



Electrical Safety: Shock Protection Boundaries





1. Key Safety Boundaries

The document defines two main types of approach limits:

Limited Approach Boundary: This is the distance from an exposed energized conductor within which a shock hazard exists.

Unqualified persons (those without specific electrical training) may only cross this boundary if they are accompanied by a **qualified person**.

The table distinguishes between **Movable** conductors (flexible cables) and **Fixed** circuit parts (like busbars in a panel).

Restricted Approach Boundary: This is the distance closest to the energized part.

Only qualified personnel are allowed to enter this zone.

It requires the use of specialized **Personal Protective Equipment (PPE)**, such as insulated gloves and tools.

It accounts for the fact that a person might slip or make an inadvertent movement.





2. How to Read the Table (Examples)

The safety distance increases as the **Phase-to-Phase Voltage** increases.

Voltage Range (Volts)	Limited Boundary (Fixed)	Restricted Boundary
50 – 150 V (Common household/office)	3 ft 6 in (~1.07 m)	Avoid contact
151 – 750 V (Standard industrial)	3 ft 6 in (~1.07 m)	1 ft (~30 cm)
15001 – 36000 V (High voltage)	6 ft (~1.83 m)	2 ft 9 in (~84 cm)
72600 – 121000 V (Very high voltage)	8 ft (~2.44 m)	3 ft 6 in (~1.07 m)





3. Important Notes

Less than 50V: Boundaries are "Not specified" because these voltages are generally not considered a lethal shock hazard under normal conditions.

Movable vs. Fixed: You will notice that for "Movable" conductors, the Limited Approach Boundary is always **10 feet** (up to 72.5kV). This is because a moving cable is less predictable than a fixed part.

Disclaimer: The text at the bottom notes that this table is an adaptation and not the complete official position of the NFPA. Always consult the full NFPA 70E manual for official safety protocols.






Arc-Flash Equipment Label

The available incident energy at the working distance. Instead of the available incident energy and the corresponding working distance, the arc-flash PPE category could have been on this label. See NFPA 70E, 130.5(H).

When an arc flash hazard exists, this is the distance from an arc source at which incident energy equals 1.2 cal/cm^2 . The onset of a second-degree burn is assumed to be when the skin receives 1.2 cal/cm^2 of incident energy.

When incident energy is on the label, it is based on a working distance so the working distance has to be on the label as well.

 WARNING	
Arc Flash and Shock Hazard Appropriate PPE Required	
2' - 10" 3.7	Arc Flash Boundary cal/cm ² Arc Flash Hazard at 18 Inches Working Distance
208 VAC 3' - 6" 1' - 0"	Shock Hazard when Cover is Removed Limited Approach Boundary Restricted Approach Boundary - Class 00 Voltage Rated Gloves
03-26-2019	Panel LJM (Fed from MDP) C. R. Miller Engineering

Date the incident-energy analysis (arc-flash analysis) was performed.

Class of voltage-rated glove. The maximum use voltage (ac) for a Class 00 insulated rubber glove is 500 volts.

Identification or name of the equipment.

Nominal system voltage at the equipment.

Closest of the two shock boundaries. Shock boundaries are determined by nominal system voltage measured phase-to-phase.

Farthest of the two shock boundaries. See NFPA Table 130.4(D)(a).





Key Components of the Label

- **Arc Flash Boundary:** This represents the distance from an arc source where the incident energy equals 1.2 cal/cm^2 . This specific value is significant because it is the threshold at which a second-degree burn is assumed to occur on unprotected skin.
- **Incident Energy and Working Distance:** The label specifies the calculated incident energy (3.7 cal/cm^2 in this example) at a specific working distance (18 inches). This data helps determine the appropriate level of Personal Protective Equipment (PPE) needed.
- **Nominal System Voltage:** The voltage of the equipment, measured phase-to-phase (e.g., 208 VAC), which identifies the level of shock hazard present when covers are removed.
- **Shock Protection Boundaries:**
 - **Limited Approach Boundary:** The farthest of the two shock boundaries ($3'-6''$ in this example).
 - **Restricted Approach Boundary:** The closest of the two shock boundaries ($1'-0''$ in this example), which defines the distance at which only qualified personnel with proper PPE may enter.
- **Required PPE Specifics:** The label may specify requirements like the class of voltage-rated gloves (e.g., Class 00, which is rated for a maximum of 500 volts AC).
- **Administrative Data:** Includes the equipment identification (Panel LJM), the date the incident-energy analysis was performed (03-26-2019), and the engineering firm that conducted the study.





Regulatory Context

- **Mandatory Marking:** According to **NFPA 70E, 130.5(H)**, equipment such as switchboards, panelboards, and motor control centers that may require maintenance while energized must be field-marked with these labels.
- **Alternatives:** Labels may display either the available incident energy or the required arc-flash PPE category, but not necessarily both.

