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# PURPOSE

To establish the minimum criteria for Texas Instruments (TI) sites to implement workplace safety practices and procedures that effectively protect persons from injuries caused directly or indirectly by electrical systems, circuits, and equipment.

# SCOPE

The provisions of this standard apply to all TI employees, suppliers, vendors, and visitors at TI sites worldwide.

# reference documents

## TI ESH Standard 01.01 "Personal Protective Equipment"

## TI ESH Standard 03.01E “Chemical Storage, Spill Control and Spill Response”

## TI ESH Standard 05.05 “Eyewash & Safety Showers”

## TI ESH Standard 06.11 “Lock Out Tag Out”

# Definitions

[TI ESH Standards Glossary of Definitions](https://sps01.itg.ti.com/sites/wwf/esh/standards/Knowledge_Bank/00.01.xlsx)

# Requirements

## Safe Work Practices

### Personnel may only perform electrical work to the level for which they have been trained in accordance with Section 5.15 of this standard.

### All electrical equipment, circuit conductors, and circuit parts shall be considered energized until placed in an electrically safe work condition.

#### Lock Out Tag Out of electrical equipment shall be performed in accordance with [TI ESH Standard 06.11 “Lock Out Tag Out”](file:///C:/11111/My%20Documents/Electrical%20Safety/Knowledge_Bank/06-11%20(Expires%2010-01-2008).doc) (LOTO).

### Employees shall not reach blindly into areas that might contain exposed energized parts.

### Adequate lighting shall be provided prior to performing any electrical activity.

#### The lighting provided shall be a non-automated type. (Examples of automated devices include but are not limited to: timers; motion sensors, or; other like devices).

### Sufficient work clearances, described in Table 1 of Appendix A, shall be provided and maintained around all electric equipment.

### Employees shall be instructed to the proper use and maintenance of PPE prior to use in accordance with TI ESH Standard 01.01 “Personal Protective Equipment”.

### Employees who may perform electrical work in hazardous locations shall be trained to understand the type(s) of equipment that can be installed or used in the area.

## Working on Energized Electrical Circuitry

### Sites shall prohibit work on energized electrical circuitry at 50 volts or greater except when de-energizing the circuitry introduces additional or increased hazards or is infeasible due to equipment design or operational limitations

#### The following tasks are examples of work to be performed de-energized:

##### Lighting ballast change-out

##### Motor replacement

##### Fuse replacement

##### Transformer replacement/service

#### Acceptable energized electrical work include, but are not limited to:

##### Interruption of life safety systems;

##### Deactivation of emergency alarms systems, and;

##### Shutdown of hazardous exhaust systems.

##### Trouble shooting and maintenance activities which required power to be present to perform task

### Only electrically Qualified Persons shall be permitted to work on energized electrical circuitry at 50 volts or greater.

### Conductive apparel (such as watch bands, bracelets, rings, key chains, necklaces, etc.) shall be removed or covered with insulating material before performing work.

### Before work on energized electrical circuitry 50 volts or greater can be performed the following must occur:

#### Completion and approval of an energized electrical work permit; or

#### Completion and approval of a written energized electrical work procedure.

1. Approval of the energized electrical work permit or procedure must be received from the electrical system owner or Manufacturing Equipment Engineer/owner and a site ESH team member.

## Energized Electrical Work Permit (EEWP)

### The EEWP must always include the following information:

#### Statement of the reason the work must be performed while the circuits are energized;

#### Date the work will be performed;

#### The time work will begin and estimated length of duration of the work;

#### Type of equipment being worked on;

#### Identification name of the equipment (Example: MISTI ID#);

#### Location(s) where the Energized Work will be performed;

#### Voltage(s) involved;

#### Calculated values for:

##### The available incident energy;

##### The fault current available; and

##### The barricade distance.

#### The specific tasks involved with performing the work (step-by-step). (Example: The specific task(s) may include routine measurement, calibration, alignment, equipment maintenance, lamp replacement, or testing of circuits to verify that they are de-energized);

#### List of specific precautions to be taken prior to start of the energized work;

#### Name and signature of the Qualified Person(s) performing the energized work;

#### Name and signature of the individual who will serve as the Safety Back-up;

#### Name and signature of individual who will approve the energized work;

#### Name and signatures of others who will be directly involved in the work (for example: other electricians, technicians, observers, etc.);

#### Name and signature of the ESH representative that approves the work must be performed energized.

#### Emergency contact numbers for first aid and medical assistance personnel;

#### A list of PPE appropriate for the voltages and incident energy for the task.

1. The PPE must be worn as long as the exposed energy is present.

#### Verification that probes used for taking voltage readings on equipment are rated for the voltage;

#### The locations where the “Hot Work in Progress” tags will be applied (Example location: “Panel H-AB1, Breaker 1”); and

1. Tags must be placed on the first upstream source, at a minimum.

#### Document the current electrical safety training dates and/or license number for the individuals who will be performing energized work and serving a safety back-up.

### An energized work permit shall not be effective for more than 24 hours. If the work continues into the next day, a new permit must be issued.

## Energized Electrical Work Procedure

### A procedure can be utilized if:

#### The work involved has been performed in the past;

#### The employee, through equipment specific training, is qualified to perform the task, and;

#### An approved equipment specific procedure identifying the hazards as documented in Appendix B.

## Electrical Equipment Listing, Labeling and Use

### Equipment shall be considered approved and acceptable for its specific use if it has been accepted, certified, labeled, or in some other way recognized by a Nationally Recognized Testing Lab (NRTL).

### Equipment shall be suitable for its intended purpose (appropriate for the environment and hazards of the location) and used in accordance with the manufacturer’s instructions and any instructions or requirements of the NRTL.

#### Each site shall document the hazardous locations within their facilities which require intrinsically safe electrical components.

##### The site may document these locations by the use of signs or on a site layout.

### Rooms, cabinets, and enclosures that contain exposed energized parts shall be labeled with obvious warning signs forbidding unqualified persons to open or enter them.

### Circuit or Electrical Identification labeling:

#### The corresponding phase or branch circuit(s) of equipment shall be identified and the label shall be applied at all terminations, connections and splice points.

#### Breakers within panels must identify the equipment they supply power to or support.

#### All labels shall be in English and the local language.

### Arc Flash Labeling

#### Effective as of January 1, 2018, Facilities Equipment shall be field marked with a label containing the following information:

##### At least one of the following:

###### Minimum arc rating of clothing

###### Required Personal Protective Equipment (PPE)

###### Highest Hazard / Risk Category (HRC) for the equipment

##### System Voltage

##### Arc Flash Protection Boundary (AFPB)

##### A method of calculating and data to support the information for the label shall be documented.

#### Effective as of January 1, 2019, Manufacturing and Assembly Test equipment shall be labeled at a minimum with the following information: signal word, electrical symbol, identify the hazard, identify how to avoid the hazard, and the consequences for not avoiding the hazard. (See appendix G) If the arc flash rating is above 4 calories per centimeter squared then this equipment shall be labeled following the Facilities equipment labeling guideline.

#### Exceptions to Labeling

##### Incident energy labels or warning label are not required for the following equipment: lighting fixtures; transformers; receptacles, or; small appliances.

#### Incident energy labels are not required when all the following are met:

##### The device or equipment is fed by a single source of 240 volts or less.

##### The device or equipment is supplied by a single transformer.

##### The transformer supplying the device or equipment is rated at less than 125 kVA.

## Requirements for Grounding or Earthing

### All equipment that is connected by cord and plug and has the potential for exposed metal parts to become energized shall be grounded and the metal parts bonded to the ground.

### All equipment connected by permanent wiring methods shall be grounded or earthed.

#### Equipment that has exposed metal parts and the potential exists for the exposed metal parts to become energized must also have the metal parts bonded to the grounding means.

#### The integrity of the ground circuit and the bonding shall be tested upon installation or when a change to the system occurs that might affect the initially tested grounding system.

#### **Exception:** Grounding circuits may not be required if power is supplied through an isolating transformer that drops to less than 50 volts.

## Use of Extension Cords and Multi-Outlet Power Strips

### The following requirements apply to the use of extension cords or multi-outlet power strips; they shall:

#### Be inspected before use;

##### Damaged extension cords or multi-outlet power strips shall be immediately removed from service and repaired or destroyed.

#### Be unplugged, removed and properly stored when not in use;

#### Not create a tripping hazard;

#### Not be covered by carpeting, furniture or other objects that could prevent adequate air circulation and cooling of the cord;

#### Be protected from damage; measures shall be taken to ensure they are not pinched when passing through doors or similar pinch points;

#### Have a current rating greater than the equipment(s)’ load connected to it; and

#### Should not be connected in series (plugged together or “daisy-chained”, unless specifically designed and approved for this use).

#### Multi-outlet power strips may be connected together (daisy chained) in areas which are frequently interchanged provided the ampacity of the cord is not exceeded.

### Extension cords shall not be used as a substitute for fixed (permanent) wiring within a building or structure.

### Extension cords shall not be secured in place in a manner that would cause damage (Example: they shall not be stapled, tacked, or nailed in place).

### Multi-plug adapters shall be allowed for use with extension cords provided the adapter is accepted, certified, labeled, or in some other way recognized by an NRTL and the current rating is greater than the equipment(s)’ load connected to it.

### Extension cords used outdoors shall be rated and labeled as suitable for outdoor use.

## Use of Ground Fault Circuit Interrupters (GFCI)

### GFCI shall be required on all outlets located outdoors, on roofs, and in all locations potentially exposed to splash or saturation with water, steam, chemicals, or other liquids.

### GFCI shall be required for the protection of all personnel utilizing extension cords when used during construction-like activities, including maintenance, remodeling, or repair activities, involving buildings, structures or equipment,

#### GFCI is not required if the equipment is distinctly marked identifying the device as being protected through double insulated construction.

## Electrical PPE

### PPE that has an expired testing date or fails a visual inspection shall be removed from service.

### PPE shall be:

#### Stored to protect it from physical and environmental damage;

#### Maintained in a safe, reliable condition;

#### Visually inspected before use; and

#### Periodically tested or inspected in accordance with Table 1 of Appendix E.

### Eye, Face and Head Protection

#### Safety glasses with hard side shields and UV protection shall be worn to protect the eyes from electric arcs, flashes or flying objects when performing energized electrical work.

##### Safety glasses shall have no exposed metal on the frame.

##### Employees can use a non-conductive strap to secure the glasses to the head to prevent the frame from sliding into exposed energy.

#### A full-face shield and/or a flame-resistant hood with a hard hat or balaclava shall be worn when incident energy calculation indicates need for such additional protection in accordance with Appendix C.

#### Insulating head protection rated for the hazard shall be worn when there is a potential for contact with energized electrical components.

##### Conductive hardhats shall not be worn while working around exposed energized electrical components.

### Hand Protection

#### Electrical insulating gloves shall be worn at all times while working on electrical equipment operating at 50 volts or greater.

#### Electrical insulating gloves shall meet the following requirements:

##### Rated for the potential voltage present;

##### Used with leather protectors

1. Class 0 and Class 00 gloves maybe used without leather protectors if working in areas where particle contamination is a concern. However, if leather protectors are not used the maximum voltage for Class 00 glove is 250 volts AC or 375 volts DC and Class 0 gloves are 500 volts AC or 750 volts DC. In addition, the glove that has been used without the leather protector must be re-tested and certified before re-used.

#### Electrical insulating gloves shall be electrically and mechanically tested in accordance with Table 1 of Appendix E.

##### The frequency of testing may need to be increased if work and environment poses a greater hazard to glove material.

##### All gloves shall have the certification date (PPE test date), rated glove class and, the name of testing laboratory ink-stamped on the cuff or documented by some other means to indicate when the gloves were last electrically and mechanically tested.

##### A method should be implemented to track the use and testing of the electrical gloves.

### Hearing Protection

#### Ear canal (ear plugs) inserts or earmuffs shall be worn when working on energized electrical equipment in accordance with Appendix C.

### Rubber Insulating Floor Mat(s)

#### Rubber insulating floor mats shall be used only for temporary application and shall be stored in accordance with the manufacturer’s recommendation(s).

#### Specific requirements for rubber insulating mats are as follows:

##### Mats shall be rated for the voltage(s);

##### A visual inspection of mats shall be performed prior to each use to ensure they are free from defects (cuts, tears, holes, foreign objects, etc.); and

##### Mats shall be tested in accordance with Table 1 of Appendix E.

### Rubber Insulating Blankets

#### Specific requirements for rubber-insulating blankets are as follows:

##### Rubber insulating blankets shall be rated for the voltage(s); and

##### Rubber-insulating blankets shall be tested in accordance with Table 1 of Appendix E.

1. Unless specifically rated, rubber-insulating blankets do not provide arc, flash, or blast protection.

### Arc/Flash Protection Blankets

#### When used, arc/flash protection blankets shall be installed to redirect the arc / flash hazard from other energy sources.

#### Arc/flash protection blankets shall be installed in accordance with the manufacturer’s instructions.

#### Arc/flash protection blankets do not typically provide electrical insulation. These blankets must be visually inspected before each use.

### Other personal protective equipment

#### Where Appendix C indicates the need for fire-resistant (FR) clothing, it shall be worn by all employees working within the hazardous approach boundary, by all employees observing the task being performed and the need for it shall be identified in the appropriate energized electrical work procedure or permit.

#### Insulating overshoes or boots shall be worn in wet conditions (25.4 mm (1 inch) or more of standing liquid) when there is a potential for contact with energized electrical components.

##### Insulated overshoes must be visually inspected before use, and mechanically and electrically tested annually.

## Test Equipment

### Test instruments shall be:

#### Visually inspected for defects and damage prior to each use;

#### Accepted, certified, labeled, or in some other way recognized by an NRTL;

#### At a voltage rating equal to or greater than the system voltage to be worked on; and

#### Designed for the environment in which they will be used.

### Damaged equipment shall be tagged as defective and removed from service until repairs are made to ensure the equipment is safe to use.

## Battery Charging and Maintenance Areas for Mobile Equipment (Forklifts, pallet jacks, etc.)

### Battery charging and maintenance areas for mobile equipment shall:

#### Be located in areas designated for that purpose;

#### Protect charging apparatus from damage;

#### Have a mechanical means available to assist lifting and transferring batteries or battery assemblies;

#### Be provided with adequate ventilation to disperse fumes and gas from battery charging;

#### Have an accessible emergency eyewash and/or safety shower in accordance with TI ESH Standard 05.05 “Emergency Eyewash and Shower Equipment”; and

#### Have spill cleanup materials accessible.

### PPE shall be provided to personnel who perform battery maintenance in accordance with TI ESH Standard 01.01, “Personal Protective Equipment”.

### Battery electrolytes shall be stored in a chemical storage cabinet or other appropriate storage system, which meets the requirements of TI ESH Standard 03.01E, “Chemical Storage”.

## Stationary Storage Battery Systems (UPS, Switchgear charging systems, etc.)

### Stationary storage battery systems having an electrolyte capacity of more than 50 gallons (189 L) for flooded lead acid, nickel cadmium (Ni-Cd) and valve-regulated lead acid (VRLA), or 1,000 pounds (454 kg) for lithium-ion, used for facility standby power, emergency power or uninterrupted power supplies, shall comply with this section and Appendix F

### Only charging stations intended for supporting the electrical switchgear may be installed in electrical switchgear rooms.

### VRLA battery systems shall be provided with an accepted, certified, labeled, or in some other way recognized by a NRTL device or other approved method to preclude, detect and control thermal runaway.

### New room design and constructionof an enclosure for stationary battery systems shall comply with the *International Building and Fire Code* or the local authority having jurisdiction whichever is more stringent.

### Battery systems shall be allowed to be in the same room with the equipment they support.

### Conduct a risk assessment to determine if the area requires an emergency eyewash and/or safety shower to be accessible in accordance with TI ESH Standard 05.05 “Emergency Eyewash and Shower Equipment.”

## Overhead Lines (non-insulated)

### While working in the vicinity of energized non-insulated overhead lines (whether in an elevated position or on the ground) Qualified Persons shall not approach or take any non-insulated conductive object closer to energized parts than the distances shown in Table 2 of Appendix A unless:

#### The Qualified Person is insulated from the energized part (gloves, with sleeves if necessary, rated for the voltage involved), or;

#### The energized part has been insulated both from all other conductive objects that have a different potential and from the Qualified Person, (i.e. insulating blankets, mats).

### When an Unqualified Person is working near energized overhead lines 22kV Nominal to ground or less, they may not come closer than 13.5 feet (4.1 m).

#### When an Unqualified Person is working near energized overhead lines 22kV Nominal to ground or greater, the clearance shall be increased by 0.4 inches (10mm) per kV above 22kV.

## Roles and Responsibilities

### Duties of the TI Supervisor / Project Manager

#### Review the project with the team performing the electrical work.

#### Obtain verification that the suppliers are currently trained prior to being permitted to perform electrical work, safety back-up work or enter areas requiring Electrically Qualified Person(s) training.

#### Inform suppliers of known hazards related to their work environment (Examples: chemical hazards, the potential for falling objects, etc.).

#### Ensure proper materials and equipment have been identified for the work (Examples include but are not limited to: ensuring the parts to be replaced or installed are rated for the task or equipment; ensure the fittings at the electrical box(s) are correct for the area of installation; ensure the hand tools to be used to perform the task are in good working condition, and; ensure the electrical meters are rated for the voltage being worked on.).

#### Review the training qualifications of the workers to ensure only Qualified Persons are assigned and are performing the work and that the Safety Back-up is properly trained and understands the work being performed.

### Duties of a Qualified Person

#### Ensure all equipment to be used for the task is in good working condition;

#### Ensure all materials needed for the task are present and functioning as designed;

#### Communicate and provide direction to anyone working in the energized work area, and;

#### Perform energized work.

### Duties of a Safety Back-up:

#### Ensure that unauthorized persons do not enter the hazard area; and

#### Observe work being performed within the barricaded area.

### Supplier Responsibilities

#### Suppliers shall ensure that each worker receives the hazard information provided by TI.

#### Suppliers shall coordinate all electrical work through TI Project Management.

#### Suppliers shall advise TI Project Management of the following:

##### Any unique hazards presented by the supplier’s work, and;

##### Any unanticipated hazards found during the supplier’s work.

#### Only those suppliers’ employees designated in writing, by their company officer, to TI are authorized to work on energized electrical systems and equipment.

#### Upon request by TI, Suppliers shall provide a record, in writing, of the electrical safety training for employees who will perform energized electrical work.

#### Qualified Suppliers’ employees performing energized electrical work must be current on their training for first aid, CPR and bloodborne pathogens.

#### Suppliers must wear appropriate PPE while performing energized electrical work.

#### Suppliers are required to obtain all applicable permits prior to starting task – (e.g., work authorization permit, energized work permit, etc.).

#### It is the responsibility of the Supplier to identify and comply with all laws and regulations applicable to the particular work.

## Training Requirements

### BasicElectrical Safety Awareness Training for Unqualified Persons

### The training should include, at a minimum, the following:

#### Identification of the hazards associated with electricity;

#### Conditions to avoid and prevent overloading of electrical circuitry and protective devices;

#### The safe use of hand tools requiring electricity;

#### Information on avoiding barricaded areas where energized electrical work is in progress or electrical circuits are exposed, and;

#### How to recognize when electrical systems have been locked and tagged out and actions to avoid.

### Electrical Safety Training - Approving TI Supervisors/Project Managers

### The training shall include, at a minimum, the following:

#### All regulations and TI ESH Standards that apply to the work being performed;

#### Instruction that all electrical systems are to be presumed energized unless verified de-energized;

#### Information on using test equipment to determine what nominal voltage levels are present;

#### How to recognize that certain parts of a system may be within contact range during work on other parts of the system;

#### Information and knowledge about determining clear working space and minimum approach distances appropriate to the voltages that might be present;

#### How to properly select and use electrical personal protective equipment;

#### Information on the dangers associated with electrical hazards due to fault conditions; how to calculate fault current; how to calculate incident energy, and; how to properly select PPE based on the incident energy calculation.

#### How to ensure the area is properly protected including barricades, notification of affected employees, illumination and other preparatory activity

### Electrical Safety Training - Qualified Persons (Energized worker and Safety Back-up)

### The training shall include, at a minimum, the following:

#### Principles of electrical safety;

#### The proper way(s) to determine the presence of voltage in electrical systems;

#### How to identify the hazards present for the task;

#### How to implement procedures for working safely around energized electrical equipment;

#### How to select proper PPE for energized work;

#### How to use, select and properly utilize metering equipment;

#### How to use the tools necessary to perform the task;

#### How to initiate emergency services;

#### How to instruct persons assisting in task;

#### How to work safely on energized electrical equipment;

#### Energized electrical systems and methodology for verifying a de-energized state;

#### Arc-flash and blast protection;

#### CPR, first aid and blood borne pathogens, and;

#### Training on specific equipment, relative to a job assignment, where energized work is being performed.

##### The specific equipment training shall be conducted initially and whenever equipment modification occurs or the employee fails to properly demonstrate working knowledge.

### All training shall be documented.

#### Documentation shall include the signatures of the trainer and trainees.

#### Retraining shall occur at intervals in accordance with Appendix D.

# STANDARD Approval

This standard has been approved by Zane Broadhead, TI Vice President.

# Revision history

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Rev#** | **Date** | **Nature of Revision** | **Author/Editor** | **Approver** |
| A | 03/25/2013 | Combining of TI 04.00 Electrical Safety, 04.01 Energized Electrical Work and 04.04 Battery Charging Stations. | R. Graves | David Thomas |
| B | 11/19/2014 | Update labeling requirements and PPE levels | R. Graves | David Thomas |
| C | 06/01/2016 | Added dates for the implementation of labels for arc flash study | R. Graves | ELC |
| D | 1/31/2018 | Changed training requirement to 3 years from annually | R. Graves | ELC |
|  |  |  |  |  |



Working Clearances

Table 1 – Minimum Depth of Clear Working Space in Front of Electrical Equipment

|  |  |  |  |
| --- | --- | --- | --- |
| **Clearance required [in meters (feet)] by Condition (Note 3)** | | | |
| Nominal voltage to ground Prior to 1981 0.76 (2'6") | Condition  A | Condition B | Condition C |
| 0-150 | 0.91 (3)**(Note 1)** | 0.91 (3)**(Note 1)** | 0.91 (3) |
| 151-600 | 0.91 (3)**(Note 1)** | 1.07 (3’6”) | 1.22 (4) |
| 601 to 2,500 | 0.91 (3) | 1.22 (4) | 1.52 (5) |
| 2,501 to 9,000 | 1.22 (4) | 1.52 (5) | 1.83 (6) |
| 9,001 to 25,000 | 1.52 (5) | 1.83 (6) | 2.74 (9) |
| 25,001 to 75kV **(Note 2)** | 1.83 (6) | 2.44 (8) | 3.05 (10) |
| Above 75kV **(Note 2)** | 2.44 (8) | 3.05 (10) | 3.66 (12) |

**Note 1:** For electrical installations built prior to April 16, 1981, the clearance distance of 0.76 meters (2'6") is acceptable until the installation is modified.

**Note 2:** For electrical installations above 25,000 Volts that were built prior to April 16, 1981, the clearance distance specified for 9,001 to 25,000 volts is acceptable until the installation is modified.

**Note 3:** *Condition A* - Exposed energized parts on one side and no energized or grounded parts on the other side of the working space, or exposed energized parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at not over 50 volts are not considered energized parts.

*Condition B* - Exposed energized parts on one side and grounded parts on the other side. Concrete, brick, or tile walls will be considered as grounded surfaces.

*Condition C* - Exposed energized parts on both sides of the workspace (not guarded as provided in Condition A) with the operator between.

Table 2 - Minimum Approach Distances For Qualified Employees To A/C Carrying Overhead Lines\*

|  |  |  |
| --- | --- | --- |
| **Voltage Range** | **Minimum Approach Distance Without Special Protection** | **Special Protection Required** |
| 300V and less | Avoid Contact | Insulated Equipment and PPE |
| Over 300V, not over 750V | 1 ft. 0 in. (30.5 cm) | Insulated Equipment and PPE |
| Over 750V, not over 2kV | 1 ft. 6 in. (46.0 cm) | Insulated Equipment and PPE |
| Over 2kV, not over 15kV | 2 ft. 0 in. (61.0 cm) | Insulated Equipment and PPE |
| Over 15kV, not over 37kV | 3 ft. 0 in. (91.0 cm) | Insulated Equipment, PPE AND Isolation from Differences of Potential |
| Over 37kV, not over 87.5kV | 3 ft. 6 in. (107.0 cm) | Insulated Equipment, PPE AND Isolation from Differences of Potential |
| Over 87.5kV, not over 121kV | 4 ft. 0 in. (122.0 cm) | Insulated Equipment, PPE AND Isolation from Differences of Potential |
| Over 121kV, not over 140kV | 4 ft. 6 in. (137.0 cm) | Insulated Equipment, PPE AND Isolation from Differences of Potential |



Energized Procedure Form

#### Energized Procedure for XXXX

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date: | |  | | | **Procedure Creator** | | |  | | | | | | | | | | | | | | | |
| Date: | |  | | | **Procedure Reviewer** | | |  | | | | | | | | | | | | | | | |
| Date: | |  | | | **Procedure Approver** | | |  | | | | | | | | | | | | | | | |
| Date | |  | | | **ESH Procedure Approver** | | |  | | | | | | | | | | | | | | | |
| **Identification of equipment/tool**  (Make/Model): | | | | | | | |  | | | | | | | | | | | | | | | |
| **Statement of the work to be performed** (For example, the tasks may include routine measurements, calibrations, or testing of circuits): | | | | | | | |  | | | | | | | | | | | | | | | |
| **Voltage(s) present:** | | | |  | | | | **Ampere Rating of power supply:** | | |  | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | |
| **Description of Hazard** | | | | | | **Method to Control** | | | | | | | | **Personal Protective Equipment** | | | | | | | | | |
| **Eye/Face/Hearing** | | | | **Body** | | **Ear** | | **Foot** | |
|  | | | | | |  | | | | | | | |  | | | |  | |  | |  | |
|  | | | | | |  | | | | | | | |  | | | |  | |  | |  | |
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|  | | | | | |  | | | | | | | |  | | | |  | |  | |  | |
|  | | | | | |  | | | | | | | |  | | | |  | |  | |  | |
|  | | | | | |  | | | | | | | |  | | | |  | |  | |  | |
| **Identified hand protection for working on energized part:**  (This PPE must be worn as long as the energy is present) | | | | | | | | | | | | **Class:** | | |  | | | | | | | | |
| **Incident Energy Available** (reference the Energized Work Log or Arc Flash Study for calculation) | | | | | | | | | | | | | | |  | | | | | | | | |
| **Arc Rated Clothing Category (Category 1-4)** | | | | | | | | | | | | | | |  | | | | | | | | |
| **Identify the barricade distance required for this task.** | | | | | | | | | | | | | | |  | | | | | | | | |
| **Verify all personal protective equipment is in good working condition, qualified for voltage to be serviced and is functioning properly:** | | | | | | | | | | | | | | | | | | | | |  | | |
|  | | | | | | | | | | | | | | | | | | | | | | | |
| **List of precautions to be taken prior to start of the energized work** | | | | | | | | | | | | | | | | | | | | | | | |
| 1. |  | | | | | | | | | | | | | | | | | | | | | | |
| 2. |  | | | | | | | | | | | | | | | | | | | | | | |
| 3. |  | | | | | | | | | | | | | | | | | | | | | | |
| 4. |  | | | | | | | | | | | | | | | | | | | | | | |
| 5. |  | | | | | | | | | | | | | | | | | | | | | | |
| 6. |  | | | | | | | | | | | | | | | | | | | | | | |
| 7. |  | | | | | | | | | | | | | | | | | | | | | | |
| 8. |  | | | | | | | | | | | | | | | | | | | | | | |
| 9. |  | | | | | | | | | | | | | | | | | | | | | | |
| 10. |  | | | | | | | | | | | | | | | | | | | | | | |
| **Tools required to perform work** | | | | | | | **Volt Meter** | | | | | | | | |  | **Digital Volt Meter** | | | | | |  |
| **Non-Conductive hand tools** | | | | | | | | |  | **Drill** | | | | | |  |
| **Temp Guards/Shielding Material** | | | | | | | | |  | **Barrier Tape** | | | | | |  |
| **Other** | | |  | | | | | | | | | | | | | |
| **Attach drawings, datasheets, or illustrations indicating location of specific hazards** | | | | | | | | | | | | | | | | | | | | | | | |
| **Name of Qualified Person** | | | | **(Print)** | | | | | **(Signature)** | | | | | | | | | | | | **(Date)** | | |
| **Name of Safety Back-up** | | | | **(Print)** | | | | | **(Signature)** | | | | | | | | | | | | **(Date)** | | |
| **Energized Work Approver** | | | | **(Print)** | | | | | **(Signature)** | | | | | | | | | | | | **(Date)** | | |
| **Other (if additional person(s) involved)** | | | | **(Print)** | | | | | **(Signature)** | | | | | | | | | | | | **(Date)** | | |
| **Name of ESH Approver** | | | | **(Print)** | | | | | **(Signature)** | | | | | | | | | | | | **(Date)** | | |
| **Person verifying required training before individual performs work:** | | | | | | | | | | | | | **(Name)** | | | | | | | | **(Date)** | | |
| **Revision History for Procedure** | | | | | | | | | | | | | | | | | | | | | | | |
| **Revision** | | | **Comment** | | | | | | | | | | **Editor** | | | | | | **Approver** | | | | |
|  | | |  | | | | | | | | | |  | | | | | |  | | | | |
|  | | |  | | | | | | | | | |  | | | | | |  | | | | |



PPE Requirements Based on incident energy available

|  |  |  |
| --- | --- | --- |
| **Category** | **PPE** | **Cal/Cm2** |
| 1 | 4 cal/cm2 minimum rating FR long sleeve shirt and pants, or coveralls, voltage rated gloves with leather protectors, Arc-rated flash suit hood or arc-rated faceshield and arc-rated balaclava, "Class E" hard hat with minimum 4 cal/cm2 face shield, non-conductive safety glasses, leather work shoes, hearing protection. | 4 |
| 2 | 8 cal/cm2 minimum rating FR long sleeve shirt and pants, or coveralls, voltage rated gloves with leather protectors, Arc-rated flash suit hood or arc-rated faceshield and arc-rated balaclava, "Class E" hard hat with minimum 8 cal/cm2 face shield, non-conductive safety glasses, hearing protection, leather work shoes | 8 |
| 3 | Long sleeve shirt and pants, non-melting material (according to ASTM F 1506-00) or Untreated Natural Fiber, 25 cal/cm2 FR bib overalls and jacket, arc flash suit hood (minimum 25 cal/cm2) with "Class E" hard hat, non-conductive safety glasses, hearing protection, voltage rated gloves with leather protectors, leather work shoes | 25 |
| 4 | Long sleeve shirt and pants, non-melting material (according to ASTM F 1506-00) or Untreated Natural Fiber, 40 cal/cm2 FR bib overalls and jacket,  arc flash suit hood (min 40 cal/cm2) with "Class E" hard hat, non-conductive safety glasses, hearing protection, voltage rated gloves with leather protectors, leather work shoes | 40 |



Minimum Training Requirements Matrix

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Basic Electrical Safety Awareness | Formal Electrical Safety Training | | | | Lock Out - Affected | Lock Out Tag Out "Authorized" | Medical & Emergency Response | | | | Specific Equipment/System Training |
|  | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | **L** |
| Qualified |  | X | X | X | X |  | X | X**1** | X**1** | X**1** | X**1** | X |
| Safety Back-up |  | X | X | X | X |  | X | X | X | X | X |  |
| TI Approving Supervisor or Project Manager |  | X | X | X | X | X |  |  |  |  |  |  |
| Unqualified | X |  |  |  |  | X |  |  |  |  |  |  |
| Frequency | 36 Months | 36 Months | | | | 36 Months | 36 Months | Meet Local Regulatory Requirement or every 12 months | | | | As Necessary |

**Note 1: “Qualified” personnel need not have Medical and Emergency Response Training if they never serve as a Safety Back-up for other “Qualified” individuals.**

**Legend**

A = Basic Electrical Safety Awareness

(B-E) = Formal Electrical Safety Training

B = Skills and techniques to distinguish energized parts

C = Skills and techniques to determine nominal voltage

D = Information and knowledge to determine clearance distances

E = Safety-related work practices

F = Lock Out Affected

G = Lock Out Tag Out - Authorized

(H-K) = Medical & Emergency Response

H = Cardiopulmonary Resuscitation (CPR)

I = First aid

J = Rescue procedures/Emergency Response

K = Bloodborne Pathogens

L = Specific equipment/System training



Electrical PPE Inspection Intervals

|  |  |
| --- | --- |
| **Rubber Insulating Equipment** | **Testing Interval** |
| Blankets | Before first issue; every 12 months thereafter |
| Covers | If insulating value is suspect |
| Gloves | Before first issue; every 6 months thereafter |
| Sleeves | Before first issue; every 12 months thereafter |



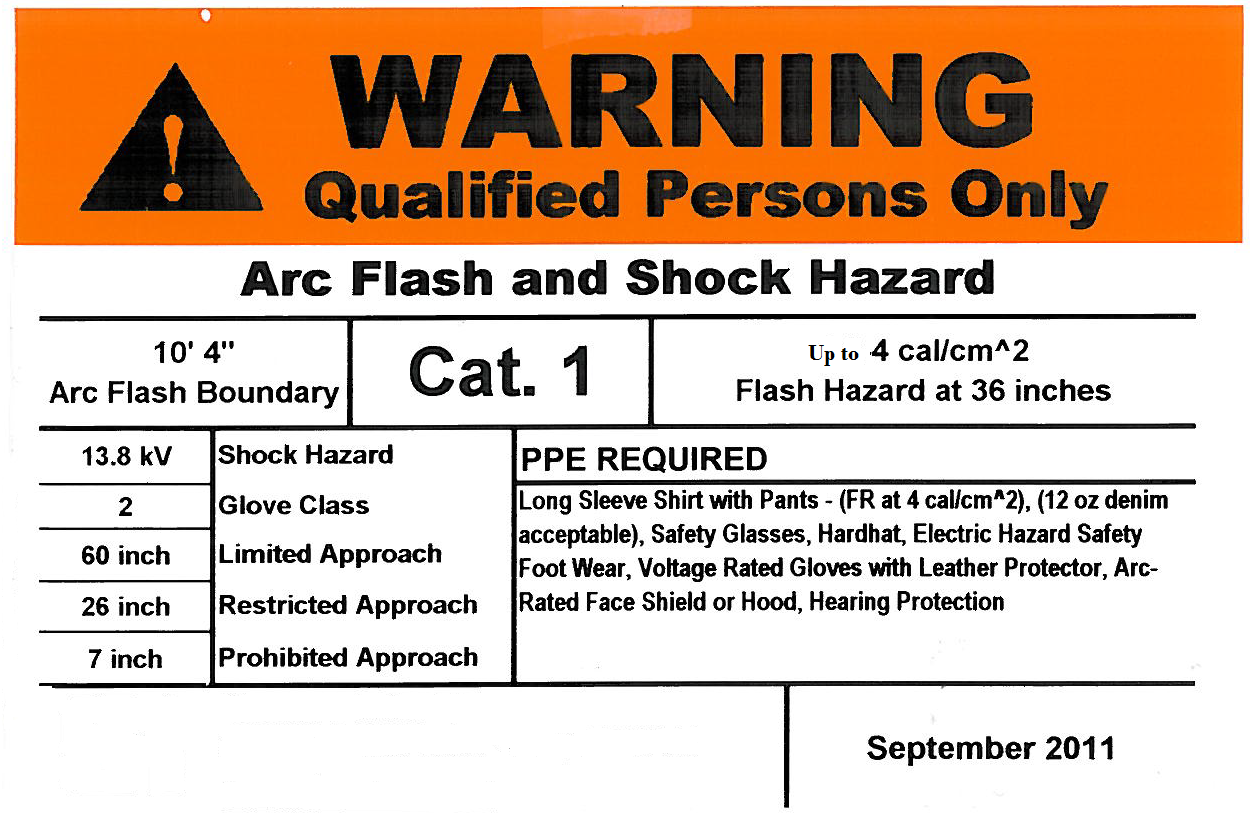
Battery Requirements

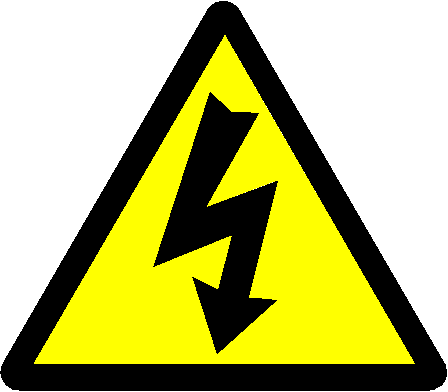
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| --- | --- | --- | --- | --- | --- |
|  | **Non-recombinant Batteries** | | **Recombinant Batteries** | | **Other** |
| **Flooded Lead Acid Batteries** | **Flood Nickel-Cadmium (Ni-Cd) Batteries** | **Valve Regulated Lead-Acid (VRLA) Batteries** | **Lithium-Ion Batteries** | **Lithium Metal Polymer** |
| **Safety Caps** | **Venting Caps** | **Venting Caps** | **Self-Resealing flame arresting caps** | **No Caps** | **No Caps** |
| **Thermal Runaway Management** | **Not Required** | **Not Required** | **Required** | **Not Required** | **Not Required** |
| **Spill Control** | **Required** | **Required** | **Not Required** | **Not Required** | **Not Required** |
| **Neutralization** | **Required** | **Required** | **Required** | **Not Required** | **Not Required** |
| **Ventilation** | **Required** | **Required** | **Required** | **Not Required** | **Not Required** |
| **Signage** | **Required** | **Required** | **Required** | **Required** | **Required** |
| **Seismic Protection** | **Required** | **Required** | **Required** | **Required** | **Required** |
| **Smoke Detection** | **Required** | **Required** | **Required** | **Required** | **Required** |

**2009 International Fire Code Table 608.1**



**Examples of Warning Label**

****



**WARNING**

**Shock Hazard Present**

Contact may cause electrical shock or burn. Category 1 PPE is required, if energized

**Turn off power when possible**

!

APPENDIX H

Medical Information for Hospital

**Electrical Injury Report**

Dear Doctor,

This information sheet and checklist is provided to assist you in determining the potential seriousness of an electrical incident (direct contact or arch flash or arch blast). Where possible, the employee will provide you with information that determines the severity of the injury. Be aware that the extent of the victim’s injuries may be worse than is first clinically apparent.

|  |  |
| --- | --- |
| Injured Persons Name |  |
| Where did the Incident Occur? |  |
| What was the person doing? |  |
| Did the person come in “DIRECT CONTACT with electricity? |  |
| Was the person involved in an arch flash? |  |
| Was the person involved in an arch blast? |  |
| What type of voltage? |  |
| What was the voltage level? |  |
| What was the current level? |  |
| The pathway of the electrical current? |  |
| What was the duration of the electrical current flow from the “direct contact”? |  |
| The condition of the body at the point of contact? (Sweating, contact with water, non-intact skin at point of contact point, humidity of air, etc.) |  |
| Did the person fall? If “yes”, please explain |  |
| Was the person wearing personal protective gear (PPE)? | YES / NO |
| Did the person seem dazed or confused, or lose consciousness at any point following the accident?  If “yes”, please explain | YES / NO (Explain) |
| Did the person require CPR? | YES / NO |
| Did the person require defibrillation? | YES / NO |
| Was the person immobilized with a cervical (neck) collar and/or were other bones of joins splinted? | YES/NO |
| Did the accident occur in as enclosed space? If “yes” please elaborate? |  |
| Who has more information? |  |
| Were there any other hazards within the vicinity of the electrical contact? |  |