

CALLAWAY ENERGY CENTER - AMEREN HAZARDOUS RISK CATEGORIES (AHRC) FOR ARC FLASH EXPOSURE

1.0 VOLTAGE AND BUS CLASSIFICATION MATRIX

Voltage and Bus Classification	Bounding Fault Location	Limited Approach Boundary	Restricted Approach Boundary	Incident Energy (Cal/cm ²)	Arc Flash Boundary	Ameren Hazardous Risk Category
50-300 volts	PPPY331 LPPG111	3 feet 6 inches	Avoid Contact	0.3	10 inches	AHRC 0
301 - 600 Volts Load Side Molded Case Circuit Breaker (MCCs , etc)	PG11J	3 feet 6 inches	14 inches	7.9	6 feet	AHRC 2
301 – 600 Volts	PG133 / PG234	3 feet 6 inches	14 inches	13.7	11 feet	AHRC 3
601 – 4160 Volts	PB04	5 feet	26 inches	22.2	60 feet	AHRC 3
>4160 – 13,800 Volts	SITE RING	5 feet	26 inches	26.4	72 feet	AHRC 4
345 KV (Open Air)	345 Open Air Line	15 feet 4 inches	9 feet 2 inches	Not Calculated	10 feet	AHRC 2*

2.0 AHRC CATEGORIES AND PPE REQUIREMENTS

Ameren Hazard Risk Categories	Arc Flash PPE Legend Minimum PPE Requirements
AHRC 0 (<1 cal /cm ²)	Non-arc rated PPE Appropriate natural fiber shirt with pants or coverall and safety glasses or goggles.
AHRC 1 (1 – 4 cal/cm ²)	Minimum Arc Rating 4 cal/cm ² (As long as business segment's arc rated policy allows) Appropriate arc rated long sleeve shirt and pants or coverall; appropriate rated rubber gloves with protectors; safety glasses with arc rated face shield or flash hood; arc rated jacket, parka, or rainwear as needed; electric rated hard hat; safety glasses or goggles; primarily leather safety footwear; and hearing protection (ear canal inserts). For AHRC 1, the shirt SHALL be tucked in at the pants and ALL neck and sleeve buttons SHALL be buttoned. This is NOT a requirement for AHRC 3, 4, or 5 when an arc rated suit is being worn over the top of the arc rated shirt and pants.

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Ameren Hazard Risk Categories	Arc Flash PPE Legend Minimum PPE Requirements
<p>AHRC 2 (>4 – 8 cal/cm²)</p>	<p style="text-align: center;">Minimum Arc Rating 8 cal/cm²</p> <p>Appropriate arc rated long sleeve shirt and pants or coveralls; appropriate rated rubber gloves with protectors; arc rated flash suit hood; arc rated jacket, parka, or rainwear as needed; electric rated hard hat; safety glasses or goggles; primarily leather safety footwear; and hearing protection (ear canal inserts).</p> <p>For AHRC 2, the shirt SHALL be tucked in at the pants and ALL neck and sleeve buttons SHALL be buttoned. This is NOT a requirement for AHRC 3, 4, or 5 when an arc rated suit is being worn over the top of the arc rated shirt and pants.</p> <p>NOTE: 8 cal/cm² arc rated balaclava and arc rated face shield may be used as a substitute for the arc rated flash suit hood. Properly wearing of the 8 cal/cm² balaclava, buttoning of the top button of the arc rated shirt is not required.</p>
<p>AHRC 3 (>8 – 25 cal/cm²)</p>	<p style="text-align: center;">Minimum Arc Rating 25 cal/cm²</p> <p>Appropriate arc rated shirt and pants***; appropriate rated rubber gloves with protectors; arc rated flash suit jacket; arc rated flash suit pants; arc flash suit hood; arc rated jacket, parka, or rainwear as needed; electric rated hard hat (arc rated liner as required); safety glasses or goggles; primarily leather safety footwear; and hearing protection (ear canal inserts).</p>
<p>AHRC 4 (>25 – 40 cal/cm²)</p>	<p style="text-align: center;">Minimum Arc Rating 40 cal/cm²</p> <p>Appropriate arc rated shirt and pants***; appropriate rated rubber gloves with protectors; arc rated flash suit jacket; arc rated flash suit pants; arc flash suit hood; arc rated jacket, parka, or rainwear as needed; electric rated hard hat (arc rated liner as required); safety glasses or goggles; primarily leather safety footwear; and hearing protection (ear canal inserts).</p>
<p>AHRC 5 (>40 – 100 cal/cm²)</p>	<p style="text-align: center;">Minimum Arc Rating 100 cal/cm²</p> <p>Appropriate arc rated shirt and pants***; appropriate rated rubber gloves with protectors; arc rated flash suit jacket; arc rated flash suit pants; arc flash suit hood; arc rated jacket, parka, or rainwear as needed; electric rated hard hat (arc rated liner as required); safety glasses or goggles; primarily leather safety footwear; and hearing protection (ear canal inserts).</p>
<p>AHRC 6 (over 100 cal/cm²)</p>	<p style="text-align: center;">DO NOT WORK ENERGIZED</p>
	<p>All AC and DC Circuits at the Callaway Energy Center have been evaluated in the Arc Flash Study and the above boundary fault locations are the most limiting.**</p>

* Required when crossing the Arc Flash Boundary (AFB).

** The table in Section 5.2.1 of the ESWPM for short circuit currents between 7 kA and 15 kA shall be used for the large batteries (NK, PK) and lines up to the first fuse box (AHRC 3).

*** At Callaway Energy Center 100% Natural Fiber Clothing meets the requirement for appropriate arc rated shirt and pants.

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- 2.1. There is no established method to calculate an incident energy for protective clothing requirements. Based on an engineering recommendation and taking the conservative approach is why AHRC 4 will be the required PPE when installing grounds on the Iso-Phase Bus when the plant is in a shutdown condition with the steam to the main turbine isolated with WPA Hold-Off tags, and the switchyard output breakers open with WPA Hold-Off tags, visual verification of double breaks, and that the 345 kV ground switch, MDV54G, is closed.
- 2.2. When the Iso-Phase is being fed from either the Generator side or the Switchyard side, the incident energy is greater than 40 cal/cm² so work cannot be performed on the Iso-Phase when energized.

3.0 REDUCTION IN ARC FLASH PPE DUE TO PLANT STRUCTURAL COMPONENTS (CR 201509084)

- 3.1. Callaway Energy Center had site engineering do an evaluation, which is documented in CA1 of CR 201509084. Based on that review, the following Line of Sight from a potential Arc Flash Point will incorporate the following guidelines:
 - 3.1.1. The plant structure would have to be constructed of sheet metal, structural steel, masonry, or concrete. The structure shall be at least 7 feet tall and 3 feet wide. The structure shall be stationary (non-movable) to prevent the structure from moving if an ARC flash occurred. If working in a cubicle, or racking a breaker in or out, even with the above structures in place, the individual shall be at least three cubicles away from the cubicle where the potential ARC flash could occur.
 - 3.1.2. The PPE requirements when following the above guidelines would be reduced to standard PPE that is required for being in the power block of the Callaway Energy. However, if an individual is outside of the guidelines listed above, but within the AFB for the electrical component, then the required AHRC PPE will be required. These guidelines were reviewed and agreed upon by Operations, Engineering, Safety, and the Maintenance Electrical Manager.
 - 3.1.3. Since the Safety Observer is required to be in continuous visual contact with the individual doing the electrical work, this recommendation cannot be used by the Safety Observer.

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4.0 **REFERENCES**

4.1. Developmental

4.1.1. ESWM, Electrical Safe Work Practices Manual

4.1.2. CR 201509084

5.0 **SUMMARY OF CHANGES**

Pages	Section or Step Number	Description
	Throughout	Updated formatting to align with Callaway Standards