

ARC FLASH

ANALYSIS, CONSULTING & TRAINING



WE IMPROVE WORKPLACE SAFETY & PERFORMANCE

PHASE I - DATA COLLECTION:

Lewellyn Technology Field Technicians will visit your facility to collect the necessary electrical data to perform an Arc Flash Hazard Analysis. Electrical information will be gathered and the systems analyzed from the utility connection point to the equipment in the plant. We will be looking for enclosures that present potential exposures to an Arc Flash. We will gather wire size, wire length, transformer data, circuit over-current protection information, among other data. We will gather data on all equipment necessary per IEEE 1584. We will not stop at an arbitrary or convenient point on your system.

To accomplish this work our Field Technicians will be required to open hinged or bolted panel enclosures. In most cases data collection can be accomplished without interruption of facility operations. In the rare case where the data cannot be gathered due to our inability to access panels due to operational needs, equipment with control interfaces, panels located in areas requiring special security clearance, panels located in clean rooms, panels located in hazardous areas requiring specialized training, or other situations beyond our control, it would be necessary for the facility to gather that data and forward it to us. Your facility's panel boards, bus ducts, motor control centers, disconnects, switchgear, etc, should be properly labeled per the National Electrical Code prior to our arrival. These labels should indicate, among other things, the name of the enclosure and what each of the fuses or circuit breakers are feeding. If there are unlabeled or mis-labeled over-current protective devices it is the responsibility of the facility to rectify these if they are to be included in the analysis. We may be able to provide some assistance in tracing circuits.

To Be Provided By Facility

- Simple floor plan drawn to scale if available
- Man-Lift and/or ladders unless otherwise arranged.
- Someone familiar with the plant, such as an electrician, to assist in identifying equipment, tracing circuits where needed, operating lifts, etc.
- Fault Current Data Supplied by your Utility Service Provider

ANTP, a 50% Non-refundable pre-payment of Phase I will be required to reserve a start date

PHASE II - SINGLE-LINE MODEL:

Data collected by our Field Technicians during Phase I and/or provided by the facility will be used to build a computer model of your facility's electrical distribution system. The model will be sent to the facility immediately. This model will be used to complete the Engineering Analyses, which includes a Short Circuit Analysis, Protective Device Coordination Analysis, Protective Device Interrupt Rating Analysis, and the Arc Flash Hazard Analysis, once the utility data is received.

PHASE III - ENGINEERING ANALYSIS DELIVERY / LABELING:

The results from phase II will be documented and provided to the facility in a report format. The report will include a binder as well as a CD-ROM containing electronic files of the report. We will also retain copies of the report and data. A presentation meeting will be held with our representative and key people from the facility to go over the report and discuss recommendations. We will assist you in affixing labels Category I and above.

Short Circuit Study

The PTW computer program, using the method of symmetrical components and the procedures of IEEE Standard 399-1986, will calculate the potential fault currents. The method of symmetrical components has been the accepted method for calculating unbalanced fault currents since the mid 1920's. Data required for the calculations is derived from the physical construction of the power system and has been documented in the feeder and transformer schedules included in the study. Although it is not required to have exact numbers, it is wise to be within roughly 5%. The information provided in our report will include tabulated input data for the utility, generators, transformers, motors, and cables, as well as a summary of the calculated fault currents at every major bus modeled in the computer program. The three-phase to ground and single-phase to ground currents are reported. These two currents typically bracket the other possible fault currents, and are sufficient for the analyses being conducted at your facility.

The applications for conducting a short circuit study are as follows:

- Arc Flash Hazard Analysis
- Protective Device Coordination Study
- Interrupt Rating Study

Arc Flash Hazard Analysis

The arc-flash hazard analysis is done to conform to OSHA recommendations described in 29CFR 1910.333. Procedures for arc-flash hazard analyses are described in both NFPA Standard 70E-2009 and IEEE Standard 1584-2002. IEEE Standard 1584-2002 describes a method for calculating the potential arc-flash energy based on the anticipated "bolted" fault current. The reported results will be calculated using the more conservative, interpreted as more rigid, IEEE Standard 1584-2002.

IEEE Standard 1584-2002 states that equipment rated below 240V need not be considered unless it involves a low-impedance transformer larger than 125 kVA in its immediate supply. The reason for this exclusion is the inability of such small capacity systems to initiate and support arcing conditions. NFPA Standard 70E-2012 applies the same reasoning to equipment rated 240V and less. Since NFPA Standard 70E is recognized as the guiding document, Lewellyn Technology will apply the limits from NFPA Standard 70E-2012.



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The report will present findings describing dangerous or disruptive conditions within the facility. The calculated arc-flash hazards are compared to the criteria in NFPA Standard 70E, and hazards requiring personal protection equipment (PPE) are reported. The report will include recommendations for mitigating hazards Category 2 and above. The facility must decide what category PPE it is comfortable with. The table included in the report will show the arc-flash data calculated for the existing system. Included in the table are the critical distances, the incident energies, the fault currents, and the PPE level required for the indicated working distance. Arc-flash hazard warning labels for the equipment will be created from this table. Label colors are: Orange Cat 0-4 and Red for Dangerous.

Protective Device Coordination Study

A properly coordinated system will minimize the impact of equipment failures within a system if a fault were to occur. To achieve this, the largest over-current protective devices in each location are analyzed for adequate coordination with upstream protective devices, and those needing attention to avoid disruption of production are reported. Individual recommendations are made for correcting each coordination issue found, and are directed at increasing the reliability of the electrical distributions system by minimizing the part of the system shut down due to faults. All recommendations made are also verified to not negatively affect the arc-flash hazard at the points of interest.

If additional coordination problems are found while examining each largest over-current protective device, it is not beyond the scope of this study to provide additional recommendations to improve this situation. The more common coordination problems are listed below:

- Protection of transformers
- Protection of conductors
- Coordination with motor starting characteristics

In addition to detailed recommendations of replacement protective devices and/or settings to improve coordination, the coordination study report will also include time-current coordination curves for the largest over-current protective devices at each examined location, and the tabulated settings for those devices. The curves present a graphical representation of the device characteristics, while the tabulated data outlines the descriptive information for each device shown on the curve as well as the settings for each over-current protective device shown.

Interrupt Rating Study

An interrupt rating study is necessary to conform to the requirements of the National Electric Code as described in 2005 NEC Article 110.9. This study is performed to identify any protective devices in the facility that appears to have inadequate interrupting capacity. If these breakers are required to interrupt a fault, they can explode, potentially causing a fire and/or injury to personnel.

Protective devices are examined to see if the calculated fault current exceeds 90% of the rated interrupting capacity, at which point they are considered to have inadequate interrupting capacity. Suitable replacement devices are recommended for correcting each interrupting capacity failure.

From these analyses a report will be created which includes:

- Findings which indicate problems discovered in interrupt ratings, coordination, and arc flash hazard
- Recommendations to:
 - mitigate arc flash hazards above Category Two
 - correct circuit protective devices with insufficient interrupt ratings
 - correct circuits not properly coordinated
- One Line Drawing of the equipment surveyed
- Table of Calculated Arc Flash Data
- Coordination Curves

Labels

Labels will be printed based on the data calculated. The labels will indicate the Arc Flash Boundary, Incident Energy, Flash Hazard Category, Voltage, Limited Approach Distance, Restricted Approach Distance, and the Prohibited Approach Distance. The label will indicate the device name and the over-current protective device which feeds it. This is no indicator of all devices of various voltages that might be feeding an enclosure. We list the device with the greatest impact on arc and shock hazard. This label is not a substitute for proper Lockout Tagout labeling which would indicate all power sources feeding an enclosure. We will assist you in affixing labels Category 1 and above.

SAFE WORK PRACTICES TRAINING:

Your Rapid Compliance Solution for 70E Bridge the Gap

Because it may take some time to organize and complete an arc flash study for your facility we have created a rapid compliance solution that will bridge this gap. Immediate training and assistance for your staff on how to protect themselves from electrical hazards until the arc flash hazard is complete. Obviously you still need to do the arc flash hazard analysis, but you can't leave your people exposed to electrical hazards while the study is completed. Our immediate solution involves training for your staff on the provisions of 70E that provide PPE recommendations for shock and flash hazards. We will also provide PPE posters and wallet cards, sample written electrical safety programs and assistance from our trained staff of experts to help you protect your employees.

Training is arguably, the most important phase of the project. Training should be done first, or at least coincide with the study followed by a short refresher and update once the labeling and study are in place. The study will be of no use unless the facility personnel are trained in the methods spelled out in NFPA 70E. The training is designed for all personnel who work on or near exposed energized equipment. Electrical hazards, proper practices and procedures, and PPE use and care will be among the many topics covered. You will be introduced to the rules and regulations as required by OSHA and NFPA 70E and you will see how the two work together. The program is designed to keep workers safe and provide them with life saving information. This class is taught with passion by instructors who have been there and believe in what they are saying.

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