

Arc Flash Study & Labeling Program

OBJECTIVES

1. Determine if the potential for a hazardous arc flash exists in equipment that employees work on or near while the equipment is exposed and energized.
2. Identify opportunities to reduce or eliminate as many of the potential arc flash hazards identified in the study as possible.
3. Determine the minimum safe working distance (arc flash boundary) from the equipment where an arc flash hazard exists.
4. Determine the appropriate PPE (Personal Protection Equipment) required to avoid a permanent injury from an arc flash.
5. Implement arc flash hazard and electrical shock warning labels on electrical equipment.
6. Inform management and workers of the results.

ARC FLASH ANALYSIS DELIVERABLES

1. Updated One-Line Electrical Drawings
2. Arc Flash & Electrical Hazard Study / Analysis
3. Short Circuit Study
4. Protective Device Coordination Study
5. Recommendations to Reduce Arc Flash Hazard Categories
6. Arc Flash Hazard Labels & Labeling
7. Help with OSHA & NFPA 70E compliance

ARC FLASH STUDY WORK PROCESS

Phase 1 - Data Collection

The first phase of any arc flash hazard study is the collection of field data necessary to calculate potential incident energy at power distribution equipment. Phase I is the labor intensive phase of the arc flash hazard study, typically taking at least half of the total effort required to complete the analysis. Data is collected on-site by qualified persons (as defined by OSHA and NFPA 70E) in appropriate PPE; preferably assisted by a qualified facility employee or someone knowledgeable of the plant's electrical equipment and facility layout.

Data collected for the study includes transformer nameplates, conductor sizes/number per phase/lengths, motors larger than 50HP, circuit breaker catalog numbers and settings, fuse catalog numbers, and on-site generator nameplates. Generally all the data can be collected without disturbing facility operations.

Please note: Proper labeling of each disconnect as to its purpose (in accordance with the 2014 NEC® Article 110.22), is required in order to complete an accurate analysis.

Generally as part of the First Step, the electric utility will be contacted to determine the short circuit current available at the facility's metering point, which is the starting point of all Arc Flash Hazard Analysis Studies.

Phase 2 - Power System Modeling / Electrical One-Line Diagram Development

Using the information from the Data Collection in Phase I, a power system electrical one-line diagram is developed. Electrical elements and components are shown by standard industry accepted symbols representing each of the three phases and the connection of the power system with one line. The diagram represents the actual facility power distribution system and path from the incoming power source to all loads and equipment.

Phase 3 - Engineering Calculations & Hazard Analysis / Study

The third step is a multi-faceted phase beginning with the input of the data from single-line diagrams from Step 2 and the data collected during Step 1 in order to complete an Arc Flash Study / Analysis to IEEE 1584 and NFPA 70E standards. This third step is completed and reviewed by a licensed professional engineer knowledgeable in the use of electrical engineering software, short circuit studies, arc flash hazards and NFPA 70E. Arc Flash Study Pro software program for Arc Flash System Analysis or EasyPower software is used to determine the following:

1. Short Circuit Study

1. Ensure all equipment is properly rated to withstand a short circuit current
2. Determination of system operating modes and conditions that can impact short circuit currents and arc flash hazard energy level
3. Determine bolted fault current
4. Calculate arc fault current

2. Device Interrupt Rating and Evaluation Study

1. Determine if protective devices have adequate interrupting capacity for the available short circuit current
2. Compare calculated values to the device and equipment interrupting rating
3. Verify that the equipment is rated to safely handle short circuit currents without creating hazardous conditions

3. Protective Device Coordination Study

1. Determine "Total Clearing Time" at fault currents
2. Determine probable sequence of which device will open during a fault
3. Find protective device characteristics and arc duration
4. Ensure electrical system reliability and determine if arc flash hazard energy levels can be reduced

4. Arc Flash Hazard Study Analysis

1. Calculate Incident Energy
2. Calculate Arc Flash Hazard Boundaries
3. Determine Arc Flash Hazard / Risk Category
4. Specify PPE Requirements

5. Recommended Solutions to Problems and Identify Opportunities

1. Inadequate Interrupting Ratings
2. Improper Coordination Problems
3. Potentially Dangerous Arc Flash Energy
4. Opportunities to reduce Arc Flash Hazard / Risk category level and level of PPE required.

6. Written Analysis Report

A written report detailing and documenting the results from the data collection and engineering studies completed.

Phase 4 - Report Presentation

Phase IV includes delivery of the report and a brief presentation of the results of the five engineering studies completed including Arc Flash Hazard Study / Analysis and

recommended solutions for improving the electrical distribution system. As part of this presentation the presenter will welcome questions and encourage a discussion of the results and report. This report is accompanied by program specific electrical one-line diagrams developed during modeling of the system. The report and updated electrical one-line drawings will be provided in digital and hard copy formats.



Phase 5 - Arc Flash & Shock Hazard Labeling

The NEC® and NFPA 70E requirements include placing a label on the equipment informing the worker of the flash protection boundary, incident energy, work distance, required PPE level and the shock hazard voltage and boundaries. The labels proposed will be high quality Brady labels, color coded to assist the workers in determining the arc flash Hazard / Risk Category. Colors based on ANSI Z535.4 are:

- Orange for Warning Incident H/R 1, 2 and 3
- Red for Danger Incident H/R 4 and above

Each piece of equipment analyzed will have a printed arc flash hazard label with an identification number to match the equipment number.

Phase 6 - Post Arc Flash Study / Analysis Support

After your arc flash study is completed and labels applied, Liberty Electric Inc. will continue to support your electrical safety program with future arc flash study updates, NFPA 70E training, electrical safety audits, infrared studies and other training.

For more information on how Liberty Electric Inc. can help you make your facility safer and OSHA compliant with an Arc Flash Study and labeling use Liberty Electric's Contact Tab on our home page.