USA Mobile, AL Electrical Safe Working Practices

Risk Assessment Procedure

(Based on NFPA 70E-2015 110.1(G) and Informative Annex F

This Risk Assessment Procedure addresses employee exposure to electrical hazards.

The process is based on:

1) Identifying Hazards
2) Assessing Risks
3) Implementing Risk Controls

Risk Assessment Procedure

Parameters Used in Risk Estimation

		Se Value
Irreversible	trauma, death	8
	skeletal damage, blindness, hearing loss	
Permanent	third degree burns	6
	minor impact, hearing damage, second	
Reversible	degree burns	3
Reversible		

Risk Assessment Procedure

Risk Register

[redacted] Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = ([redacted] (Fr)	Pr + Av (Pr)	(Av)	Total	R[redacted]core Se x Po
[redacted]					4	1	1	6	36

[redacted]

USA Mobile, AL Electrical Safe Working Practices

Risk Assessment Procedure

Risk Register

Arc Flash IE cal/cm2	Risk Score

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Risk Assessment Procedure

Risk Register

Risk Assessment Procedure

Risk Register

**Equipment Condition Assessment
The equipment is properly installed
The equipment is properly maintained
There is no evidence of impending failure
All equipment doors are closed and secur (applies only to closed door switch operation)
All equipment covers are in place and secured (applies only to closed door switc operation)
< Acceptable Equipment Condition is defined as one or more of the following:
The equipment is not properly installed
The equipment is not properly maintained
There is evidence of impending failure
Equipment doors are open or not secured (applies only to closed door switch operation)
Equipment covers are off or not secured (applies only to closed door switch operation)
Risk Classification
Se - Severity
Fr - Frequency
Pr - Probability
Av - Avoidability
Po - Probability of Occurrence of Harm

USA Mobile, AL Electrical Safe Working Practices

Risk Assessment Procedure

Risk Reduction Protective Measures

Risk Assessment Procedure

Risk Reduction Protective Measures

Risk	Risk Reduction Protective Measure
Meter does not show correct reading due to meter malfunction	Test meterm6.994 ( )-21.996 (n)-24.998 (

USA Mobile, AL Electrical Safe Working Practices

Risk Assessment Procedure

Risk Reduction Protective Measures

Job Briefing

Before starting each job, the employee in charge shall conduct a Job briefing with all employees involved which shall include at least the following subjects:

Hazards associated with the job,

Work procedures to be used,

Special precautions,

Energy source controls,

PPE requirements.

Work shall not proceed until everyone involved thoroughly understands the work to be done, the procedures to be followed, and the safety and health practices that apply.

If conditions change or if unforeseen circumstances become apparent, employees shall re-evaluate the work and follow appropriate safe work practices.

Employees working without supervision shall review the above listed subjects prior to starting each job.

Routine Work. A brief discussion shall be satisfactory if the work involved is routine, and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job.

A more extensive discussion shall be required if either of the following apply:

The work is complicated or particularly hazardous.

The employee cannot be expected to recognize and avoid the hazards involved in the job.

Emergency Release Procedures

Release of victim from contact with exposed energized conductors or circuit parts

De-energize circuit and/ or

Remove victim with non-conductive object

Do not touch the employee

In case of an injury, contact a member of the medical response team.

Electrical Safety Auditing

An audit of the electrical safety program shall be performed every three years to verify the principles and procedures are in compliance with the latest version on NFPA 70E.

A field audit shall be performed annually to verify the procedures and practices of this standard are being followed.

The audits shall be documented.

Training Requirements

- Employees that will be exposed to electrical hazards shall be trained to understand the specific hazards associated with electrical energy.
  - They shall be trained in safety-related work practices and procedural requirements, as necessary, to provide protection from the electrical hazards associated with their respective job or task assignments. Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury.
  - The training can be classroom, on the job, or a combination.
- Emergency Response Training
  - Employees exposed to shock hazards shall be trained and retrained annually in methods of safe release of victims from contact with exposed energized electrical conductors or circuit parts.
  - Employees responsible for responding to medical emergencies shall be

        - Skills and techniques necessary to distinguish between exposed energized electrical conductors and circuit parts from other parts of electrical equipment.
        - Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts.
        - Arc flash boundary, limited approach boundary and restricted boundary.
        - Decision making process necessary to be able to do the following:
            - Perform the job safety planning
            - Identify electrical hazards
            - Assess the associated risk
            - Select the appropriate risk control methods from the Risk Assessment.
    - An employee undergoing on-the-job training that demonstrates an ability to perform specific duties safely, and is under the direct supervision of a qualified person shall be considered to be qualified for the performance of those specific duties.
    - Tasks that are performed less than once per year shall require retraining before the task is performed.
    - Employees shall be trained to select an appropriate test instrument and demonstrate how to use it to verify the absence of voltage.
        - The training shall include information that enables the employee to understand all limitations of each test instrument.
- Unqualified Person
    - Shall be trained in, and be familiar with, any safety related practices necessary for their safety such as:
        - Not to perform housekeeping duties inside the limited approach or arc flash boundaries.
        - Not to leave hinged doors to electrical equipment opened.
        - Not to remain around electrical equipment where there is evidence of impending failure.
        - Not to use flammable materials near electrical equipment that can create a spark.
        - Not to remove plugs from receptacles where the combination is not load-break rated.
        - Not to use damaged fixed or portable electrical equipment, damaged cables, cords, connectors or receptacles.
        - Not to reset a tripped a circuit breaker unless the cause of the trip is known and corrected.
        - To use switches that are load rated.
        - To be aware of safety signs and tags, barricades, warning attendants.

- To remain outside of the arc flash and shock protection boundaries.
- 4ÈÅ ÕÓÅ ÏÆ '&#)ÓÓ8
- The proper distance to keep away from and keep elevated vehicles from overhead power lines.
- To have a basic understanding of the relationship between exposure to potential hazards and possible bodily injury.
- To have a basic understanding and recognition of potential hazards.

- Retraining
  - Retraining shall be performed every three years.
  - Additional training or retraining is required for any of the following conditions:
    - Supervision or annual inspections indicate an employee is not complying with the safety-related work practices.
    - New technology, equipment or changes in procedures that are different than normally used presently.
    - The employee must use safety-related work practices that are normally as part of their regular job.
- Training shall be documented and contain the content of the training, the ÅÍÐÌÏÙÅÅÓ ÎÁÍÅÓ ÁÎÄ ÔÈÅ ÄÁÔÅ ÏÆ ÔÈÅ ÔÒÁÉÎÉÎÇ8

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- Host Employer Responsibilities
  - Inform contract employers of the following:
    - Known hazarÄÓ ÔÈÁÔ ÁÒÅ ÒÅÌÁÔÅÄ ÔÏ ÔÈÅ ÃÏÎÔÒÁÃÔ ÅÍÐÌÏÙÅÒÓ ×ÏÒË ÔÈÁÔ might not be recognized by the contract employer or its employee.
    - Information about the installation to allow the contract employer to make safety-related assessments.
    - Observed contract employer related safety violations.
- Contract Employer Responsibilities
  - Inform their employees of the hazards communicated by the host employer.
  - %ÎÓÕÒÅ ÅÁÃÈ ÏÆ ÔÈÅÉÒ ÅÍÐÌÏÙÅÅÓ ÆÏÌÌÏ× ÔÈÅ ÓÁÆÅÔÙ-related work rules communicate by the host employer.
  - Advise the host employer of the following:
    - ! ÎÙ ÕÎÉÑÕÅ ÈÁÚÁÒÄÓ ÐÒÅÓÅÎÔÅÄ ÂÙ ÔÈÅ ÃÏÎÔÒÁÃÔ ÅÍÐÌÏÙÅÒÓ ×ÏÒË8
    - Hazards identified during the course of work that were not communicated by the host employer.
    - Measures taken to correct any contract employee violations identified by the host employer.

Use of Electrical Equipment

(A) Test Instruments and Equipment

(1) Testing. Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring within the limited approach boundary or energized electrical equipment operating at => 50V.

(2) Rating. Test instruments, equipment and their accessories shall be rated for circuits and equipment where they are utilized.

(3) Design. Test instruments, equipment, and their accessories shall be designed for the environment for which they will be exposed and the manner in which they will be utilized. A minimum rating of 600V and CAT III is required for circuits rated 600V and below.

(4) Visual Inspection and Repair. Test instruments and equipment and all associated test leads, cables, power cords, probes and connectors shall be visually inspected for external defects and damage before each use. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service.

(5) Operation Verification. When test instruments are used for testing the absence of voltage on conductors or circuit parts operating at 50V or greater, the operation of the test instrument shall be verified on a known voltage source before and after an absence of voltage test is performed.

(B) Portable Electric Equipment. This section applies to the use of cord-and-plug connected equipment, including extension cords.

(1) Handling and Storage. Portable equipment shall be handled and stored in a manner that will not cause damage. Flexible cords connected to equipment shall not be used for raising or lowering the equipment. Flexible cords shall not be fastened with staples or hung in such a fashion as could damage the outer jacket or insulation.

(2) Grounding-Type Equipment.

a. A flexible cord used with grounding-type utilization equipment shall contain an equipment grounding conductor.

b. Attachment plugs and receptacles shall not be connected or altered in a manner that would interrupt continuity of the equipment grounding conductor. Additionally, these devices shall not be altered in order to allow use in a manner that was not intended by the manufacturer.

c. Adapters that interrupt the continuity of the equipment grounding conductor shall not be used.

(3) Visual Inspection and Repair of Cord-and-Plug- Connected Equipment and Flexible Cord Sets.

a. Frequency of Inspection. Before each use, portable cord-and-plug connected equipment shall be inspected for defects and for evidence of possible internal damage. Exception: Cord-and-plug-connected equipment and extension cords that remain connected once they are put in place and not exposed to damage shall not be required to be inspected until they are relocated.

b. Defective equipment. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service.

c. Proper mating. When an attachment plug is to be connected to a receptacle, the relationship of the plug and receptacle contacts shall first be checked to ensure that they are of mating configurations.

(4) Conductive Work Locations. Portable electric equipment used in highly conductive work locations (such as those inundated with water or other conductive liquids) shall be approved for those locations. In job locations where employees are likely to contact or be drenched with water or conductive liquids, GFCI protection for personnel protection shall be used.

(5) Connecting Attachment Plugs.

a. % Í ÐÌÏÙÅÅÓ ÈÁÎÄÓ ÓÈÁÌÌ ÎÏÔ ÂÅ ×ÅÔ ×ÈÅÎ ÐÌÕÇÇÉÎÇ ÏÒ ÕÎÐÌÕÇÇÉÎÇ flexible cords and cord-and-plug-connected equipment if energized equipment is involved.

b. Energized plug and receptacle connections shall be handled only with insulating protective equipment if the condition of the connection ÃÏÕÌÄ ÐÒÏÖÉÄÅ Á ÃÏÎÄÕÃÔÉÖÅ ÐÁÔÈ ÔÏ ÔÈÅ Å Í ÐÌÏÙÅÅÓ ÈÁÎÄ8

c. Locking type connectors such as Twist-lock® shall be secured after the connection.

(C) Ground-Fault-Circuit-Interrupter (GFCI) Protection

(1) General. Employees shall be provided with GFCI protection.

(2) Maintenance and Construction. GFCI Protection shall be provided where an employee is operating or using cord-and-plug-connected tools supplied by 125V 15-, 20-, or 3-ampere circuits. Where employees operate or use equipment supplied by > 125V 15-, 20-, or 3-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

(3) Outdoors. GFCI protection shall be provided when an employee is outdoors and operating or using cord-and-plug-connected equipment supplied by 125V 15-, 20-, or 3-ampere circuits. Where employees working outdoors operate or use equipment supplied by > 125V 15-, 20-,

or 3-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

(4) Assured Equipment Grounding Conductor Program.

a. All equipment grounding conductors shall be tested for electrical continuity and shall be electrically continuous. Electrically continuity is defined as <= 1.25 ohms.

b. Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

c. All required tests shall be performed as follows:

i. Before first use on site.

ii. When there is evidence of damage.

iii. Before equipment is returned to service following any repairs.

iv. At intervals not exceeding 3 months.

(D) Ground-Fault-Circuit-Interrupter (GFCI) Protection Devices. GFCI protection devices shall be tested in áãÃÏÒÄÁÎÃÅ ×ÉÔÈ ÔÈÅ ÍÁÎÕÆÁÃÔÕÒÅÒȭÓ instructions.

(E) Overcurrent Protection Modification . Overcurrent protection of circuits and conductors shall not be modified, even on a temporary basis, beyond what is permitted by applicable portions of electrical codes and standards dealing with overcurrent protection.

Establishing an Electrically Safe Work Condition

An electrically safe work condition does not exist until all six steps specified in NFPA 70E-2015 and listed below have been completed.

(1)

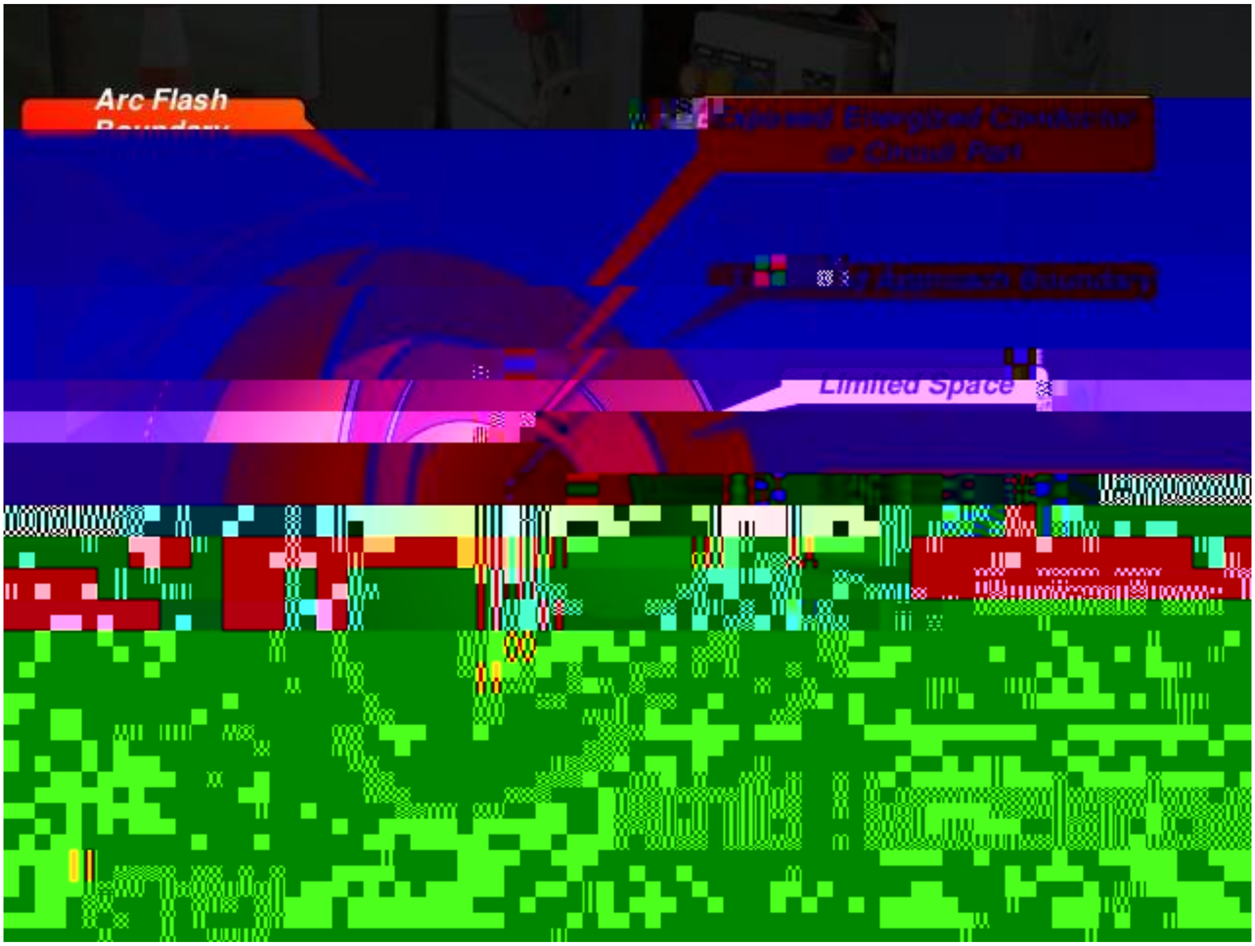
Energized Electrical Work Permit

When working on energized electrical equipment, work to be performed shall be considered energized electrical work and shall be performed by written permit only.

Exemptions to Work Permit

- ‡ Work performed within the Limited Approach Boundary by qualified personss related to tasks such as testing, troubleshooting, voltage or amperage measur,ing shall be permitted to be performed without an energized electrical work permit, provided appropriated safe work practices and personal protective equipment are provided and used.
- ‡ If the purpose of crossing the Limited Approach Boundary is only for visual

Approach Boundaries



Recognizing & Avoiding Electric Shock and Arc Flash Hazards

Anytime you are inside the Restricted Approach Boundary, you must use the appropriate Shock Hazard PPE.

Anytime you are inside the Flash Hazard Boundary, you must use the appropriate Flash Hazard PPE.

Anytime means when there is nothing but air between you and the exposed parts, meaning the enclosure door is open exposing live parts.

Recognizing & Avoiding Electric Shock Hazards

Distinguishing exposed energized parts from other parts of electrical equipment. Use the elementary drawing to visually identify the components by starting at the incoming line conductors on the drawing and visually matching them to actual components.

If it is a control cabinet, identify on the drawing where the power enters the cabinet and find that physical component visually using terminal strips, wire numbers, fuse labels, transformers, etc.

The voltage will need to be measured to determine if the parts are energized. Do not exceed the voltage rated of the meter.

Determining the nominal voltage level of exposed live parts

First determine what voltage level you expect to read based on the drawings, nameplate of the equipment, panel meter, etc.

Next use the appropriate PPE and test instrument to measure the voltage.

0-600V use a multimeter. Know the voltage rating of your test equipment and ÄÏ Îôô ÅØÃÅÅÄ ÉÔ8

> 600V, or an AC Audio/ Video Voltage Detector such as a Salisbury 4244, 4344, 4444, 4544, 4644, or 4744.

Use 1000V Rated Insulated tools whenever working inside the Restricted Approach Boundary.

These tools must be maintained in good condition and will be inspected every six months.

Each electrician will be issued a pair of 500 Volt rated gloves. They will be exchanged for a second pair every six months to be tested.

Limited Approach Boundary-

- Listed on every orange and red Arc and Shock Hazard Label
- Unqualified personnel must be escorted if they are to cross this boundary.
  - <50V ζ no limit
  - 50 to 750V -σôφô
  - 751 to 15kV ζ υôπô

Restricted Approach Boundary-

- Listed on every orange and red Arc and Shock Hazard Label
- Unqualified personnel are not allowed to cross this boundary.
- Voltage rated gloves must be worn and voltage rated tools must be used inside this boundary.

<50V ζ no limit

50 to 300V - avoid contact Class 00 gloves with protectors

301 to 750 - ρ0̃π0̄8 Class 00 gloves with protectors

751 to 15kV ζ 2-ς0̄8 Voltage rated gloves with protectors

Recognizing & Avoiding Arc Flash Hazards

An Arc Flash Hazard Analysis has been completed for all Electrical Equipment rated 208V and above.

Arc Flash and Shock Hazard Warning labels are posted on this equipment.

The Arc Flash energy level listed on the label is the worst case for the equipment it is posted on.

The Flash Hazard Boundary and PPE are listed on the label.

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Guidance on Selection of Arc-Rated Clothing and Other PPE
(Reference: NFPA 70E-2015 TABLE H3(b))

<= 1.2 cal/cm2

Long sleeve shirt & long pants, or coverall (non-melting or untreated natural fiber)
Safetyglasses
Hearing protection
Gloves: rubber insulating w/ leather protectors or heavy duty leather

>1.2 to 12 cal/cm2

Arc-rated clothing and equipment with an arc rating equal to or greater than the determined incident energy

- Arc-rated long-sleeve shirt & arc-rated pants or arc-rated coverall
- Arc-rated face shield and arc-rated balaclava or arc-flash suit hood
- Hard hat, Safety glasses, Hearing Protection, Leather footwear
- Gloves: rubber insulating w/ leather protectors or heavy duty leather

> 12 cal/cm2

Arc-rated clothing and equipment with an arc rating equal to or greater than the determined incident energy

- Arc-rated long-sleeve shirt & arc-rated pants or arc-rated coverall and/ or arc flash suit
- Arc-rated arc-flash suit hood
- Hard hat, Safety glasses, Hearing Protection, Leather footwear
- Gloves: Arc-rated gloves or rubber insulating w/ leather protectors

> 40 cal/cm2

Wear the following PPE only for the purpose of verification the equipment is de-energized.
Arc-rated clothing and equipment with an arc rating equal to or greater than 40 cal/cm2 .

- Arc-rated long-sleeve shirt & arc-rated pants or arc-rated coverall and/ or arc flash suit
- Arc-rated arc-flash suit hood
- Hard hat, Safety glasses, Hearing Protection, Leather footwear
- Gloves: Arc-rated gloves or rubber insulating w/ leather protectors

Other Precautions for Personnel Activities

(A) Alertness and Common Sense

(1) When Electrical Hazards Might Exist. Maintain a high level of alertness at all times when working within the Limited Approach or Arc Flash Boundary or in work situations where electrical hazards may exist.

(2) When Impaired. Employees are not allowed to work within the Limited Approach or Arc Flash Boundary or in work situations where electrical hazards may exist while their alertness is recognizably impaired due to illness, injury, fatigue or physical or mental conditions.Watch out for your co-worker.

(3) Changes in Scope. Be alert for changes in the job or task that may lead the person outside the electrically safe work condition or expose the person to additional hazards that were not part of the original plan.

(B) Blind Reaching. Do not reach blindly into areas that may contain exposed live parts.

(C) Illumination

(1) General. Do not enter where electrical hazards exist unless illumination is provided that enables you to be able to perform the work safely.

(2) Obstructed View of Work Area. Where lack of illumination or an obstruction precludes observationof the work to be performed, do not perform any taskwithin the Limited Approach or Arc Flash Boundary or in work situations where electrical hazards may exist.

(D) Conductive Articles Being Worn. Conductive articles of jewelry or clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal-framed glasses) shall not be worn within the Restricted Approach Boundary or where they present an electrical contact hazard with exposed energized electrical conductors or circuit parts. Conductive articles of clothing shall not be worn under voltage rated gloves.

(E) Conductive Materials, Tools, and Equipment Being Handled.

(1) General. Conductive tools, materials, and equipment that are in contact with any part of your body shall be handled in a manner that prevents accidental contact with energized electrical conductors or circuit parts. Such materials and equipment shall include, but are not limited to, long conductive objects, such as ducts, pipes and tubes, conductive hose (ond)4 (uc)3 (ti)

exposed energized electrical conductors and circuit parts no closer than the Limited Approach Boundary.

(F) Confined or Enclosed Work Spaces. When working in a confined or enclosed space that contains exposed energized electrical conductors or circuit parts, or where an electrical hazard exists, use protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts and the effects of their electrical hazards.

Work Within the Limited Approach or Arc Flash Boundary of Overhead Lines

- Uninsulated and Energized.
    - Precautions shall be taken to prevent employees from contacting uninsulated energized overhead lines that are not guarded or isolated with any part of their body or indirectly through conductive materials, tools or equipment whenever work is performed in the area.
    - The lines shall be de-energized and visibly grounded at the point of the work whenever contact is possible with uninsulated energized overhead lines that are not guarded or isolated.
- Approach Distances for Unqualified Persons.
    - When unqualified persons are working on the ground or in an elevated position near overhead lines, the locations shall be such that the employee and the longest conductive object the employee might contact do not come closer to any unguarded, energized overhead power line than the limited approach boundary in NFPA 70E Table 130.4(D) a, column 2. These distances are partially reprinted below:
        - 50V to 145,000V Limited Approach Boundaryχ ρρ0̃ π0̄8
- Vehicular and Mechanical Equipment
    - Where any vehicle or mechanical equipment structure will be elevated near energized overhead lines, it shall be operated so the limited approach boundary in NFPA 70E Table 130.4(D) a, column 2, is maintained. These distances are partially reprinted below:
        - 50V to 145,000V Limited Approach Boundaryχ ρρ0̃ π0̄8
    - Equipment Contact. Employees standing on the ground shall not contact the vehicle or mechanical equipment or any of its attachments.
    - Equipment Grounding. If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding shall not stand at the grounding location whenever there is a possibility of overhead line contact.

Underground Electrical Lines and Equipment

- Before excavation starts where there exists a reasonable possibility of contacting electrical lines or equipment, the employer shall take the necessary steps to contact the appropriate owners or authorities to identify and mark the location of the electrical lines or equipment.
- When it has been determined that a reasonable possibility of contact exists, appropriate safe working practices and PPE shall be used during the excavation.

Cutting or Drilling

- Before cutting or drilling into equipment, floors, walls, or structural elements where a likelihood of contacting energized lines or parts exists, the employer shall perform a risk assessment to:
  - Identify and mark the location of conductors, cables, raceways, or equipment
  - Create an electrically safe work condition
  - Identify safe work practices and PPE to be used