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Arc Flash Analysis: IEEE Method versus the NFPA 70E Tables July 2017 / 1910DB1702

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Summary

1.0 Abstract

Recent changes in workplace safety regulations have heightened the awareness of hazards associated with electrical arcs. The hazard level must be quantified and workers properly protected before entering proximity of exposed energized conductors. National Fire Protection Association's (NFPA) standard 70E provides the guidelines for work involving electrical hazards and the selection of arc flash protective equipment. In order to properly select the protective gear one must have knowledge of the potential thermal energy of the electric arc. Institute of Electrical and Electronics Engineers (IEEE) standard 1584 has been the de facto standard for calculating the arc energy levels at different points in the electrical power system.

However, NFPA 70E also provides the option of using the Arc Flash Hazard PPE Category task tables for personal protective equipment (PPE) selection. These tables provide pre-defined levels of PPE, which are based on the available short circuit current and the speed of the overcurrent protective device. In order to properly apply the tables, some degree of electrical calculations must be performed. Otherwise, the tables could be subjected to misuse if they are applied without knowledge of the necessary calculations.

In this paper the basic differences between the IEEE 1584 method and the NFPA 70E PPE Category are discussed. A recommended specification is also provided for facility owners who are interested in achieving compliance with the regulations.

2.0 OSHA and NFPA Rules

OSHA has enacted new rules in a concerted effort to reduce electrical-related work fatalities. Part 1910 of 29 CFR contains several rules that prescribe requirements for clothing, training, and hazard assessment when employees are exposed to electrical hazards. OSHA has been writing citations to facilities that are not in compliance with arc flash requirements.

NFPA 70E, the Standard for Electrical Safety in the Workplace, was created to provide OSHA a standard for establishing safe work practices for electrical workers. Among other things, this document requires shock and arc flash risk assessment and aids in the selection of personal protective equipment (PPE). Minimum approach boundaries are also established. NFPA 70E states that facilities must provide:

1. A safety program with defined responsibilities
2. Calculations for the degree of arc flash hazard
3. PPE for workers
4. Training for workers
5. Tools for safe work practices

It must be noted that de-energizing equipment does not absolve the facility from the responsibility of performing the arc flash analysis or providing the necessary PPE. Both OSHA and NFPA have basic rules that prohibit energized work. In order to establish that a circuit is de-energized, the circuit must be approached to verify that it has been de-energized. Until the verification testing is completed, the circuit must be considered energized per NFPA 70E. Therefore, the worker who approaches the circuit for verification testing must wear full PPE. Hiring contractors to perform electrical work does not absolve the facility from performing the calculations and providing the arc flash exposure levels to the contractor's workers.

3.0 Use of NFPA 70E Tables

NFPA 70E provides Arc Flash Hazard PPE Category tables, which highlight specific personnel protective equipment to be used on various electrical distribution equipment.

However, these tables are based on fundamental assumptions about the available fault current and the overcurrent device clearing time.

In order to use the tables, the person in charge must verify that the available fault current and the overcurrent protective device (OCPD) tripping time are both equal to or lower than the values assumed for developing the tables. This essentially requires performing the majority of the calculations that are necessary for determining the arc flash energy.

However, a common but incorrect approach to using the tables is to select the PPE based on the equipment and voltage levels only and ignore the limitations imposed by the fault current and overcurrent protective device operating time. This simplistic approach could subject the electrical workers to either too little PPE (risk of injury) or too much PPE (risk of reduced mobility). In order to provide appropriate protection for electrical workers, the necessary calculations must be performed to establish the short circuit currents and the OCPD opening times. Only then can the NFPA 70E tables be effectively used.

Table 1

Summarizes the basic differences in methodology between the simplistic method of using NFPA 70E PPE category tables (without performing short circuit and coordination studies) versus the IEEE 1584 method.

Table 1

Specification Item	IEEE 1584 Method	Mis-Applied Table[1] Method	Description of Specification Item and Why it is Important
Provide complete electrical system data collection	Yes	No	During data collection all components of the electrical system are documented to establish their characteristics and settings
Establish all modes of operation	Yes	No	Which modes of operation may be in effect? (Utility feeders, generators, UPS systems, etc.)
Establish available fault current at each piece of equipment under study (short circuit study)*	Yes	No	Available fault current must be accurately known in order to verify proper equipment application
Determine arcing fault current for each piece of equipment under study	Yes	No	The arcing current must be determined in order to determine the overcurrent protective device opening times and to calculate the arc flash energy levels
Determine protective device characteristics and arc fault duration	Yes	No	Arc fault duration is critical to establish the arc flash hazard incident energy and PPE requirements
Determine incident energy (calories per CM^2) for each piece of equipment under study	Yes	No	Incident energy calculation will determine the Personal Protective Equipment (PPE) that workers must wear
Document system voltages and classes of equipment	Yes	Yes	Voltage level for each piece of equipment must be known and labeled for shock protection
The work shall be overseen by registered professional engineers (P.E.)	Yes	Unknown	By state law, engineering work must only be performed by engineers licensed in the state where the facility is located
The work shall identify opportunities to improve code compliance and over-dutied equipment and make recommendations on strategies to reduce high arc flash hazard levels (time-current coordination study)	Yes	No	In order to make equipment maintainable, this information must be known. System reliability requires properly coordinated overcurrent devices
Arc Hazard warning labels shall be provided for the equipment	Yes	Yes	Required by the NFPA 70E

* The short circuit study establishes the available fault current. The NFPA 70E arc flash hazard PPE category tables 130.7(C)(15)(a) will provide estimates of the PPE category, but they cannot be used properly without knowing the available fault current and clearing time.

[1] Incorrect application of the task tables without evaluating short circuit currents and OCPD opening times

4.0 IEEE 1584 Analysis Procedure

The IEEE 1584 analysis procedure begins with a complete data collection from the power system. Characteristics of the power source — utility or generator — and the power system components such as transformers and cables, as well as the tripping characteristics of overcurrent protective devices are identified and entered into a digital computer program. The program first calculates the bolted 3-phase short circuit current at each bus of concern in the system. Then the arc fault current is calculated at each location. For low voltage systems, the arc fault current will be lower than the bolted fault current because of arc impedance.

Next, under the arc-fault current condition, the clearing time of the protective device protecting the bus is determined. For fuses, the manufacturer's total clearing time is used. For low voltage breakers, the right hand side of the manufacturer's time-current curve band is used. For relayed medium voltage breakers, the relay's curve shows only the relay operating time and the particular breaker's opening time must be added to the clearing time.

Following the clearing time determination, the working distance at each bus is selected. Next, incident energies are calculated for each bus. Incident energy is the amount of energy impressed on the face and body of the electrical worker. One of the units used to measure incident energy is calories/cm^2.

The flash protection boundary based on an incident energy of 1.2 calories/cm^2 is calculated. This is the generally accepted energy level that causes the onset of a second-degree burn. Finally, the hazard risk category and the worker's protective clothing system for each bus under consideration are determined.

All arc flash hazard analysis results are presented in an easy to understand format. A summary spreadsheet, such as the one shown below, will be presented as part of the final analysis.

Adequate PPE may be required during load interruption, during the visual inspection that verifies that all disconnecting devices are open, and during the lockout/tagout.

Table 2

Example of information provided in the final analysis.

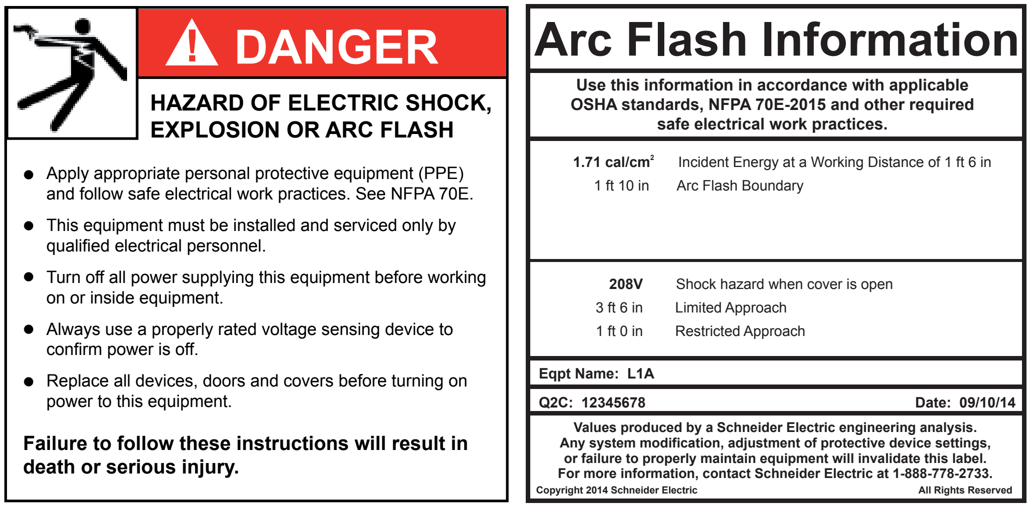
Table 2

	BUS Name		
	100 T-920A	101 PNL PCA	102 TD-304
Protective Device Name	004 Dual	101 PCA Main	101 PCA-10
kV	0.48	0.48	0.48
Bus Bolted Fault (kA)	14.81	14.31	7.51
Protective Device Bolted Fault (kA)	13.65	13.15	7.51
Arcing Fault (kA)	8.45	8.19	5.14
Time / Delay Trip (sec)	1.451	0.04	0.017
Breaker Opening Time (sec)	0	0	0
GND	Yes	Yes	Yes
Equipment Type	PNL	PNL	PNL
GAP (mm)	25	25	25
Arc Flash Boundary (in)	145	18	7
Working Distance (in)	18	18	18
Incident Energy (cal/cm^2)	36.8	1.17	0.27
PPE Level	4	0	0

5.0 Arc Flash Labels

Where specified in the scope of work, arc flash labels are provided. The data in the labels will be populated based on the arc flash calculation software output. The labels must have the following characteristics.

1. UL 969 standard compliance for durability and adhesion
2. Include shock protection data per NFPA 70E in addition to arc flash hazard data



6.0 Conclusion

In order to correctly apply the NFPA 70E Arc Flash Hazard PPE Category tables, knowledge of the available short circuit current and the opening time of the overcurrent protective device is required. A common misapplication of the tables occurs when they are applied solely based on the class of equipment and the system voltage. This results in an incomplete hazard evaluation and PPE that may be too little or too much.

The IEEE 1584 method, however, is a systematic approach which calculates the exact arc flash energies from the electrical power system parameters. Schneider Electric Engineering Services (SEES) recommends a complete data collection from the power system in order to generate short circuit and coordination studies in addition to arc flash energy calculations. Our recommended specification for arc flash studies is provided in the next section.

7.0 Recommended Specifications: Arc Flash Hazard Analysis / Short-Circuit / Coordination Study

(for existing installations)

PART 1 GENERAL

1.01 SCOPE

A. The Owner shall be furnished short-circuit and protective device coordination studies as prepared by Schneider Electric Engineering Services or approved equal.

B. Schneider Electric Engineering Services shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current issue of NFPA 70E - *Standard for Electrical Safety in the Workplace*. The arc flash hazard analysis shall be performed per the IEEE Standard 1584 – 2002, the *IEEE Guide for Performing Arc-Flash Calculations*.

C. The scope of the studies shall include the electrical distribution equipment as identified by the Owner.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract.

1.03 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
6. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories

C. The National Fire Protection Association (NFPA)

1. NFPA 70 – National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.04 SUBMITTALS FOR REVIEW/APPROVAL

A. The studies shall be submitted to the Owner for review and approval prior to final completion.

1.05 FINAL SUBMITTALS

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Electronic PDF copies of the report shall be provided upon request.

B. The report shall include the following sections:

   1. Executive Summary including Introduction, Scope of Work and Results/ Recommendations.
   2. Short-Circuit Methodology Analysis Results and Recommendations
   3. Short-Circuit Device Evaluation Table
   4. Protective Device Coordination Methodology Analysis Results and Recommendations
   5. Protective Device Settings Table
   6. Time-Current Coordination Graphs and Recommendations
   7. Arc Flash Hazard Methodology, Analysis, Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
   8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
   9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.06 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be an employee of the approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten (10) actual arc flash hazard analyses it has performed in the past year.

E. The engineering firm shall have a minimum of twenty-five (25) years experience in performing power system studies.

1.07 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using a commercially available electrical engineering software program.

PART 2 PRODUCT

2.01 STUDIES

A. Schneider Electric Engineering Services shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – *Standard for Electrical Safety in the Workplace*, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies.

2.02 DATA COLLECTION

A. Field data collection shall be performed, under a professional engineer's supervision, by a Schneider Electric Service Technician, qualified (as defined by the current edition of NFPA 70E) to ensure accurate equipment modeling. The technician shall have completed an 8-hour instructor-led Electrical Safety Training Course. The course shall include NFPA 70E training that includes the selection and use of personal protective equipment.

B. Schneider Electric will visually inspect to verify the equipment ratings and overcurrent device information to document the necessary data used in the analysis. If the equipment is unable to be placed in an electrically safe working condition as defined by NFPA 70E Article 120 for the purpose of obtaining conductor data, Schneider Electric will utilize a proprietary tool that evaluates conductor sizes over a rage of values to perform the analysis. The Owner shall provide qualified personnel to show the Schneider Electric Service personnel the equipment locations and to open all electrical room doors, locks, etc. necessary to collect nameplate data.

C. Schneider Electric Engineering Services will verify the owner's one-line drawings and provide marked corrections where discrepancies are found.

Data collection shall begin downstream from the utility service and continue down through the Owner's electrical distribution system as defined under scope of work. The study shall not include any single phase AC circuits or DC distribution systems as these types of circuits and systems are excluded from IEEE 1584-2002 Arc Flash calculation guidelines. The study will not include equipment below 240 Volts, per Section 4.2 of IEEE 1584, unless it involves (1) 125KVA or larger low impedance transformer in its immediate power supply.

D. Schneider Electric shall obtain from the utility the minimum, normal, and maximum operating service voltage levels, three-phase short circuit MVA and X/R ratio, as well as line-to-ground short circuit MVA and X/R ratio at the point of connection as shown on the drawings.

2.03 SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:

1. Calculation methods and assumptions.
2. Selected base per unit quantities.
3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, and other information pertinent to the computer analysis.

4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings.
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Schneider Electric shall notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.04 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility's overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Medium voltage conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:

 1. A one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.

 2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.

 3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.

 4. The study shall include a separate, tabular printout containing both as found and recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram.

 5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

 6. Schneider Electric shall notify Owner in writing of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

2.05 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed per the IEEE 1584 equations. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04).

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards and busway) where work could be performed on energized parts.

C. Circuits less than 240V fed by transformers 112.5 kVA or less may be omitted from the computer model per IEEE 1584.

D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must consider the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:

   1. Fault contribution from induction motors should not be considered beyond five (5) cycles.

H. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of two (2) seconds will be used based on IEEE 1584-2002 section B.1.2.

L. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.

M. The Arc-Flash Hazard Analysis shall report incident energy values based on both as found and recommended device settings for equipment within the scope of the study.

N. The Arc-Flash Hazard Analysis may include other recommendations to reduce AFIE levels and enhance worker safety.

PART 3 EXECUTION

3.01 FIELD ADJUSTMENT

A. The Owner shall adjust relay and protective device settings per the recommended settings table provided by the coordination study.

   <OPTION>

Field adjustments to be completed by Schneider Electric Services under the separate Startup and Acceptance Testing contract portion of project specifications.

B. Owner shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Schneider Electric shall notify Owner in writing of any required major equipment modifications.

3.02 ARC FLASH LABELS <OPTION>

A. Schneider Electric Engineering Services shall provide a 4.0 in. x 4.0 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The labels shall be designed per the following standards:

1. UL969 – Standard for Marking and Labeling Systems
2. ANSI Z535.4 – Product Safety Signs and Labels
3. NFPA 70 (National Electric Code) – Article 110.16
4. NFPA 70E Standard For Electrical Safety In the Workplace

C. The label shall include the following information:

1. System Voltage
2. Flash protection boundary
3. Arc Flash Incident energy value (cal/cm²)
4. Limited and restricted Approach Boundaries
5. Study report number and issue date

D. Labels shall be printed by a thermal transfer type printer, with no field markings.

E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

1. Floor Standing Equipment − Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

Label Installation <OPTION>

F. Labels shall be field installed by qualified technicians under engineering supervision. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

PART 4 TRAINING

4.01 ARC FLASH TRAINING <OPTION>

A. The vendor supplying the Arc Flash Hazard Analysis shall train the Owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 8 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.

B. The vendor supplying the Arc Flash Hazard Analysis shall offer instructor led and online NFPA 70E training classes.

PART 5 ELECTRICAL SAFETY POLICY REVIEW

5.01 ELECTRICAL SAFETY REVIEW <OPTION>

A. The vendor supplying the Arc Flash Hazard Analysis shall review the Owner's Electrical Safety Policy for compliance to the NFPA 70E and OSHA Standards.

B. The results of the audit shall be presented in a report with a tabular listing of all of the policies' shortcomings.

8.0 References

1. Occupational Safety and Health Standards, 29CFR, Part 1910, Subpart S, Electrical, *Occupational Safety and Health Administration (OSHA)*
2. Standard for Electrical Safety in the Workplace, NFPA 70E - 2015, *National Fire Protection Association (NFPA), Quincy, MA*
3. IEEE Guide for Performing Arc-Flash Hazard Calculations, IEEE Standard 1584 – 2002, *Institute of Electrical and Electronics Engineers, New York, NY*
4. Update of Field Analysis of Arc Flash Incidents, PPE Protective Performance and Related Work Injuries, Doan, Hoagland and Neal, *IEEE IAS Electrical Safety Workshop, February 1-5, 2010, Memphis, TN*

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