

# USA Mobile, AL Electrical Safe Working Practices

## Compliance

- Compliance with these safe work practices is mandatory. Failure to comply may result in disciplinary action.
- These Safe Working Practices apply to any person performing electrical work at the Plant.

## Qualified Person

- According to NFPA 70E – 2015, the Standard for Electrical Safety in the Work Place, a Qualified Person is defined as:
  - One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and Installations and has received safety training to identify and avoid the hazards involved.

## Electrical Safety Principles

- **Inspecting and evaluating the electrical equipment**
- **Maintaining the electrical equipment's insulation and enclosure integrity**
- **Planning every job**
- **De-energize the equipment if possible**
- **Treat every circuit as energized until proven de-energized.**
- **Anticipate unexpected events**
- **Identify the electrical hazards and reduce the associated risk**
- **Protecting employees from shock, burn, blast, and other hazards due to the working environment**
- **Using the right tools for the job**
- **Assessing people's abilities**
- **Auditing these principles**

# 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

Severity of the Possible Injury or Damage to Health (Se) Classification		Se Value
Irreversible	trauma, death	8
Permanent	skeletal damage, blindness, hearing loss, third degree burns	6
Reversible	minor impact, hearing damage, second degree burns	3
Reversible	minor laceration, bruises, first degree burns	1
Frequency and Duration of Exposure (Fr) Classification		Fr Value
<= 1 per day		5
> 1 per day to <= 1 every 2 weeks		4
> 1 every two weeks to <= 1 per year		3
> 1 per year		2
Likelihood of a Hazardous Event (Pr) Classification		Pr Value
Very High		5
Likely		4
Possible		3
Rare		2
Negligible		1
Likelihood of Avoiding or Limiting Injury (Av) Classification		Av Value
Impossible		5
Rare		3
Probable		1

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Register

Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
					(Fr)	(Pr)	(Av)	Total	Se x Po
Voltage, current testing, trouble- shooting	ES		Acc	6	4	1	1	6	36
	ES		< Acc	6	4	3	3	10	60
	AF/AB	<1.2	Acc	1	4	1	1	6	6
	AF/AB	<1.2	<Acc	1	4	3	1	8	8
	AF/AB	>=1.2 to <=8	Acc	3	3	1	1	5	15
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	6	3	1	1	5	30
	AF/AB	>8 to <=40	<Acc	6	3	4	3	10	60
	AF/AB	>40	Acc	8	3	2	3	8	64
	AF/AB	>40	<Acc	8	3	5	3	11	88
Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
Infrared inspection	ES		Acc	6	3	1	1	5	30
	ES		< Acc	6	3	1	1	5	30
	AF/AB	<1.2	Acc	1	3	1	1	5	5
	AF/AB	<1.2	<Acc	1	3	3	1	7	7
	AF/AB	>=1.2 to <=8	Acc	3	3	1	1	5	15
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	6	3	1	1	5	30
	AF/AB	>8 to <=40	<Acc	6	3	4	3	10	60
	AF/AB	>40	Acc	8	3	1	3	7	56
	AF/AB	>40	<Acc	8	3	5	3	11	88
Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
Visual inspection, data collecting	ES		Acc	6	3	1	1	5	30
	ES		< Acc	6	3	1	1	5	30
	AF/AB	<1.2	Acc	1	3	1	1	5	5
	AF/AB	<1.2	<Acc	1	3	3	1	7	7
	AF/AB	>=1.2 to <=8	Acc	3	3	1	1	5	15
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	6	3	1	1	5	30
	AF/AB	>8 to <=40	<Acc	6	3	4	3	10	60
	AF/AB	>40	Acc	8	3	1	3	7	56
	AF/AB	>40	<Acc	8	3	5	3	11	88

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Register

Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
					(Fr)	(Pr)	(Av)	Total	Se x Po
Cleaning, house- keeping	ES		Acc	6	4	1	1	6	36
	ES		< Acc	6	4	3	3	10	60
	AF/AB	<1.2	Acc	1	4	1	1	6	6
	AF/AB	<1.2	<Acc	1	4	3	1	8	8
	AF/AB	>=1.2 to <=8	Acc	3	3	1	1	5	15
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	6	3	1	1	5	30
	AF/AB	>8 to <=40	<Acc	6	3	4	3	10	60
	AF/AB	>40	Acc	8	3	2	3	8	64
	AF/AB	>40	<Acc	8	3	5	3	11	88
Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
CB or switch operation with doors open	ES		Acc	3	4	1	1	6	18
	ES		< Acc	3	4	3	3	10	30
	AF/AB	<1.2	Acc	1	4	1	1	6	6
	AF/AB	<1.2	<Acc	1	4	3	1	8	8
	AF/AB	>=1.2 to <=8	Acc	3	3	1	1	5	15
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	6	3	1	1	5	30
	AF/AB	>8 to <=40	<Acc	6	3	4	3	10	60
	AF/AB	>40	Acc	8	3	2	3	8	64
	AF/AB	>40	<Acc	8	3	5	3	11	88
Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
Making or tightening connections	ES		Acc	6	4	2	1	7	42
	ES		< Acc	6	4	3	3	10	60
	AF/AB	<1.2	Acc	1	4	2	1	7	7
	AF/AB	<1.2	<Acc	1	4	3	1	8	8
	AF/AB	>=1.2 to <=8	Acc	3	3	2	1	6	18
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	6	3	2	1	6	36
	AF/AB	>8 to <=40	<Acc	6	3	4	3	10	60
	AF/AB	>40	Acc	8	3	3	3	9	72
	AF/AB	>40	<Acc	8	3	5	3	11	88

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Register

Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
					(Fr)	(Pr)	(Av)	Total	Se x Po
Removal or replacing components	ES		Acc	6	4	2	1	7	42
	ES		< Acc	6	4	3	3	10	60
	AF/AB	<1.2	Acc	1	4	2	1	7	7
	AF/AB	<1.2	<Acc	1	4	4	1	9	9
	AF/AB	>=1.2 to <=8	Acc	3	3	2	1	6	18
	AF/AB	>=1.2 to <=8	<Acc	3	3	5	3	11	33
	AF/AB	>8 to <=40	Acc	6	3	2	1	6	36
	AF/AB	>8 to <=40	<Acc	6	3	5	3	11	66
	AF/AB	>40	Acc	8	3	3	3	9	72
	AF/AB	>40	<Acc	8	3	5	3	11	88
Task	*Hazard	Arc Flash IE cal/cm2	**Equip Cond	(Se)	Po = (Fr + Pr + Av)				Risk Score
CB or switch operation with doors closed	ES		Acc	1	4	1	1	6	6
	ES		< Acc	1	4	1	1	6	6
	AF/AB	<1.2	Acc	1	4	1	1	6	6
	AF/AB	<1.2	<Acc	1	4	3	1	8	8
	AF/AB	>=1.2 to <=8	Acc	1	3	1	1	5	5
	AF/AB	>=1.2 to <=8	<Acc	3	3	4	3	10	30
	AF/AB	>8 to <=40	Acc	1	3	1	1	5	5
	AF/AB	>8 to <=40	<Acc	3	3	4	3	10	30
	AF/AB	>40	Acc	1	3	2	3	8	8
	AF/AB	>40	<Acc	3	3	5	3	11	33

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Register

<b>*Hazard</b>
<b>ES = Electric Shock</b>
<b>AF/AB = Arc Flash/ Arc Blast</b>
<b>**Equipment Condition Assessment</b>
<b>Acceptable Equipment Condition is defined as all of the following:</b>
The equipment is properly installed
The equipment is properly maintained
There is no evidence of impending failure
All equipment doors are closed and secured (applies only to closed door switch operation)
All equipment covers are in place and secured (applies only to closed door switch operation)
<b>&lt; Acceptable Equipment Condition is defined as one or more of the following:</b>
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)
<b>Risk Classification</b>
<b>Se - Severity</b>
<b>Fr - Frequency</b>
<b>Pr - Probability</b>
<b>Av - Avoidability</b>
<b>Po - Probability of Occurrence of Harm</b>

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Score

Risk	Score	Level
<b>Red</b>	<b>&gt;=60</b>	<b>Extreme</b>
Intolerable Risk - Do not proceed De-energize Equipment		
<b>Orange</b>	<b>37-59</b>	<b>High</b>
High Risk - Energized Work Permit Required Consider de-energizing equipment Implement Risk Reduction Protective Measures		
<b>Yellow</b>	<b>15-36</b>	<b>Moderate</b>
Implement Risk Reduction Protective Measures		
<b>Green</b>	<b>0-14</b>	<b>Low</b>
Implement Risk Reduction Protective Measures		

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Reduction Protective Measures

<b>Electric Shock, Arc Flash and Arc Blast Hazard Risk Reduction Protective Measures</b>	
<b>Risk</b>	<b>Risk Reduction Protective Measure</b>
<b>Inadvertent contact with energized part</b>	Use Class 00 (500V) rated gloves and 1000V rated tools in all cases. For circuits >600V, use voltage rated gloves appropriate for the voltage level.
	De-energize the equipment whenever possible
	Work with one hand when possible to avoid current path through body,
	Always use insulated tools
	Maintain a high level of awareness at all times
	Secure hinged panels
	Ensure there is proper illumination
	Consider environmental hazard such as fork truck traffic, slip hazards, etc.
<b>Equipment failure while replacing components</b>	De-energize the equipment whenever possible
	Ensure breaker is in open position and perform insulation resistance test phase-phase, phase-ground, line-load, before installing
	Use and follow the Electrical Energized Work Permit Process if it is not feasible to de-energize
<b>Equipment failure</b>	Perform visual inspection and avoid exposure to suspect equipment
	Properly install and maintain electrical equipment
<b>Equipment failure while operating breaker or disconnect with doors open.</b>	De-energize equipment, correct issue with door/ disconnect and operate disconnect with door closed
	Wear AF PPE listed on label for open door operation and position body away from device and turn head away while operating



# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Reduction Protective Measures

<b>Electric Shock Hazard Risk Reduction Protective Measures</b>	
<b>Risk</b>	<b>Risk Reduction Protective Measure</b>
<b>Meter does not show correct reading due to meter malfunction</b>	Test meter on live circuit before and after use for circuits rated 480V and below.
<b>Voltage rating of meter exceeded</b>	Ensure use of meter rated at a minimum of 600V for circuits rated 480V and below. Use adequately rated voltage detector for circuits > 600V.
<b>Short Circuit rating of meter exceeded</b>	Ensure use of meter rated at a minimum of CAT III
<b>Damaged test leads</b>	Inspect test leads before each use.
<b>Damage to voltage rated gloves</b>	Test gloves for leaks before use.
	Test gloves every six months.
<b>Failure to properly distinguish energized parts from de-energized parts</b>	Ensure electricians are audited to demonstrate proficiency as needed.
	Ensure only qualified electricians are allowed to perform electrical work.
	Ensure employees are properly trained
	Inform supervision if you lack the knowledge to make proper distinction.
<b>Inability to release oneself from energized parts resulting from inadvertent contact.</b>	Inform a backup person of location of power source and how to open breaker in case of emergency
	Do not touch the person. Release victim with non-conductive object.

# USA Mobile, AL Electrical Safe Working Practices

## Risk Assessment Procedure

### Risk Reduction Protective Measures

Arc Flash/ Blast Hazard Risk Reduction Protective Measures	
Risk	Risk Reduction Protective Measure
Burns resulting from Arc Flash incident	Do not operate equipment rated > 40cal/cm <sup>2</sup> (de-energize before operating)
	Wear AF PPE appropriate for incident energy level
	Consider reducing trip settings, or evaluating equipment changes to reduce AFH incident energy level
High pressure, sound and shrapnel resulting from Arc Blast incident	Do not operate equipment rated > 40cal/cm <sup>2</sup> (de-energize before operating)
	Wear AF PPE appropriate for incident energy level
	Consider reducing trip settings, or evaluating equipment changes to reduce AFH incident energy level
Increased AF energy level at 12"	Follow PPE instructions on Label, leather protectors <=8cal, AF gloves for 8cal to 40cal.
Increased AF energy level at 4"	Follow PPE instructions on Label, leather protectors <=8cal, AF gloves for 8cal to 40cal, use 8" test lead extenders as needed.
Equipment failure while operating breaker or disconnect with doors closed.	Position body away from device and turn head away while operating
	<b>Ensure all of the following are true before operating disconnect:</b>
	The equipment is properly installed
	The equipment is properly maintained
	There is no evidence of impending failure
	All equipment doors are closed and secured
All equipment covers are in place and secured	

# USA Mobile, AL Electrical Safe Working Practices

## 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.

# USA Mobile, AL Electrical Safe Working Practices

## 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 trained in first aid and emergency procedures, CPR and AED (if the employer's emergency response plan includes its use). Refresher training on CPR and AED use shall occur annually.
- Employee Training
  - Qualified Person
    - A qualified person shall be trained and knowledgeable in the construction and operation of electrical equipment and trained to identify and avoid the electrical hazards that might be present.
    - Shall be familiar with
      - Special precautionary techniques
      - Electrical safety policies and procedures
      - PPE
      - Insulating and shielding materials
      - Insulated tools
      - Test equipment
    - Persons permitted to work within the limited approach and/ or the arc flash boundary shall, at a minimum, be trained in all of the following:

## USA Mobile, AL Electrical Safe Working Practices

- 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.

# USA Mobile, AL Electrical Safe Working Practices

- To remain outside of the arc flash and shock protection boundaries.
- The use of GFCI's.
- 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 employee's name, and the date of the training.

## **Host and Contract Employers' Responsibilities**

- Host Employer Responsibilities
  - Inform contract employers of the following:
    - Known hazards that are related to the contract employer's work that 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.
  - Ensure each of their employee's follow the safety-related work rules communicate by the host employer.
  - Advise the host employer of the following:
    - Any unique hazards presented by the contract employer's work.
    - 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.

# USA Mobile, AL Electrical Safe Working Practices

## 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  $\geq 50V$ .
- (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.**

## USA Mobile, AL Electrical Safe Working Practices

- 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. Employee's hands shall not be wet when plugging or unplugging 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 could provide a conductive path to the employee's hand.
      - 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-,



## USA Mobile, AL Electrical Safe Working Practices

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  $\leq 1.25$  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 accordance with the manufacturer's 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.

# USA Mobile, AL Electrical Safe Working Practices

## 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) Determine all possible sources of electrical supply to the specific equipment:
  - Check applicable up-to-date drawings, diagrams and identification tags.
  - Always refer to the plant one-line to develop lockout procedures for power distribution equipment and the appropriate drawing for other equipment.
  - Always ask for help in critical lockouts. It is a good idea to get a second opinion from another Electrician.
- (2) After properly interrupting the load current, open the disconnecting device for each source.
- (3) Whenever possible, visually verify that all blades of the disconnecting devices are fully open.
- (4) Apply locks/ tags in accordance with the Lockout Policy.
- (5) Use an adequately rated test instrument to test each phase conductor or circuit part to verify it is de-energized.  
Test each phase conductor or circuit part both phase-to-phase and phase-to-ground.
  - Before and after the test, verify that the test instrument is operating satisfactorily through verification on a known voltage source.
  - Wear the same PPE you would use if the circuit was energized while making the voltage verification checks.
- (6) Where the possibility of induced voltages or stored energy exists, ground the circuits parts or phase conductors 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 ground connecting devices rated for the available fault duty.

## Establishing an Electrically Safe Work Condition

### (Important PPE Considerations)

Even though you have locked the equipment out, since the line side of the main breaker or disconnect is still energized and exposed, you must still wear the appropriate PPE.

# USA Mobile, AL Electrical Safe Working Practices

## Energized Work

- 1) Energized work is permitted where it can be demonstrated that de-energizing additional hazards or increased risk.
- 2) Energized work is permitted where it can be demonstrated the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.
- 3) Energized electrical conductors and circuit parts that operate at less than 50V shall not be required to be de-energized.
- 4) Normal operation of electrical equipment shall be permitted where all of the following conditions are satisfied:
  - a) The equipment is properly installed.
  - b) The equipment is properly maintained.
  - c) The equipment doors are closed and secured.
  - d) All equipment covers are in place and secured.
  - e) There is no evidence of impending failure.

# USA Mobile, AL Electrical Safe Working Practices

## 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 persons related to tasks such as testing, troubleshooting, voltage or amperage measuring, 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 inspection and the Restricted Approach Boundary will not be crossed, an energized electrical work permit is not required.

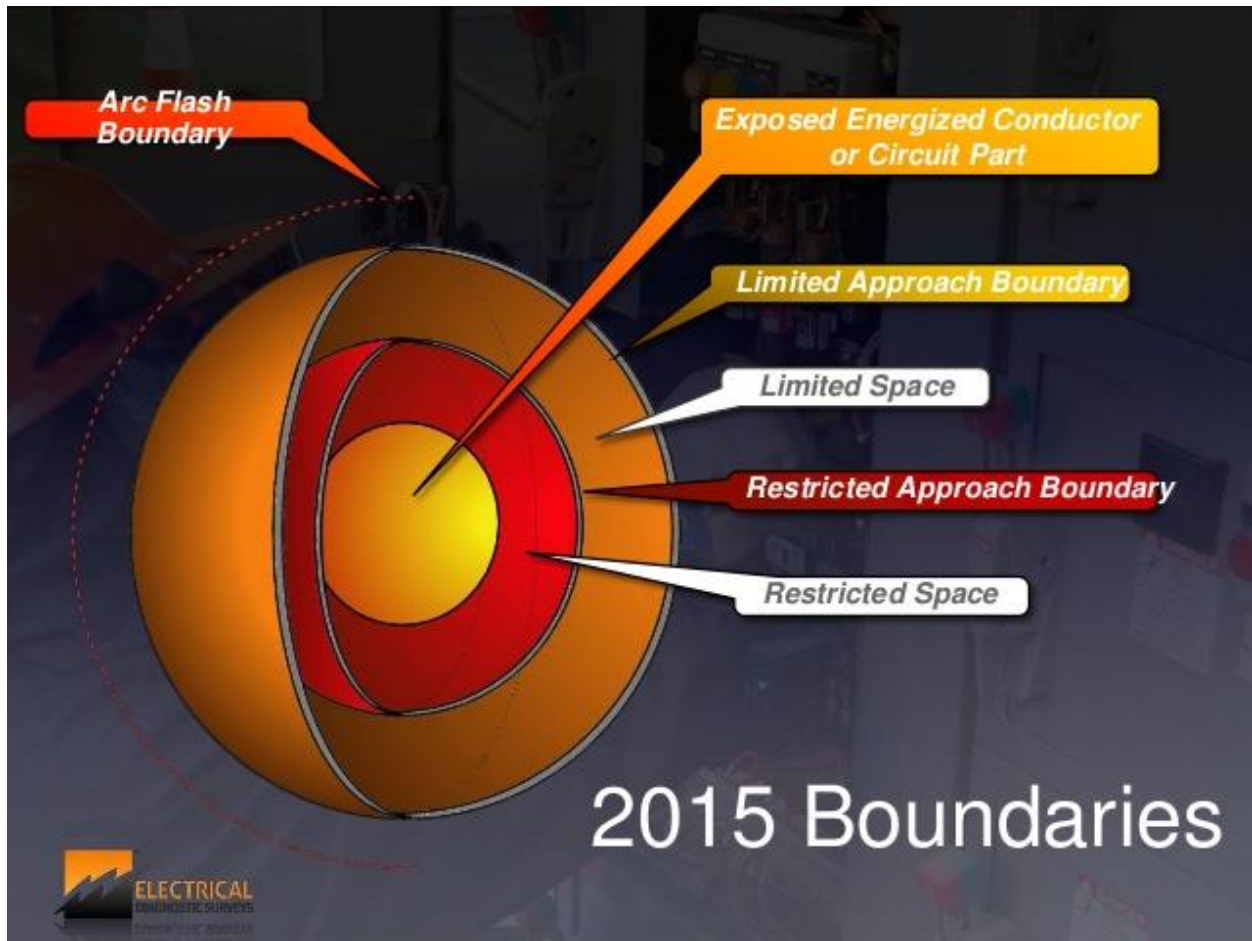
### Energized Work Permit Requirements

Use of the Energized Electrical Work Permit is required to remove or install (that is replace) any part in an energized electrical system > 50V such as:

- 1) Making or tightening connections,
- 2) Using a tool or other means to physically move conductors while energized such as changing a limit switch, or moving a wire on a terminal strip,
- 3) Replacing a circuit breaker in a lighting panel,
- 4) Replacing a bucket in an MCC.
- 5) Replacing a bus plug in a bus duct.
- 6) Racking a breaker in or out.
- 7) When work is performed within the restricted approach boundary.
- 8) When the employee interacts with the equipment when conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc exists.

# USA Mobile, AL Electrical Safe Working Practices

## 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.

# USA Mobile, AL Electrical Safe Working Practices

## 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 don't exceed it.
  - > 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 – no limit
    - 50 to 750V - 3'6"
    - 751 to 15kV - 5'0"
- 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.

## USA Mobile, AL Electrical Safe Working Practices

- <50V – no limit
- 50 to 300V - avoid contact. Class 00 gloves with protectors
- 301 to 750 - 1'0". Class 00 gloves with protectors
- 751 to 15kV – 2-2". Voltage rated gloves with protectors

# USA Mobile, AL Electrical Safe Working Practices

## 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.
- The Arc Flash PPE listed for 18" on the label must be worn inside the Flash Hazard Boundary.
- What this means:
  - If the worst case arc flash fault occurs, and
  - You are wearing the PPE listed on the label, and
  - You are 18" (the standard distance the calculations are made at) from the energized parts,
  - Your PPE will protect you from getting an incurable burn. (In other words, you may receive injuries, but no greater than a just curable (2<sup>nd</sup> degree burn).
- The incident energy calculated from the Arc Flash Study and listed on the Warning Label is used to determine the PPE.

**Anytime** you working are inside the Arc Flash Boundary, you must use the appropriate Arc Flash PPE.

### Protecting your hands

Use the 4" and 12" Arc Flash Hazard Levels listed on the label to determine when you should use the 8" test lead extensions, the leather protectors or the Arc Flash rated gloves.



# USA Mobile, AL Electrical Safe Working Practices

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

### <= 1.2 cal/cm<sup>2</sup>

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

### >1.2 to 12 cal/cm<sup>2</sup>

- 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/cm<sup>2</sup>

- 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/cm<sup>2</sup>

- 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/cm<sup>2</sup> .
  - 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

# USA Mobile, AL Electrical Safe Working Practices

## 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 observation of the work to be performed, do not perform any task within 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 and rope, metal-lined rules and scales, pulling lines, metal scaffold parts, structural members, bull floats, and chains.
- (2) **Approach to Energized Electrical Conductors and Circuit Parts.** Means shall be employed to ensure that conductive materials approach

## USA Mobile, AL Electrical Safe Working Practices

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.
- (G) **Doors and Hinged Panels.** Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized electrical conductors or circuit parts.
- (H) **Clear Spaces.** Working space required by other codes shall not be used for storage. This space shall be kept clear to permit safe operation and maintenance of electrical equipment.
- (I) **Housekeeping Duties.** Employees shall not perform housekeeping duties inside the limited approach boundary where there is a possibility of contact with energized electrical conductors or circuit parts, unless adequate safeguards (such as insulating equipment or barriers) are provided to prevent contact. Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicone carbide, as well as conductive liquid solutions) shall not be used inside the limited approach boundary unless procedures to prevent electrical contact are followed.
- (J) **Occasional Use of Flammable Materials.** Where flammable materials are present only occasionally, electric equipment capable of igniting them shall not be permitted to be used, unless measures are taken to prevent hazardous conditions from developing. Such materials shall include, but are not limited to, flammable gases, vapors, or liquids; combustible dust; and ignitable fibers or flyings.
- (K) **Anticipating Failure.** When there is evidence that electric equipment could fail and injure employees, the electric equipment shall be de-energized, unless the employer can demonstrate that de-energizing introduces additional hazards or increased risk or is infeasible because of equipment design or operational limitation. Until the equipment is de-energized or repaired, employees shall be protected from hazards associated with the impending failure of the equipment by suitable barricades and other alerting techniques necessary for safety of the employees.
- (L) **Routine Opening and Closing of Circuits.** Load rated switches, circuit breakers, or other devices specifically designed as disconnecting means shall be used for the opening, reversing, or closing of circuits under load conditions. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections shall not be permitted to be used for such purposes, except in an emergency.
- (M) **Reclosing Circuits After Protective Device Operation.** After a circuit is de-energized by the automatic operation of a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing

## USA Mobile, AL Electrical Safe Working Practices

- of circuit breakers or reenergizing circuits through replaced fuses shall be prohibited. When it is determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment shall not be required before the circuit is reenergized.
- (N) **Safety Interlocks.** Only qualified persons following the requirements for working inside the restricted approach boundary as covered by 130.4(C) shall be permitted to defeat or bypass an electrical safety interlock over which the person has sole control, and then only temporarily while the qualified person is working on the equipment. The safety interlock system shall be returned to its operable condition when the work is completed.
  - (O) The best PPE available is common sense. If a procedure seems unsafe, then it probably is, and should not be attempted. Treat a circuit as energized until proven otherwise, properly lock out the circuit, and Use your experience and common sense to avoid putting yourself in an unsafe position. If you have been assigned work that you feel unqualified to safely perform, notify the supervisor. The supervisor shall then decide how to proceed safely with performing the work.
  - (P) **Labeling Discrepancies.** All electrical equipment shall be labeled appropriately. If discrepancies are found, temporary corrections should be made and reported to supervision.
  - (Q) **Capacitors** shall be discharged for 10 minutes with a discharge resistor.

# USA Mobile, AL Electrical Safe Working Practices

## 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 Boundary – 11' 0".
- 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 Boundary – 11' 0".
  - 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.

# USA Mobile, AL Electrical Safe Working Practices

## 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