

<b>CNS OPERATIONS MANUAL</b> <b>ADMINISTRATIVE PROCEDURE 0.36.8</b>  <b>ELECTRICAL SAFETY RULE BOOK</b>	<b>USE: INFORMATION</b> <b>QUALITY: NON-QAPD</b> <b>EFFECTIVE: 5/28/10</b> <b>APPROVAL: GMPO</b> <b>OWNER: MNT-E SUPT</b> <b>DEPARTMENT: MNT-E</b>
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REV.	DATE	CHANGES
13	8/20/09	Deleted table at top of Attachment 1. Added steps for performing Live-Dead-Live check.
14	5/28/10	Added CAUTION concerning location of Live-Dead-Live checks.

**1. PURPOSE**

- 1.1 To establish electrical safety requirements for work on or near exposed energized equipment. This document includes but is not limited to:
  - 1.1.1 Selection and use of work practices.
  - 1.1.2 Personal Protective Equipment (PPE) requirements including the in service care, use, and inspection of electrical protective devices such as insulating gloves, blankets, sleeves, mats, line hose, and covers made from rubber or other approved insulating materials.
  - 1.1.3 Wearing apparel/protective clothing requirements.
  - 1.1.4 Temporary protective grounding requirements including the inspection, installation, and removal of temporary protective grounds.

1.2 The standard for electrical work at CNS is that it should be de-energized. When this standard is impractical or unsafe, this procedure shall be utilized for guidance when working on or near energized equipment.Ⓟ<sup>3</sup>

1.2.1 Attachment 1 shall be utilized to document deviation from this standard.

## 2. INSTRUCTIONS

2.1 Complete Electrical Safety Checklist, as necessary (Attachment 1).

2.2 Use Task Matrix (Attachment 2) and Job Hazards Analysis (Attachment 3), as appropriate, to determine PPE and Boundary requirements.

2.3 Conduct Pre-Job Brief (use Attachment 1 if completed).

2.4 Establish appropriate boundary.

2.5 Perform work as directed.

**NOTE** – If test points are not visible to the user, Electrical Supervision should be contacted.Ⓟ<sup>1</sup>

2.6 Ensure test points for voltage check (Live-Dead-Live) are visible to the tester and test points are free of corrosion.Ⓟ<sup>1</sup>

## 3. RECORDS

3.1 Completed Attachments 1 and 3, when used, are included in the work package for CNS Records.



**TABLE 1 - VOLTAGE LEVEL 50 TO 300**

A Safety Observer is required when working ON exposed energized equipment.

TASK	VOLTAGE RATED GLOVES (Shock Protection)	100% COTTON CLOTHING	FR CLOTHING AND ARC FACE SHIELD	FLASH SUIT AND HOOD	REQUIRED BOUNDARIES: FLASH - NONE LIMITED APPROACH - 3'6" RESTRICTED APPROACH - AVOID CONTACT
• <u>Visual Observation</u> of components in panel without breaking plane.	N/A	N/A	N/A	N/A	X
• Removing/installing, opening/closing bolted or hinged covers. • Operating circuit breakers. • Installing/removing temporary protective grounds (tags/locks in place).	N/A	X	N/A	N/A	X
• Work on energized circuits. • Work in energized panels. • Change lighting ballasts. • Lifting/installing energized leads. • Installing/removing jumpers. • Removing/installing fuses.	N/A (1)	X	N/A	N/A	X
• Removing/installing circuit breakers.	X	X	N/A	N/A	X
• Connecting load test leads for battery discharge test.	X	N/A	X	N/A	X
• Racking DC breakers.	N/A	N/A	N/A	X	X

(1) Rubber insulating gloves are also required in situations where there is a danger of hand contact with exposed energized parts. "Danger of contact" shall be determined by the qualified individual performing the work.

**TABLE 2 - VOLTAGE LEVEL 301 TO 750**

A Safety Observer is required when working ON or WITHIN 1' of exposed energized components.

TASK	VOLTAGE RATED GLOVES (Shock Protection)	100% COTTON	FR CLOTHING AND ARC FACE SHIELD	FLASH SUIT AND HOOD	REQUIRED BOUNDARIES: FLASH - GENERAL ACTIVITIES - 5' RACKING BREAKERS - 10' LIMITED APPROACH - 3'6" RESTRICTED APPROACH - 1'
• Opening/closing hinged covers on panels.	N/A	X	N/A	N/A	X
• Work in energized panels. • Remove/install panel breakers. • Operating circuit breakers - covers off. • Removing/installing bolted covers on panels (NOT MCC OR SWGR). • Work on energized circuits in miscellaneous panels or load side of MCC breakers.	X	N/A	X	N/A	X
• Removing/installing MCC starter buckets. • Removing/installing bolted covers (line side) of MCCs/load centers or switchgear. • Racking load center/switchgear breakers.	N/A	N/A	N/A	X	X
• Work on energized circuits in load centers/switchgear or line side of MCCs. • Installing/removing temporary protective grounds (tags/locks in place) (minimum worker distance 18").	X	N/A	N/A	X	X

**TABLE 3 - VOLTAGE LEVEL 751 TO 15 kV**

A Safety Observer is required when working ON or WITHIN 5' of exposed energized components.

TASK	VOLTAGE RATED GLOVES	FR CLOTHING AND ARC FACE SHIELD	FLASH SUIT AND HOOD	REQUIRED BOUNDARIES: FLASH - 20' LIMITED APPROACH - 5' RESTRICTED APPROACH - 2'2"
<ul style="list-style-type: none"> <li>Racking breakers IN and OUT.</li> </ul>	N/A	N/A	X	X
<ul style="list-style-type: none"> <li>Install temporary protective grounds (after voltage test) (minimum worker distance 36").</li> <li>Removal of temporary protective grounds (tags/locks in place).</li> </ul>	X	N/A	X	X
<ul style="list-style-type: none"> <li>Removing/installing bolted covers to expose &gt; 751V.</li> <li>Work on energized circuits (line or load side).</li> <li>Operating circuit breakers door open.</li> <li>Work on control circuits while within the restricted approach boundary of exposed energized equipment &gt; 751V.</li> </ul>	Complete Attachment 3, Electrical Safety Job Hazards Analysis			

**TABLE 4 - MISCELLANEOUS TASKS**

A Safety Observer is NOT required for these activities.

TASK	VOLTAGE RATED GLOVES	FR CLOTHING AND ARC FACE SHIELD	FLASH SUIT AND HOOD	REQUIRED BOUNDARIES: FLASH - NONE LIMITED APPROACH - 3'6" RESTRICTED APPROACH - AVOID CONTACT
<ul style="list-style-type: none"> <li>• Connect/disconnect 220V cord.</li> <li>• Connect/disconnect 480V cord.</li> </ul>	Leather Gloves and Safety Glasses			N/A
<ul style="list-style-type: none"> <li>• OWC cell maintenance.</li> <li>• Station battery cell or intercell maintenance.</li> </ul>	(1)(3)	N/A	N/A	N/A
<ul style="list-style-type: none"> <li>• Removing/installing circuit cards, modules, and drawers.</li> <li>• Work on radiation monitoring equipment, including hand-held instrumentation.</li> <li>• Calibration, testing, string checks on electronic equipment.</li> </ul>	(1)	N/A	N/A	X
<ul style="list-style-type: none"> <li>• Cleaning switchgear cubicles.</li> <li>• Cleaning potential transformer drawers.</li> </ul>	(2)	N/A	N/A	X

- (1) Rubber insulating gloves are also required in situations where there is a danger of hand contact with exposed energized parts. "Danger of contact" shall be determined by the qualified individual performing the work. The qualified individual can avoid contact by distance, use of voltage rated barriers, or work techniques.
- (2) When cleaning switchgear cubicles and potential transformer drawers, insulated gloves are recommended as protection for incidental contact to undetected live parts.
- (3) Use non-sparking tools for cell maintenance to prevent tool or bus damage if a short circuit should occur.

**ELECTRICAL JOB HAZARDS ANALYSIS**

<b>REASON FOR JHA</b>			
<input type="checkbox"/> Required by Attachment 2 <input type="checkbox"/> Detail not covered in Rule Book <input type="checkbox"/> Exception/Deviation (Provide section and step)			
<b>EQUIPMENT AND TASK/WORK ACTIVITY DETAILS</b>			
List Equipment Type:		Voltage:	
Describe Activity:			
If Requesting An Exception, Provide Reason:			
<b>HAZARD REVIEW</b>			
Describe Each Step Necessary For Activity	Hazard (Shock/Flash/None)	For Each Hazard, Describe Work Practices, Boundaries, or PPE That Will Be Used To Protect Individuals	
1.			
2.			
3.			
4.			
<b>REQUEST</b>			
Originator	Date	Superintendent/Supervisor	Date
<b>CONCURRENCE</b>			
Industrial Safety	Date	Department Manager	Date

**GENERAL REQUIREMENTS**

1. The thought process for performing electrical work shall consider the following Electrical Safety Principles:

- 1.1 De-energize the source.

**NOTE** – If test points are not visible to the user, Electrical Supervision should be contacted. Ⓟ<sup>1</sup>

- 1.2 Ensure test points for voltage check are visible to the user and test points are free of corrosion. Ⓟ<sup>1</sup>

**WARNING** – When performing Live-Dead-Live checks, ensure the test equipment is used on the appropriate scale (i.e., correct voltage level and AC/DC scales to prevent personnel injury). Ⓟ<sup>4</sup>

**CAUTION** – Live-Dead-Live checks should be performed at the isolation source and the work location whenever possible. Ⓟ<sup>5</sup>

- 1.3 Verify no voltage present (Live-Dead-Live).

- 1.3.1 Test the test equipment on a known live source to verify the test equipment is functional. Ⓟ<sup>4</sup>

- 1.3.2 Test the circuit in question and verify it is de-energized. Ⓟ<sup>4</sup>

- 1.3.3 Retest the test equipment on a known live source to verify the test equipment is still functional. Ⓟ<sup>4</sup>

- 1.4 Evaluate hazards involved in working on or near exposed energized equipment.

- 1.5 Use covers, barriers, as practical to eliminate hazards.

- 1.6 Use appropriate tools, PPE, and clothing.

2. GENERAL REQUIREMENTS

- 2.1 Safe work practices shall be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact with exposed energized equipment.

- 2.2 Electrical insulating gloves shall be worn when handling wet energized electrical cords. Ⓟ<sup>2</sup>

- 2.3 The specific safety work practices shall be consistent with the nature and extent of the associated electrical hazards.

2.4 Vehicles used to work on exposed energized lines or equipment > 600V or when any part of the vehicle fully extended can come within the minimum approach distance of lines or equipment > 600V, it shall be mandatory to connect vehicles to the best approved ground with a minimum #2 AWG copper conductor equipment grounding jumper. In the event the vehicle cannot be grounded, the vehicle shall be barricaded prior to the start of work.

**NOTE** – The voltages listed in this document are nominal voltages.

- 2.5 Only qualified individuals shall be assigned to perform work ON or WITHIN the limited approach boundary of exposed energized electrical equipment.
- 2.6 All circuits and equipment operating > 50V to ground should be de-energized prior to beginning work, unless:
- 2.6.1 Additional or increased hazards are introduced by de-energizing; OR
  - 2.6.2 De-energizing is infeasible or impractical due to equipment design, operational limitations, or requirements of the work activity; OR
  - 2.6.3 Work involves electronic equipment operating at low current (< 5 mA); OR
  - 2.6.4 Cycling of sensitive equipment could be detrimental to its reliability.
- 2.7 Isolation for work on electrical circuits shall be provided per Site Lockout/Tagout Procedures.
- 2.8 Electrical equipment and lines shall be considered energized until verified de-energized.
- 2.9 When two or more individuals are working on exposed energized equipment and are within reach of each other, they shall not work on different phases/polarity at the same time (e.g., battery systems).
- 2.10 Personnel operating circuit breakers or disconnect devices opened or closed, on an energized bus, shall stand clear to one side, preferably on the hinged side when practical.
- 2.11 Blind reaching into areas that contain exposed energized equipment is not permitted.
- 2.12 Individuals should not work on exposed energized electrical equipment in any position from which a shock or slip will tend to bring the body toward exposed parts that are at a potential different from the individual's body.
- 2.13 Clothing worn when performing electrical work or when in situations where arc/flash could occur should be 100% cotton or other natural fabric or flame resistant. Specific requirements for wearing apparel are specified in Attachment 6, Step 6.

- 2.14 Only CNS Electricians or approved supplemental individuals may construct temporary cords (> 120 VAC), splitters, or place plugs (male or female) on power cords.
- 2.15 The location of the Safety Observer depends on the activity. For example:
- 2.15.1 When the primary hazard is flash (such as when pulling MCC starter buckets and racking switchgear breakers), the Safety Observer should be outside the flash protection boundary if possible so that they can go for help.
  - 2.15.2 When the primary hazard is shock (such as when working ON energized equipment), the Safety Observer should be close enough to perform rescue.

**NOTE** – Access to the various Battery Rooms in the Protected Area at CNS shall be by qualified personnel only. Unqualified individuals may be briefed on the hazards and enter the area, provided they are with a qualified individual. The basis for this is that due to the limited space in these rooms, knowledge of the hazards associated with electrical arc is required, even though they are not performing work.

- 2.16 The following actions should be taken when working near exposed energized parts OR when working in a manner where conductive items could be dropped or otherwise come in contact with exposed energized parts (i.e., when breaking the plane of a panel or battery rack):
- 2.16.1 Remove all conductive jewelry type items (such as keys, watches, watch chains, rings, wristbands, large belt buckles, bracelets, necklaces, etc.) and other unnecessary conductive articles that could pose a hazard.
  - 2.16.2 Remove metal-framed glasses or render them non-conductive by wearing a non-conductive face shield or non-conductive safety glasses over them. Metal framed glasses shall be restrained.
  - 2.16.3 Secure items such as badges.
  - 2.16.4 Take measures to insulate adjacent equipment if practical so that no arc flash potential/shock exists OR establish a boundary area as appropriate.
  - 2.16.5 Use appropriate tools.
  - 2.16.6 Use appropriate PPE.

### 3. HIGH VOLTAGE, LOW AVAILABLE FAULT CURRENT EQUIPMENT

- 3.1 Electronic components that operate at high voltages and low current do not pose an arc/flash hazard. If these components operate at low current, < 5 milliampere, they pose no significant shock hazard.
- 3.2 Compliance with the guidance set forth in Attachment 2, Task Matrix, is required.

4. HIGH CURRENT, LOW VOLTAGE EQUIPMENT

4.1 Equipment that operates at high current but low voltage (< 50V) can still pose an arc/flash or short circuit hazard.

4.1.1 Compliance with the guidance set forth in Attachment 2, Task Matrix, is required.

4.1.2 This equipment should have an appropriate boundary established around it when maintenance is performed to keep unauthorized personnel at a safe distance.

4.1.3 Personnel working ON exposed components of this type of equipment should use insulated tools and take the necessary precautions to prevent phase-to-phase or phase-to-ground faults.

4.1.4 Personnel should wear the appropriate rated gloves to prevent inadvertently touching exposed energized parts.

5. TEMPORARY POWER

5.1 Guidance for temporary power cords and extension cords is found in Procedure 7.3.61, Temporary Power, and Procedure 0.36.7, Electrical Cord Control/GFCI Program.

## ESTABLISHING BOUNDARIES

**NOTE 1** – The most conservative boundary is normally used. For example, there is no need to establish a shock protection boundary and a flash protection boundary.

**NOTE 2** – Flash protection boundaries may be shorter/smaller than the specified boundaries if work is done in a room with a physical barrier such as a wall.

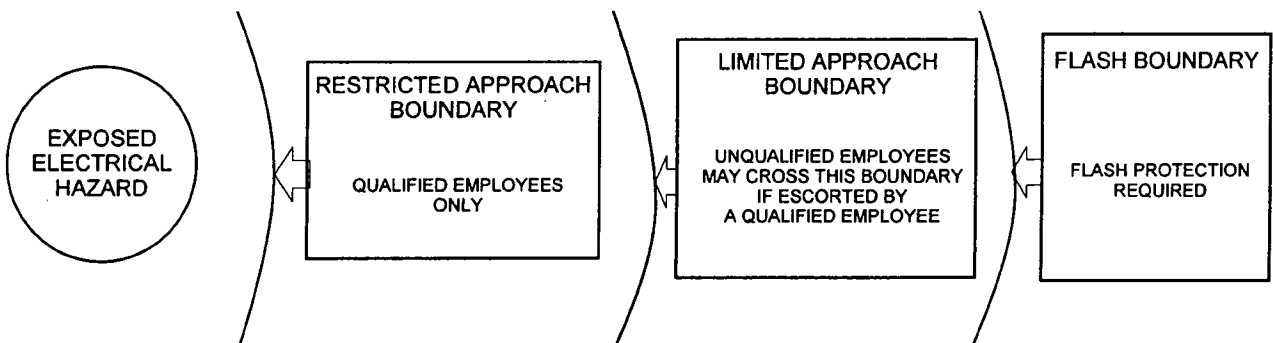
**NOTE 3** – Specified boundary or approach distances for shock/flash are minimum distances.

**NOTE 4** – Establishing boundaries at the threshold of the cabinet is acceptable for large cabinets similar to Control Room cabinets provided there is no energized equipment on the door.

1. When working on or within the limited approach boundary of exposed energized equipment, alert others of potential shock and arc flash hazards associated with your work. This can be accomplished by doing at least ONE of the following:
  - 1.1 Post appropriate signs/tags.
  - 1.2 Place barricade or flagging to mark off work area.
  - 1.3 Use of personnel to control the work area.
2. When performing tasks with the potential for high energy such as racking breakers or accessing the main bus, a physical boundary such as flagging or use of personnel shall be used.
3. Flash protection boundaries shall be considered when performing activities similar to:
  - 3.1 Racking breakers.
  - 3.2 Work on or near (within the limited approach boundary) of exposed energized parts > 300 VAC.
  - 3.3 Equipment manipulations where failure of equipment could occur.
  - 3.4 Work where exposure to automatic actuation of equipment could occur.
4. Shock protection boundaries shall be considered any time individuals are working on or near (within the limited approach boundary) of exposed energized equipment where there is danger of unqualified individuals contacting exposed energized parts.

**BOUNDARY CHART**

AC/DC VOLTAGE (PHASE-TO-PHASE OR PHASE-TO-GROUND)	RESTRICTED APPROACH BOUNDARY	LIMITED APPROACH BOUNDARY	FLASH PROTECTION BOUNDARY
< 50V	NOT SPECIFIED	NOT SPECIFIED	NONE
50V to 300V	AVOID CONTACT	3'6"	NONE
301V to 750V	1'	3'6"	5' FOR GENERAL ACTIVITIES; 10' FOR RACKING BREAKERS
751V to 15 kV	2'2"	5'	20'
15.1 kV to 36 kV	2'7"	6'	THESE ARE VOLTAGES TYPICALLY NOT APPROACHED NEARER THAN A SAFE DISTANCE BY INDIVIDUALS
36.1 kV to 46 kV	2'9"	8'	
46.1 kV to 72.5 kV	3'2"	8'	
72.6 kV to 121 kV	3'3"	8'	
138 kV to 145 kV	3'7"	10'	
161 kV to 169 kV	4'	11'8"	
230 kV to 242 kV	5'3"	13'	
345 kV to 362 kV	8'6"	15'4"	
500 kV to 550 kV	11'3"	19'	
ELECTRONICS (LOW CURRENT)	AVOID CONTACT	AVOID CONTACT	NONE



Adapted from Table 2-1.3.4, NFPA 70E, 2004 Edition.

## PERSONAL PROTECTIVE EQUIPMENT (PPE) AND TOOLS

**NOTE 1** – This section provides guidance for the selections, use, care, and testing of Electrical PPE, tools, and wearing apparel used when performing activities where there is the potential for injury due to electrical arc/flash or electrical contact.

**NOTE 2** – The Personal Protective Equipment requirements in this section are minimum requirements. Additional PPE may be worn if deemed necessary by the qualified individual or by site specific procedures or assessments.

**NOTE 3** – The Auxiliary Relay Room panels have been evaluated and no risk of head injury from electrical contact exists.

**NOTE 4** – Insulating material may be used instead of head protection to eliminate danger. Individuals shall wear non-conductive head protection wherever there is a danger of head injury due to contact with exposed energized parts unless exempted per Procedure 0.36.

### 1. GENERAL REQUIREMENTS

- 1.1 Rubber goods, insulated tools, and flame resistant clothing shall be purchased to meet applicable ASTM standards.
- 1.2 Rubber goods are to be used only for their intended purpose (e.g., rubber blankets are not to be used instead of rubber mats).
- 1.3 Rubber goods rated for the appropriate voltage shall be used.
- 1.4 Rubber goods with the exception of voltage rated barrier material and mats shall not be cut or modified.
- 1.5 Rubber goods shall be visually inspected prior to use.
- 1.6 Rubber goods (with the exception of mats) shall reflect the issue date.

### 2. INSPECTION, STORAGE, AND TESTING OF RUBBER GOODS

- 2.1 Rubber goods found to be past the test due date shall be immediately placed out of service.
- 2.2 Rubber goods found to have damage shall be removed from service and destroyed.
- 2.3 Protector gloves that are found to have tears, cuts, holes, or have oil, grease, or other substances on them shall be removed from service and destroyed.
- 2.4 Visual inspection should include both exterior and interior surfaces, and both sides of the rubber goods.

- 2.5 Inspection should include looking for evidence of the following:
- 2.5.1 Cuts, snags, cracks, punctures, burns, ozone/corona cutting or cracking, swellings, abrasions.
  - 2.5.2 Embedded foreign objects.
  - 2.5.3 Contamination from materials such as oil, grease, or other damaging substances.
  - 2.5.4 Loss of elasticity when stretched.
- 2.6 Rubber goods shall be wiped clean of any oil, grease, or other damaging substances as soon as practical.
- 2.7 An approved cleaner shall be used unless the manufacturer allows alternate methods of cleaning such as mild soap and water.
- 2.8 Rubber goods shall not be stored in a manner where they are folded, bent, turned inside out, or in any other manner that distorts them from their natural shape or in a manner that exposes them to sunlight, direct heat, chemicals, or other harmful substances. Cool, dark, dry locations are best for storage.

### 3. GLOVES

- 3.1 Rubber gloves shall be given an air test prior to each use. This can be accomplished by rolling the cuff tightly toward the palm to trap air inside the glove. The individual then checks for punctures by listening for escaping air or holding the glove against their cheek to feel for escaping air OR by use of an air inflator.
- 3.2 Rubber gloves should be stored in glove bags or other approved containers in their natural shape (i.e., not folded or creased in any manner). If stored in tool boxes or tool bags, ensure the gloves are stored in a manner where tools and other items aren't stored on top of them.
- 3.3 Gloves should be rinsed, as necessary, to remove perspiration. Excess water should be removed and the gloves should be air-dried.
- 3.4 Fabric liners may be worn under rubber gloves in warm weather to absorb perspiration or in cold weather for warmth.
- 3.5 Protector gloves shall be worn over insulating gloves.
- 3.6 Protector gloves shall match in size or size range to the rubber gloves.
- 3.7 Protector gloves shall not be used for any other purpose.

**GLOVE CLASSIFICATION**

CLASS OF GLOVE (WITH LEATHER PROTECTOR)	MAXIMUM USE VOLTAGE AC OR DC	LABEL COLOR
00	500	BEIGE
0	1,000	RED
1	7,500	WHITE
2	17,000	YELLOW
3	26,500	GREEN
4	36,000	ORANGE

**VOLTAGE RATINGS FOR BLANKETS OR SLEEVES**

CLASS OF BLANKET OR SLEEVE	MAXIMUM USE VOLTAGE AC OR DC
0	1,000
1	7,500
2	17,000
3	26,500
4	36,000

**4. ARC FACE SHIELDS**

**NOTE** – Hot surfaces such as grating, piping, and hangers can damage the arc face shield. Care should be taken to prevent the arc face shield from coming in contact with hot surfaces.

- 4.1 Face shields worn for protection against potential electric arc exposure shall be rated for a minimum ATPV of 8 cal/cm<sup>2</sup> and appropriate for the flash hazard.
- 4.2 Face shields should be replaced if view will be obstructed due to scratching on the surface of the face shield.
- 4.3 The requirements for face protection are as specified in Attachment 2, Task Matrix.
- 4.4 Safety glasses shall be worn under face shield.

## 5. TOOLS

**NOTE** – Typical tuning tools or "tweakers" are acceptable for use when within the restricted approach boundary of exposed energized parts. These tools are typically made of a non-conductive material. They are used for adjustments on electronic components. Although, they do have an exposed metallic tip, the metallic portion of the tool is not continuous.

- 5.1 Insulated tools, which are rated for the conditions, shall be used for work within the restricted approach boundary of exposed energized parts OR when working in a manner where the tool could be dropped, slip, or otherwise come in contact with exposed energized parts unless:
  - 5.1.1 An insulated tool not manufactured for the situation; OR
  - 5.1.2 Where equipment configuration does not allow for the performance of the work with available insulated tools. Then, the following are required:
    - 5.1.2.1 Use of a rated material such as tape or splice kit as an additional precaution only; AND
    - 5.1.2.2 Use of voltage rated gloves for work ON energized equipment.
- 5.2 Insulated tools shall be inspected prior to use. Upon evidence of damage to the insulating portion of the tool, the tool shall be removed from service.
- 5.3 Live line tools such as hot sticks shall be inspected for defects and wiped down as appropriate prior to use.
- 5.4 Hot sticks shall be used where appropriate to maintain "minimum approach distance".

## 6. WEARING APPAREL/FLAME RESISTANT CLOTHING/FLASH SUITS

**NOTE** – Layering of clothing increases the level of protection to the individual. Clothing made from synthetic materials such as acetate, nylon, polyester, rayon either alone or in blends with cotton shall not be worn unless treated to be flame resistant (FR).

- 6.1 Wearing apparel/clothing when working inside a flash protection boundary shall be flame resistant and appropriate for the potential arc flash conditions.
- 6.2 Wearing apparel/clothing underneath flash suits or flame resistant clothing shall be either flame resistant or a minimum of 100% cotton. Non-melting materials such as other natural fiber fabrics or other items that have been proven to be non-melting and do not continue to burn also meet the intent of this step.

**NOTE** – An incidental amount of elastic used on non-melting fabric underwear or socks is permitted.

- 6.3 Under layers made from meltable fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric under layers (underwear) next to the skin.
- 6.4 When FR clothing is required, wearing apparel/clothing must cover any areas of the body that could be exposed to a flash that are not covered by other approved PPE (i.e., long sleeves are required when individuals are exposed to a flash hazard).
- 6.5 Wearing apparel/clothing when layered should not fit tightly. The air gap between layers of clothing provides additional protection for the individual in the event of a flash.
- 6.6 When flame resistant clothing or flash suits are required, protection for the hands and feet are also required. Voltage-rated gloves with leather protectors are considered appropriate for flash protection as well as shock protection. If voltage-rated gloves are not worn, leather work gloves are required.
- 6.7 Flame resistant clothing that becomes torn or becomes contaminated with oil, grease, flammable or combustible liquids, shall not be worn for flash protection.

**FLAME RESISTANT CLOTHING/FLASH SUIT DESCRIPTIONS**

100% Cotton	<ol style="list-style-type: none"> <li>1. Cotton shirt (long or short sleeved) and cotton pants (denim is acceptable), OR</li> <li>2. 100% cotton scrubs, OR</li> <li>3. 100% cotton Anti-C's.</li> </ol>
FR Clothing	<ol style="list-style-type: none"> <li>1. FR uniform, OR</li> <li>2. FR coveralls, OR</li> <li>3. FR Anti-C's <u>AND</u> 100% cotton shirt (long or short sleeved) and 100% cotton pants or denim.</li> </ol>
Flash Suit with Switching Hood	<ol style="list-style-type: none"> <li>1. Flash suit worn over FR clothing, OR</li> <li>2. Flash suit worn over 100% cotton shirt (long or short sleeved) and 100% cotton pants or denim.</li> </ol>

**TESTING FREQUENCY FOR INSULATED EQUIPMENT**

TYPE OF EQUIPMENT (INSULATED)	TESTING FREQUENCY
Gloves	Before first use, then every 6 months
Blankets	Before first use, then every 12 months
Sleeves	Before first use, then every 12 months
Insulating Hot Sticks	Every 2 years
Rescue Hooks	Every 2 years

**EQUIPMENT CONSIDERATIONS****1. SWITCHGEAR**

- 1.1 Work on switchgear having an energized feeder shall be restricted such that access to the feeder bus/conductor is physically locked, barricaded, and/or posted with a DANGER sign.
- 1.2 When work is to be conducted on a load center/switchgear compartment that has an energized tiebreaker, a physical barrier (i.e., rubber blanket) shall be used to protect from inadvertent contact.

**2. FUSES AND CAPACITORS**

- 2.1 When other disconnect devices are not provided, instrumentation control and power fuses must be removed and controlled to prevent them from being inadvertently reinstalled.
- 2.2 Fuse pullers or insulated gloves, if applicable, used to pull fuses shall be of the same voltage rating or greater for the voltage of the circuit.
- 2.3 Before working on power capacitors, the capacitor shall be disconnected from energized sources, discharged, and shunted or grounded.

**3. ELECTRONIC EQUIPMENT**

**NOTE** – The use of insulated tools and voltage rated gloves may increase the potential for static.

- 3.1 Individuals should take measures to dissipate static prior to touching this type of equipment.

## TEMPORARY PROTECTIVE GROUNDING

**NOTE** – This section establishes requirements for electrical safety when inspecting and installing temporary grounds designed and used to provide personnel protection against inadvertent energizing of electrical equipment.

### 1. GENERAL REQUIREMENTS

**NOTE** – Each site determines the appropriate size of temporary protective grounding cables to be used based on site fault current data.

- 1.1 Temporary protective grounds shall be installed and tagged per site lockout/tagout procedures.
- 1.2 If installation of temporary protective grounds is infeasible, a Job Safety Hazards Analysis must be performed. At a minimum, the following should be addressed:
  - 1.2.1 The circuits/buses are de-energized per the site lockout/tagout procedure.
  - 1.2.2 Possibility of contact with an energized source.
  - 1.2.3 The potential for hazardous induced voltage is not present.
  - 1.2.4 Personal protective equipment requirements.
  - 1.2.5 Other positive methods of control (i.e., use of locks).
- 1.3 Temporary protective grounding cables shall be capable of conducting the maximum ground-fault current that could flow at the point of grounding for the time necessary to clear the fault and keep the worker within a safe equal potential zone.

### 2. CARE AND INSPECTION OF GROUNDS

- 2.1 Temporary protective grounds should be stored in an area relatively free of dirt, dust, and moisture to reduce the possibility of damage.
- 2.2 All temporary protective grounding devices (cables and connections, breakers, ground trucks, etc.) shall be inspected and tested (refer to Step 1.3) prior to use.

### 3. INSTALLATION/REMOVAL OF GROUNDS

- 3.1 Verify the circuit is de-energized and tagged prior to installing temporary protective grounding cables.
- 3.2 Ensure temporary protective grounds have adequate capacity clamps and cable, and are intended for use as temporary protective grounds.

- 3.3 Select a grounding location that is between the work location and all possible sources of electric power but as close as practical to the work location.
- 3.4 Ensure all connections are clean.
- 3.5 When a ground is to be attached to a line or equipment, the ground end connections shall be attached first and then the line or equipment end shall be attached.
- 3.6 When a ground is to be removed, the grounding device shall be removed from the line or equipment before the ground end connection is removed.
- 3.7 Use the shortest grounding cable possible.

**DEFINITIONS**

1. Arc Flash Hazard - A dangerous condition associated with the release of thermal energy by an electric arc.
2. Barricade - A physical obstruction such as tape, cones, or A-frame type wood, metal, or plastic structures intended to provide a warning about and to limit access to a hazardous area.
3. Barrier - A physical obstruction which is intended to prevent contact with exposed energized equipment or to prevent unauthorized access to work areas (example: voltage rated barrier material installed in such a manner as to prevent access to energized area or component).
4. De-Energized - Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of earth. This definition describes an operating condition only; it does not describe a safe condition.
5. Electrical Hazard - A dangerous condition in which inadvertent or unintentional contact or electrical failure can result in shock, arc flash burn, thermal burn, or blast.
6. Electrically Safe - A state in which the conductor or circuit part to be worked on or near (within the limited approach boundary) has been disconnected from the energized parts, locked/tagged in accordance with site procedures, tested to ensure the absence of voltage, and grounded if necessary. Placement of insulating barriers can be used to make a work environment electrically safe, if de-energizing is determined infeasible.
7. Energized - Electrically connected to a source of potential difference or electrically charged.
8. Exposed (Live Parts) - Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.
9. Flash Protection Boundary - A boundary established to prevent an individual from receiving a second-degree burn in the event of an electric arc flash. Individuals entering this boundary must wear flame resistant clothing and other PPE as required. A flash protection boundary is needed when there is reasonable expectation of a flash (see Attachment 5, Establishing Boundaries).
10. Incident Energy - The amount of energy impressed on a surface, at a certain distance from the source, generated during an electrical arc event.
11. Limited Approach Boundary - A shock protection boundary from an exposed energized part that can only be crossed by a qualified individual or an unqualified individual if escorted by a qualified individual.

12. Restricted Approach Boundary - A shock protection boundary from an exposed energized part that can only be crossed by qualified individuals. Crossing this boundary, due to its proximity to a shock hazard, requires the use of shock protection techniques and equipment.
13. Qualified Individual - One who has the skills and knowledge to maintain and operate the associated electrical equipment and has successfully completed Electrical Safety Rulebook Training.
14. Safety Observer - The Safety Observer is an individual who is qualified in First Aid and CPR. The Safety Observer may be a member of the team/crew performing the work. At the point in the activity where the individual is functioning as the Safety Observer, they shall have no other conflicting duties. Example of items that are considered "conflicting duties" are: holding or handling meters, leads, or tools; OR reading prints, procedures, technical texts.
15. Working ON Exposed Energized Equipment (Live Parts) - Coming in contact with live parts with the hands, feet, or other body parts, or with tools, regardless of the personal protective equipment a person is wearing.
16. Working Near Exposed Energized Equipment (Live Parts) - Any activity inside the limited approach boundary of exposed energized equipment (live parts).

## 1. DISCUSSION

### 1.1 SCOPE

- 1.1.1 The requirements in this document apply to work performed by CNS and supplemental personnel on or near energized equipment.
- 1.1.2 The requirements in this document do not apply to:
  - 1.1.2.1 Work in Switchyards and Substations normally performed by Transmission and Distribution personnel or where covered by other procedures.
  - 1.1.2.2 Any actions to mitigate plant transients and conditions as determined by the Shift Manager.

## 2. RESPONSIBILITIES

### 2.1 RESPONSIBLE SUPERVISORS/SUPERINTENDENTS AND ABOVE

- 2.1.1 Monitoring the electrical safety practices of personnel under their direction.
- 2.1.2 Ensuring only qualified individuals are assigned to perform work on or near exposed energized equipment.
- 2.1.3 Ensuring adequate pre-job briefings are performed.
- 2.1.4 Ensure the adequate personal protective equipment and tools are provided.

### 2.2 QUALIFIED INDIVIDUALS

- 2.2.1 Utilizing their knowledge, skills, and experience to perform their job in a safe manner.
- 2.2.2 Proper use and care of personal protective equipment, wearing apparel, and test equipment.
- 2.2.3 Ensuring test equipment is rated for the voltage at which it is used.
- 2.2.4 Ensuring damaged equipment, including test equipment and personal protective equipment, is appropriately tagged and removed from service.

### 2.3 SAFETY OBSERVER

- 2.3.1 Ensure applicable rescue equipment is immediately available.
- 2.3.2 Ensure communication mechanisms are available in case of an emergency.
- 2.3.3 Observe for safety issues.

2.3.4 Provide life-saving care.

2.3.5 Implement emergency actions as identified during the Pre-Job Brief.

2.3.6 Don PPE appropriate to his/her proximity.

2.4 ENGINEERING

2.4.1 Engineering Department is responsible for maintaining arc flash calculations.

3. REFERENCES

3.1 COMMITMENTS AND OBLIGATIONS MATRIX

COMMITMENTS AND OBLIGATIONS	AFFECTED STEPS
QAPD	None
Ⓟ <sup>1</sup> CAT A CR-CNS-2008-05397, CA-5	NOTE prior to Step 2.6 and Step 2.6, NOTE prior to Step 1.2 and Step 1.2 on Attachment 4
Ⓟ <sup>2</sup> SCR 2003-1632, Action #5	2.2 on Attachment 4
Ⓟ <sup>3</sup> CR-CNS-2009-2270, CA-4	1.2
Ⓟ <sup>4</sup> CR-CNS-2009-5450, CA-4	1.3.1, 1.3.2, and 1.3.3, and WARNING prior to Step 1.3 on Attachment 4
Ⓟ <sup>5</sup> CR-CNS-2009-9910, CA-37	Affects CAUTION prior to Attachment 4, Step 1.3

3.2 CODES AND STANDARDS

3.2.1 American Society for Testing and Materials - Collection of ASTM Standards for Electrical Protective Equipment for Workers.

3.2.2 National Fire Protection Association NFPA 70E, Electrical Safety Related Work Practices.

3.2.3 OSHA 29CFR1910.137, Electrical Protective Equipment.

3.2.4 OSHA 29CFR1910.269, Subpart R-Special Industries, Electric Power Generation, Transmission, and Distribution.

3.3 PROCEDURES

3.3.1 Administrative Procedure 0.36, Industrial Safety Procedure.

3.3.2 Administrative Procedure 0.36.7, Electrical Cord Control/GFCI Program.

3.3.3 Maintenance Procedure 7.3.61, Temporary Power.

3.4 MISCELLANEOUS

3.4.1 DED 2003-0008, Electrical Safety Requirements based on NFPA 70E-2000.