative when an energized electrical work permit is required in accordance with this policy and determined to be capable of being performed safely.

Description:

- All energized electrical work on systems of 50 volts or more must be justified in accordance with NFPA 70E® and OSHA as follows:
 - Deenergizing will cause additional or increased hazards.
 - Deenergizing is infeasible due to equipment design/operational limits.

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Energized Electrical Work Policy

- All energized electrical work on systems of 50 volts or more requires:
- Energized Electrical Work Permit signed off by all responsible parties prior to work commencing unless work to be performed meets the exemption criteria established in NFPA 70E®.



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Energized Electrical Work Policy

- Completion of a job safety meeting/briefing prior to beginning all projects involving exposure to electrical hazards and document the meeting, with a copy provided to their foreman. A job briefing will also be completed even when working alone.
- Voltages less than 50 volts, decision to deenergize should consider capacity of source and overcurrent protection between source and worker.



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Energized Electrical Work Policy

Examples of justification to work energized:

- Interruption of life support equipment
- Deactivate of emergency alarms, and cause shutdown of hazardous location ventilation.
- Infeasible due to equipment design/operational limits including performing diagnostics and testing that can only be performed energized.
- The work is on an integral part of a continuous process that would otherwise need to be completely shut down in to permit work.



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Energized Electrical Work Policy

What constitutes a "Normal Operating Condition" is described in NFPA 70E® Section 110.2(B) Exception No. 1?

- Equipment is properly installed.
- Equipment is properly maintained.
- Equipment is rated for the available fault current
- Equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
- Equipment doors are closed and secured.
- Equipment covers are in place and secured.
- No evidence of impending failure.

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Electrically Safe Work Condition: Lockout/Tagout (LOTO) Policy

Purpose:

- Lockout/Tagout shall be performed as part of the company procedures to ensure that all energized electrical conductors and circuit parts are in an *Electrically Safe Work Condition* before an employee performs work, where; an employee is to be within the limited approach boundary, or the employee interacts with equipment where conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.



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Electrically Safe Work Condition: Lockout/Tagout (LOTO) Policy

Description:

- All employees shall be trained and have a copy of the company Lockout/Tagout (LOTO) Program. All qualified employees shall implement the LOTO program and verify an Electrically Safe Work Condition.

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Electrically Safe Work Condition: Lockout/Tagout (LOTO) Policy

Description:

- Employees shall achieve an Electrically Safe Work Condition.
- Determine all possible supply sources.
- Interrupt load current and open disconnecting device
- Verify blades are open and draw out-type circuit breakers fully withdrawn and disconnected.
- Release stored electrical and mechanical energy
- Apply lockout/tagout
- Use rated test instrument to verify absence of voltage
- Apply temporary protective grounding equipment as needed

Refer to company written program for detailed procedures. (ex. NECA Guide to Lockout/Tagout)

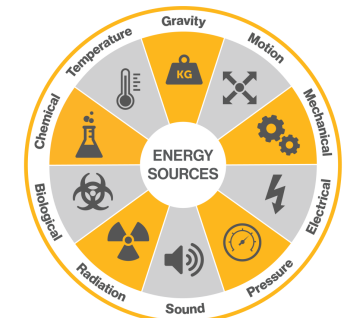


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Identify the Hazard

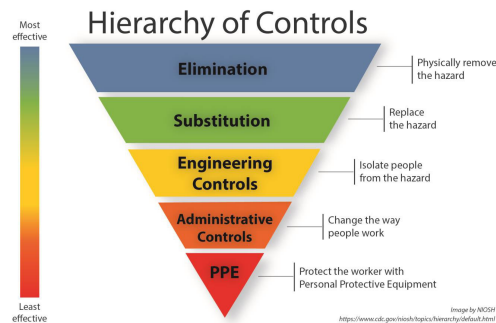
“The Energy Wheel is a simple, yet effective way to improve worker hazard recognition. This method focuses the worker’s attention on the various types of energy present in the workplace rather than randomly attempting to identify workplace hazards.”



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Hierarchy of Safety Controls



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Job Briefing

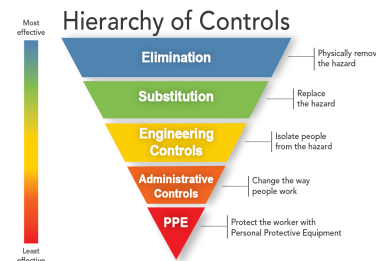
- Discuss mandatory topics and other supplementary info
 - **Hazards associated with the job**
 - Work procedures involved
 - Special precautions
 - Energy-source controls
 - PPE
- ID Critical Tasks and HOLD Points
- Assign tasks, confirm understanding

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JOB HAZARD ANALYSIS (JHA)

- What is the Task to be done and the steps for completion?
- What are the hazards associated with the task?
- What measures will be taken to mitigate those hazards?
- Other key safety measures



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Job Safety Analysis (JSA)

- Performed by crew, day of
- Represents the actual hazard assessment vs. job brief
- Involves all crewmembers and other workers in area
- Systematic review of tasks, associated hazards, controls, training, tooling, and equipment needed
- Use Energy Wheel as a tool to trigger observation and discussion

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JOB HAZARD ANALYSIS SAMPLE

Job Hazard Analysis Title: Replace electric receptacles and lamps *

Supervisor _____

Person(s) Performing Job: _____

Task	Hazards	Controls
Remove old receptacle or lamp	- Electrical shock - Arc flash	- Deenergize all equipment as well as circuits to be worked on before work is started - Wear personnel protective equipment and clothing as prescribed by the electric hazard analysis - Maintain clearance procedures and grounding - Use insulated tools
Using a ladder	- Fall	- Use of ladders that conform to ANSI safety codes - Use ladders of sufficient length - Wear proper protective footwear - Clear area of material and any debris that would create a tripping hazard - Make sure surface against which ladder rests can support load and ladder is secured at top and bottom - Set ladders at proper pitch 4:1

* The JHA provided here is for sample purposes only. It does not represent a complete JHA.

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Post Job Briefing

- Post Action Report
- Conducted after the job to ID what went right and what went wrong
- Proactive way to make corrections
- Involve the whole crew
- Doesn't have to be a "science project"
- Continuous improvement

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Risk and Risk Assessment

- Definition of "Risk"
 - It is a combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard.
- Definition of "Risk Assessment"
 - An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health, and determines if protective measures are required.

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Risk and Risk Assessment

- Likelihood of Occurrence
 - The condition of being likely or probable that something will occur.
 - Likelihood is just one part of the risk assessment process. The potential severity of the arcing incident must also be considered




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Risk and Risk Assessment

- Severity of Injury or Damage to Health
 - Determined based upon the hazard that exists
 - Can range from minor to catastrophic
 - The risk assessment procedure considers both the likelihood of occurrence and the potential severity of injury or damage to health



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- **Severity of Injury or Damage to Health**
 - Determined based upon the hazard that exists
 - Can range from minor to catastrophic
 - The risk assessment procedure considers both the likelihood of occurrence and the potential severity of injury or damage to health




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Risk Assessments NFPA 70E

 Shock Risk Assessment Form	
Required Actions	Results
Identify shock hazards	
<p>1) (a) Determine potential voltage(s)</p> <p>1(b) Identify exposed conductors and exposed parts</p> <p>1(c) Consider unanticipated voltage</p>	
<p><i>Examine the likelihood of occurrence of injury or damage to health and the potential severity of such injury or damage in event compliance with 2.8.3</i></p>	
<p>2(a) Evaluate all tasks to be performed</p> <p>2(b) Will the limited approach boundary (LAB) be crossed?</p> <p>2(c) Will the restricted approach boundary (RAB) be crossed?</p> <p>2(d) Consider the design of the electrical installation</p> <p>2(e) Consider the operating condition of the electrical equipment</p> <p>2(f) Consider the condition of maintenance of the electrical equipment</p> <p><i>An additional safety measure required?</i></p>	
<p><i>Are the measures sufficient according to the hierarchy of risk control?</i></p>	
<p>3(a) Is PPE required?</p> <p>3(b) YES/NO</p> <p>3(c) Shock protection boundary requirements</p> <p>3(d) Are PPE and other protective equipment required?</p> <p>3(e) Where is personal approach by unqualified?</p>	
<p><i>Is a second person required?</i></p>	

[illegible]

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OSHA 29 CFR 1926.20(b)

Accident Prevention Responsibilities

- 1926.20(b)(1) - It shall be the responsibility of the employer to initiate and maintain such programs as may be necessary to comply with this part.
- 1926.20(b)(2) - Such programs shall provide for **frequent and regular inspections of the job sites**, materials, and equipment to be made by competent persons designated by the employers.



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- **1926.20(b)(1)** - It shall be the responsibility of the employer to initiate and maintain such programs as may be necessary to comply with this part.
- **1926.20(b)(2)** - Such programs shall provide for **frequent and regular inspections of the job sites**, materials, and equipment to be made by competent persons designated by the employers.





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INSPECTIONS

Periodic inspections should be completed

- Workers should inspect their work area daily
 - Checklists
 - List of hazard categories



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- Periodic inspections should be completed
 - Workers should inspect their work area daily
 - Checklists
 - List of hazard categories



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INSPECTIONS: CHECKLISTS

Develop a Safety Checklist

- Review past incidents
- Consult OSHA and consensus standards applicable to the electrical industry
- Company lists created by management/workers



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Sample Office Area Health and Safety Inspection Checklist		
Work Environment Safety		
Description	Corrective Action Needed	Date
Employee work areas are adequately illuminated.		
Employees are not engaged in ergonomic hazards, e.g. awkward postures, prolonged repetitive motion, contact stress, etc.		
Employee work areas are clean, orderly and don't present a hazard.		
Employees are not engaged in unsafe acts, e.g. using chairs as ladders, using multiple extension cords, etc.		
Walking Surfaces		
Aisles correctly established and clear		
No tripping hazards in evidence		
Floors dry - not slippery		
Cords not stretched across aisles or under carpets		
Entrance mats available and used to wet weather		
Garage is secure and free of tears, lumps or loose pieces		
Stairways, Aisles, Storage Rooms, Halls, Emergency Exits, Fire Extinguishers		
Adequate lighting in stairways, aisles and storage rooms		
Stairways clear - not cluttered		
Stair treads in good condition		
Handrails installed and in good condition		
Hall kept clear of equipment and supplies		
Emergency exit doors clearly marked and accessible		
Fire extinguishers accessible and fully charged		
Bookcases, Shelves, Cabinets		
Bookcases and shelves not overloaded		
Heavy storage shelves secured to wall		
File drawers closed when not in use		
Bookcases and cabinets secured against tipping		
Electrical Safety, Chairs, Chemical Products, Step Stools, Ladders, Air Movement		
Electrical outlets not overloaded		
Equipment properly grounded (3 pronged plugs)		
Electrical cords and plugs in good condition		
Extension cords not substituted for permanent wiring		
Chairs in good mechanical condition (spring/casters)		
Chemical products properly used, stored and labeled		
Paper roller equipped with guard (desk spring)		
Ladders		
Safe step stools and ladders properly used when needed		
Paper shredder guarded		
Unobstructed air movement and vents		

SAMPLE MACHINE GUARDING SELF-INSPECTION CHECKLIST	
Requirements for All Safeguards	
<input type="checkbox"/> Do the safeguards provided meet the minimum OSHA requirements?	
<input type="checkbox"/> Do the safeguards prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts?	
<input type="checkbox"/> Are the safeguards firmly secured and not easily removable?	
<input type="checkbox"/> Do the safeguards ensure that no objects will fall into the moving parts?	
<input type="checkbox"/> Do the safeguards permit safe, comfortable, and relatively easy operation of the machine?	
<input type="checkbox"/> Can the machine be cycled without removing the safeguard?	
<input type="checkbox"/> Is there a system for shutting down the machinery and locking/tagging out before safeguards are removed?	
<input type="checkbox"/> Can the existing safeguards be improved?	
Mechanical Hazards	
The Point of Operation:	
<input type="checkbox"/> Is there a point-of-operation safeguard provided for the machine?	
<input type="checkbox"/> Does it keep the operator's hands, fingers, body out of the danger area?	
<input type="checkbox"/> Is there evidence that the safeguards have been tampered with or removed?	
<input type="checkbox"/> Could changes be made on the machine to eliminate the point-of-operation hazard entirely?	
Power Transmission Apparatus:	
<input type="checkbox"/> Are there any unguarded gears, sprockets, pulleys, or flywheels on the apparatus?	
<input type="checkbox"/> Are there any exposed belts or chain drives?	
<input type="checkbox"/> Are there any exposed set screws, key ways, collars, etc.?	
<input type="checkbox"/> Are starting and stopping controls within easy reach of the operator?	
<input type="checkbox"/> If there is more than one operator, are separate controls provided?	
Other Moving Parts:	
<input type="checkbox"/> Are safeguards provided for all hazardous moving parts of the machine, including auxiliary parts?	
Non-Mechanical Hazards:	
<input type="checkbox"/> Have appropriate measures been taken to safeguard workers against noise hazards?	
<input type="checkbox"/> Have special guards, enclosures, or personal protective equipment been provided, where necessary to protect workers from exposure to harmful substances used in machine operation?	
Electrical Hazards:	
<input type="checkbox"/> Is the machine installed in accordance with National Fire Protection Association and National Electrical Code requirements?	
<input type="checkbox"/> Are there loose conduit fittings?	
<input type="checkbox"/> Is the machine properly grounded?	
<input type="checkbox"/> Is the power supply correctly fused and protected?	
<input type="checkbox"/> Do workers occasionally receive minor shocks while operating any of the machines?	

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INSPECTIONS: BY HAZARD CATEGORY

Possible Hazard Categories

- Light/ Radiation
- Impact
- Penetration



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INSPECTIONS: BY HAZARD CATEGORY

- Compression
 - Crush or roll-over
- Chemical
- Temperature

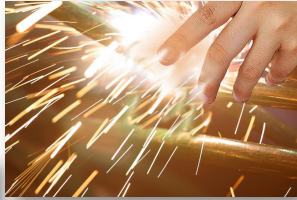


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INSPECTIONS: BY HAZARD CATEGORY

- Electrical
 - Arc Flash
 - Shocks
 - Burns



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HAZARD CATEGORY INSPECTION CHECKLIST

Operation	Task/Steps	Hazard		Control	
		Type	Description	Class	Description
Welding	Striking an arc	<input checked="" type="checkbox"/> Light / Radiation <input type="checkbox"/> Impact <input type="checkbox"/> Penetration <input type="checkbox"/> Compression (roll-over) <input type="checkbox"/> Chemical <input type="checkbox"/> Temperature <input type="checkbox"/> Electrical	Intense light	<input type="checkbox"/> Engineering <input type="checkbox"/> Administrative <input checked="" type="checkbox"/> PPE	Welding Lens Auto-Darkening

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INSPECTIONS: By OSHA

The Designated Management Representative:

- Verify the Compliance Officer's credentials
- Have Compliance Officer limit inspection to complaint or accident
- Accompany inspector on inspection, take photos and notes of anything compliance officer does
- Attend non-private employee interview/take notes
- Do not provide documents not required by law

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LOTO Objectives

- Apply OSHA 1910.147, the control of hazardous energy
- NFPA 70E® defines an “electrically safe work condition (ESWC)”
- Determine the appropriate form of control needed given a specific set of conditions
- Identify the procedures necessary for implementing a Lockout/Tagout (LOTO) operation.
- Describe the differences between a simple and complex LOTO.
- Identify the steps in a Lockout/Tagout (LOTO) Removal

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Controlling Hazardous Energy

- LOTO is a basic safety concept
- Directed by federal regulations and consensus standards
 - OSHA 29 CFR 1910 and 1926
 - NFPA 70E® Standard for Electrical Safety in the Workplace



Courtesy of NFPA

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Who does this standard apply to?

- General Industry workers performing servicing and/or maintenance on machines or equipment and who are exposed to the unexpected energization, startup, or release of hazardous energy [\[29 CFR 1910.147\(a\)\(1\)\(i\)\]](#).

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What activities and operations are not covered?

Construction, agriculture, and maritime employment [\[29 CFR 1910.147\(a\)\(1\)\(ii\)\(A\) and \(B\)\]](#).

Under exclusive control of electric utilities [\[29 CFR 1910.147\(a\)\(1\)\(ii\)\(C\)\]](#)

Work on cord and plug connected electrical equipment, if:
The equipment is unplugged from the energy source and the authorized employee has exclusive control of the plug [\[29 CFR 1910.147\(a\)\(2\)\(iii\)\(A\)\]](#).

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What are the obligations of the outside contractor and the on-site employer?

Whenever contractors and other outside servicing personnel perform tasks covered by the Lockout/Tagout standard, they must adhere to all the standard's requirements [\[29 CFR 1910.147\(a\)\(1\); 29 CFR 1910.147\(a\)\(2\); 29 CFR 1910.147\(a\)\(3\)\(i\); 29 CFR 1910.147\(f\)\(2\)\(i\)\]](#).

The contractor or outside employer and the on-site employer must inform each other of their respective lockout or tagout procedures [\[29 CFR 1910.147\(f\)\(2\)\(i\)\]](#).

The on-site employer must ensure that his/her employees understand and comply with the restrictions and prohibitions of the outside employer's energy control program [\[29 CFR 1910.147\(f\)\(2\)\(ii\)\]](#).

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What is the purpose of the standard?

To prevent injury to servicing and/or maintenance employees due to the unexpected energization or startup of machines and equipment, or release of stored energy. [[29 CFR 1910.147\(a\)\(3\)\(i\)](#)].

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How is this accomplished?

Employers must establish an **energy control program**, consisting of energy control procedures, employee training, and periodic inspections to ensure that before service and maintenance is performed, machines and equipment that could unexpectedly startup, become energized, or release stored energy, are isolated from their energy source(s) and rendered safe [[29 CFR 1910.147\(a\)\(3\)\(i\)](#); [\(c\)\(1\)](#)].

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29 CFR 1926, Subpart K Construction Lockout and tagging of circuits.

[1926.417\(a\)](#)

Controls. Controls that are to be deactivated during the course of work on energized or deenergized equipment or circuits shall be tagged.

[1926.417\(b\)](#)

Equipment and circuits. Equipment or circuits that are deenergized shall be rendered inoperative and shall have tags attached at all points where such equipment or circuits can be energized.

[1926.417\(c\)](#)

Tags. Tags shall be placed to identify plainly the equipment or circuits being worked on.

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Establishing Electrical Safe Work Condition (ESWC)

- 1.Lockout/Tagout Program
- 2.Lockout/Tagout Principles
- 3.Lockout/Tagout Equipment
- 4.Lockout/Tagout Procedures
- 5.Process for Establishing/Verifying an ESWC

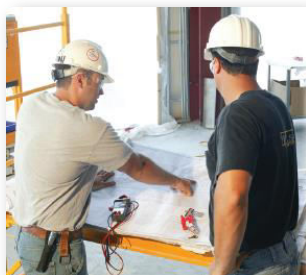


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Lockout/Tagout (LOTO) Program - General

- (1) Apply to the experience/training of the workers and working conditions
- (2) Meet requirements of NFPA 70E® Article 120, Sections 120.2 through 120.6
- (3) Apply to fixed, permanently installed, temporary, or portable equipment



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LOTO Program – Employer Responsibilities

- (1) Provide equipment necessary to execute lockout/tagout/procedures
- (2) Provide Lockout/Tagout training per NFPA 70E® 110.4(B)
- (3) Audit the program for compliance according to NFPA 70E® 110.3(L)(3)
- (4) Audit the execution of the lockout/tagout procedures according to NFPA 70E® 110.3(L)(3)



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LOTO – Principles

- Conductors and circuit parts are not considered in ESWC until achieving compliance with 70E® Article 120, Sections 120.2 through 120.6.
- Safe work practices must be used (70E® Article 130) when establishing an ESWC.
- Risk Assessments and applicable PPE are required when testing for absence of voltage
- All must be involved in LOTO process
- All energy source controlled and LOTO is coordinated with energy control procedures



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Hazardous Electrical Energy Control

- Two forms of hazardous electrical energy control shall be permitted:
 - Simple Lockout/Tagout
 - Complex Lockout/Tagout
- Simple LOTO requires a qualified person to be in charge.
- Complex LOTO recognizes a “person in charge” with overall responsibilities.



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Lockout/Tagout Equipment

- LOTO devices shall include a lock (keyed or combination) and must be unique and clearly identifiable and not used for any other purpose and be operable only by individual who installed the LOTO device.
- Tagout Device suitable for purpose and environment and shall include a statement prohibiting operation or removal
- Hold card tagging tools are acceptable



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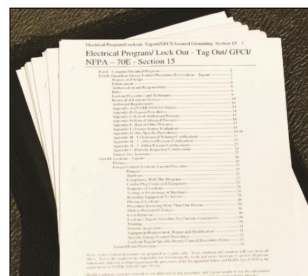


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Lockout/Tagout Procedures

- Shall include planning
- Location of energy sources (using up to date single line diagrams when possible)
- Identifying all exposed persons and required PPE
- Identify the person in charge
- Determine either simple or complex LOTO procedure



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Lockout/Tagout Elements of Control

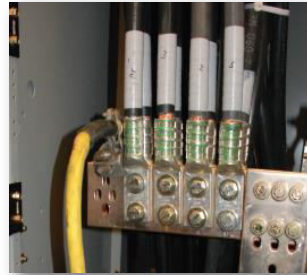
- Deenergize equipment
- Release stored electrical or mechanical energy
- Verify disconnecting means opened (off position)
- How to verify equipment cannot be restarted
- Verify absence of voltage & apply temporary grounds
- How to address shift change, coordination with other tasks
- Accountability for personnel.
- Address application/removal of LOTO devices and tags
- Releasing for return to service
- Temporary release for testing or positioning

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Process for Establishing and ESWC

- Steps mirror the OSHA requirements in 1910.333(b)(2)
- Prescriptive methods must meet the OSHA performance-based requirements
- NFPA 70E® does not recognize implementing an ESWC by simply following the steps.
- All the requirements of 70E® Article 120, Sections 120.2 through 120.6 must be met.



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Electrically Safe Work Condition (ESWC)

- Electrically Safe Work Condition is defined as “a state in which an energized conductor or circuit part has been disconnected from the energized parts, locked/tagged in accordance with established standards, tested to verify the absence of voltage and, if necessary, temporarily grounded for personnel protection.”

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OSHA Standards

- 1910.147 The Control of Hazardous Energy
- 1926.417 Lockout and tagging of circuit.
- 1910.269 Electric Power Generation, Transmission, and Distribution for General Industry and
- Subpart V Power Transmission and Distribution
- 1926.950 General Requirements
- 1910.333 Subpart S Electrical



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Comparing OSHA Standards

- 29 CFR 1910.147 compliant with 1910.333 if:
 - a qualified person ensures tests
 - tag alone plus additional safety measure
- When addressing performance-based standards, follow procedures in all applicable standards.

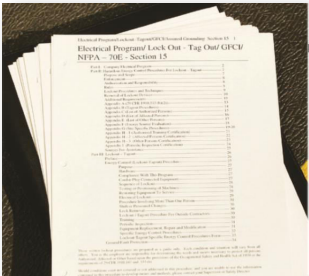


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LOTO Preparation

- Review the company written LOTO plan
- Identify energy sources including stored energy
- Locate all disconnecting means and identify procedures to release stored energy
- Determine the means for verifying disconnection.
- Identify workers affected or exposed
- Ensure employees are trained



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LOTO Preparation (continued)

- Identify appropriate test instrument
- Develop procedures for verifying test instrument operation
- Determine need for temporary protective grounding
- Develop procedures for controlling energy
- Coordinate LOTO with other energy control



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Required Determinations

	Simple	Complex
Purpose of lockout includes work to performed unqualified persons		
Work involves multiple employees, crews, employers		
LOTO includes deenergizing more than one set circuits		
Work will involve multiple locations, energy different disconnecting means		
Job/task will extend beyond one work period		



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Example of a Prescriptive Lockout/Tagout Written Program for Electrical Contractors

Prescriptive Procedures are outlined in 29 CFR 1910.333(b) and 2021 NFPA 70E 120.6

See Note to 1910.333(b)(2)(i) that permits 1910.333(b) to be used as a written LOTO procedure.

These prescriptive steps required in 1910.333(b) are supplemented with requirements from 120.6 in NFPA 70E (2021).

DEENERGIZING EQUIPMENT

See (OSHA) prescriptive steps to deenergize

1910.333(b)(2)(i) "Deenergizing equipment."

STEP # 1

1910.333(b)(2)(i)(A) Safe procedures for deenergizing circuits and equipment shall be determined before circuits or equipment are deenergized.

NFPA 70E 120.6(4) Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.

STEP # 2

1910.333(b)(2)(i)(B) The circuits and equipment to be worked on shall 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 deenergizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for lockout and tagging procedures.

NFPA 70E 120.6(2) After properly interrupting the load current, open the disconnecting device(s) for each source.

NFPA 70E 120.6(3) Whenever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout type circuit breakers are withdrawn to the test or fully disconnected position.

STEP # 3

1910.333(b)(2)(i)(C) Stored electric energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded. If the stored electric energy might endanger personnel.

Note: If the capacitors or associated equipment are handled in meeting this requirement, they shall be treated as energized.

NFPA 70E 120.6(5) Release stored electrical energy.

STEP # 4

1910.333(b)(2)(i)(D) Stored non-electrical energy in devices that could reenergize electric circuit parts shall be blocked or relieved to the extent that the circuit parts could not be accidentally energized by the device.

NFPA 70E 120.6(5) Block or relieve stored non-electrical energy in devices to the extent the circuit parts cannot be unintentionally energized by such devices.

STEP # 5

1910.333(b)(2)(ii) "Application of locks and tags."

1910.333(b)(2)(ii)(A) A lock and a tag shall be placed on each disconnecting means used to deenergize circuits and equipment on which work is to be performed, except as provided in paragraphs (b)(2)(iii)(C) and (b)(2)(iii)(E) of this section. The lock shall be attached so as to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.

NFPA 120.6(6) Apply lockout/tagout devices in accordance with a documented and established procedure.

1910.333(b)(2)(ii)(B) Each tag shall contain a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag.

1910.333(b)(2)(ii)(C) If a lock cannot be applied, or if the employee can demonstrate that tagging procedures will provide a level of safety equivalent to that obtained by the use of a lock, a tag may be used without a lock.

1910.333(b)(2)(ii)(D) A tag used without a lock, as permitted by paragraph (b)(2)(iii)(C) of this section, shall be supplemented by at least one additional safety measure that provides a level of safety equivalent to that obtained by use of a lock. Examples of additional safety measures include the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device.

1910.333(b)(2)(ii)(E) A lock may be placed without a tag only under the following conditions:

1910.333(b)(2)(ii)(E)(i) Only one circuit or piece of equipment is deenergized, and 1910.333(b)(2)(ii)(E)(ii) The lockout period does not extend beyond the work shift, and 1910.333(b)(2)(ii)(E)(iii) Employees exposed to the hazards associated with reenergizing the circuit or equipment are familiar with this procedure.



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STEP # 6

1910.333(b)(2)(iv) Verification of deenergized condition. The requirements of this paragraph shall be met before any circuits or equipment can be considered and worked as deenergized.

1910.333(b)(2)(v)(A) A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be started.

1910.333(b)(2)(v)(B) A qualified person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and shall verify that the circuit elements and equipment parts are deenergized. The test shall also determine if any energized condition exists as a result of inductively induced voltage or ungrounded voltage backfeed even though specific parts of the circuit have been deenergized and presumed to be safe. If the circuit to be tested is over 600 volts, nominal, the test equipment shall be checked for proper operation immediately after this test.

NFPA 70E, 120.6(C) Use an adequately rated test instrument to test each phase conductor or circuit part ~~at least~~ *point-to-point* to test for the absence of voltage. 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 known voltage source. (See 2017, 70E, 120.5 for exceptions)

NFPA 70E, 120.6(B) Where the possibility of induced voltages or stored electrical energy exists, ground all circuit conductors and 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 in accordance with the following:

(1) Placement. Temporary protective grounding equipment shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to any ~~energized~~ shock hazard (i.e., hazardous differences in electrical potential). The location, sizing, and application of temporary protective grounding equipment shall be identified as part of the employer's job planning.

(2) Capacity. Temporary protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault.

(3) Impedance. Temporary protective grounding equipment and connections shall have an impedance low enough to cause immediate operation of protective devices in case of unintentional energizing of the electric conductors or circuit parts.

REENERGIZING EQUIPMENT

Four prerequisite steps to reenergize:

1910.333(b)(2)(v) "Reenergizing equipment." These requirements shall be met, in the order given, before circuits or equipment are reenergized, even temporarily.

STEP # 1:

1910.333(b)(2)(v)(A) A qualified person shall 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.

STEP # 2:

1910.333(b)(2)(v)(B) Employees exposed to the hazards associated with reenergizing the circuit or equipment shall be warned to stay clear of circuits and equipment.

STEP # 3:

1910.333(b)(2)(v)(C) Each lock and tag shall be removed by the employee who applied it or under his or her direct supervision. However, if this employee is absent from the workplace, then the lock or tag may be removed by a qualified person designated to perform this task provided that:

1910.333(b)(2)(v)(C)(1) The employer ensures that the employee who applied the lock or tag is not available at the workplace, and

1910.333(b)(2)(v)(C)(2) The employer ensures that the employee is aware that the lock or tag has been removed before he or she resumes work at that workplace.

STEP # 4:

1910.333(b)(2)(v)(D) There shall be a visual determination that all employees are clear of the circuits and equipment.

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Safety: A Shared Responsibility

- Between Employers and Employees
- Safety is a core value of the organization
- Management Leads by Example
- Workers are Engaged

"Everyone is Responsible for Safety"

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NECA Safety Round Up - NECA Podcast Network

- Throughout this monthly series, the NECA Risk Management Executive Directors of Safety will discuss specific topics within electrical construction safety. They'll welcome guests onto the podcast to talk about safety issues and obstacles the industry is facing. Prepare to learn about laws and policies that spread into everything from FLSA, Immigration, FACTA, Title VII, ADA and FMLA to Workers Comp, Leaves and Return-to-Work procedure. Other episodes revolve around protective cover, safety leadership, OSHA and Safety training practices, JSAs, HSAs and job briefings as well as incident investigation.

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How Does NFPA 70E Standard Apply To Your Business

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