Energy 141

Electrical & Mechanical Applications for Solar Installers

Energy Instructor

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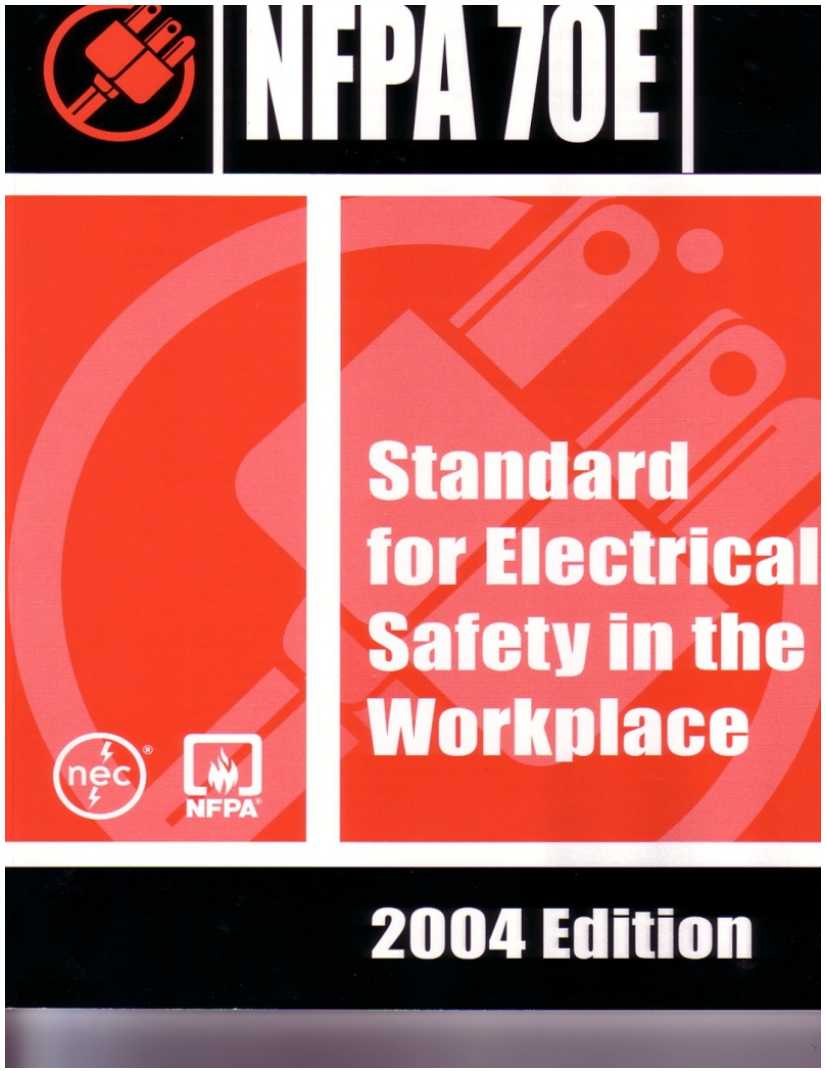
AMERICAN RIVER COLLEGE

Welcome!

Lesson Plan

- Welcome
- Course Overview
- Syllabus and Calendar
- Ground Rules
- Introductions
- Resources
- Safety Refresh
- Class Labs

Electrical Safety in the Workplace



NEC - OSHA - NFPA 70E

- NEC – National Electric Code NFPA 70
- OSHA 1910 and 1926

  Subparts S and K Relate to Electricity
- NFPA 70E – Electrical Safety in the Workplace

Some Statistics

- 286 Fatalities and 4,100 cases of lost time due to electrical shock or electrical burns each year from 1992-1998
  - 98% of the fatalities due to electrical shock
  - 38% injuries were due to flash burns
- 113 electrocutions in 2004
- Financial costs can be staggering
  - Can exceed $13 Million for one incident

Consequences of an Arc-Flash Incident

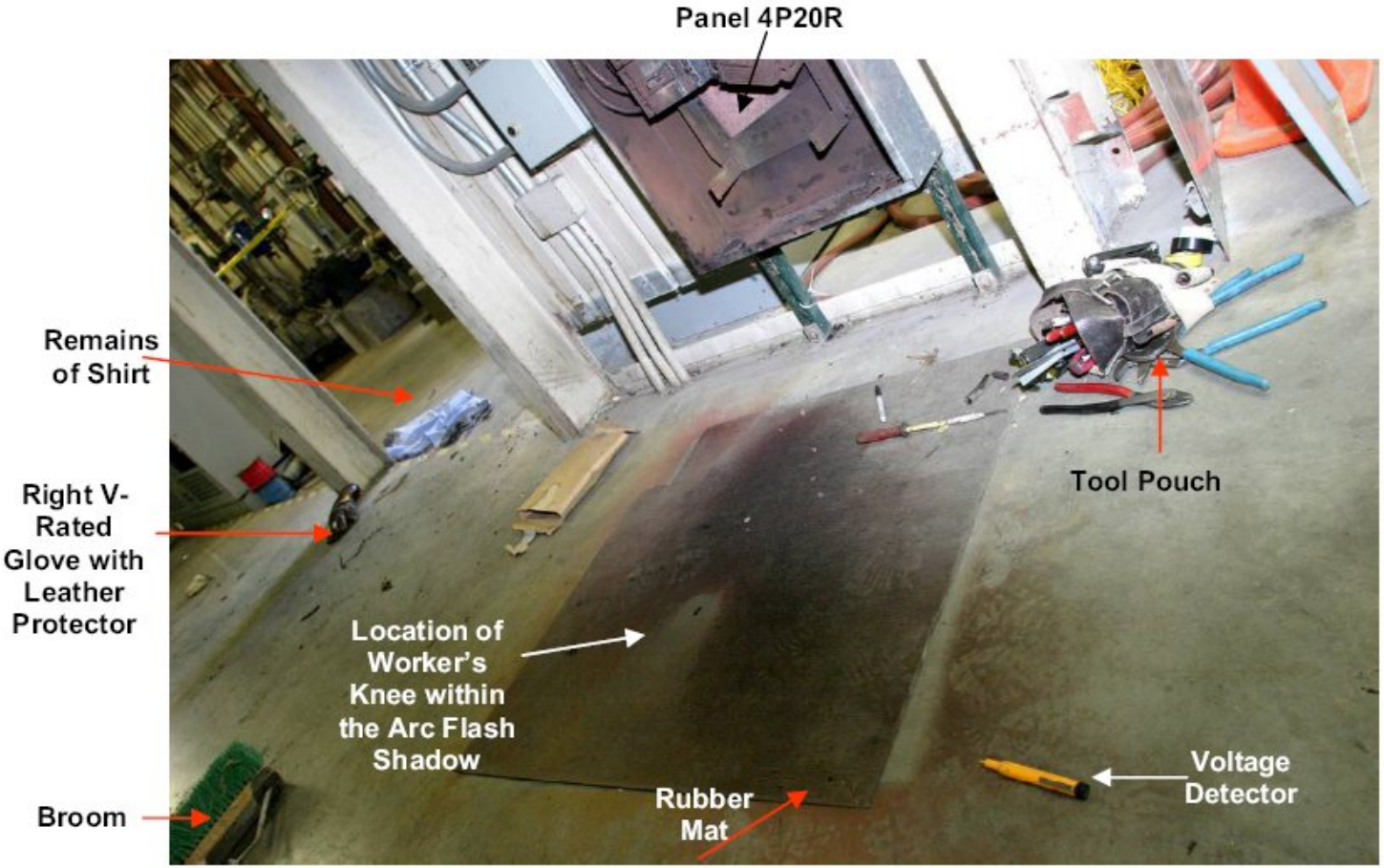


Figure 2-3. The insulating mat with the outline of BSE-1's knee in the arc flash shadow

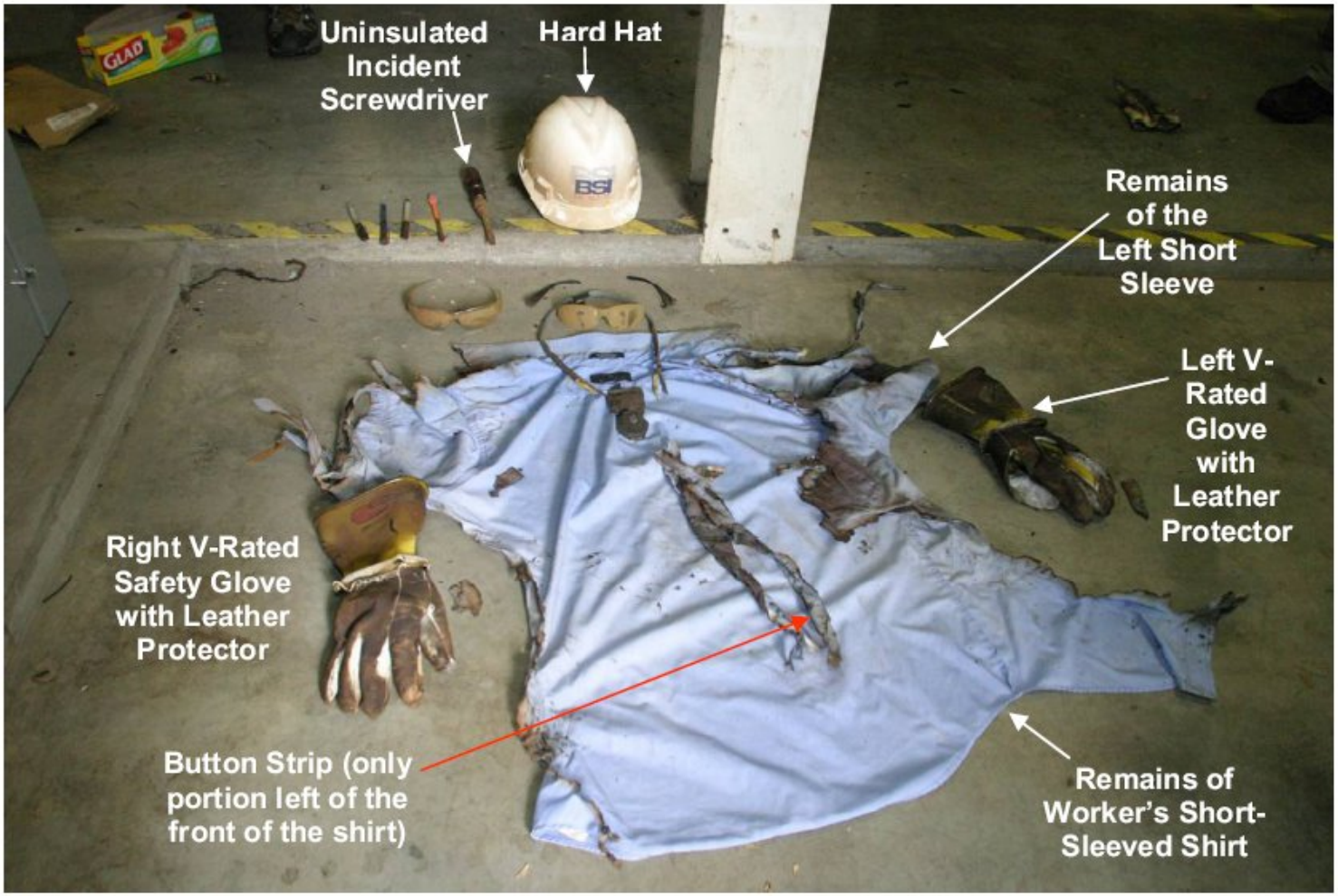


Figure 2-6. BSE-1's burned shirt and his flash-damaged PPE and tools

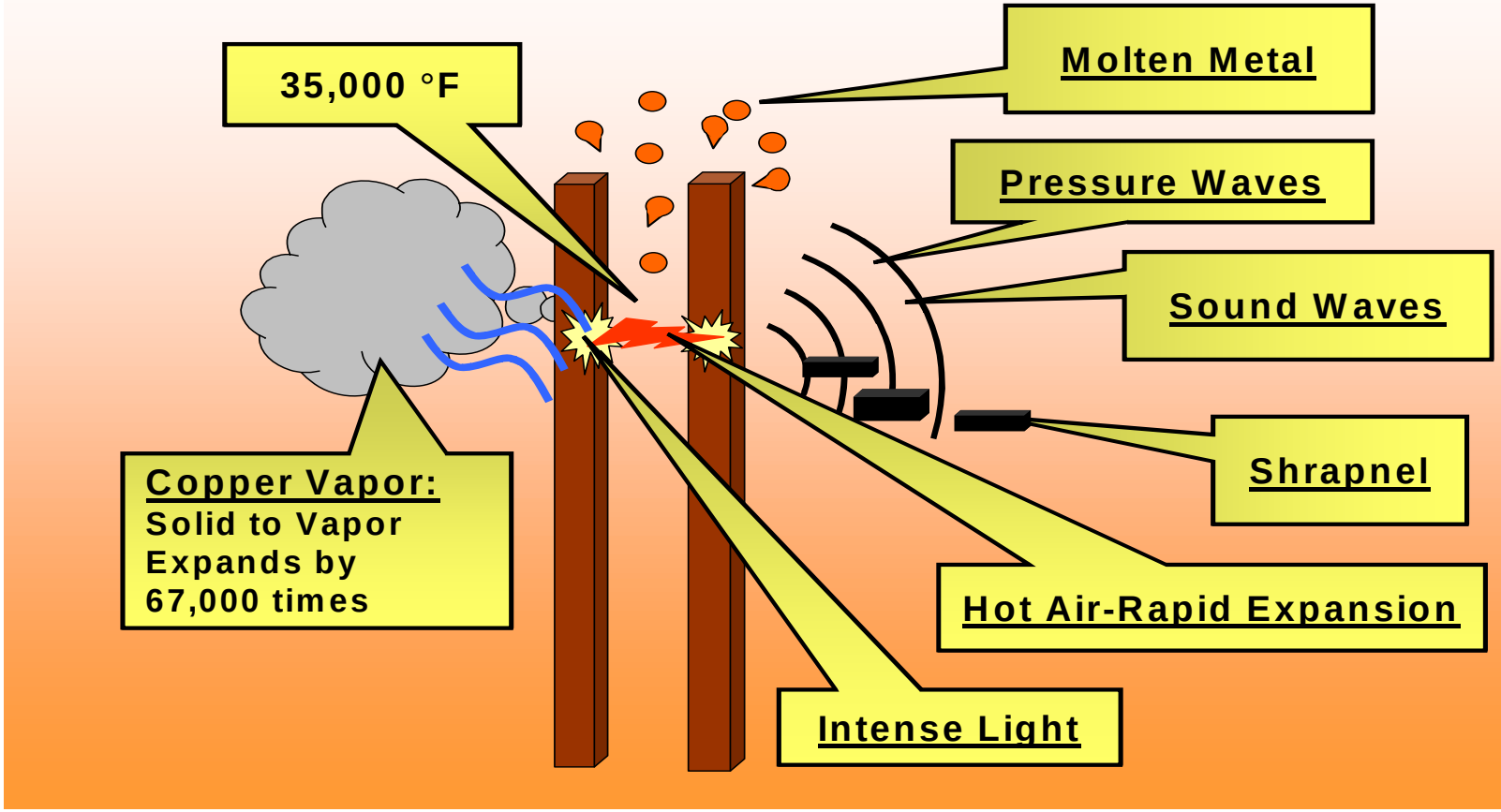
Hazards of Electricity

- Electric Shock and Electrocution
  - Electric Current through Body – Electrocution and Burns
- Arc-Flash
  - Burns due to high heat and molten metal
  - Fire Ignition
- Arc-Blast
  - Hearing loss due to blast explosion
  - Lacerations/Punctures from blast debris
  - Percussion force
  - Explosion

Arc-Flash

- Electric current passes through air, between a “Hot” conductor and ground, or between “Hot” conductors
- Temperatures can reach 35,000 ^{0}F
- Exposure can easily cause skin burns & ignite clothing
- Clothing or PPE that Burns and Melts is a Real Problem

Electrical Arc



Mitigation of Electrical Hazards

- Work De-Energized
- Engineer Out the Hazard
- Follow Electrical Safe Work Practices
  - Employ Lockout/Tagout of Hazardous Electrical Energy Sources
  - Use Voltage Insulating PPE and Equipment
  - Use PPE for Arc-Flash Protection
  - Use Ground Fault Circuit Interrupters

Safe Work Practices

- Should be pretty intuitive
  - Be Alert
  - Use Common Sense
  - No blind reaching. If view is obstructed, you cannot work on live parts.
  - Illumination must be provided
  - Conductive articles (jewelry, clothing) shall not be worn

Wear and Care of PPE

- Wear Cotton
- Avoid Scratching Eye Protection
- No Bleach or Fabric Softeners
- Wear Clothing Loose, rather than Tight
- Layering Increases Protection
- Dry is Better than Wet

Safe Work Practices

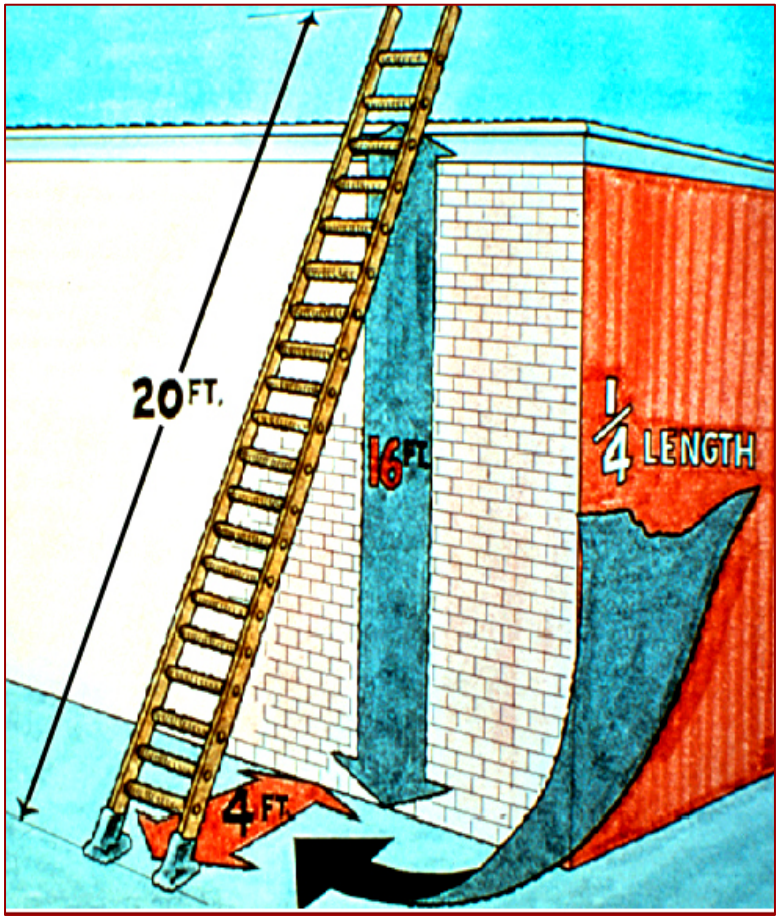
- Plan for Emergencies
  - Know how to de-energize Quickly
  - Be prepared to pull classmate free with an Insulated Rescue Hook
  - Have the Means Available to Contact Emergency Personnel
    - (916) 558-2221; extension 2221 on ARC campus
  - Know CPR & Where AED's are located

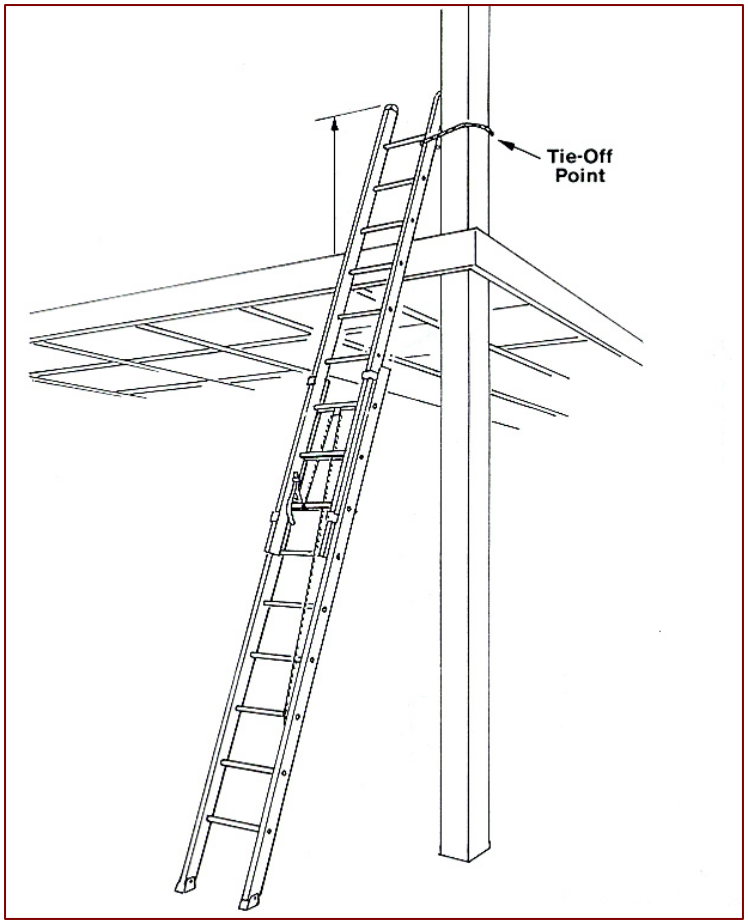
Fall Protection

- What's wrong in this picture?

Fall Protection

- What are these pictures telling us?





Fall Protection

- Some relevant numbers
  - 6ft — Fall protection required for work above this height
  - 39in to 45in — Guard rails top height – open floors & platforms
  - 3 ½ in — Toe guard minimum height – platforms
  - 30ft — Maximum distance for safety nets
  - 19in — Max vertical break without ladder or stairway
  - 30in — Max stairway height without handrail
  - 30° to 50° — Allowable stairway rise/run angle
  - 20in — Stairway platform space beyond door swing

Have a Safe Day!