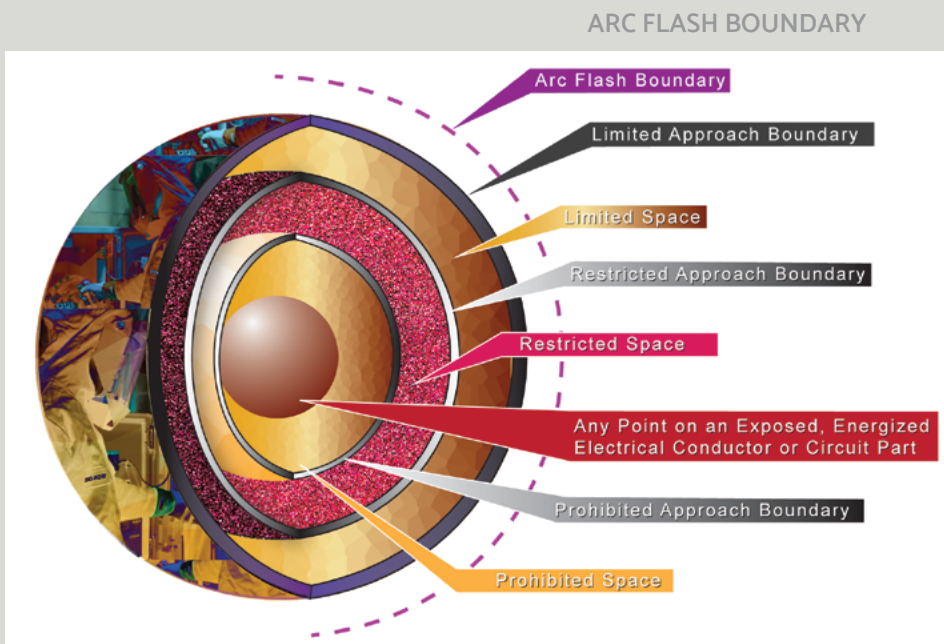


1.0 INTRODUCTION

When working on any generator system the technician must be aware of the potential for coming into contact with any uninsulated component carrying an electrical charge. NFPA sets standards for personnel protection and guidance on performing an arc flash study.

This Information Sheet This bulletin discusses the requirements and standards for Electrical Safety In the Workplace, as covered by NFPA 70E. These requirements are enforced by the Occupational Safety and Health Administration (OSHA).



The arc boundary is the approach limit that is the distance from the exposed live parts within which a person could receive a second degree burn if an electric arc flash were to occur (nfpa 70e)

RISK/HAZARD CATEGORY	INCIDENT ENERGY (cal/cm ²)	EXAMPLES OF PPE (PERSONAL PROTECTIVE EQUIPMENT) REQUIRED
0	2 or lower	Non-melting clothing
1	2 - 4	FR (Fire Resistant) shirt and pants
2	4 - 8	FR shirt and pants, cotton underwear
3	8 - 25	FR shirt and pants, FR coveralls, cotton underwear
4	25 - 40 and higher**	FR shirt and pants, full-coverage flash suit, cotton underwear

* Other combinations are possible; see NFPA 70E for details. Safety boots, face shields, and leather over voltage-rated gloves should be worn.

** Incident energy levels above 40 cal/cm² require special care to de-energize equipment when possible, as they represent the most extreme hazards. Some companies offer PPE rated above 40 cal/cm², but in general this level of risk is considered impractical to protect against.

To fulfill our commitment to be the leading supplier in the power generation industry, the Loftin Equipment team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

2.0 SAFE WORK CONDITIONS

The primary focus of NFPA 70E is the establishment of an electrically safe work condition. This means that equipment is fully de-energized and cannot be re-energized while work is being performed. Each of the following steps should be followed to create an electrically safe work condition.

- Determine all possible sources of electrical energy to the equipment
- Interrupt load current and open disconnecting devices for all sources
- Where possible, visually confirm that all disconnecting devices are open
- Follow all appropriate lockout and/or tag out procedures
- Verify that equipment is de-energized using a voltmeter. Until equipment is tested, you should assume that it is still energized.
- Use grounding devices where the possibility exists of stored energy or induction

3.0 GUIDELINES FOR NFPA 70E COMPLIANCE WITH OSHA

It is not always possible to de-energize equipment before beginning work. In order to minimize the risk of live electrical work, NFPA 70E lays out six (6) steps that employers should take to be in compliance with OSHA regulations.

- Create a facility safety program with defined responsibilities
- Calculate arc flash hazards for relevant equipment
- Provide appropriate personal protective equipment (PPE) for live work
- Train workers on arc flash hazards and safe work practices
- Provide appropriate tools for working with energized equipment
- Place warning labels on equipment that poses an arc flash risk

4.0 ARC FLASH SAFETY PROGRAM

NFPA 70E requires companies to create a written program outlining all aspects of the company's electrical safety policy including work permits, lockout/tag-out procedures, assessment of electrical hazards, maintenance procedures, and personnel responsible for electrical safety. Up-to-date and accurate information on a company's electrical systems, including one-line diagrams and equipment specifications, should be included in this document. The goal of the program should be to establish a culture of safety awareness that includes ALL employees.

5.0 WARNING LABELS: 2012 EDITION HAS NEW SECTION 130.5 (C):

Requires all electrical equipment such as switchboards, panel-boards, industrial control panels, meter socket enclosures, and motor control carriers that are other than dwelling units are likely to require examination, adjustment, servicing or maintenance while energized, shall be field marked with a label containing:

1. Available incident energy and corresponding working distance
2. Minimum arc rating of clothing,
3. Required level of PPE
4. Highest hazard/risk category (HRC) for the equipment

Types of equipment to be labeled and placements of labels are covered by NEC 110.16.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

This includes: cotton and flame-resistant (FR) clothing, voltage-rated gloves, and hard hats with full-face shields, full-coverage flash suits, and insulated blankets. Appropriate PPE MUST be worn whenever live electrical work must be performed. NFPA 70E describes six (6) risk/hazard categories for which varying degrees of PPE are appropriate. All clothing worn round live circuits should be 100% untreated fiber. Synthetic materials such as nylon or acetate will melt onto the skin in the event of an arc flash or electrical shock, increasing the risk of serious burns.

7.0 TOOLS FOR USE ON LIVE EQUIPMENT

All tools used to work on energized electrical equipment must be non-conductive. Voltmeters should be insulated and voltage rated for the equipment. In some instances, long-handled tools may also be appropriate, as even a small increase in working distance can cause a significant drop in incident energy.

8.0 CALCULATING ARC FLASH (NFPA 70E) HAZARDS:

An arc flash hazard analysis is an in-depth study of a company's electrical systems in order to identify equipment that could cause an arc flash, as well as the degree of hazard involved. This requires the work of a competent electrical engineer who is familiar with the electrical system and methods of analysis. For many company's the hazard analysis is the most expensive and time consuming requirement of NFPA 70E - but it is perhaps the most critical.

9.0 NFPA 70E ARC FLASH TRAINING:

NFPA 70E draws a distinction between 'qualified persons' and 'non-qualified' persons. The former is one who has the skills and knowledge related to the construction and operation of electrical equipment and systems, and has received safety training on the hazards involved. It is a good idea to also train non-qualified persons on the general hazards of arc flash, which allows them to identify and avoid hazardous situations.

We recommend that a reputable training firm with specific expertise in arc flash be contracted to assist in this regard.

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