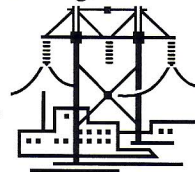


Job Name: _____ Job Site Location: _____

Date: _____ Start Time: _____ Finish Time: _____ Foreman/Supervisor: _____

Topic 297: Arc Flash Hazards (Marking Requirements)

Introduction: National Electrical Code (NEC) regulation 110.16 states that “Switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electrical arc flash hazards. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment”. Though NEC regulations state *field marking* of equipment is required, some municipalities and other jurisdictions are requiring printed stickers or decals marking equipment. It is recommended that the sign on the equipment warning of the flash hazard contain the following eight points of information:



① **Hazard statement-** Required by NEC 110.16 this statement should read “**WARNING – Arc Flash Hazard**” in conspicuous lettering.

② **Flash Hazard Boundary** – This is the minimum distance from the equipment that personnel can be located during an arc flash event and sustain only curable burns while not wearing any PPE. You will need four pieces of information to calculate this distance:

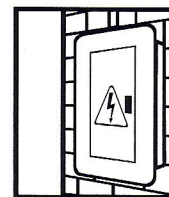
■ **The bolted fault MVA** at the point involved – this is the kVA rating of the transformer divided by 1,000 = MVA

■ **The voltage of the system** – Use the actual measured voltage if it is known.

■ **The percentage of impedance** rating of the transformer supplying the equipment. All transformers must have a name plate and the name plate must have the impedance rating. Do not convert this number to its decimal equivalent; i.e. if rated at Z2.5%, use the number 2.5.

■ **The fault clearing time** of the over current protection for the equipment. This is the time that will elapse before the overcurrent protective device (fuse or breaker) will trip and interrupt the power in the event of a fault current, i.e. 6 cycles at 60 hertz = $6/60 = 0.1$

■ **The formula** to calculate the Flash hazard boundary is: **Distance** = $\sqrt{(2.65 \times \text{MVA} \times \% \text{IMPEDANCE} \times \text{TIME (of fault clearing)})}$. This will give you the distance in feet and inches which should be posted on the equipment.



③ **Cal/cm² Flash Hazard at 18”**- The calories per square centimeter is a very important piece of information. NFPA 70E requires that anytime work will be performed within the flash hazard boundary the employer must make a flash hazard analysis and the Cal/cm² must be documented.

④ **Personal Protective Equipment (PPE) level recommendation** - This is determined using NFPA 70E after performing a hazard risk analysis. The hazard risk analysis and selection of PPE may only be done by qualified personnel who have received adequate training in these procedures.



⑤ **Shock hazard** – This is the nominal voltage when the cover is removed and the energized parts are exposed.

Approach boundaries: These are determined by reference to NFPA 70E tables 2-1.3.4.

⑥ **Limited approach boundary-** A shock protection boundary may be crossed only by qualified persons (at a distance from a live part). This boundary may not to be crossed by unqualified persons unless escorted by a qualified person.

⑦ **Restricted approach boundary-** A shock protection boundary to be crossed only by qualified persons which, due to its proximity to a shock hazard requires the use of shock protection techniques and personal protective equipment when crossed.

⑧ **Prohibited approach boundary-** A protection boundary which is not to be crossed regardless of personal protective equipment.

Conclusion: NEC 110.16 requires only that the equipment be labeled “WARNING – Arc Flash Hazard”. However the above information will help those who must service the equipment evaluate the hazards of working on energized parts, and help to safeguard non-qualified personnel who work in the vicinity of such hazards.



Work Site Review

Work-Site Hazards and Safety Suggestions: _____

Personnel Safety Violations: _____

Employee Signatures: _____
(My signature attests and verifies my understanding of and agreement to comply with, all company safety policies and regulations, and that I have not suffered, experienced, or sustained any recent job-related injury or illness.)

These guidelines do not supercede local, state, or federal regulations and must not be construed as a substitute for, or legal interpretation of, any OSHA regulations.