

**DOCUMENT REVISION**

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**Electrical Hazard Classification Table**

The USA DOE has developed and implemented an Electrical Safety Program. In reviewing the Electrical hazards related to their work and work tasks performed they created a comprehensive electrical hazard classification system and then applied this against work tasks and developed and implemented a comprehensive qualitative risk assessment process that included a related risk matrix. In Table 1 below I have provided a simple summary of the electrical hazard classifications the USA DOE initially created and evolved over the years. Some of the information is also extracted/validated from other information sources as noted below.

**Table 1 – Summary of Electrical Hazard Classification<sup>1</sup>**

Electrical Hazard Classification Voltage or Electrical Equipment	Potential Severity of Injury or Damage to Health
<b><u>50/60hz ac Electrical Equipment.</u></b> Abnormal arcing fault, no arc flash. Shock hazard. <ul style="list-style-type: none"> <li>• ≤30VAC, CSA Z462. No shock.</li> <li>• &lt;50VAC, NFPA 70E. No shock.</li> <li>• 120VAC single phase.</li> <li>• 240VAC single phase.</li> <li>• 277VAC single phase.</li> <li>• 347VAC single phase.</li> </ul>	<b><u>Abnormal Arcing Fault:</u></b> Resulting in potential thermal exposure burn injury to the Qualified Person's hands, noise, ejected molten metal, and bright light. <b><u>Electric Shock Effects:</u></b> <ul style="list-style-type: none"> <li>• ≥30VAC, CSA Z462.</li> <li>• ≥50VAC, NFPA 70E.</li> <li>• Current flow into body, survivable injury.</li> <li>• Electrocution.</li> <li>• Electric shock sequela.</li> </ul>
<b><u>50/60hz ac Electrical Equipment.</u></b> Abnormal arcing fault resulting in an arc flash. Shock hazard. <ul style="list-style-type: none"> <li>• ≥208VAC three phase, 2000A available fault current.</li> <li>• 480VAC/600VAC three phase.</li> <li>• &gt;1000VAC.</li> </ul>	<b><u>Abnormal Arcing Fault and Arc Flash</u></b> <b><u>Multiple Potential Effects:</u></b> <ul style="list-style-type: none"> <li>• Thermal burn injury.</li> <li>• Expansion of air resulting in arc blast pressure.</li> <li>• Molten metal/shrapnel.</li> <li>• UV/IR light.</li> <li>• Toxic smoke/vapour.</li> <li>• Noise</li> </ul> <b><u>Electric Shock Effects:</u></b>

	<ul style="list-style-type: none"> <li>• Current flow into body, survivable injury.</li> <li>• Electrocution.</li> <li>• Electric Shock Sequela.</li> </ul>
<p><b><u>Batteries:</u></b></p> <ul style="list-style-type: none"> <li>• ≤60VDC, CSA Z462. No shock.</li> <li>• &lt;50VDC, NFPA 70E. No shock.</li> <li>• ≥125VDC power e.g. UPS battery rack or other DC power source.</li> </ul>	<p><b><u>Abnormal arcing fault and arc flash multiple potential effects:</u></b></p> <ul style="list-style-type: none"> <li>• Thermal burn injury.</li> <li>• Expansion of air resulting in arc blast pressure.</li> <li>• Molten metal/shrapnel.</li> <li>• UV/IR light.</li> <li>• Toxic smoke/vapour.</li> <li>• Noise.</li> </ul> <p><b><u>Electric Shock Effects:</u></b></p> <ul style="list-style-type: none"> <li>• Current flow into body, survivable injury.</li> <li>• Electrocution.</li> <li>• Electric Shock Sequela.</li> </ul>
<p><b><u>Capacitors</u></b></p> <p>Hazard Thresholds (NFPA 70E, Article 360.3:</p> <ul style="list-style-type: none"> <li>• &lt;100V and &gt;100J stored energy.</li> <li>• ≥100V and &gt;1.0 J of stored energy.</li> <li>• ≥400V and &gt;0.25 J of stored energy.</li> </ul>	<p><b><u>Abnormal Arcing Fault:</u></b></p> <ul style="list-style-type: none"> <li>• &gt;120kJ, &gt;1.2 cal/cm<sup>2</sup>.</li> <li>• Thermal hazard if &gt;100J of stored energy.</li> <li>• Acoustical shock wave, hearing protection &gt;100J of stored energy.</li> </ul> <p><b><u>Electric Shock Effects:</u></b></p> <ul style="list-style-type: none"> <li>• Function of energy, risetime, pulse length and body impedance.</li> <li>• Impulse shock.</li> <li>• ≥100V threshold.</li> <li>• <u>Energy delivered, 1 to 10ms:</u></li> <li>• Slight sensation, 0.05 to 1mJ.</li> <li>• Disagreeable, 5 to 100mJ.</li> <li>• Painful, 0.1 to 0.5J.</li> <li>• Injury likely, 1 to 50J.</li> <li>• Fibrillation likely, 50 to 1000J.</li> </ul> <p><b><u>Other:</u></b></p> <ul style="list-style-type: none"> <li>• Lung protection boundary, &gt;122kJ.</li> <li>• Fire hazard, dielectric fluids. Toxic vapours.</li> </ul>
<p><b><u>RF</u></b></p> <ul style="list-style-type: none"> <li>• &gt;3kHz to 100MHz.</li> </ul>	<p><b><u>Shock/Burn Threshold:</u></b></p> <ul style="list-style-type: none"> <li>• <b><u>0.003 to 0.1 MHz:</u></b></li> <li>• ≤1000f mA. No injury, no controls</li> <li>• &gt;1000f mA. Injury or fatality.</li> </ul>

	<ul style="list-style-type: none"> <li>• <b><u>0.1 to 100 MHz:</u></b></li> <li>• ≤100mA. No injury, no controls.</li> <li>• &gt;100mA. Injury or fatality.</li> </ul>
<p><b><u>Sub-RF</u></b></p> <ul style="list-style-type: none"> <li>• 1Hz to 3kHz.</li> </ul>	<p><b><u>Thermal Threshold:</u></b></p> <ul style="list-style-type: none"> <li>• <b><u>≤50V:</u></b></li> <li>• ≤1000 W. No injury, no controls.</li> <li>• ≥1000 W. Injury or fatality.</li> <li>• <b><u>50-250V:</u></b></li> <li>• ≤5 mA. No injury, no controls.</li> <li>• &gt;5 mA. Injury or fatality.</li> <li>• <b><u>&gt;250V:</u></b></li> <li>• <b><u>Shock threshold:</u></b></li> <li>• ≤5 mA. No injury, no controls.</li> <li>• 5-75 mA. Injury or fatality.</li> <li>• <b><u>Arc Flash Threshold:</u></b></li> <li>• 75 mA to 500A. Injury or fatality.</li> <li>• &gt;500A. Very serious, avoid work.</li> </ul>

Note: This is a summary table only and may not be a complete reference. See Note 1 below.

**<sup>1</sup>References:**

1. CSA Z462 Workplace electrical safety Standard, 2021 Edition. CSA Group, Mississauga, ON.
2. NFPA 70E Standard for Electrical Safety in the Workplace, 2021 Edition. NFPA, Quincy, MA.
3. IEEE 1584 Guide for Performing Arc-Flash Hazard Calculations, 2018 Edition. IEEE, New York, NY.
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