

## Interpretation of the Electrical Safety Committee – August 2009

### When Electrical Equipment is Not A Shock Hazard

#### Summary

Electrical equipment operating above 50 volts and below 10,001 volts, but incapable of delivering greater than 5 mA of current or an acute energy discharge of 10 joules, are not electrical shock hazards. Secondary hazards such as the persons reaction to receiving a mild shock, such as dropping a tool or stepping off a ladder, exist and must be addressed in work planning. Working on such equipment shall not require lockout tagout or special PPE. The minimal training required is Basic Electrical (HP-OSH-150A) and equipment specific training by the organization.

#### Relevant Codes Sections

##### NFPA 70 E

###### Article 110.8 (B)

Under General Requirements for Electrical Safety Work Practices, NFPA 70 E **article 110.8 (B)** states, “Prior to working on or near exposed electrical conductors and circuit parts operating at 50 volts or more, lockout / tagout devices shall be applied.....”

###### Article 340.5 (1)

Article 340.5 of “Hazards Associated with Power Electronic Equipment” states at 5 mA shock is perceptible, the let go limit is 10 mA, and it takes a 40 mA shock lasting 1 second to cause ventricular fibrillation.

###### Article 340.5 (7)

Article 340.5 (7) states a capacitive discharge of 1 microfarad at 10 kV (50 joules) may cause ventricular fibrillation.

#### Discussion / Analysis

Shocks from currents below 5 mA are perceivable. Greater than 99.5 percent of people exposed to this current are able to let go of it. -Currents in the range of 20 to 40 mA-, passing through the chest, are required to -arrest respiration and currents of 40 mA are required for ventricular fibrillation. -An upper limit of 5 mA, therefore, would allow working without PPE or LOTO with a safety factor of at least 4. -NFPA 70 E states that 50 joules (1 uF@10 kV) “may cause ventricular fibrillation” Selecting 10 joules as an allowable amount of stored energy for is a conservative level for safety with a safety factor of at least 5.

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### References

**Definition:** Acute discharge energy is a one time discharge of energy in less than 10 ms.

#### **DOE Handbook-Electrical Safety (DOE-HDBK\_1092-2004)**

**Figure 10.1** *Process for the analysis of circuit hazards.*

This chart indicates that for systems incapable of producing more than 5 mA of current or 10 Joules of acute discharge energy protection against shock hazards is not required. Such systems require protection against secondary hazards only.

#### **IEEE Std 80-2000 IEEE Guide for Safety in AC Substation Grounding**

“Current of 1-6 mA, often termed let-go currents, though unpleasant to sustain, generally do not impair the ability of a person holding an energized object to control his muscles and release it.”