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Implementing NFPA 70E for Arc Flash Safety

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Introduction

This is a discussion about Arc Flash and NFPA 70E for decision makers. It is designed to clear up some of the confusion about what Arc Flash is, what NFPA 70E is, and why complying with NFPA 70E is important.

Firstly, what is an Arc Flash? An Arc Flash is an explosive release of energy caused by an electrical arc due to either a phase to ground or phase-to-phase fault. This fault can be caused by many different things including: accidental contact with electrical systems, build-up of conductive dust, corrosion, dropped tools, and improper work procedures.

The OSHA General Duty Clause states that each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees (OSHA 1970). Furthermore, a review of OSHA 29CFR 1910.335 (a) (1)(i), which requires the use of protective equipment when working where a potential electrical hazard exists, and 29CFR 1910.132(d)(1), which requires the employer assess the workplace for hazards and the need for personal protective equipment, are given to show the importance of NFPA 70E (OSHA 1990) (OSHA 1994).

On January 7, 1976, at OSHA's request, the NFPA created a committee to write an electrical standard that OSHA could use: Committee on Electrical Safety Requirements for Employee Workplaces – NFPA 70E.

In a 2004 interview with IEEE's Industry Applications Magazine, David Wallis, OSHA Director, stated, "It certainly seems to me that if I'm an employer, and I want to comply with a general requirement for protecting my employees from electric shock and electric arc, that the first place I'm going to look is NFPA70E ("An Interview" 8)."

A Summary of NFPA 70E

NFPA 70E, Standard for Electrical Safety in the Workplace covers the full range of electrical safety issues from safety-related work practices to maintenance, special equipment requirements, and installation. OSHA 1910 Subpart S and OSHA 1926 Subpart K are based on this standard. NFPA 70E is a "how to comply" standard for OSHA electrical regulations. In addition, NFPA 70E is the standard that assists with conducting an Arc Flash Analysis to determine the protection needed. Can you be cited for not complying with NFPA 70E? Yes!

What is an Arc Flash Analysis?

An Arc Flash Analysis is a study of a facility's electrical distribution system to determine if hazards exist and their severity. The study will show if a short circuit or equipment failure will result in a small spark or a life-threatening explosion. This is called the incident energy.

What Changes During an Arc Flash Analysis?

Implementing NFPA 70E requires:
• Arc Flash Hazard Analysis
• Removing found hazards where possible
• Written Electrical Safety Program
• Energized work permits
• Wearing of PPE
• Training of Qualified Personnel (Maintenance)
• Training of Unqualified Personnel (Operations)
• Cultural change

Of all the changes that must take place, the cultural change will more than likely be the most difficult. It changes the way people go about their work lives. If maintenance workers haven't ever had to wear PPE of any kind, and now they do, it will almost certainly be hard for them to get used to. Cultural change is expensive, time-consuming, and is the first thing that a facility needs to work on. It must occur throughout an entire facility in order to be effective.

Phases of an Arc Flash Analysis

An Arc Flash Analysis is a multifaceted process. There are three distinct phases for an Arc Flash Analysis: Phase I – Site assessment and electrical system data gathering; Phase II – Analysis of the data using IEEE 1584 and/or NFPA 70E methods; and Phase III – Develop and document an

Electrically Safe work Practices Program, labelling of panels, and determining PPE. These phases are followed by Electrical Safe Work Practices Training.

The first phase deals with the assessment of the facility's electrical system. Data is collected from the facility's electrical panels. Key points of the site assessment are shown in Table 1.

Phase I - Site Assessment and Electrical System Data Gathering
• Accurate, up-to-date information on the facility electrical system is absolutely essential to the analysis
• Transformer data - KVA, voltages, impedance
• Conductor sizes and lengths
• Fuse and circuit breaker data
• Electric utility - available capacity (minimum & maximum)
• Develop accurate one-line diagrams

Table 1. A list of key points for Phase I of an Arc Flash Analysis.

The second phase involves analyzing the electrical data that was collected from the facility during Phase I. In this phase, Electrical Engineers make recommendations to reduce the amount of potentially hazardous equipment in a facility. These recommendations are extremely important and should be carried out. They can only make the facility a safer place. Table 2 shows why Phase II of a hazard analysis is critical.

Phase II - Analysis of the Data Using IEEE 1584 and/or NFPA 70E Methods
• Short-circuit analysis
• Protective device coordination analysis
• Interrupting rating analysis
• Arc Flash Hazard Analysis
• Recommend solutions to problems and identify opportunities

Table 2. Carefully analyzing electrical data during Phase II is vital in making the study precise.

Phase III of the hazard analysis covers many areas. It entails development of an Electrically Safe Work Practices Program, labelling of electrical panels (label sample shown in

Figure 1), and the proper use and understanding of Personal Protective Equipment (PPE). Table 3 outlines the magnitude of this phase.

Phase III - Develop and Document an Electrically Safe Work Practices Program – Labelling Panels - PPE
Electrically Safe Work Practices Program
• Determine policies on electrically safe work conditions
• Develop an electrically energized work permit
• Establish PPE requirements inside shock boundaries
• Determine PPE clothing policy
• Establish method of maintaining integrity of the Arc Flash Analysis
Determine and Procure Appropriate PPE
• Arc-rated clothing based on hazard/risk
• Voltage-rated gloves
• Voltage-rated tools
Labelling of Electrical Panels
• Apply warning labels to specified equipment
• Include incident energy, hazard/risk category, boundaries, and PPE

Table 3. A facility's positive outlook towards safety is key in making this phase effective.

Figure 1 shows an example of what a label might look like. Actual size of this label is 3" x 4".

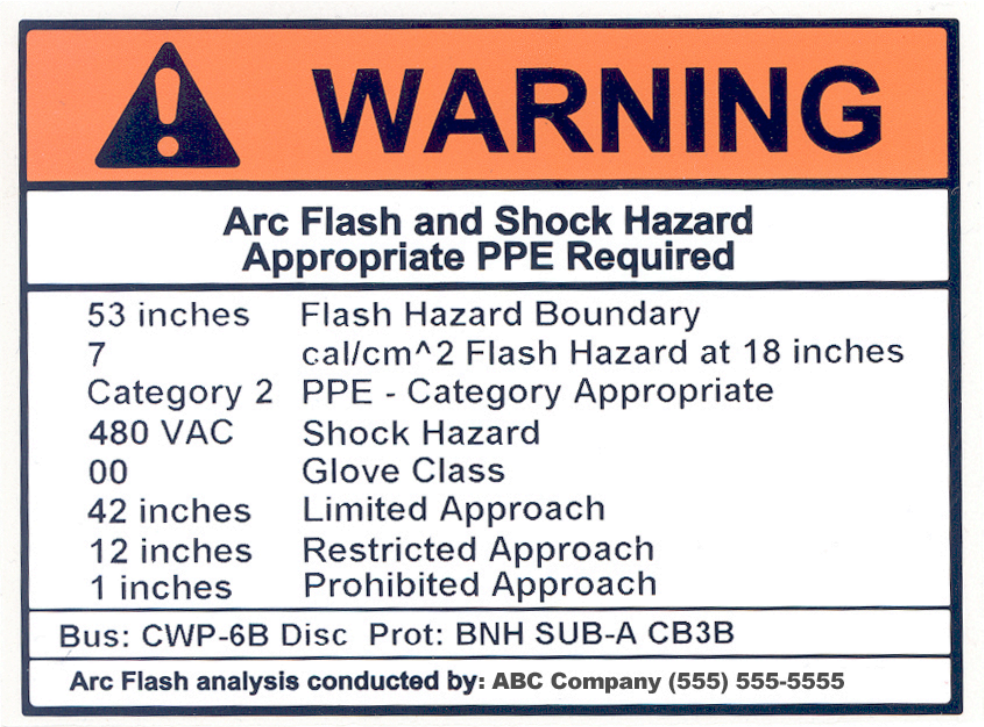

Figure 1. This sample label shows the equipment's electrical information, as well as its Arc Flash approach boundaries.

Electrical Safe Work Practices training is offered to educate facility workers on the dangers of Arc Flash and the proper use of PPE. Table 4 shows the breakdown of what the training might look like for facility employees.

Electrical Safe Work Practices Training
• Provide training for all Qualified Employees, Supervisors, and Safety Personnel on the Electrically Safe Work Practices Program and Hazard Recognition and Avoidance (Two Days)
• Provide training for all Affected Employees - Operators, Mechanics, and Management (Half-Day)

Table 4. The training offered covers the causes of Arc Flash and the importance of PPE.

Once all of these programs are completed, the facility must keep all of its electrical data up-to-date in order to retain the Arc Flash Study's accuracy.

Bibliography

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