e-Hazard Taking the Flash Out of Electrical Safety

March 4, 2026

Arc Flash Study

Prepared for:

Company ABC

Anyplace, USA

Prepared by:

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March 4, 2026

Customer X
Company ABC
5678 Random Road,
Anyplace, USA

Customer X,

Thank you for the opportunity to provide this Arc Flash Study.

This report contains all information relevant to your Arc Flash Study, including drawings and site information. In addition, electronic versions of the files in PDF, and the study data files are transferred using file sharing. The relevant engineering software package (such as SKM PowerTools or EasyPower) is required to open the study files.

It is recommended the file folder be retained in a secure, documented location within your organization, as it contains important information that may need to be referenced over time as changes in equipment and personnel occur. e-Hazard retains an electronic version of all related files, in the event further discussion is needed or questions arise.

For any additional clarification, relative to this report, please call me at (502) 709-7235.

Thank you,

Zarheer Jooma, P.E.

Electrical Engineer

Zarheer@e-Hazard.com

Arc Flash Study Overview

Introduction

The ETAP22.2 and ArcPro V3 software programs were used to determine Arc Flash incident energy levels and arc flash boundaries based on the *IEEE 1584™ 2018 Guide for Performing Arc-Flash Hazard Calculations* and the *NFPA 70E® 2024 Standard for Electrical Safety in the Workplace®*. This project also provides the short-circuit current analysis and equipment evaluation.

The results of the calculations and models are presented in drawings based on the facility's distribution system. The calculations have been based on design drawings, maintenance records, and the data collected by e-Hazard personnel during an on-site visit. The plant operations team made themselves available to assist as required.

The model is presented in drawings for both the AC and DC systems. The file folder contains drawings in PDF (in Arch D size only) and AutoCAD compatible DXF files.

Estimation of Utility Fault Current Contribution

The site-specific short circuit fault current available at the primary incoming bus for the incoming utility service was not made available from the local utility for this Arc Flash Study. The utility contribution was thus used form the design drawings and the previous arc flash study.

Study Philosophy

This site consists of three energy sources consisting of the Local Power Utility, the Solar System, and the Battery Energy Storage System (BESS). This implies that there are potentially $2^3 = 8$ options creating a possibility of multiple labels and confusion during operations. To simplify labeling, the worst-case scenario considering all three sources on-line, was used. Where protective devices took longer than 2s to clear, the arcing duration was limited to 2s per generally acceptable engineering practices and standards.

The BESS 800A Disconnects contained SIBA fusing that was unavailable in the ETAP 22.5 Library. An equivalent Bussman fuse was used instead. The internals of the BESS (racks and banks) were not accessed and inspected, as such, no overcurrent protective devices (OCPD) were modeled between the racks/bank and 800A disconnect. Limiting the arcing duration to 2s yielded 88 cal/cm^2 at the 800 Disconnect switch. The fuses acted in reducing the arcing duration at BESS-0x (converter input) and DC-0x (converter output). At the input and output of the converters the highest arc flash incident energy (IE) was selected for the labeling. (Note that the BESS was not incorporated into the previous AFS – this January 2026 study will supersede the previous study and site labeling entirely).

The cables between the combiner boxes (CB) and the inverter was estimated at differing lengths. The cables between the PV modules had little effect on the IE and was not included in the final model.

The 34.5 kV model was performed using ArcPro V3 (with patch). It was assumed that during normal operations, a single line to ground fault in open air would be the most likely event. In certain situations, however, the elbows on the medium voltage side of the transformer may be exposed, and the bay-o-net fuses inside the transformer may require replacement—conditions that could potentially create a three phase arc flash hazard.

The short circuit study was performed using ETAP and OSHA standards were used to generate the inputs for the single phase and three phase arcing scenarios.

Table 1 summarizes the guidance provided in OSHA 1910.269 for the two scenarios considered. Note that not all operational conditions could be incorporated into the calculations. While conservative results are presented, the end user shall consult the engineer of record to identify any specific operating conditions that require additional modeling. Based on Table 1, the working distance factoring the MAD was set at 36 inches for both single line to ground (SLG) and three phase enclosure (3PH) events. The larger arc gap produces a more conservative result and was therefore selected. The fault current at 34.5 kV was based on the higher three phase short circuit current, rounded up to 3 kA. A two second arcing duration was used.

TABLE 1: OHSA 1910.269 STANDARD AND APPENDIX E

Scenario	Working Distance	Arc Gap	MAD	Reference
SLG	23.46”	3.45”	2.53’ = 2’7”=30.36” (R-6)	1910.269 Table R-6 and Appendix E Table 4 & 5
3PH	N/A	6”	2.92’=2’11”=35.04” (R-6)	1910.269 Table R-6 and Appendix E Table 5

These factors were used as inputs into ArcPro and the SLG and 3PH arcing scenarios are shown in Table 2 and Table 3 respectively.

ARCPRO Inputs and results: Table of Heat vs. Distance (radial distance from midpoint of arc)

TABLE 2: ARCPRO SLG MODEL

Current (kA): 3; Duration (cycles): 120; Arc Gap (in.): 6; Source Voltage (V): 34500; Electrode Material: Stainless Steel; Calculation Type: Full; AFB: arc flash boundary:

Arc Type: Single Phase AC Open		
Distance (in)	Heat Flux (cal/s/cm^2)	Heat Energy @ 2s (cal/cm^2)
36	0.923	1.85
AFB = 44.67in @ 1.2 cal/cm^2		

TABLE 3: ARCPRO 3PH MODEL

Current (kA): 3; Duration (cycles): 120; Arc Gap (in.): 6; Source Voltage (V): 34500; Electrode Material: Stainless Steel; Calculation Type: Full; AFB: arc flash boundary:

Arc Type: Three Phase AC Enclosed		
Distance (in)	Heat Flux (cal/s/cm^2)	Heat Energy @ 2s (cal/cm^2)
36	3.23	6.46
AFB = 83.63in @ 1.2 cal/cm^2		

Final result: Work on the 34.5kV network requires a minimum Level 2 PPE with appropriate shock protection and live-line tools with a working distance = 36" and the arc flash protection boundary = 7' (or 84")

Operation of the Plant

The plant operation is very complex due to the presence of multiple power generation sources and circuit parts that are accessible for absence of voltage verification. Since no plant operations procedures were made available for this study (as requested from site personnel), worst case scenario where selected for labeling purposes. BESS operations are at dangerous levels and should not be interacted with locally. For other installations the calculated energy levels as indicated on the drawings are in excess of 1.2 cal/cm² and as such would require some levels of PPE. Where the arc flash labels indicate values less than or equal to 1.2 cal/cm², specific arc rated levels of PPE are not required but may be used for an additional layer of safety. PLEASE READ EACH LABEL WHILE PLANNING WORK. The extracted text from *NFPA 70E* is provided next.

> **110.2(B) Electrically Safe Work Condition. …When Required.**
> …
>
> ***Exception No. 1:*** Normal operation of electric equipment shall be permitted where a normal operating condition exists. A normal operating condition exists when all of the following conditions are satisfied:
>
> (1) The equipment is properly installed.
>
> (2) The equipment is properly maintained.
>
> (3) The equipment is rated for the available fault current.
>
> (4) The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
>
> (5) The equipment doors are closed and secured.
>
> (6) All equipment covers are in place and secured.
>
> (7) There is no evidence of impending failure.
>
> *Informational Note No. 1*: The phrase properly installed means that the equipment is installed in accordance with applicable industry codes and standards and the manufacturer's recommendations. The phrase properly maintained means that the equipment has been maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards. The phrase evidence of impending failure means that there is evidence such as arcing, overheating, loose or bound equipment parts, visible damage, deterioration, or water damage.
>
> *Informational Note No. 2:* See *NEMA GD 1-2019, Evaluating Water-Damaged Electrical Equipment*, as an example of a document that provides further information on evaluating electrical equipment that may have been exposed to water.

NFPA 70E® 2024, pg. 15-16

> **130.7 Personal and Other Protective Equipment.**
>
> (A) **General.** Employees exposed to electrical hazards when the risk associated with that hazard is not adequately reduced by the applicable electrical installation requirements shall be provided with, and shall use, protective equipment that is designed and constructed for the specific part of the body to be protected and for the work to be performed.
>
> *Informational Note:* The PPE requirements of 130.7 are intended to protect a person from arc flash and electric shock hazards. While some situations could result in burns to the skin, even with the protection selected, burn injury should be reduced and survivable. Due to the explosive effect of

some arc events, physical trauma injuries could occur. The PPE requirements of 130.7 do not address protection against physical trauma other than exposure to the thermal effects of an arc flash.

NFPA 70E® 2024, pg. 29

Table 130.5(C) Estimate of the Likelihood of Occurrence of an Arc Flash Hazard Incident for ac and dc Systems

Task	Operating Condition	Likelihood of Occurrence*
…		
Operation of a circuit breaker (CB), switch, contactor, or starter	Normal Abnormal	No Yes

NFPA 70E® 2024, pg. 27-28

NFPA 70E makes it clear the determination of this condition can only be made by the responsible person in charge of the facility. If the facility has evidence and documentation as per the requirements of *NFPA 70E 205.4, 205.5* and *210.6* that all seven conditions of *110.2(B) Exception No. 1* are met, then no arc rated PPE would be required to operate disconnects with the doors properly closed and latched. It is, however, unlikely that equipment is maintained to the exact specifications of the manufacturer. For reference see the NFPA extracts listed below.

The facility should adopt a safer approach by providing appropriate Arc Rated clothing as specified in *NFPA 70E, Table 130.5(G) Selection of Arc-Rated Clothing and Other PPE When the Incident Energy Analysis Method Is Used.* At minimum these would require the use of arc rated clothing and equipment by the task qualified workers including at least an arc rated face shield, arc rated balaclava, arc rated clothing, leather gloves, and standard issued PPE when performing the lock out procedure or to interact with the MCC, panelboard, or disconnect in question. If this approach is taken, the under-layer clothing shall be 100% natural fiber non-melting clothing per *NFPA 70E*. After the disconnect switch is operated to the "off" position and electrically verified then lock out procedures can be performed on the equipment under an electrically safe work condition without any arc rated PPE.

205.4 General Maintenance Requirements. Electrical equipment shall be maintained in accordance with manufacturers' instructions or industry consensus standards to reduce the risk associated with failure. The equipment owner or the owner's designated representative shall be responsible for maintenance of the electrical equipment and documentation.

Informational Note No. 1: Common industry practice is to apply test or calibration decals to equipment to indicate the test or calibration date and overall condition of equipment that has been tested and maintained in the field. These decals provide the employee immediate indication of last maintenance date and if the tested device or system was found acceptable on the date of test. This local information can assist the employee in the assessment of overall electrical equipment maintenance status.

Informational Note No. 2: Noncontact diagnostic methods in addition to scheduled maintenance activities of electrical equipment can assist in the identification of electrical anomalies.

205.5 Overcurrent Protective Devices. Overcurrent protective devices shall be maintained in accordance with the manufacturers' instructions or industry consensus standards. Maintenance, tests, and inspections shall be documented.

…

> **210.6 Protective Devices.** Protective devices shall be maintained to adequately withstand or interrupt available fault current.
>
> *Informational Note:* Improper or inadequate maintenance can result in increased opening time of the overcurrent protective device, thus increasing the incident energy.

NFPA 70E® 2024, pg. 43-44

Equipment Labeling

The MCC sections will be labeled to the actual incident energy levels per the requirements of *IEEE 1584* and *NFPA 70E* for testing, troubleshooting and interacting with the device with exposed energized parts. All disconnects that could require maintenance, testing or trouble shootings will be labeled to the requirements of *NFPA 70E 130.5(H).*

> **130.5 Arc Flash Risk Assessment.**
>
> **...**
>
> **(H) Equipment Labeling.** Electrical equipment such as switchboards, panel boards, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling units and that are likely to require examination, adjustment, servicing, or maintenance while energized shall be marked with a label containing all the following information:
>
> (1) Nominal system voltage
>
> (2) Arc flash boundary
>
> (3) At least one of the following:
>
> a. Available incident energy and the corresponding working distance, or the arc flash PPE category in *Table 130.7(C)(15)(a)* or *Table 130.7(C)(15)(b)* for the equipment, but not both
>
> b. Minimum arc rating of clothing
>
> c. Site-specific level of PPE
>
> *Exception No. 1:* Unless changes in electrical distribution system(s) render the label inaccurate, labels applied prior to the effective date of this edition of the standard shall be acceptable if they complied with the requirements for equipment labeling in the standard in effect at the time the labels were applied.
>
> *Exception No. 2:* In supervised industrial installations where conditions of maintenance and engineering supervision ensure that only qualified persons monitor and service the system, the information required in *130.5(H)(1)* through *130.5(H)(3)* shall be permitted to be documented in a manner that is readily available to persons likely to perform examination, servicing, maintenance, and operation of the equipment while energized.
>
> The method of calculating and the data to support the information for the label shall be documented. The data shall be reviewed for accuracy at intervals not to exceed 5 years. Where the review of the data identifies a change that renders the label inaccurate, the label shall be updated.
>
> The label shall be of sufficient durability to withstand the environment involved.
>
> The owner of the electrical equipment shall be responsible for the documentation, installation, and maintenance of the marked label.

NFPA 70E® 2024, pg. 29

The labels provided are based on a site-specific PPE selection as per *NFPA 70E 30.5(H)(3)(c)* and the *PPE Poster* in this report. Refer to the table below and further details provided at the end of the Incident Energy Summary Report.

Site Specific PPE Selection

LEVEL	Incident Energy (cal/cm²)	Arc Rated Clothing
0	0.0 - 1.2	Nonmelting or Untreated Fiber with Weight >= 4.5 oz/sq yd
1	1.2 - 4.0	Arc-rated shirt & pants OR arc-rated coverall
2	4.0 - 8.0	Arc-rated shirt & pants OR arc-rated coverall
3	8.0 - 25.0	Arc-rated shirt & pants OR arc-rated coverall OR arc-rated arc flash suit
4	25.0 - 40.0	Arc-rated shirt & pants OR arc-rated coverall OR arc-rated arc flash suit
Dangerous	> 40.0 - 999.0	Dangerous: Contact Plant Management. Detailed Risk Assessment Required

System Mis-coordination

A system coordination study was not performed as part of this review.

A generic note regarding system coordination is that in a power system, mis-coordination is not an uncommon situation to find and it typically works in your favor relative to arc flash as the speed of the upstream protective device reduces the incident energy exposure. These upstream protective devices function in this manner only in an overload condition. A detailed system analysis could be considered although, it should be noted that this power system device coordination analysis could consume significant engineering and field monitoring cost.

Equipment Evaluation Report

A Device Evaluation Summary was not performed as part of this review.

A generic note regarding Equipment Evaluations is that there are primarily two areas of over current device ratings in the Equipment Evaluation Report. One area is the Short Circuit Current Available ratings for a device > 80% SCCA ratings and the other is related to connected load to the device > 80% for continuous load ratings.

a) In the case of the available short circuit current ratings, these devices are continuous duty rated and thus they are suitable for the service as designed and intended. This is a software default value based on the NEC and in this case, is not applicable to your system.

b) The second area is relative to connected load greater than 80% and 100%. The software cannot determine the real horsepower of a particular motor and assumes it to be 100% loaded. It cannot determine true loading of multiple motors operated in a lead / lag configuration. It calculates to 100% load on every device connected. It cannot calculate diversity of loads per the *NEC*. This is the only reason you will find a marginal rating on a device due to loading > 80% or a failure rating on a device due to loading > 100%.

General Information

The BESS incident energy exceeded the maximum available on-site PPE (40 cal/cm²). Sectionalizing procedures at cell and bank level should be considered to reduce BESS incident energy. For all other operations (AC, DC,

LV, and MV/HV), 40 cal/cm^2 arc rated protection together with the appropriate shock protective PPE shall be used.

The calculations and resultant incident energy levels are based upon the overcurrent device operating as designed and maintained. Maintenance intervals should be based on the manufacturer's recommendations or industry consensus testing standards. This is typically a 3-year interval based on the conditions of the equipment. NFPA 70B – *Standard for Electrical Equipment Maintenance*® and ANSI/NETA MTS – *Standard for Maintenance Testing Specifications* provide guidance to adjust maintenance intervals based on location conditions. The circuit breakers at the location are operated and cleaned on an annual basis according to plant maintenance personnel.

Layering of arc-rated clothing is allowed, as long as it has been tested as a system. This information is available on the clothing makers websites as well as on ArcWear.com. Contact your clothing supplier for rating information on your specific PPE.

Additional *NFPA 70E* Requirements

A written Electrical Safety Program (ESP) is required by *NFPA 70E*. This requirement incorporates criteria for all aspects of electric safety. An Electrical Safety Program provides a framework for assessing risks, i.e. an arc flash study, training and procedures related to maintenance, labeling, and safe work practices.

> **110.3 Electrical Safety Program.**
>
> **(A) General.** The employer shall implement and document an overall electrical safety program that directs activity appropriate to the risk associated with electrical hazards.
>
> *Informational Note No. 1:* Safety-related work practices such as verification of proper maintenance and installation, alerting techniques, auditing requirements, and training requirements provided in this standard are administrative controls and part of an overall electrical safety program.
>
> ...
>
> **(C) Condition of Maintenance.** The electrical safety program shall include elements that consider condition of maintenance of electrical equipment and systems.
>
> ...
>
> **(H) Risk Assessment Procedure.** The electrical safety program shall include a risk assessment procedure and shall comply with *110.3(H)(1)* through *110.3(H)(3)*.
>
> (1) Elements of the Risk Assessment Procedure. ...
>
> (2) Human Error. ...
>
> (3) Hierarchy of Risk Control Methods. ...

NFPA 70E® 2024, pg. 16-17

NFPA 70E requires initial qualified training and retraining every three years for your qualified electrical workers. We typically recommend electrical safety training after the labeling activity as this can provide a customized session for your specific equipment and what the labels require as far as proper work practices.

> **110.4(A) Training Requirements. Electrical Safety Training.**
>
> ...
>
> **(1) Qualified Person.** A qualified person shall be trained and knowledgeable in the construction and operation of equipment or a specific work method and be trained to identify and avoid the electrical hazards that might be present with respect to that equipment or work method.

> (a) Such persons shall also be familiar with the proper use of applicable precautionary techniques, electrical policies, procedures, PPE, insulating materials, shielding materials, and insulated tools and test equipment.
>
> (b) A person shall be qualified for certain equipment and tasks to be performed.
>
> ...
>
> **(3) Additional Training and Retraining.** Additional training and retraining in safety-related work practices and applicable changes in this standard shall be performed at intervals not to exceed 3 years. An employee shall receive additional training or retraining if any of the following conditions exists:
>
> (1) The supervision or annual inspections indicate the employee is not complying with the safety-related work practices.
>
> (2) New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices different from those that the employee would normally use.
>
> (3) The employee needs to review tasks that are performed less often than once per year.
>
> (4) The employee needs to review safety-related work practices not normally used by the employee during regular job duties.
>
> (5) The employee's job duties change.

NFPA 70E® 2024, pg. 18

This arc flash study should be reviewed and updated anytime there is a significant change in equipment, facility expansion/renovation, or at least every five years as required by *NFPA 70E*. If the utility contacts you for a service interruption, ask the question for what purpose. If they are upgrading the transmission line or transmission / distribution transformers, this is your indication to find out what the change will be to your incoming fault current and relay clearing times which can affect the arc flash calculations.

If the utility has not changed anything relative to your incoming service fault current and you have not changed anything in your distribution system on site, then the review can be a very simple process of noting this fact every five years. A verification from the utility contribution as indicated in the utility information in this document and listed on the drawing is all that would be required.

Referenced Documents

American National Standards Institute, Inc. (ANSI) Publications
ANSI/NETA MTS – *Standard for Maintenance Testing Specifications*

Institute for Electrical and Electronic Engineers (IEEE) Publications
IEEE 1584™ – *Guide for Performing Arc Flash Hazard Calculations*

National Fire Protection Association (NFPA) Publications
NFPA 70® – *National Electrical Code®*, (NEC®)
NFPA 70B – *Standard for Electrical Equipment Maintenance®*
NFPA 70E® – Standard for Electrical Safety in the Workplace®, 2024 edition

National Electrical Manufacturers Association (NEMA) Publications
NEMA GD 1-2019, Evaluating Water-Damaged Electrical Equipment

e-Hazard

Taking the Flash Out of Electrical Safety

ARC FLASH INCIDENT ENERGY SUMMARY REPORT

electrical WORKPLACE SAFETY

Bus Arc Flash Hazard Analysis Summary

Faulted Bus				Fault Current			Trip Device							
ID	Nom. kV	Equipment Type	Gap (mm)	Bolted Fault (kA) Bus	Bolted Fault (kA) PD	PD Arc Fault (kA)	Source Trip Device ID	Trip (cycle)	Open (cycle)	FCT (cycle)	Arc Flash Boundary (ft)	Incident Energy (cal/cm²)	Working Distance (in)	Energy Level
AC BREAKER	0.600	Other	13	28.451						120.00	23.2	95.9	18	Dangerous
AUX PANEL	0.208	Panelboard	25	6.542	0.039	0.017	RECLOSER	17.16	0.00	17.16	2.0	1.9	18	Level 2
INVERTER AC BUS	0.600	Other	13	28.418						120.00	23.2	95.8	18	Dangerous
MANUAL TRF SW	0.208	Other	13	6.542	0.039	0.020	RECLOSER	16.73	0.00	16.73	1.9	1.7	18	Level 2
XFMR-1 LV BUS	0.600	Other	13	28.451						120.00	23.2	95.9	18	Dangerous

Summary - DC Arc Flash Hazard Calculations

Faulted Bus				Fault Current								
ID	Nom. kV	Equip. Type	Gap (mm)	Bolted Fault (kA) Bus	PD	PD Arc Fault (kA)	Source Trip Device ID	Total FCT (seconds)	Flash Boundary (ft)	Incident Energy (cal/cm²)	Working Distance (inches)	Energy Level
BATTERY BANK 1	1.104	Panelboard	20	33.220	0.000	0.000		2.000	13.19	88.543	18.00	Dangerous
BATTERY BANK 2	1.104	Panelboard	20	33.220	0.000	0.000		2.000	13.19	88.543	18.00	Dangerous
BATTERY BANK 3	1.104	Panelboard	20	33.220	0.000	0.000		2.000	13.19	88.543	18.00	Dangerous
BATTERY BANK 4	1.104	Panelboard	20	33.220	0.000	0.000		2.000	13.19	88.543	18.00	Dangerous
BESS-01	1.104	Panelboard	20	31.376	15.688	14.270	dcFuse10	0.010	0.84	0.416	18.00	Recommended
BESS-02	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse7	0.010	0.84	0.416	18.00	Recommended
BESS-03	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse17	0.010	0.84	0.416	18.00	Recommended
BESS-04	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse21	0.010	0.84	0.416	18.00	Recommended
CB-01-01	1.020	Junction Box	20	5.968	0.000	0.000		2.000	7.83	23.785	18.00	Level 4
CB-01-02	1.020	Junction Box	20	5.977	0.000	0.000		2.000	7.83	23.824	18.00	Level 4
CB-01-03	1.020	Junction Box	20	5.968	0.000	0.000		2.000	7.83	23.782	18.00	Level 4
CB-01-04	1.020	Junction Box	20	5.982	0.000	0.000		2.000	7.84	23.847	18.00	Level 4
CB-01-05	1.020	Junction Box	20	5.995	0.000	0.000		2.000	7.85	23.903	18.00	Level 4
CB-01-06	1.020	Junction Box	20	5.999	0.000	0.000		2.000	7.85	23.921	18.00	Level 4
CB-01-07	1.020	Junction Box	20	6.007	0.000	0.000		2.000	7.86	23.955	18.00	Level 4
CB-01-08	1.020	Junction Box	20	6.013	0.000	0.000		2.000	7.86	23.982	18.00	Level 4
CB-01-09	1.020	Junction Box	20	6.028	0.000	0.000		2.000	7.87	24.048	18.00	Level 4
CB-01-10	1.020	Junction Box	20	6.031	0.000	0.000		2.000	7.87	24.060	18.00	Level 4
CB-01-11	1.020	Junction Box	20	6.025	0.000	0.000		2.000	7.87	24.035	18.00	Level 4
CB-01-12	1.020	Junction Box	20	6.016	0.000	0.000		2.000	7.86	23.995	18.00	Level 4
CB-01-13	1.020	Junction Box	20	6.032	0.000	0.000		2.000	7.87	24.067	18.00	Level 4
CB-01-14	1.020	Junction Box	20	6.029	0.000	0.000		2.000	7.87	24.055	18.00	Level 4
DC DISCONNECT 1	1.104	Panelboard	20	31.394	0.000	0.000		2.000	12.78	83.172	18.00	Dangerous
DC DISCONNECT 1A	1.104	Panelboard	20	31.394	0.000	0.000		2.000	12.78	83.172	18.00	Dangerous
DC DISCONNECT 2	1.104	Panelboard	20	31.394	0.000	0.000		2.000	12.78	83.172	18.00	Dangerous
DC DISCONNECT 2A	1.104	Panelboard	20	31.394	0.000	0.000		2.000	12.78	83.172	18.00	Dangerous
dcBus1	1.020	Panelboard	20	6.034	0.736	0.673	dcSW15	2.000	5.08	13.210	18.00	Level 4
dcBus3	1.020	Panelboard	20	6.034	0.000	0.000		2.000	5.08	13.210	18.00	Level 4
dcBus4	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse9	0.010	0.84	0.416	18.00	Recommended
dcBus6	1.020	Panelboard	20	6.034	0.000	0.000		2.000	5.08	13.210	18.00	Level 4

Summary - DC Arc Flash Hazard Calculations

Faulted Bus				Fault Current								
ID	Nom. kV	Equip. Type	Gap (mm)	Bolted Fault (kA) Bus	PD	PD Arc Fault (kA)	Source Trip Device ID	Total FCT (seconds)	Flash Boundary (ft)	Incident Energy (cal/cm²)	Working Distance (inches)	Energy Level
dcBus7	1.020	Panelboard	20	6.034	0.000	0.000		2.000	5.08	13.210	18.00	Level 4
dcBus8	1.020	Panelboard	20	6.034	0.000	0.000		2.000	5.08	13.210	18.00	Level 4
dcBus9	1.020	Panelboard	20	6.034	6.034	5.524	dcFuse13	0.150	1.35	0.988	18.00	Recommended
dcBus10	1.020	Panelboard	20	6.031	0.736	0.673	dcFuse3	2.000	5.08	13.202	18.00	Level 4
dcBus11	1.020	Panelboard	20	6.031	0.736	0.673	dcFuse15	2.000	5.08	13.202	18.00	Level 4
dcBus12	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse8	0.010	0.84	0.416	18.00	Recommended
dcBus14	1.020	Panelboard	20	6.031	0.736	0.673	dcFuse19	2.000	5.08	13.202	18.00	Level 4
dcBus16	1.104	Panelboard	20	31.376	0.000	0.000		2.000	12.77	83.119	18.00	Dangerous
dcBus17	1.020	Panelboard	20	6.031	0.736	0.673	dcFuse23	2.000	5.08	13.202	18.00	Level 4
dcBus18	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse18	0.010	0.84	0.416	18.00	Recommended
dcBus19	1.104	Panelboard	20	31.394	31.394	28.556	dcFuse22	0.010	0.84	0.416	18.00	Recommended
dcBus20	1.104	Panelboard	20	6.031	6.031	5.559	dcFuse4	0.144	1.33	0.959	18.00	Recommended
dcBus22	1.104	Panelboard	20	6.031	6.031	5.559	dcFuse16	0.144	1.33	0.959	18.00	Recommended
dcBus23	1.104	Panelboard	20	6.031	6.031	5.559	dcFuse24	0.144	1.33	0.959	18.00	Recommended
dcBus24	1.104	Panelboard	20	6.031	6.031	5.559	dcFuse20	0.144	1.33	0.959	18.00	Recommended
DCC-01	1.020	Panelboard	20	6.031	5.296	4.848	dcFuse3	0.313	1.99	2.064	18.00	Level 2
DCC-02	1.020	Panelboard	20	6.031	5.296	4.848	dcFuse15	0.313	1.99	2.064	18.00	Level 2
DCC-03	1.020	Panelboard	20	6.031	5.296	4.848	dcFuse19	0.313	1.99	2.064	18.00	Level 2
DCC-04	1.020	Panelboard	20	6.031	5.296	4.848	dcFuse23	0.313	1.99	2.064	18.00	Level 2
INVERTER DC BUS	1.020	Panelboard	20	6.034	0.000	0.000		2.000	5.08	13.210	18.00	Level 4

ARCPRO: Table of Heat vs. Distance
  (radial distance from midpoint of arc)

Current (kA): 3
Duration (cycles): 120
Arc Gap (in.): 6
Source Voltage (V): 34500
Electrode Material: Stainless Steel
Arc Type: Single Phase AC Open
Distance to Arc (in.): 36
Calculation Type: Full
AFB: arc flash boundary

Arc Voltage (V): 235
Arc Energy (kcal): 295
Arc Type: Single Phase AC Open

	Distance (in.)	Heat Flux (cal/s/cm^2)	Heat Energy (cal/cm^2)
	0.4	1024	2048
	2	166	333
	4	60.0	120
	6	29.8	59.6
	8	17.6	35.1
	10	11.5	23.0
	12	8.08	16.2
	14	5.99	12.0
	16	4.61	9.21
	18	3.65	7.31
	20	2.97	5.93
	22	2.46	4.91
	24	2.07	4.13
	26	1.76	3.53
	28	1.52	3.04
	30	1.33	2.65
	32	1.17	2.33
	34	1.03	2.07
*	36	0.923	1.85
	38	0.828	1.66
	40	0.748	1.50
AFB	44.67	0.6	1.2

(User: Greg Stevens greg@e-hazard.com) kinectrics.com Arcpro3 v2017,3r 1/26/2026 11:07:56 AM

ARCPRO: Table of Heat vs. Distance
  (radial distance from midpoint of arc)

Current (kA): 3
Duration (cycles): 120
Arc Gap (in.): 6
Source Voltage (V): 34500
Electrode Material: Stainless Steel
Arc Type: Three Phase AC Enclosed
Distance to Arc (in.): 36
Calculation Type: Full
AFB: arc flash boundary

Arc Voltage (V): 235
Arc Energy (kcal): 295
Arc Type: Three Phase AC Enclosed

	Distance (in.)	Heat Flux (cal/s/cm^2)	Heat Energy (cal/cm^2)
	0.4	3542	7084
	2	582	1165
	4	210	420
	6	104	209
	8	61.4	123
	10	40.2	80.4
	12	28.3	56.6
	14	20.9	41.9
	16	16.1	32.2
	18	12.8	25.6
	20	10.4	20.8
	22	8.60	17.2
	24	7.23	14.5
	26	6.17	12.3
	28	5.33	10.7
	30	4.64	9.29
	32	4.08	8.17
	34	3.62	7.24
*	36	3.23	6.46
	38	2.90	5.80
	40	2.62	5.23
AFB	83.63	0.6	1.2

(User: Greg Stevens greg@e-hazard.com) kinectrics.com Arcpro3 v2017,3r 1/26/2026 11:05:10 AM

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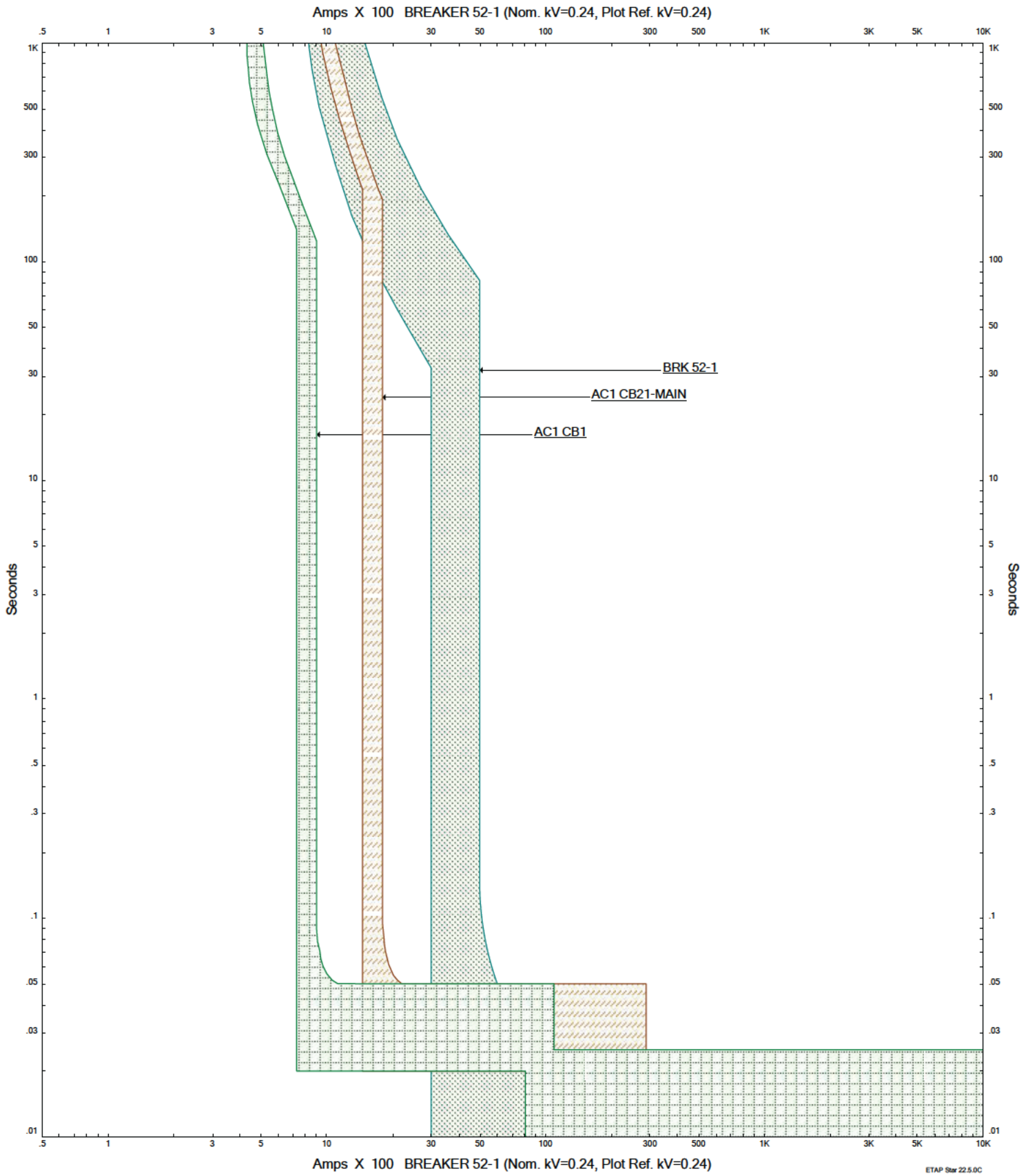
Taking the Flash Out of Electrical Safety

TIME CURRENT CURVES (TCCs)

electrical
WORKPLACE SAFETY



Main Breakers Co-Ord

Project:
Location:
Contract:
Engineer:

Date: 03-28-2025
SN: PWRPROTECT
Rev: Base
Fault: Phase

e-Hazard

Taking the Flash Out of Electrical Safety

PPE POSTER

electrical
WORKPLACE SAFETY

Personal Protective Equipment

Arc Flash Calculation Method
for Equipment Assessment

Make sure your PPE Arc Rating Exceeds the Hazard

e-Hazard®
Taking the Flash Out of Electrical Safety
(502) 716-7073
e-Hazard.com

Download PDFs

Recommended Best Practice for IE < 1.2 cal/cm²

PPE Arc Rating (AR) Must Be ≥ *Estimated* Incident Energy (IE)

IE = 1.2 – 12 cal/cm²

IE > 12 cal/cm²

Head

- ☑ Eye Protection
- ☑ Hearing Protection
- ○ *Hard Hat*
- ○ *Face Shield*

Safety Glasses/Goggles
Hearing Protection
Hard Hat
AR Arc Flash Hood
or
AR Face Shield with AR Balaclava

Body

- ☑ **Shirt, long-sleeve & Pants**

ALL clothing made of Non-melting/Natural Fiber

AR Shirt, long-sleeve & AR Pants
or
AR Coverall
or
AR Arc Flash Suit

Hands

- ○ *Gloves: Leather, AR, or VR*

Heavy-duty Leather Gloves
or
AR Gloves
or
Rubber Insulating Gloves with Leather Protectors

Feet

- ☑ **Leather Footwear**

Leather Footwear

AR* Outerwear
*Only required to meet min. AR if primary protection

NFPA 70E / CSA Z462

- ● *Required*
- ◪ *Required, Choices Available*
- ○ *As Needed*

Requirements per NFPA 70E (2021), Table 130.5(G) / CSA Z462-18, Table 3

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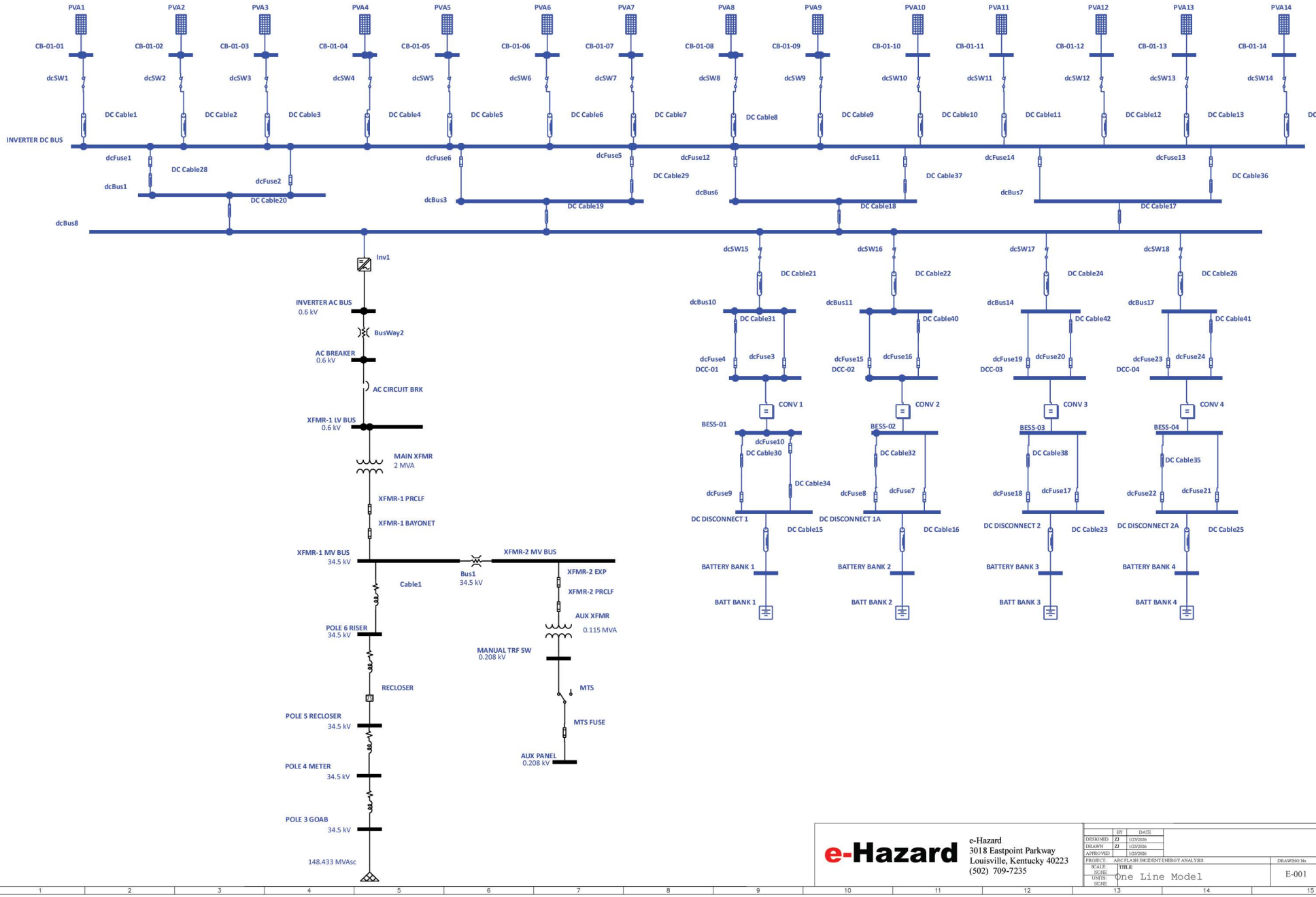
Taking the Flash Out of Electrical Safety

ARC FLASH MODEL

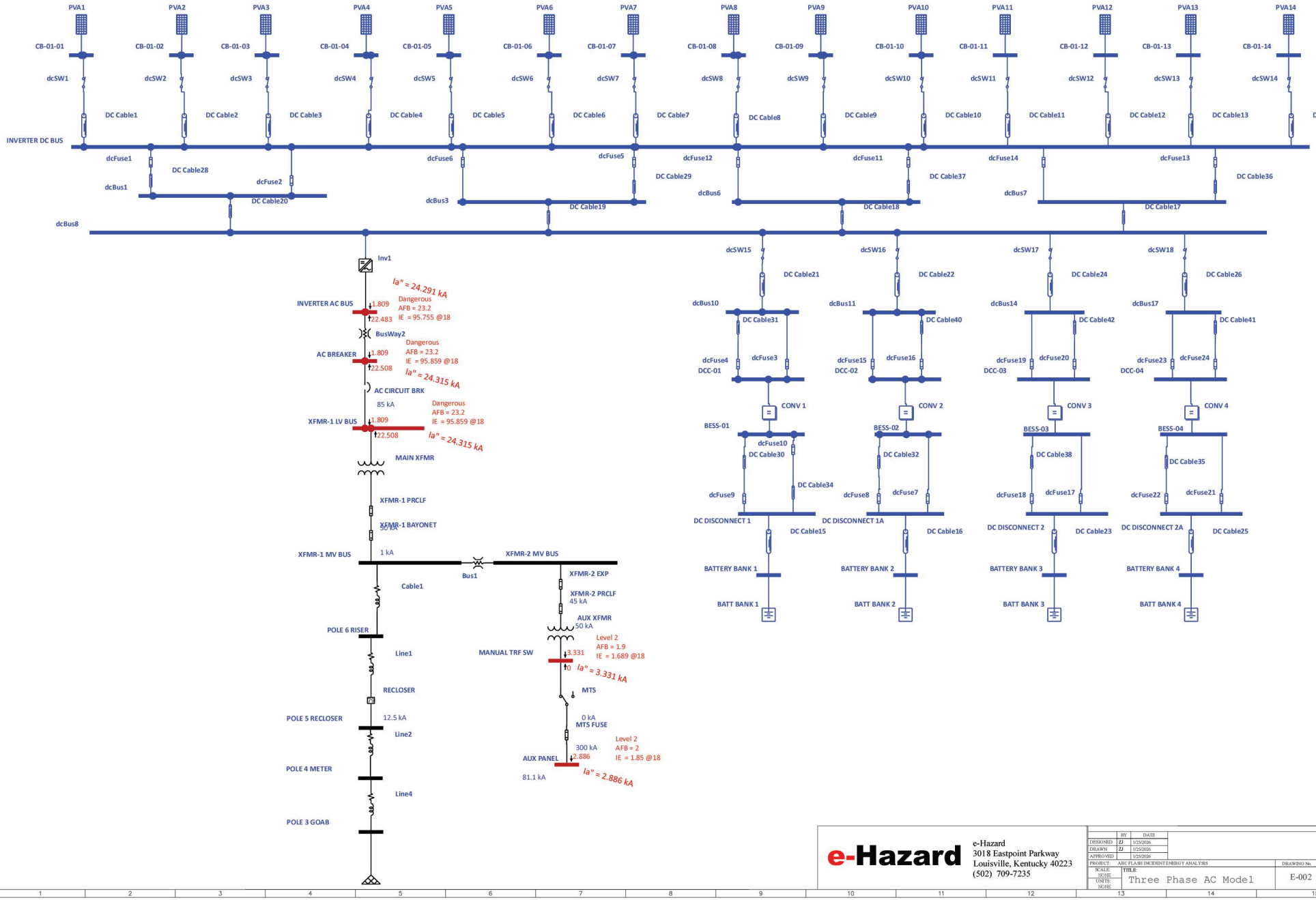
electrical
WORKPLACE SAFETY



e-Hazard
3018 Eastpoint Parkway
Louisville, Kentucky 40223
(502) 709-7235

	BY	DATE
DESIGNED	ZJ	1/25/2026
DRAWN	ZJ	1/25/2026
APPROVED		1/25/2026

PROJECT: ARC FLASH INCIDENT ENERGY ANALYSIS
DRAWING No.: E-001
REV.: 0
SCALE: NONE
UNITS: NONE
TITLE: One Line Model



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	BY	DATE
DESIGNED	ZJ	1/25/2026
DRAWN	ZJ	1/25/2026
APPROVED		1/25/2026

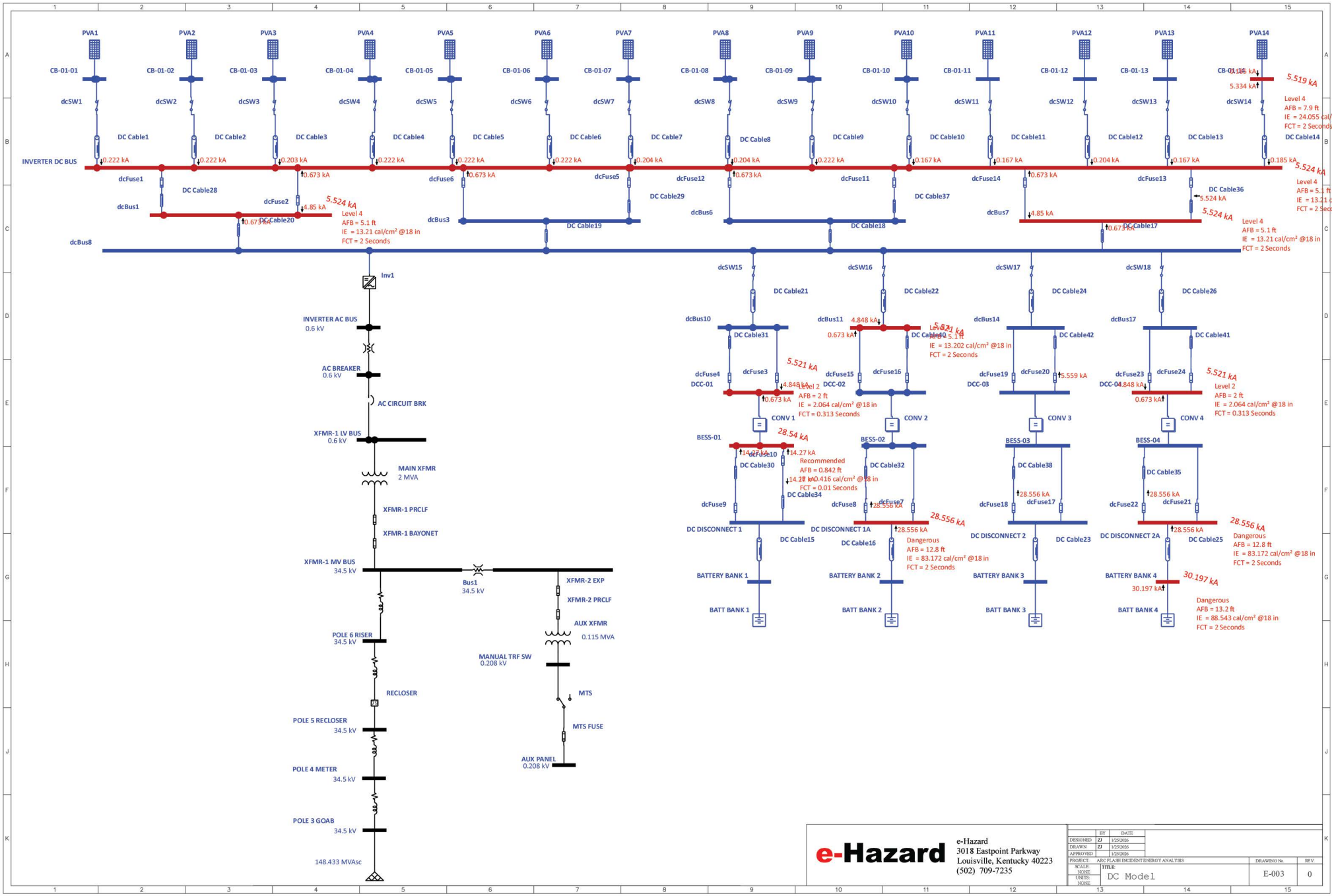
PROJECT: ARC FLASH INCIDENT ENERGY ANALYSIS

SCALE: NONE
UNITS: NONE

TITLE: Three Phase AC Model

DRAWING No.: E-002

REV.: 0



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	BY	DATE
DESIGNED	ZJ	1/25/2026
DRAWN	ZJ	1/25/2026
APPROVED		1/25/2026

PROJECT: ARC FLASH INCIDENT ENERGY ANALYSIS		DRAWING No.	REV.
SCALE: NONE UNITS: NONE	TITLE: DC Model	E-003	0