

## Introduction

Many of our clients have an awareness of recent developments in workplace safety for the electrical worker. Many insurance providers are asking how they are addressing the requirements of NFPA 70E which OSHA has recently endorsed. While Arc Flash is a new buzzword in industry today, power distribution system analysis has always been a part of good electrical system design. Hargrove Engineers + Constructors is qualified to assist in evaluating plant electrical power systems and recommending procedures that meet the requirements of NFPA 70E.

## Independent Advice

Hargrove Engineers + Constructors can provide independent advice and recommendations not dependent on any specific manufacturer's equipment. We are not associated with any equipment manufacturer but have performed power distribution system analysis on virtually every brand of electrical equipment.

## Starting Point

A Short Circuit Study with Protective device coordination analysis is the starting point for understanding your power distribution system characteristics and capacity. Among other things, these studies will determine the incident energy available at worker exposure points in your electrical system. From this information, limits are established on the unprotected approach distances and the proper level of PPE required while working on equipment. This analysis is based on the NFPA 70E and IEEE Standard 1584.

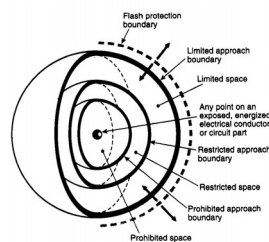


Figure C.1.2.4 Limits of Approach.

Source: NFPA 70E, Figure C.1.2

## Benefits of Arc Flash Hazard Analysis

Hargrove Engineers + Constructor's power engineers are currently assisting clients in determining the impact of NFPA 70E within their plant. We are helping answer these questions:

1. What safety requirements of NFPA 70E will impact my plant operations?
2. What procedures must be developed for worker safety?
3. What type of safety clothing and equipment will be required?
4. Are there practical alternatives to reduce arc flash hazard?
5. Will fault currents be safely interrupted in the event of a short circuit?
6. Will plant outages be confined to the smallest possible areas of the plant?
7. What are the safe distances from exposed electrical components?
8. Can power factor improvement decrease my power bill?
9. Is harmonic content affecting system performance?
10. Can my electrical distribution system handle a proposed plant expansion?

## Power System Analysis Results

A power system analysis can:

1. Determine proper interrupting capability of electrical equipment
2. Determine proper protective device coordination, isolating electrical power at the proper point
3. Indicate opportunities for power factor correction, lowering electrical power bill
4. Indicate excessive harmonic content and recommend solutions for mitigation
5. Help coordinate electrical load flow, assuring available power for expansions
6. Determine the calculated incident arc energy
7. Recommend electrical energy monitoring hardware based on existing equipment
8. Improve the Plant Electrical documentation

## Typical Power System Study Components

**System Fault Study:** A three-phase and line-to-ground fault analysis of the electrical distribution system is performed from the utility ties to the lowest level to be documented. The case study calculations illustrate the worst case short circuit currents for the switching configuration, including interrupting equipment duty evaluation. A one-line diagram is generated to illustrate the system components, configuration, and impedance data. The device and bus nomenclature used in the model, fault calculation prints and coordination curves are included.

**Protective Device Coordination Study:** This is performed for the electrical system for both phase and ground protection devices. The relay coordination study extends from the utility intertie downstream, to the 480V switchgear feeder breakers serving motor control centers and continues to the lowest level to be documented. Recommended low voltage settings are provided for 480V switchgear main and feeder breakers, and fuses to allow proper coordination. The study includes recommendations for protective device settings which allow the optimum coordination.

**Arc Flash Hazard Study:** A flash hazard analysis includes the calculation of the flash protection boundary limits and the incident energy exposure for the maximum arc producing flash expected from a piece of electrical equipment. The study determines incident energy exposure level and arc-flash protection boundaries for electrical equipment in accordance with IEEE-1584 and NFPA-70E. It is based on the protective device settings and the interrupting device clearing times. The study makes recommendations for improvements to lower the incident energy levels.

**Load Flow Study:** The results predict power flow magnitudes, voltage levels and losses in

branches of the system based on the operating conditions. The results are useful for planning future expansions.

**Harmonic Measurement Service:** This evaluation is to identify harmonic content of electrical parameters at the facility load centers. Recommendations will be made for mitigation, if required.

**Power Factor Study:** The study is based on actual load measurements. The results are evaluated and specific recommendations made for power factor improvement. This often lowers the plant power bill.

## Why Hargrove?

Our engineers have been performing plant electrical system analysis to determine available short circuit current, safe circuit interrupting capacity and proper coordination of protective devices for a combined total of over 100 years. We are currently assisting customers in meeting the requirements of NFPA 70E.

Founded in 1995, Hargrove provides comprehensive engineering, technical support and project management services to industrial and commercial customers throughout the Southeast.

We function as an extension of our customers' plant engineering or facility management team. Our experienced engineering and project management staff can assist with:

- ✧ Developing innovative process solutions or facility plans
- ✧ Design and construction management services to deliver the facility solution
- ✧ Engineering support for continuous facility improvements
- ✧ Technical support for maintenance, planning and inspection
- ✧ Consulting and site management for plant relocations, asset sales or facility demolitions