

**Shock Protection Boundaries and PPE  
Fermilab Summary for NFPA 70E**

<b>System Voltage Range Phase to Phase</b>	<b>Limited Approach Boundary (Fixed Parts) (LAB)</b>	<b>Restricted Approach Boundary (RAB)</b>	<b>Prohibited Approach Boundary (PAB)</b>	<b>Shock Protection Insulating PPE</b>
<b>50 to 300</b> Including 120, 277 and 120/208	<b>3 Ft 6 In</b>	<b>Avoid Contact</b>	<b>Avoid Contact</b>	<b>LAB - None RAB - Wear/Use if Contact Likely PAB - Wear/Use if Contact Likely</b>
<b>301 to 750</b> Including 480/277	<b>3 Ft 6 In</b>	<b>1 Foot</b>	<b>1 Inch</b>	<b>LAB - None RAB - Must Wear PAB - Must Wear</b>
<b>751 to 15K</b> Including 13.8K	<b>5 Feet</b>	<b>2 Ft 2 In</b>	<b>7 Inches</b>	<b>LAB - None RAB - Must Wear PAB - Must Wear</b>
<b>345K to 362K</b>	<b>15 Ft 4 In</b>	<b>9 Ft 2 In</b>	<b>8 Ft 8 In</b>	<b>LAB - None RAB - Must Wear PAB - Must Wear</b>

<b>Within the Limited Approach Boundary</b>	<b>Non-Qualified Worker Allowed Within Only if Advised and Escorted by a Qualified Worker. Insulated Equipment/Tools if Contact Likely.</b>
<b>Within the Restricted Approach Boundary</b>	<b>Only Qualified Worker Allowed Within. May Not Cross Into with Conductive Objects. Conductive Objects Prohibited. Body Parts Must be Insulated.</b>
<b>Within the Prohibited Approach Boundary</b>	<b>Consider Activity as Same as Working On.</b>

**Arc-Flash Hazard/Risk Categories - Required Clothing - Required PPE**  
**Fermilab Summary for NFPA 70E**

Calculated Exposure from Prospective Arc-Flash	Hazard/Risk Category	Minimum Required Arc-rating	Clothing Requirements	Additional PPE
Zero up to 1.2 cal/cm <sup>2</sup>	<b>0</b>	<b>NA</b>	Long Sleeve Cotton Shirt and Pants	Safety Glasses, Hearing Protection, Leather Gloves
More than 1.2 and up to 4 cal/cm <sup>2</sup>	<b>1</b>	<b>4 cal/cm<sup>2</sup></b>	FR Coverall*	Hard Hat, Safety Glasses, Arc-rated Face Shield, Hearing Protection, Leather Gloves, Leather Work Shoes
More than 4 and up to 8 cal/cm <sup>2</sup>	<b>2</b>	<b>8 cal/cm<sup>2</sup></b>	Cotton Clothing Under FR Coverall*	Hard Hat, Safety Glasses, Arc-rated Face Shield, Hearing Protection, Leather Gloves, Leather Work Shoes
More than 4 and up to 8 cal/cm <sup>2</sup>	<b>2*</b>	<b>8 cal/cm<sup>2</sup></b>	Cotton Clothing Under FR Coverall*	Hard Hat, Safety Glasses, Flash Suit Hood, Hearing Protection, Leather Gloves, Leather Work Shoes
More than 8 and up to 25 cal/cm <sup>2</sup>	<b>3</b>	<b>25 cal/cm<sup>2</sup></b>	Cotton Clothing Under FR Coveralls* plus Multilayer Flash Suit Jacket & Pants	Hard Hat, FR Hard Hat Liner, Safety Glasses, Flash Suit Hood, Hearing Protection, Arc-Rated Gloves, Leather Work Shoes
More than 25 and up to 40 cal/cm <sup>2</sup>	<b>4</b>	<b>40 cal/cm<sup>2</sup></b>	Cotton Clothing Under FR Coverall* plus Multilayer Flash Suit Jacket & Pants	Hard Hat, FR Hard Hat Liner, Safety Glasses, Flash Suit Hood, Hearing Protection, Arc-Rated Gloves, Leather Work Shoes
* Coverall Rated at 8 cal/cm <sup>2</sup> Available from Fermilab Stockroom				

**Simplified Guidance for Electrical Work on Fermilab AC POWER DISTRIBUTION Equipment**  
**Diagnostic Work Including LOTO Voltage Testing Unless Otherwise Noted, Plus Some Additional Operations**

Equipment	Voltage	Rated Full Load Current	Hazard/Risk Category	Conditions or Qualifications
Primary Panelboards SWBD DHP	480/277 VAC	More than 1,200 Amps	3	Primary Transformer Larger than 1000 KVA (Assuming More Than 25,000 ISC Available with Fault Clearing Time >2 Cycles) Take Advantage of Installed Panelboard Meter for LOTO Verification if Present.
Motor Control Centers MCC	480 VAC	Typical 600 Amps and Above	2*	Take Advantage of Installed Central Monitoring Unit for LOTO Verification if Present
Primary or Secondary Panelboards DHP PHP LP	480/277 VAC	400 to 1,200 Amps	2*	Proximity to Transformer Power Source Presumed
Operating 13.8 KV Disconnects with Doors Closed	13.8 KV	NA	2	Booster Brentford or RF Anode Power Supplies are Examples
Secondary Panelboards PHP LP	480/277 VAC	100 to 225 Amps	1	More Than 200 Feet from Panelboard Sourcing Power
Work in Lighting Panelboards (LP) including LOTO Verification	480/277 VAC	100 Amps	1	More Than 100 Feet from Secondary Panelboard Sourcing Power
Work in Utility Panelboards including LOTO Verification	120/208 VAC 120/240 VAC	Below 350 Amps	0	Circuits Fed With Transformers Less Than 125 kVA NFPA 70E 130.3 Exception 1 Knowing Transformer KVA and %IZ, Apply Formula for Suspect Installations
Operating Circuit Breakers and Disconnect Switches with Covers On or Closed	480/277 VAC	NA	0	Requirement Direct from NFPA 70E 130.7(C)(9)
	120/208 VAC 120/240 VAC	NA	0	Requirement Direct from NFPA 70E 130.7(C)(9)

**This Simplified Table for AC Power Distribution Equipment Has Been Approved by the Electrical Safety Subcommittee.**

**If Stated Conditions or Qualifications Are Not Met or the Circumstances of the Work Activity Appear Unique, Refer to NFPA 70E Table 130.7(C)(9) or Consult with Your D/S Electrical Coordinator.**

**Simplified Guidance for Electrical Work on Fermilab UTILIZATION Equipment**  
**Diagnostic Work Including LOTO Voltage Testing Unless Otherwise Noted**

<b>Equipment</b>	<b>Voltage</b>	<b>Sourcing Branch CB</b>	<b>Hazard/Risk Category</b>	<b>Conditions or Qualifications</b>
Power Supplies	480 VAC	Various	<b>Can Range from 1 to 3</b>	Ask Your Department for an Assessment. Take Advantage of Installed Panel Meters for LOTO Verification.
Various Equipment	480 VAC or 480/277 VAC	100 to Less than 400 Amps	<b>2</b>	Distance from Primary Panelboards and Feed Conductors Limit Available Fault Currents
Various Equipment	480 VAC or 480/277 VAC	Less Than 100 Amps	<b>1</b>	Distance from Primary Panelboards and Feed Conductors Limit Available Fault Currents
Sump Pump Controllers Motor Controllers HVAC Equipment	480 VAC	60 Amps and Below	<b>1</b>	Distance from Primary Panelboards and Feed Conductors Limit Available Fault Currents
Ballasts and Light Fixtures	277 VAC	30 Amps and Below	<b>0</b>	Typical Lighting Ballast
Power Supplies	208 VAC	350 Amps and Below	<b>0</b>	Circuits Fed With Transformers Less Than 125 kVA NFPA 70E 130.3 Exception 1 Knowing Transformer KVA and %IZ, Apply Formula for Suspect Installations
Various Equipment	120/208 VAC	350 Amps and Below	<b>0</b>	Circuits Fed With Transformers Less Than 125 kVA NFPA 70E 130.3 Exception 1 Knowing Transformer KVA and %IZ, Apply Formula for Suspect Installations
Various Equipment	120 VAC	30 Amps and Below	<b>0</b>	Circuits Fed With Transformers Less Than 125 kVA NFPA 70E 130.3 Exception 1 Knowing Transformer KVA and %IZ, Apply Formula for Suspect Installations

**This Simplified Table for Utilization Equipment Has Been Approved by the Electrical Safety Subcommittee.**  
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