Lynn Werkheiser

From:	Michael Ellis <MEllis@Pennoni.com>
Sent:	Friday, August 8, 2025 12:06 AM
To:	Mark Miller; Ridley STP Lab; Lynn Werkheiser
Cc:	Haley Zuritsky; Erika Addison; John Rengepis; Nathan M. Cline
Subject:	RCSTP Arc Flash Study Report - FINAL
Attachments:	EGMAU25005 - RCSTP SC-Coord-AF Study.pdf

Hi All,

We met virtually with Lenni Electric to discuss their review of the draft Arc Flash report. We made a few minor updates thereafter, and the final signed & sealed report is attached. This can be provided to the MA for Monday's packet for their reference.

The recommendations remain the same as in the draft report. It is our understanding that Lenni has already implemented the recommendations and that updated labels have already been installed. If so, no further action is needed at this time regarding this study.

Mark – The actual effort to complete the study was more than we had initially scoped, and I would like to respectfully request supplemental funding for a portion of that additional effort. There were at least 15 breakers in the MCC that were not clearly visible even when the panels were opened. Additional effort was needed to research the specific breakers manufacturer, model number, AIC ratings, etc. via internet searches. Project submittals were vetted to verify the model(s) was accurate, and the arc flash computer model had to be iteratively updated as a result. Our proposal was based on an assumption that "all equipment are clearly labeled and that all equipment ratings are readily visible without opening panels. Effort is not included to research equipment ratings via internet searches or other means. Should research be required, additional effort will be billed in accordance with Pennoni's rate schedule." We are tracking well under budget on our 2025 General Service task order so we would like to discuss if the portion of supplemental effort on this project can be applied against a portion of the remaining General Services budget. I will call to discuss the effort and feasibility of this request in more detail.

Thanks!
Mike

Michael Ellis, PE
Municipal Division Manager

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From: Erika Addison <eaddison@Pennoni.com>
Sent: Thursday, May 29, 2025 3:21 PM
To: Mark Miller (mmiller@eastgoshen.org) <mmiller@eastgoshen.org>; Ridley STP Lab <ridley2@eastgoshen.org>
Cc: Michael Ellis <MEllis@Pennoni.com>; Haley Zuritsky <HZuritsky@Pennoni.com>
Subject: RCSTP Arc Flash Study Report
Importance: High

Good afternoon,

Please see the attached draft of the arc flash study report for the RCSTP. In short, we are recommending the replacement of a few breakers in panels MCC-1 and CBH and the replacement of a couple of arc flash labels.

Would you be available sometime next week to have a short call with us to finalize this draft report and to discuss any questions you may have? We would like to have the report finalized before the next municipal authority meeting.

Thanks,
Erika

Erika Addison, PE

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What's Possible Podcast Episode 1

Ridley Creek Sewage Treatment Plant (RCSTP) Protective Device Coordination & Arc Flash Study

West Chester, PA

Submitted To:

East Goshen Municipal Authority
Mark Miller, Public Works Director
1580 Paoli Pike
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Arc Flash Report
EGMAU25005
July 22, 2025

Pennoni

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Executive Summary

Pennoni has been contracted to perform an Arc Flash Study of the updated electrical system for the Ridley Creek Sewage Treatment Plant in West Chester, PA. The system underwent updates since the last arc flash study done in 2011. These changes include replacing the existing 400KW "Generator 1" with a new 450KW generator, transferring panel CBH to be fed by "Generator 1.

This report includes a short circuit study, an overcurrent protection device coordination study, and an arc flash study. All studies were performed using Easypower software version 11.0 for Windows.

Input data used in this study were obtained from vendor cutsheets, design drawings, and site visit observations and photos. Short circuit, HV fuse, and utility transformer data were provided by the utility.

Protective devices within the electrical equipment and power systems have (SCCR) Short-Circuit- Current-Ratings, which are the maximum short-circuit current the equipment can withstand (without being damaged) and/or (AIC) Available-Interrupting-Current ratings which are the maximum short circuit amps the protection devices can safely interrupt. The unit of measurement, Amps RMS Symmetrical, is the same for SCCR and AIC ratings. A short-circuit study is performed to calculate the maximum short-circuit current possible at each point of interest in an electrical system. A comparison is then made between the calculated short-circuit current and the short-circuit ratings of the equipment and the interrupting capacity of each protective device, to determine if the electrical equipment can safely withstand the available short-circuit current and if the protective device can safely interrupt the short-circuit current, that would be present at that point (node) in the electrical distribution system. A properly coordinated system is one in which all components are adequately protected, and a minimum number of protective devices will operate to safely isolate a fault condition, and to minimize the interruption of service to the rest of the system.

Electrical system changes within the facility or in the utility system can have a significant impact on the results of this power system analysis. To account for this, three different scenarios were analyzed: (1) The system operating at full utility calculated short circuit levels, (2) the system operating at 50% utility short circuit current, and (3) The system operating at the generator short circuit current. Utility short circuit contribution was received from the Philadelphia Electric Company (PECO) as shown in Appendix I.

The short circuit study evaluates the adequacy of the Fully Rated electrical distribution equipment illustrated in the electrical one-line diagram. The study determines the maximum available short-circuit current at each bus location.

The coordination study evaluates the protective device current settings against all other "upstream" devices so that a system outage, caused by an overcurrent event, is limited in effecting as little of the electrical infrastructure as possible. This is accomplished by coordinating breaker settings so that lower "stream" devices (affecting smaller branches of the electrical system) trip before upstream devices. This process is referred to as selective coordination.

The arc flash study establishes the flash protection boundary around electrical equipment within which a worker exposed to an arcing fault may expect to receive injury if not adequately protected. The analysis determines the incident energy levels at specific working distances from the equipment, which is then used to select the appropriate personal protective equipment (PPE) to be worn when working within the flash protection boundary. Please note however, that high incident energy conditions present in a particular location in the gear may not have a "PPE" solution and must be turned off prior to being accessed and /or worked upon. Arc flash labels are provided in the report.

Introduction

The Ridley Creek Sewage Treatment Plant has undergone changes to its existing electrical infrastructure since a previous study was conducted in 2011. These changes include replacing the existing 400KW "Generator 1" with a new 450KW generator, transferring panel CBH to be fed by "Generator 1".

This report includes a short circuit study, an overcurrent protection device coordination study, and an arc flash study. Each study was performed using EasyPower's analysis focuses (modules) and are to verify the adequacy of electrical equipment ratings, protective device coordination within various levels of the electrical distribution systems, and arc flash hazards. The studies cover the facility's power distribution system from its point of connection to the utility service and generator through the system down to the panelboard and motor level.

Input data used in this study were obtained from vendor cutsheets, design drawings, and site visit observations and photos. Short circuits, HV fuse, and utility transformer data were provided by the utility.

To complete this study, the following scenarios were considered:

1. System operating at 100% Utility Short Circuit Current
2. System operating at 50% Utility Short Circuit Current
3. System operating on Generator Short Circuit Current

The worst-case scenarios were then used to determine the analysis presented in the report.

This report is sub-divided into the following sections:

- Executive Summary
- Introduction
- System Description
- Short-Circuit Study: Description of all standards and procedures used in calculating short-circuit currents for the facility
- Coordination Study: Includes standards and procedures used in evaluating system coordination, also included are the suggested protective device settings for the adjustable protective devices and plots of time-current curves
- Arc Flash Study: Include standards and procedures used in evaluating the arc flash energy levels for the equipment throughout the facility. A tabulation of incident energy, recommended working distance and personnel protective equipment (PPE) is also provided, as well as equipment warning labels
- Appendixes: Contain EASYPOWER input data, various simulation reports and single line power riser models. This section contains material that could not easily be included within the body of the written document.
    - Appendix A: Input Data
    - Appendix B: Original one-line diagram and EasyPower one-line diagram
    - Appendix C: Short circuit one-line diagram
    - Appendix D: Equipment duty scenario comparison report
    - Appendix E: Time-current curves of selected protective device coordination
    - Appendix F: Arc flash hazard scenario comparison report
    - Appendix G: Arc flash one-line diagram
    - Appendix H: Arc flash sample labels
    - Appendix I: Utility provided Short Circuit, Fuse, and Transformer information at the point of service

(The short circuit one-line diagram, arc flash one-line diagram, and arc flash report sections are further divided by 100% of the utility fault current, 50% of the utility fault current, and generator fault current.)

Input Data

Information Gathering

The system model was created from design drawings, submittals, and site visit photos. All input data is documented in Appendix A of this report.

Utility Electric Service

The incoming service for the electrical distribution system for the RCSTP is provided by PECO. The 480Y/277V service is fed from a utility 1000KVA, 33000Y/19052V - 480Y/277V Y-Y pad-mounted transformer with 5.72% impedance and protected by three (3) upstream S&C Co. SMU-20 80E fuses. The 3-phase fault is 2,215A with X/R = 5.3, and the 1 phase fault current is 1,639A with X/R = 4.4.

Generator Contribution

Two generators are used to provide auxiliary power to RCSTP. Generator 1 is 450kW/562.5kVA and provides standby power to MCC-1, MCC-2, and panel CBH. Generator 2 is 500kW/625kVA and provides standby power to MCC-3. Both generators are 480V, 3ph, 1800 RPM, Diesel, and are installed adjacent to the existing exterior MDP switchboard.

Feeders

All major feeders within the system have been included in the model. The input data includes conductor size (AWG/kcmil) and type (aluminum or copper), number of conductors per phase, conduit material (magnetic or non-magnetic), and length. From this data, conductor impedance is calculated utilizing IEEE 242 (Recommended Practice for Electrical Power Distribution and Coordination of Industrial and Commercial Power Systems).

When feeder lengths were not provided by others verified field efforts, the lengths were estimated from building plans, assuming that overhead conduit runs are parallel and perpendicular to building structure and underground conduit runs are straight. When conductor sizes were not provided and could not be field verified, conductor sizes were assumed based on NEC table 301.16. In this case it is assumed that the feeders are properly sized based on the size of the upstream overcurrent device.

Transformers

All three-phase transformers within the system have been included in the system model. Ratings for each transformer include kVA, primary and secondary voltages, winding configurations, percent impedance (%Z) and X/R ratio. Typical X/R ratios were assumed for small try-type transformers. In some cases, percent impedance values were assumed when actual data was not available.

Short Circuit Study

Short Circuit Analysis Basics

A short circuit analysis is the fundamental portion of any power system study. In order to perform subsequent analysis, such as load flow, overcurrent device coordination, or arc flash hazard analysis, the power system must be modeled in its entirety and short circuit values must be calculated at all major buses within the distribution system.

A short circuit analysis is utilized for the following purposes:

1. Low-Voltage Overcurrent Device Interrupting Rating (AIC) Evaluation – determine the adequacy of low-voltage overcurrent devices (such as circuit breakers, fuses, etc.) by comparing the calculated short circuit duty to the device's interrupting rating (AIC rating).
2. Withstanding Rating (Short Circuit Current Rating) Evaluation – determine the adequacy of electrical components with are not capable of interrupting fault current (such as equipment bussing, transfer switches, non-fused disconnect switches, etc.) by comparing the calculated short circuit duty to the components withstand rating or SCCR (Short Circuit Current Rating).
3. Time-Current Curve (TCC) Cut-Off Points – each overcurrent device's time-current curve ends at the maximum available short circuit current at the device's terminals. The cutoff point aids in coordination of overcurrent devices.
4. Arc Flash Bolted Fault Current – in order to calculate the arc flash incident energy levels, the bolted fault current at each bus must be calculated.

The short circuit analysis was completed utilizing the Short Circuit module of EasyPower. The calculation procedures are based on recommendations included in ANSI standards C37.13, C37.010, and C37.5. The program calculates the maximum available three-phase and single line-to-ground fault current without any reduction due to current-limiting overcurrent devices which may be present. The calculated short circuit values are RMS symmetrical amperes and are comparable with the RMS symmetrical short circuit ratings of electrical equipment.

Electrical distribution equipment must be able to withstand and/or interrupt the most severe fault duty that it may be subjected to at its location in the system. In particular, NEC section 110.9 requires circuit breakers to have a sufficient rating for interrupting the maximum available fault current present at their line side terminals. For locations where calculated fault currents exceed the ratings of the equipment, recommendations for corrective actions are provided.

Electrical equipment manufacturers provide their equipment's short circuit interrupting or withstanding rating in symmetrical RMS current values. However in reality, fault currents are not exclusively symmetrical. At the inception of a fault, system reactance (X) and resistances (R), in addition to the time that the fault occurs on the alternating current (AC) voltage waveform, will introduce a component of asymmetry. This asymmetrical component lasts only for the first few cycles after the initial fault occurs. The duration and magnitude of this component depends on the composition of all system components that provide a contributing source to the fault location.

Due to this, actual asymmetrical faults can only be estimated. The capability of overcurrent devices to interrupt an asymmetrical fault must be based upon the maximum possible asymmetrical fault current at its location within the electrical distribution system.

Motor Contribution to Short Circuit Current

Any motor that is running at the time of a fault will temporarily act as a generator and contribute fault current due to its rotational kinetic energy. This fault contribution only lasts for the first few cycles of a fault. At the motor's terminals, the fault contribution is equal to the motor's load current rating (FLA) divided by its sub-transient reactance.

For the purpose of this study, typical data from Easypower was used for each motor's sub-transient reactance.

In order to document the worst-case short circuit current levels, the short circuit analysis assumes that all modeled motors are running at the time of the fault. Motors that are fed by VFDs which have bypass contactors are assumed to be in bypass mode, thus able to contribute fault current. Motors that are fed by VFDs which do not have bypass contactors have not been considered as a motor contribution.

Calculation Results and Conclusion

Maximum short circuit values were calculated for each bus within the system model. The three-phase fault was considered. X/R ratios for the fault type were calculated for use in as asymmetrical fault current derating (adjustment) factor, when the calculated X/R ratio exceeds the rated (test) X/R ratio for a given low-voltage device. The resulting maximum short circuit duty was calculated from the three-phase current.

Three scenarios were considered in order to determine the highest short circuit level at each bus. These scenarios include:

1. System operating at 100% Utility Short Circuit Current
2. System operating at 50% Utility Short Circuit Current
3. System operating on Generator Short Circuit Current

The detailed results of the short circuit analysis for each scenario are documented in Appendices C and D. Appendix C includes three single-line diagrams, one for each scenario, identifying how the short circuit current changes as it goes through each bus. Appendix D includes an Equipment Duty Scenario Comparison Report that identifies which scenario has the highest fault current and compares it to either the Interrupting Rating (AIC) or Short Circuit Current Rating (SCCR) for each bus, panel, motor, etc.

The results of this evaluation of existing equipment capabilities have determined that the branch breakers in MCC-1 and panel CBH have lower AIC ratings than the calculated faults. Under rated breakers have the potential to create hazardous conditions when subjected to a fault condition. Equipment may become inoperable or may catastrophically explode under certain conditions.

Recommendations

It is recommended that the branch breakers in panels MCC-1 and CBH to be replaced with (at a minimum) breakers with 22kAIC ratings.

It is also recommended that the facility provide safety measures until these conditions are remedied. All other equipment is adequately sized, having short circuit current ratings higher than the calculated short circuit current.

The electrical power distribution system in the one-line configuration represents the interconnection between electrical equipment and all data/parameters. This is required to make the successful short circuit calculation and analysis. The short circuit results show worst-case short circuit values at bus locations in the electrical system.

Coordination Study

Overcurrent Device Coordination Basics

An overcurrent device coordination study is the process of selecting settings for overcurrent devices, such that operation of the devices will occur in a specified order to minimize interruption due to a system disturbance (short circuit, ground fault, or overload condition). This selective coordination (or selectivity) of overcurrent devices will open the overcurrent device nearest to the system distribution while allowing the remainers of the system to remain in operation. Non-selective operation of overcurrent devices may result in unnecessary outages to portions of the electrical distribution system.

The NEC defines Selective Coordination as:

Localization of an overcurrent condition to restrict outages to the circuit or equipment affected by the selection and installation of overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.

The COORDINATION module in EasyPower was used to complete the overcurrent device coordination study. The methodology used in this analysis is based upon the recommendations in IEEE 242 "IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems" and in part on professional experience. During this process, a series of overcurrent devices are examined by overlaying each overcurrent device's time-current characteristic curve (TCC) on a log-log plot.

Determining the most appropriate setting for adjustable overcurrent devices in any system is more of an art than a science, because it is usually not possible for overcurrent devices in series to be completely coordinated for all ranges of possible fault current Coordination often stops short of complete selectivity when an acceptable compromise is reached between maximum protection and maximum selectivity. In addition, arc flash levels must be evaluated and limited, when possible, by reducing overcurrent device settings.

Molded-case Circuit Breakers (MCCBs)

The molded-case circuit breaker is the simplest, least expensive, and most commonly used circuit breaker in the industry. As such, their trip characteristics are of particular importance. The most common type of molded case circuit breaker is the thermal-magnetic type, which contains a thermal portion for overload protection and magnetic portion for short circuit and ground fault protection.

On the TCC of a molded case circuit breaker, there is a band with two distinct borders. The left-most border represents the minimum unlatched time, which is the time when the circuit breaker begins its unlatching (tripping) sequence. The right-most border represents the maximum interrupting time, which is the total time it will take the circuit breaker to separate its contact and extinguish the arc between internal contacts.

The majority of thermal-magnetic molded case circuit breakers rated 225A or less are not adjustable. Many rated 250A or greater have an adjustable instantaneous setting (typically 5-10x of their current rating). In order for molded case circuit breakers to be self-protecting, they must trip instantaneously for fault currents above their instantaneous trip level (typically no more than 10x their current rating). On a TCC, this can appear as in overlap in the lower decade (0.01-0.1 sec).

When molded case circuit breakers are applied in series, they can be selectively coordinated when there is sufficient impedance between the two devices to limit the maximum available short circuit current at the downstream molded case circuit breaker to a values less than the instantaneous setting of the upstream molded case circuit breaker. Selective coordination can also be achieved when using specific combinations of molded case circuit breakers which have been tested and certified by the manufacturer to selectively coordinate.

When there is insufficient impedance in the system between molded case circuit breakers connected in series to selective coordinate, the TCCs will overlap in the instantaneous trip regions. This area of non-coordination is generally viewed as acceptable when the following factors are considered

- The cutoff points on TCCs of overcurrent devices are based three-phase bolted faults. Bolted faults are low to zero impedance; whereas typical fault impedances are greater than this bolted level so that actual cutoff point on the TCC will be less than shown.

- Most faults occur at the end of branch circuits serving motors, lighting panels, and control panels. This added distance/impedance to the fault will significantly reduce fault levels and thus, reduce the probability of not achieving selectivity. Ground faults, which typically have very high impedance values are much more common than three-phase faults.

Transformer Protection

ANSI/IEEE standards (C57.109 for liquid-cooled and C57.12.59 for air-cooled transformers) identity two types of damage that potentially can occur when a transformer is exposed to through-fault currents. The first is thermal damage, which is caused by resistive heating of conductors and insulation material within the transformer. The second type of damage mechanical, which is caused by the large magnetic forces that act on the windings and structural components of the transformer during a through-fault. The thermal and mechanical damage curve for the primary and secondary windings have been included on the transformer TCCs. Additional factors that are considered in the selection of transformer protective devices are full load currents and magnetizing inrush currents.

For small 480-208Y/120V distribution transformers (225kVA or less), coordination is typically not able to be achieved between the primary and secondary overcurrent devices. This lack of selectivity is acceptable considering that the operation of either overcurrent device will result in the same loss of service.

Generator Protection

Two curves have been produced for each generator in the system. The first curve is the generator decrement curve, which represents the maximum current what will be produced by the generator during the initial few cycles of a short circuit. The second curve is the thermal damage curve, which takes into consideration both the thermal and mechanical stresses which the generator is exposed to during short circuit conditions.

Overcurrent Device Coordination Results and Analysis

Appendix E of this report includes the Time-Current Curves for overcurrent devices. There are three instances of non-coordination that are discussed below. In all other instances, the coordination study shows acceptable levels of selectivity.

The descriptions of the plots included are as follows:

- **MCC-1 Generator and MCC-2 Generator TCCs (GEN-1 CB)**
  "GEN-1" circuit breaker (CB) overlaps with "B-1A CB" in the instantaneous region and overlaps

with "MCC-1 Main CB" in the short-time delay region. However, when attempting to coordinate the GEN-1 CB by increasing the instantaneous setting, this increases the arc flash hazard. This is because the generator produces a much lower short circuit current than a normal source, and therefore increases the fault clearing time. All other breakers in this TCC are coordinated.

- **MCC-3 Generator TCC (GEN-2 CB)**
  "GEN-2" circuit breaker (CB) overlaps with "MCC-3-ESBH" in the instantaneous region and overlaps with "MCC-3 Main" in the longtime delay region. However, this is acceptable because of the same reasons stated above and because all downstream breakers of "GEN-2" are in series and therefore will not impact other equipment. All other breakers in this TCC are coordinated.
- **MCC-1 Utility and MCC-3 Utility (MDP-MAIN CB)**
  "MDP-MAIN CB" overlaps slightly with fused disconnect switch"FS-1" in the long-time delay and short-time pickup regions. Decreasing the long-time band and short-time pickup settings on the "MDP-MAIN CB" breaker would create coordination but it does not effect the arc flash hazard. All other breakers in this TCC are coordinated.

Arc Flash Study

Arc Flash Risk Assessment Calculation Method

The arc flash risk assessment has been performed according to NFPA 70E-2018, which uses methodologies and equations from IEEE-1584-2018 (IEEE Guide for Performing Arc Flash Hazard Calculations). In addition, IEEE 1584.1-2013 (IEEE Guide for the Specification and Deliverable Requirements for an Arc Flash Hazard Calculation Study in Accordance with IEEE 1584) was utilized as a basis for the scope and deliverables of this analysis.

IEEE 1584 equations for calculating incident energy and arc flash boundaries are based on statistical analysis and curve fitting of available test data. An IEEE working group produced the data from tests it performed to produce models of incident energy.

IEEE 1584 equations can be used for systems that meet the following criteria:

- 0.208kV to 15kV; three-phase
- 50Hz or 60Hz
- 700A to 106,000 bolted fault current
- 13mm to 152mm conductor gaps

Equipment rated at 240V or less with a fault current less than 25kA shall have standard level of an arc flash category of "Level 1". This is based on criteria evaluated with reference to the 2018 NFPA 70E Table 130.7(C)(15)(a) "Arc-Flash PPE Categories for Alternating Current (ac) Systems.

Scenarios

The following scenarios were used to determine the worst-case Arc Flash Hazard.

Scenario 1 - System operating on 100% Utility Fault Current (Base case).

Scenario 2 - System operating on 50% Utility Fault Current (50P Utility kA Values).

Scenario 3 – System operating on generator (Generator).

The scenario comparison report is documented in Appendix F and the detailed single-line diagram for each result is documented in Appendix G

Arc Flash Risk Assessment Results

The arc flash hazard evaluation program provides results as follows:

- Bus Name - Equipment designation at bus location.
- Voltage - Voltage at the bus in kV.
- Upstream Protective Device Name.

- Bus Bolted Fault in kA – The three-phase bolted fault current at the analyzed bus (in kA)
- Bus Arc Fault in kA – The fault current flowin through an electrical arc plasma (in kA).
- Trip Time – The time required for the overcurrent protective device to operate (in seconds).
- Clearing Time – The time required for the overcurrent protective device to clear a fault.
- Arc Flash Boundary – The working distance at which the incident energy is equal to 1.2 cal/cm^2, the level at which a person could receive a 2nd degree burn. Only qualified persons with appropriate PPE are permitted within this boundary when energized parts are exposed (in inches).
- Working Distance – The distance between the potential arc source inside the equipment and the head/torso of the worker performing the task. Typical working distances are provided by IEEE 1584 based on the equipment voltage and type (switchgear, MCC, panelboard, etc.)(in inches).
- Incident Energy – The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event (measured in calories per square centimeter (cal/cm^2) at a given working distance).

Conclusion

The evaluation results are shown as follows:

- Table 1: Personal Protection Equipment Categories and Descriptions (PPE).
- Appendix F: Arc Flash Hazard Scenario Comparison Report.
- Appendix G: Arc Flash Single-Line Diagrams for each scenario.

All equipment downstream of the overcurrent protective devices for the utility and generator have incident energies equal to or less than 7.0 cal/cm^2 requiring PPE levels of 2 or less. The utility and generator upstream of the protective devices have incident energies higher than 40.0 cal/cm^2 and require that work only be done when electrical equipment is de-energized.

Table 1: NFPA 70E-2018 Table 130.7(C)(15)(c)

Table 1		
PPE Category	PPE/ Clothing Description	Incident Energy (cal/cm^2)
	Refer to Arc Flash Hazard Identification and task to be performed in accordance with NFPA 70E. Shirt (long sleeve) and pants (long) or coverall or untreated natural fiber.	0.0 - 1.2 cal/cm^2
1	Arc-Rated Clothing, Minimum Arc Rating of 4cal/cm^2. Arc-rated long-sleeve shirt and pants or arc-rated-coverall Arc-rated face shield or arc flash suit hood Arc-rated jacket, parka, rainwear, or hard hat liner (AN) Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves Leather footwear (AN)	1.2 - 4.0 cal/cm^2
2	Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm^2. Arc-rated long-sleeve shirt and pants or arc-rated-coverall Arc-rated flash suit hood or arc-rated face shield and arc-rated balaclava Arc-rated jacket, parka, rainwear, or hard hat liner (AN) Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves Leather footwear	4.0 - 8.0 cal/cm^2

- Continuation from previous page -		
PPE Category	**PPE/ Clothing Description**	**Incident Energy (cal/cm^2)**
3	Arc-Rated Clothing Selected so that the System Arc Rating Meets the Required Minimum Arc Rating of 25 cal/cm^2. Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves Arc-rated jacket, parka, rainwear, or hard hat liner (AN) Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather footwear	8.0 – 25.0 cal/cm^2
4	Arc-Rated Clothing Selected so that the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm^2. Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves Arc-rated jacket, parka, rainwear, or hard hat liner (AN) Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather footwear	25.0 - 40.0 cal/cm^2
	Dangerous! No appropriate PPE can be found. Work only on de-energized electrical equipment.	40.0 - 999.0 cal/cm^2

Appendices

Appendix A: Input Data

Database Report using Configuration 'HSZ'
EasyPower v11.0.1.8039 5/18/2025 U:\...\EGMAU25005.dez
EasyPower LLC.

Buses	Base kV	Service	Equipment	AF Option	Electrode Gap (mm)	Enclosure Height (in)	Enclosure Width (in)	Enclosure Depth (in)
800A FUSE DS BUS	0.48	3PH-4W	Other	TCC	32	20	20	20
CBH	0.48	3PH-4W	Panelboard	TCC	25	14	12	10.402
CSPP	0.48	3PH-4W	Panelboard	TCC	25	14	12	10.402
CV-51	0.48	3PH-4W	Other	TCC	32	20	20	20
CV-52	0.48	3PH-4W	Other	TCC	32	20	20	20
EF-3	0.48	3PH-4W	Other	TCC	32	20	20	20
EF-4	0.48	3PH-4W	Other	TCC	32	20	20	20
FDR TO CBH	0.48	3PH-4W	Other	TCC	32	20	20	20
FDR TO MCC-1	0.48	3PH-4W	Other	TCC	32	20	20	20
GEN-1	0.48	3PH-4W	Other	TCC	32	20	20	20
GEN-2	0.48	3PH-4W	Other	TCC	32	20	20	20
MCC-1	0.48	3PH-4W	Switchgear	TCC	32	20	20	20
MCC-2	0.48	3PH-4W	Panel	TCC	25	14	12	5.701
MDP	0.48	3PH-4W	Switchgear	TCC	32	20	20	20
ME-10	0.48	3PH-4W	Other	TCC	32	20	20	20
ME-11	0.48	3PH-4W	Other	TCC	32	20	20	20
ME-61A	0.48	3PH-4W	Other	TCC	32	20	20	20
ME-61B	0.48	3PH-4W	Other	TCC	32	20	20	20
ME-63	0.48	3PH-4W	Other	TCC	32	20	20	20
ME-64	0.48	3PH-4W	Other	TCC	32	20	20	20
ME-65	0.48	3PH-4W	Other	TCC	32	20	20	20
OF-1 CB	0.48	3PH-4W	Other	TCC	32	20	20	20
OH DOOR	0.48	3PH-4W	Other	TCC	32	20	20	20
P-11	0.48	3PH-4W	VFD	TCC	32	20	20	20
P-12	0.48	3PH-4W	VFD	TCC	32	20	20	20
P-13	0.48	3PH-4W	VFD	TCC	32	20	20	20
P-41	0.48	3PH-4W	VFD	TCC	32	20	20	20
P-42	0.48	3PH-4W	VFD	TCC	32	20	20	20
P-43	0.48	3PH-4W	VFD	TCC	32	20	20	20
P-61	0.48	3PH-4W	Other	TCC	32	20	20	20
SCCP	0.48	3PH-4W	Panel	TCC	25	14	12	5.701
T-PECO PRI	33	3PH-4W	Transformer Terminal	TCC	254			
T-PECO SEC	0.48	3PH-4W	Transformer Terminal	TCC	32	20	20	20

Panels	Service	Base kV	Main Bus Rating (A)	Panel SC Rating (kA)	Incoming Device Type	Conn Watts	Conn kVA	Conn FLA
ECBL	3PH-4W	0.208	60	42	Main Breaker	0	0	0
ESBH	3PH-4W	0.48		42	Main Breaker	0	0	0
ESBL	3PH-4W	0.208	100	22	Main Breaker	0	0	0
PNL-1	3PH-4W	0.208	60	42	Main Breaker	0	0	0
UWCP	3PH-4W	0.48	40	42	Main Lug Only	19999.8	20	24.056

MCCs	Base kV	Service	MCC SC Rating (kA)	Conn kVA	Conn FLA	Int MF (<50)	X"dv or Xlr (>50)	R1 pu (>50)	X1 pu (>50)
FCP #1	0.48	3PH-4W	42	3.585	4.312	100000	16.7	1000	1e+06
FCP #2	0.48	3PH-4W	42	3.585	4.312	100000	16.7	1000	1e+06
MCC-3	0.48	3PH-4W	42	237.509	285.679	100000	16.7	1000	1e+06

Utilities	AC/DC	Service	To Bus ID	Base kV	Util kV	3Ph SC1	Fault Unit	SLG SC1
PECO UTILITY	AC	3PH-4W	T-PECO PRI	33	34.5	2.215	Amps	1.639

Generators	Service	To Bus ID	Rating	No of Phases	Gen kV (LL)	Gen kV (LN)	Conn	RatingUnit	Type
GEN-1	3PH-4W	GEN-1	562.5	3	0.48	0.277	YG	kVA	SYN-SPA
GEN-2	3PH-4W	GEN-2	625	3	0.48	0.277	YG	kVA	SYN-SPA

Generators	Power Factor	Efficiency	RPM	X/R	Ctl Bus	X"dv	X'dv	X0	R1 pu
GEN-1	0.8	0.95	1800	21.098	GEN-1	11	15	9	0.0927
GEN-2	0.8	0.95	1800	21.098	GEN-2	9	13	8	0.0683

Generators	X1 pu	R0 pu	X0 pu	Xd	T"'d	T'd	Ta
GEN-1	1.956	0.0758	1.6	280	0.012	0.08	0.019
GEN-2	1.44	0.0607	1.28	335	0.012	0.08	0.017

Cables	No of Phases	From Bus ID	To Bus ID	To Base kV	Size	Length	Rating (A)
C-26	3	CBH	CV-51	0.48	12	30	25
C-27	3	CBH	CV-52	0.48	12	30	25
FDR FR 800A DS TO ATS-1	3	800A FUSE DS BUS	ATS-1:Src Bus 1	0.48	300	20	855
FDR FR ATS-1 TO MCC-2	3	ATS-1:Load Bus	MCC-2	0.48	250	10	510
FDR FR ATS-2 TO MCC-3	3	ATS-2:Load Bus	MCC-3	0.48	500	10	1140
FDR FR GEN-1 TO ATS-1	3	ATS-1:Src Bus 2	GEN-1	0.48	300	40	855
FDR FR GEN-2 TO ATS-2	3	ATS-2:Src Bus 2	GEN-2	0.48	500	145	1140
FDR FR MDP TO 800A DS	3	MDP	800A FUSE DS BUS	0.48	300	30	855
FDR FR MDP TO ATS-2	3	MDP	ATS-2:Src Bus 1	0.48	500	90	1140
FDR T-PECO TO MDP	3	T-PECO SEC	MDP	0.48	500	5	1900
FDR TO CBH PT1	3	ATS-1:Load Bus	FDR TO CBH	0.48	500	10	380
FDR TO CBH PT2	3	FDR TO CBH	CBH	0.48	500	10	380
FDR TO CSPP	3	CBH	CSPP	0.48	1	65	130
FDR TO EF-3	3	CBH	EF-3	0.48	12	40	25
FDR TO EF-4	3	CBH	EF-4	0.48	12	60	25
FDR TO ESBH	3	MCC-3	ESBH	0.48	6	33	65
FDR TO FCP #1	3	MCC-3	FCP #1	0.48	12	70	25
FDR TO FCP #2	3	MCC-3	FCP #2	0.48	12	70	25
FDR TO ME-10	3	SCCP	ME-10	0.48	12	20	25
FDR TO ME-11	3	SCCP	ME-11	0.48	12	20	25
FDR TO ME-63	3	CSPP	ME-63	0.48	12	10	25
FDR TO ME-64	3	CSPP	ME-64	0.48	12	10	25
FDR TO ME-65	3	CBH	ME-65	0.48	12	40	25
FDR TO OH DOOR	3	CBH	OH DOOR	0.48	12	60	25
FDR TO SCCP	3	MCC-2	SCCP	0.48	12	20	25
FDR TO UWCP	3	MCC-3	UWCP	0.48	8	80	50
FED FR 800 DS SW TO MCC1-1	3	ATS-1:Load Bus	FDR TO MCC-1	0.48	500	5	380
FED FR 800 DS SW TO MCC1-2	3	FDR TO MCC-1	MCC-1	0.48	500	5	380

2W Transformers	No of Phases	From Bus ID	From Base kV	To Base kV	Type	Temp	MVA	Z	Z0
T-ECBL	3	MCC-2	0.48	0.208	Dry	65	0.015	4.5	3.825
T-PECO	3	T-PECO PRI	33	0.48	Oil	65	1	5.72	4.862
T-PR1	3	MCC-1	0.48	0.208	Dry	65	0.015	4.5	3.825
TX-1	3	ESBH	0.48	0.208	Dry	65	0.03	2.86	2.431

2W Transformers	X/R	To Bus ID	To Conn	From Conn
T-ECBL	1.553	ECBL	YG	D
T-PECO	5.677	T-PECO SEC	YG	YG
T-PR1	1.553	PNL-1	YG	D
TX-1	1.602	ESBL	YG	D

LV Breakers	Base kV	Breaker Mfr	Breaker Style	Trip	Trip Style	Frame (A)	Trip (A)	SC Int kA	Inst Setting	Inst (A)
ATS-1 CB	0.48	GE	SKL8	SST	MCCB SK	800	800	65	Max	8705
ATS-2	0.48	GE	SKL12	SST	MCCB SK	1200	1000	65	Max	10180
B-1A BREAKER	0.48	SQD	FA	TMGN	FA	100	100	18	Fixed	
B-1B BREAKER	0.48	SQD	FA	TMGN	FA	100	100	18	Fixed	
B-1C BREAKER	0.48	SQD	FA	TMGN	FA	100	100	18	Fixed	
B-2 BREAKER	0.48	SQD	FA	TMGN	FA	100	100	18	Fixed	
CBH MAIN CB	0.48	GE	SGL4	SST	MCCB SG	400	400	42	Max	4080
CSPP CB	0.48	GE	SELA 3P	SST	MCCB SE	150	80	65	Max	999
CV-51 CB	0.48	GE	TEY	TMGN	TEY	100	20	14	Fixed	
CV-52 CB	0.48	GE	TEY	TMGN	TEY	100	20	14	Fixed	
EF-3 CB	0.48	GE	TEY	TMGN	TEY	100	20	14	Fixed	
EF-4 CB	0.48	GE	TEY	TMGN	TEY	100	20	14	Fixed	
GEN-1 CB	0.48	SQD	PJ-800 AF	SST	MCCB	800	800	65	1.5	1200
GEN-2 CB	0.48	SQD	PJ	SST	MCCB	1200	1000	65	1.5	1500
MCC-1 MAIN CB	0.48	GE	SGL4	SST	MCCB SG	400	400	65	Max	4080
MCC-2 MAIN CB	0.48	GE	SGL6	SST	MCCB SG	600	400	65	Max	4050
MDP MAIN CB	0.48	GE	SS-20	SST	ICCB	2000	2000	65	15	30000
ME-61A CB	0.48	GE	SEDA 3P	SST	MCCB SE	150	70	18	Max	863
ME-61B	0.48	GE	SEDA 3P	SST	MCCB SE	150	70	18	Max	863
ME-63 CB	0.48	GE	SEDA 3P	SST	MCCB SE	150	20	18	Max	254
ME-64 CB	0.48	GE	SEDA 3P	SST	MCCB SE	150	20	18	Max	254
ME-65 CB	0.48	GE	TEY	TMGN	TEY	100	20	14	Fixed	
OF-1 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	50	65	Max	637
OH DOOR CB	0.48	GE	TEY	TMGN	TEY	100	20	14	Fixed	
P-11 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	70	65	Max	863
P-12 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	70	65	Max	863
P-13 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	70	65	Max	863
P-41 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	40	65	Max	501
P-42 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	40	65	Max	501
P-43 CB	0.48	GE	SELA 3P	SST	MCCB SE	150	40	65	Max	501
P-61 CB	0.48	GE	SEDA 3P	SST	MCCB SE	150	20	18	Max	254
PANEL ECBL CB	0.48	GE	SELA 3P	SST	MCCB SE	150	30	65	Max	415
PANEL PR1 BREAKER	0.48	SQD	FA	TMGN	FA	100	30	18	Fixed	
SCCP CB	0.48	GE	SELA 3P	SST	MCCB SE	150	20	65	Max	254
SCCP MAIN CB	0.48	<None>	<None>	SST		25	25	65		

Fuses	No of Phases	On Bus	Base kV	Options	Fuse Mfr	Fuse Type	Fuse Style
800A FUSE DS	3	800A FUSE DS BUS	0.48	Fused Switch	Littelfuse	POWR-PRO	KLPC(L)
FS-1	3	T-PECO PRI	33	Fuse Only	S&C	SMU	SMU-20

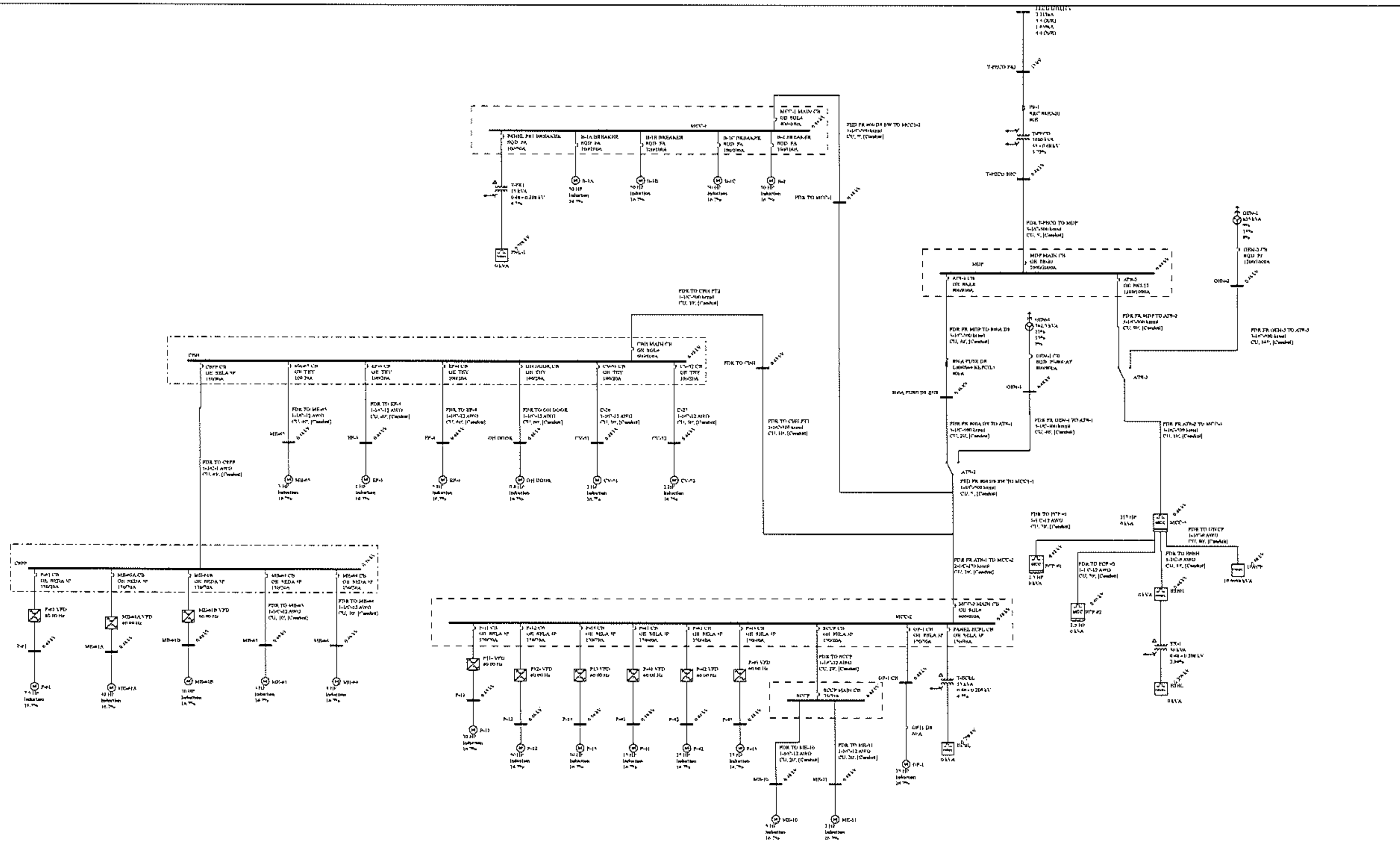
Fuses	Model	Library kV	Size	SC Int kA	SC Test X/R
800A FUSE DS		0.6	800A	200	4.9
FS-1	Standard Speed	38	80E	10	15

Switches	On Bus	Base kV	Normal State	Cont Current (A)	Assumed Open Time
ATS-1:Switch 1	ATS-1:Load Bus	0.48	Closed	0	30
ATS-2:Switch 1	ATS-2:Src Bus 1	0.48	Closed	0	30
OF11 DS	OF-1 CB	0.48	Closed	60	30

Motors	No of Phases	To Bus ID	Base kV	Motor kV	HP or kW	RPM	FLA	Power Factor	Efficiency
B-1A	3	MCC-1	0.48	0.46	50	1800		0.9	0.924
B-1B	3	MCC-1	0.48	0.46	50	1800		0.89	0.93
B-1C	3	MCC-1	0.48	0.46	50	1800		0.9	0.924
B-2	3	MCC-1	0.48	0.46	50	1800		0.9	0.924
CV-51	3	CV-51	0.48	0.46	2	1800	3.4	0.82	0.91
CV-52	3	CV-52	0.48	0.46	2	1800	3.4	0.82	0.91
EF-3	3	EF-3	0.48	0.46	1	1800	2.1	0.82	0.91
EF-4	3	EF-4	0.48	0.46	5	1800	7.6	0.82	0.91
ME-10	3	ME-10	0.48	0.46	5	1800	7.6	0.82	0.91
ME-11	3	ME-11	0.48	0.46	2	1800	3.4	0.82	0.91
ME-61A	3	ME-61A	0.48	0.46	30	1800	40	0.82	0.91
ME-61B	3	ME-61B	0.48	0.46	30	1800	40	0.82	0.91
ME-63	3	ME-63	0.48	0.46	3	1800	4.8	0.82	0.91
ME-64	3	ME-64	0.48	0.46	3	1800	4.8	0.82	0.91
ME-65	3	ME-65	0.48	0.46	3	1800	4.8	0.82	0.91
OF-1	3	OF-1 CB	0.48	0.46	25	1800	34	0.82	0.91
OH DOOR	3	OH DOOR	0.48	0.46	0.8	1800		0.82	0.91
P-11	3	P-11	0.48	0.46	30	1800	40	0.82	0.91
P-12	3	P-12	0.48	0.46	30	1800	40	0.82	0.91
P-13	3	P-13	0.48	0.46	30	1800	40	0.82	0.91
P-41	3	P-41	0.48	0.46	15	1800	21	0.82	0.91
P-42	3	P-42	0.48	0.46	15	1800	21	0.82	0.91
P-43	3	P-43	0.48	0.46	15	1800	21	0.82	0.91
P-61	3	P-61	0.48	0.46	7.5	1800	11	0.82	0.91

ATSs	Base kV	Service	Working Distance (in)	Electrode Gap (mm)	Model
ATS-1	0.48	3PH-4W	18	32	Switch
ATS-2	0.48	3PH-4W	18	32	Switch

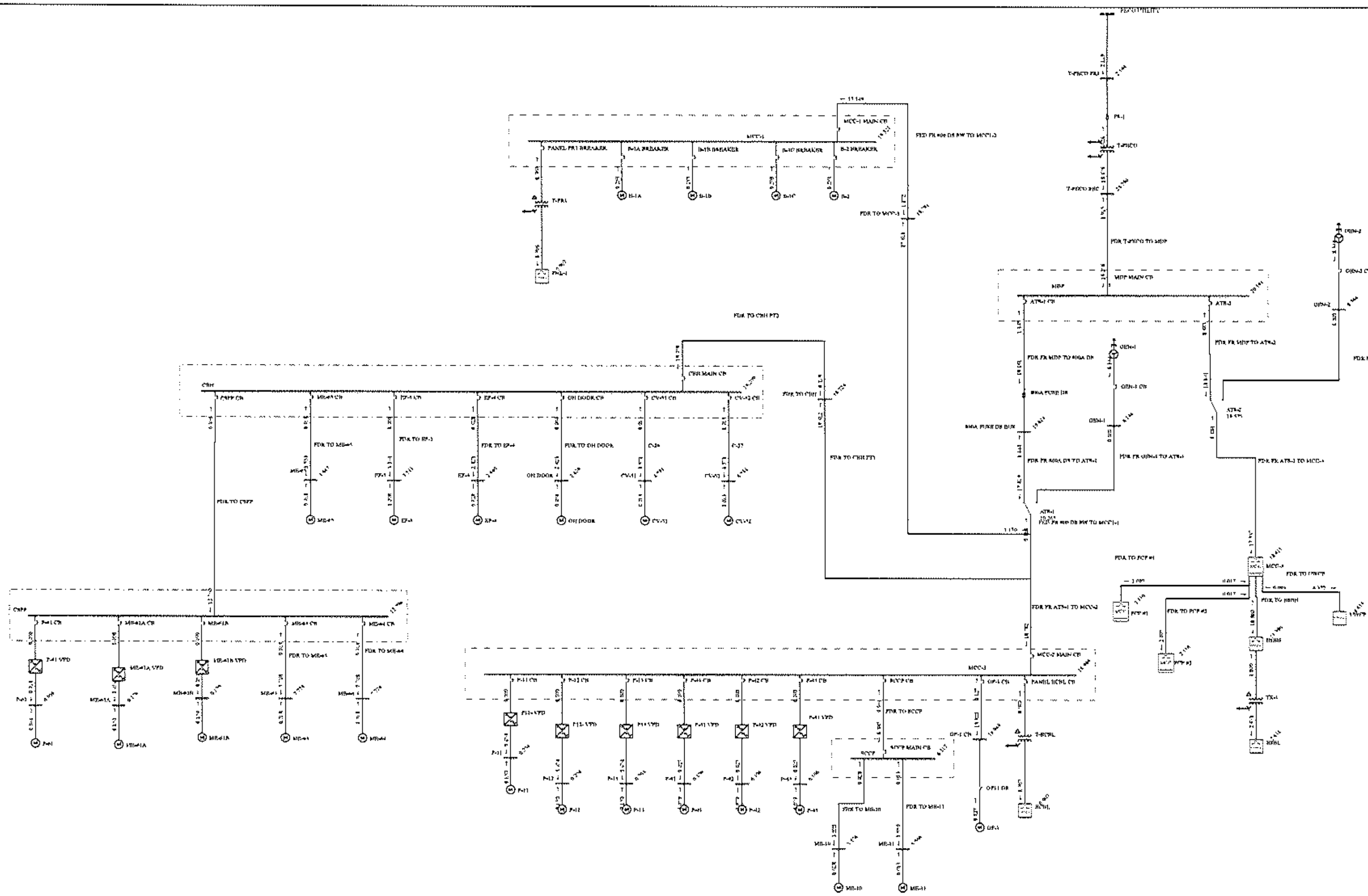
Appendix B:
One Line Diagram



RCSTP
ONE-LINE DIAGRAM

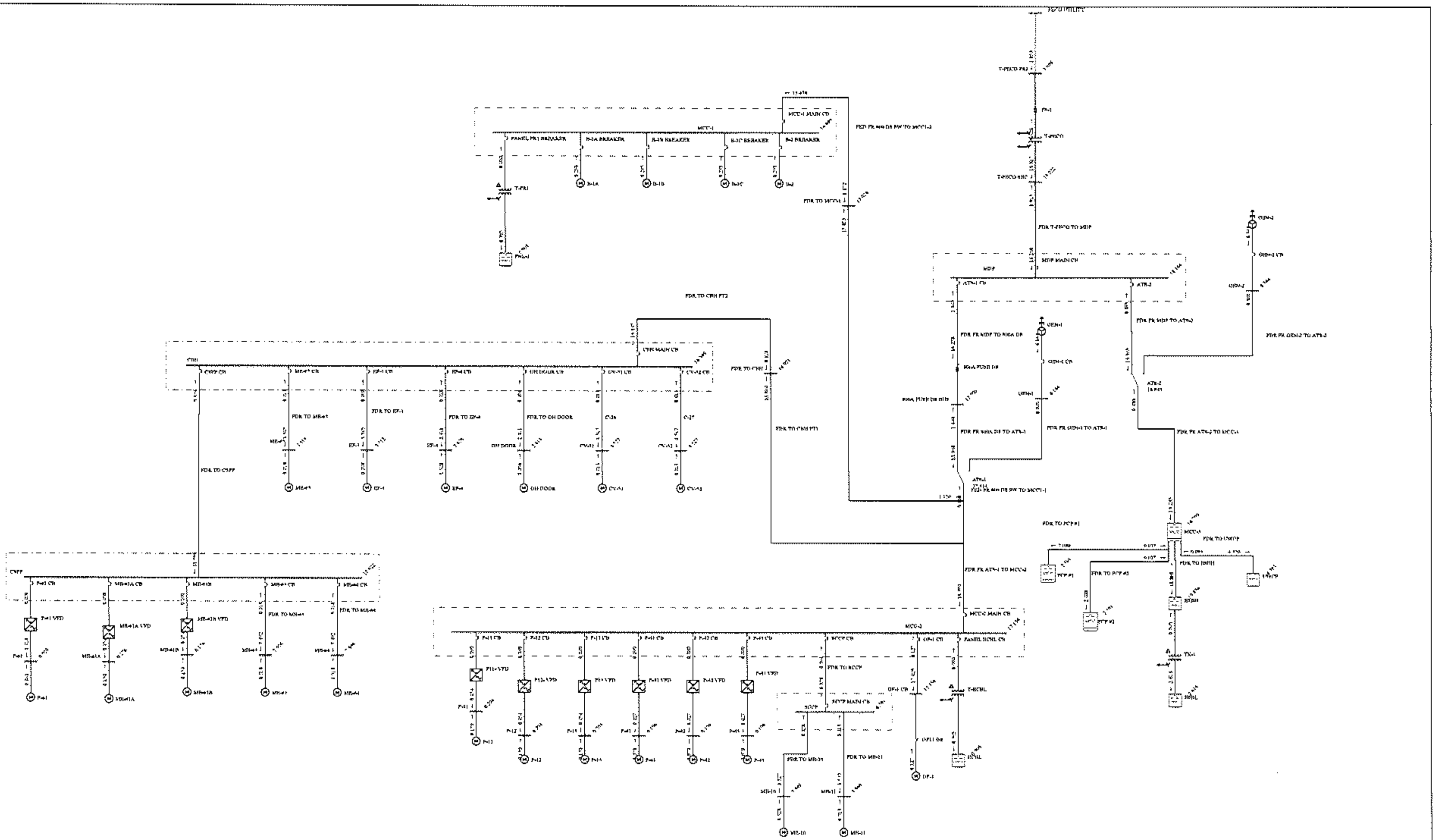
100% UTILITY

Appendix C:
Short Circuit One-Line Results



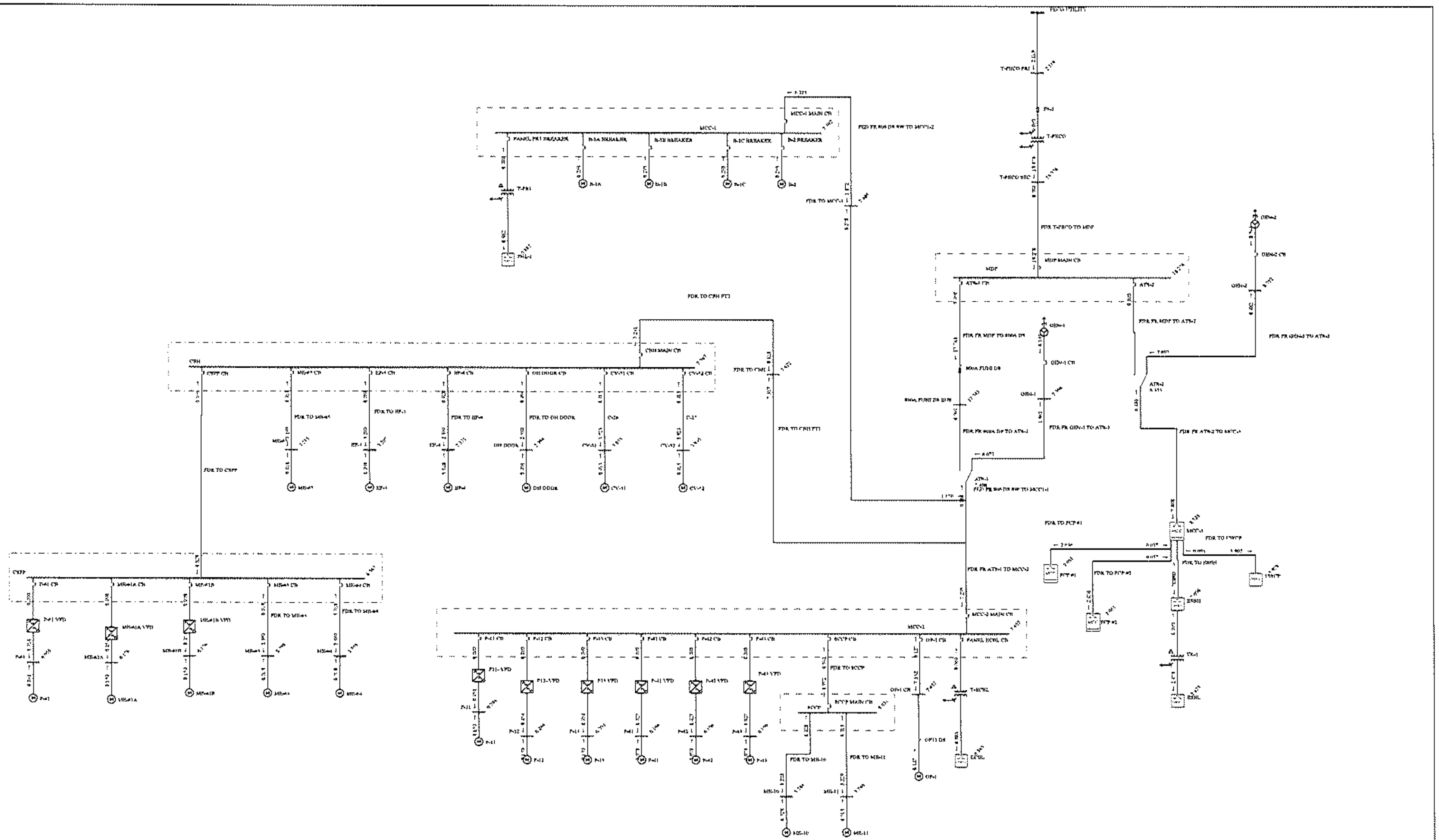
RCSTP
SHORT CIRCUIT ONE-LINE DIAGRAM

100% UTILITY



RCSTP
SHORT CIRCUIT ONE-LINE DIAGRAM

60% UTILITY



RCSTP
SHORT CIRCUIT ONE-LINE DIAGRAM

GENERATOR

Appendix D:
Equipment Duty Scenario Comparison Report

Short Circuit Equipment Duty - Scenario Comparison Report Worst Case Duty

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Bus Name	Equipment Name	Worst Case	Scenario	Fault Type	Vpu	Bus Base kV	Bus Ph	Manufacturer	Style	Test Standard	1/2 Cycle Rating (kA)	1/2 Cycle Duty (kA)	1/2 Cycle Duty (%)	Comments
800A FUSE DS BUS	800A FUSE DS	X	Base Case	3-Phase	1.00	0.480	3	Littelfuse	KLPC(L)	ANSI-SYM	200.000	18.181	-90.9%	
			50 Percent Utility	3-Phase	1.00	0.480	3	Littelfuse	KLPC(L)	ANSI-SYM	200.000	16.258	-91.9%	
			Generator	3-Phase	1.00	0.480	3	Littelfuse	KLPC(L)	ANSI-SYM	200.000	17.768	-91.1%	
CBH	CBH MAIN CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SGL4	ANSI-SYM	65.000	18.098	-72.2%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SGL4	ANSI-SYM	65.000	16.437	-74.7%	
			Generator	3-Phase	1.00	0.480	3	GE	SGL4	ANSI-SYM	65.000	8.075	-87.6%	
	CSPP CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.175	-72.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	16.515	-74.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.157	-87.5%	
	CV-51 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	19.190	37.1%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	17.501	25.0%	VIOLATION
			Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	8.996	-35.7%	
	CV-52 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	19.190	37.1%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	17.501	25.0%	VIOLATION
			Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	8.996	-35.7%	
	EF-3 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	19.195	37.1%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	17.506	25.0%	VIOLATION
			Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	9.003	-35.7%	
	EF-4 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	19.173	37.0%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	17.484	24.9%	VIOLATION
			Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	8.978	-35.9%	
	ME-65 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	19.184	37.0%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	17.495	25.0%	VIOLATION
			Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	8.990	-35.8%	
	OH DOOR CB	X	Base Case	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	19.199	37.1%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	17.510	25.1%	VIOLATION
			Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	9.007	-35.7%	
CSPP	ME-61A CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.796	-28.9%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.022	-33.2%	
			Generator	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	6.563	-63.5%	
	ME-61B	X	Base Case	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.796	-28.9%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.022	-33.2%	
			Generator	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	6.563	-63.5%	
	ME-63 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.778	-29.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.004	-33.3%	
			Generator	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	6.545	-63.6%	
	ME-64 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.778	-29.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.004	-33.3%	

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Bus Name	Equipment Name	Worst Case	Scenario	Fault Type	Vpu	Bus Base kV	Bus Ph	Manufacturer	Style	Test Standard	1/2 Cycle Rating (kA)	1/2 Cycle Duty (kA)	1/2 Cycle Duty (%)	Comments
			Generator	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	6.545	-63.6%	
	P-61 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.796	-28.9%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	12.022	-33.2%	
			Generator	3-Phase	1.00	0.480	3	GE	SEDA 3P	ANSI-SYM	18.000	6.563	-63.5%	
ECBL	[Main]	X	Base Case	3-Phase	1.00	0.208	3	SQD	QO	ANSI-SYM	10.000	0.907	-90.9%	
			50 Percent Utility	3-Phase	1.00	0.208	3	SQD	QO	ANSI-SYM	10.000	0.905	-90.9%	
			Generator	3-Phase	1.00	0.208	3	SQD	QO	ANSI-SYM	10.000	0.883	-91.2%	
ESBH	[Lowest]	X	Generator	3-Phase	1.00	0.480	3	GE	TEY	ANSI-SYM	14.000	7.096	-49.3%	
			Base Case	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	11.390	-72.9%	
			50 Percent Utility	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	10.836	-74.2%	
	[Main]	X	Base Case	3-Phase	1.00	0.480	3	GE	SGLA 3P	ANSI-SYM	65.000	11.390	-82.5%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SGLA 3P	ANSI-SYM	65.000	10.836	-83.3%	
			Generator	3-Phase	1.00	0.480	3	GE	SGLA 3P	ANSI-SYM	65.000	7.096	-89.1%	
ESBL	[Lowest]	X	Base Case	3-Phase	1.00	0.208	3			ANSI-SYM	22.000	2.631	-88.0%	
			50 Percent Utility	3-Phase	1.00	0.208	3			ANSI-SYM	22.000	2.616	-88.1%	
			Generator	3-Phase	1.00	0.208	3			ANSI-SYM	22.000	2.473	-88.8%	
	[Main]	X	Base Case	3-Phase	1.00	0.208	3	GE	THQB	ANSI-SYM	22.000	2.631	-88.0%	
			50 Percent Utility	3-Phase	1.00	0.208	3	GE	THQB	ANSI-SYM	22.000	2.616	-88.1%	
			Generator	3-Phase	1.00	0.208	3	GE	THQB	ANSI-SYM	22.000	2.473	-88.8%	
FCP #1	[Main]	X	Base Case	3-Phase	1.00	0.480	3	SQD	FAL	ANSI-SYM	18.000	2.097	-88.4%	
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FAL	ANSI-SYM	18.000	2.088	-88.4%	
			Generator	3-Phase	1.00	0.480	3	SQD	FAL	ANSI-SYM	18.000	2.036	-88.7%	
FCP #2	[Main]	X	Base Case	3-Phase	1.00	0.480	3	SQD	FAL	ANSI-SYM	18.000	2.097	-88.4%	
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FAL	ANSI-SYM	18.000	2.088	-88.4%	
			Generator	3-Phase	1.00	0.480	3	SQD	FAL	ANSI-SYM	18.000	2.036	-88.7%	
GEN-1	GEN-1 CB	X	Base Case	3-Phase	1.00	0.480	3	SQD	PJ-800 AF	ANSI-SYM	65.000	7.404	-88.6%	
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	PJ-800 AF	ANSI-SYM	65.000	7.404	-88.6%	
			Generator	3-Phase	1.00	0.480	3	SQD	PJ-800 AF	ANSI-SYM	65.000	7.042	-89.2%	
GEN-2	GEN-2 CB	X	Base Case	3-Phase	1.00	0.480	3	SQD	PJ	ANSI-SYM	65.000	10.054	-84.5%	
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	PJ	ANSI-SYM	65.000	10.054	-84.5%	
			Generator	3-Phase	1.00	0.480	3	SQD	PJ	ANSI-SYM	65.000	9.768	-85.0%	
MCC-1	B-1A BREAKER	X	Base Case	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	19.065	5.9%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	17.360	-3.6%	Warning
			Generator	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	8.742	-51.4%	
	B-1B BREAKER	X	Base Case	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	19.063	5.9%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	17.359	-3.6%	Warning
			Generator	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	8.740	-51.4%	
	B-1C BREAKER	X	Base Case	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	19.065	5.9%	VIOLATION

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Bus Name	Equipment Name	Worst Case	Scenario	Fault Type	Vpu	Bus Base kV	Bus Ph	Manufacturer	Style	Test Standard	1/2 Cycle Rating (kA)	1/2 Cycle Duty (kA)	1/2 Cycle Duty (%)	Comments
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	17.360	-3.6%	Warning
			Generator	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	8.742	-51.4%	
	B-2 BREAKER	X	Base Case	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	19.065	5.9%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	17.360	-3.6%	Warning
			Generator	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	8.742	-51.4%	
	MCC-1 MAIN CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SGL4	ANSI-SYM	65.000	17.149	-73.6%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SGL4	ANSI-SYM	65.000	15.478	-76.2%	
			Generator	3-Phase	1.00	0.480	3	GE	SGL4	ANSI-SYM	65.000	6.967	-89.3%	
	PANEL PR1 BREAKER	X	Base Case	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	19.374	7.6%	VIOLATION
			50 Percent Utility	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	17.671	-1.8%	Warning
			Generator	3-Phase	1.00	0.480	3	SQD	FA	ANSI-SYM	18.000	9.101	-49.4%	
MCC-2	MCC-2 MAIN CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SGL6	ANSI-SYM	65.000	18.782	-71.1%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SGL6	ANSI-SYM	65.000	16.990	-73.9%	
			Generator	3-Phase	1.00	0.480	3	GE	SGL6	ANSI-SYM	65.000	8.199	-87.4%	
	OF-1 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.822	-71.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.029	-73.8%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.240	-87.3%	
	P-11 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	
	P-12 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	
	P-13 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	
	P-41 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	
	P-42 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	
	P-43 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	
	PANEL ECBL CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.949	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.156	-73.6%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.380	-87.1%	

Short Circuit Equipment Duty - Scenario Comparison Report Worst Case Duty

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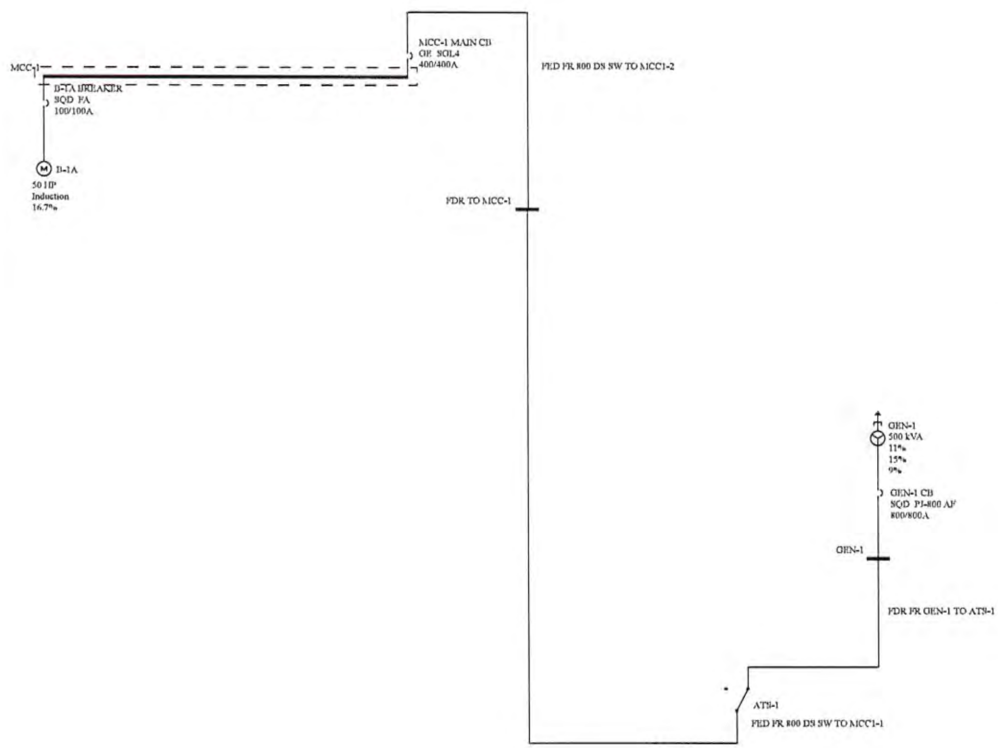
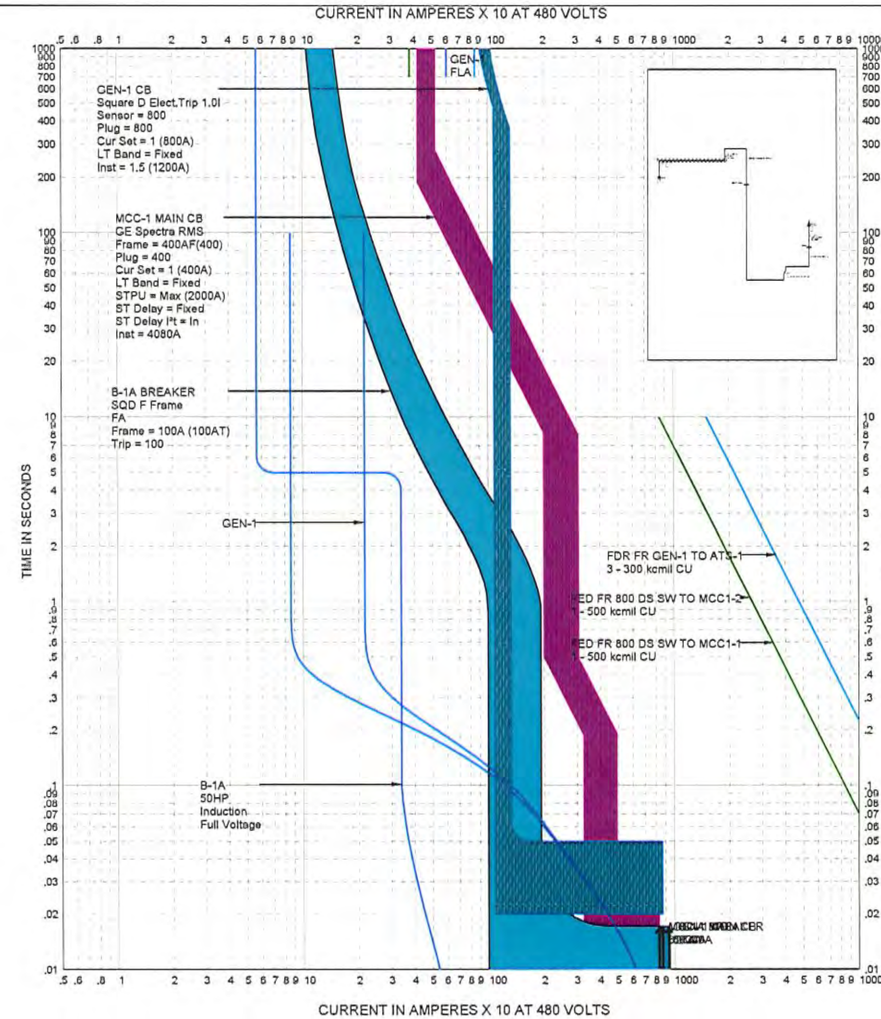
Pennoni Associates Inc. (Serial #C2-49329-2L)

Bus Name	Equipment Name	Worst Case	Scenario	Fault Type	Vpu	Bus Base kV	Bus Ph	Manufacturer	Style	Test Standard	1/2 Cycle Rating (kA)	1/2 Cycle Duty (kA)	1/2 Cycle Duty (%)	Comments
	SCCP CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.909	-70.9%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.117	-73.7%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.339	-87.2%	
MCC-3	[Lowest]	X	Base Case	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	18.411	-56.2%	
			50 Percent Utility	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	16.709	-60.2%	
			Generator	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	8.811	-79.0%	
	[Main]	X	Base Case	3-Phase	1.00	0.480	3	GE	SKL12	ANSI-SYM	65.000	17.937	-72.4%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SKL12	ANSI-SYM	65.000	16.235	-75.0%	
			Generator	3-Phase	1.00	0.480	3	GE	SKL12	ANSI-SYM	65.000	8.795	-86.5%	
MDP	ATS-1 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SKL8	ANSI-SYM	65.000	18.986	-70.8%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SKL8	ANSI-SYM	65.000	16.888	-74.0%	
			Generator	3-Phase	1.00	0.480	3	GE	SKL8	ANSI-SYM	65.000	18.716	-71.2%	
	ATS-2	X	Base Case	3-Phase	1.00	0.480	3	GE	SKL12	ANSI-SYM	65.000	19.969	-69.3%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SKL12	ANSI-SYM	65.000	17.868	-72.5%	
			Generator	3-Phase	1.00	0.480	3	GE	SKL12	ANSI-SYM	65.000	18.716	-71.2%	
	MDP	X	Base Case	3-Phase	1.00	0.480	3			ANSI-SYM	65.000	20.181	-69.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3			ANSI-SYM	65.000	18.144	-72.1%	
			Generator	3-Phase	1.00	0.480	3			ANSI-SYM	65.000	18.276	-71.9%	
	MDP MAIN CB		Base Case	3-Phase	1.00	0.480	3	GE	SS-20	ANSI-SYM	65.000	18.512	-71.5%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SS-20	ANSI-SYM	65.000	16.415	-74.7%	
		X	Generator	3-Phase	1.00	0.480	3	GE	SS-20	ANSI-SYM	65.000	18.716	-71.2%	
OF-1 CB	OF-1 CB	X	Base Case	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	18.822	-71.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	17.029	-73.8%	
			Generator	3-Phase	1.00	0.480	3	GE	SELA 3P	ANSI-SYM	65.000	8.240	-87.3%	
PNL-1	[Main]	X	Base Case	3-Phase	1.00	0.208	3	SQD	QO	ANSI-SYM	10.000	0.906	-90.9%	
			50 Percent Utility	3-Phase	1.00	0.208	3	SQD	QO	ANSI-SYM	10.000	0.905	-91.0%	
			Generator	3-Phase	1.00	0.208	3	SQD	QO	ANSI-SYM	10.000	0.882	-91.2%	
SCCP	SCCP MAIN CB	X	Base Case	3-Phase	1.00	0.480	3			ANSI-SYM	65.000	6.485	-90.0%	
			50 Percent Utility	3-Phase	1.00	0.480	3			ANSI-SYM	65.000	6.358	-90.2%	
			Generator	3-Phase	1.00	0.480	3			ANSI-SYM	65.000	4.992	-92.3%	
T-PECO PRI	FS-1	X	Base Case	3-Phase	1.00	33.000	3	S&C	SMU-20	ANSI-SYM	10.000	2.119	-78.8%	
			50 Percent Utility	3-Phase	1.00	33.000	3	S&C	SMU-20	ANSI-SYM	10.000	1.059	-89.4%	
			Generator	3-Phase	1.00	33.000	3	S&C	SMU-20	ANSI-SYM	10.000	2.119	-78.8%	
UWCP	[Lowest]	X	Base Case	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	4.433	-89.4%	
			50 Percent Utility	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	4.383	-89.6%	
			Generator	3-Phase	1.00	0.480	3			ANSI-SYM	42.000	3.978	-90.5%	

Appendix E:
Time-Current Curves of Selected Protective Device Coordination





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		FAULT: DATE: 5/7/2025 BY: REVISION: 1

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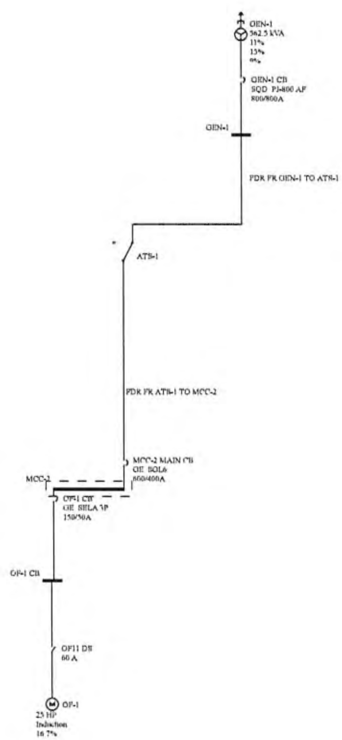

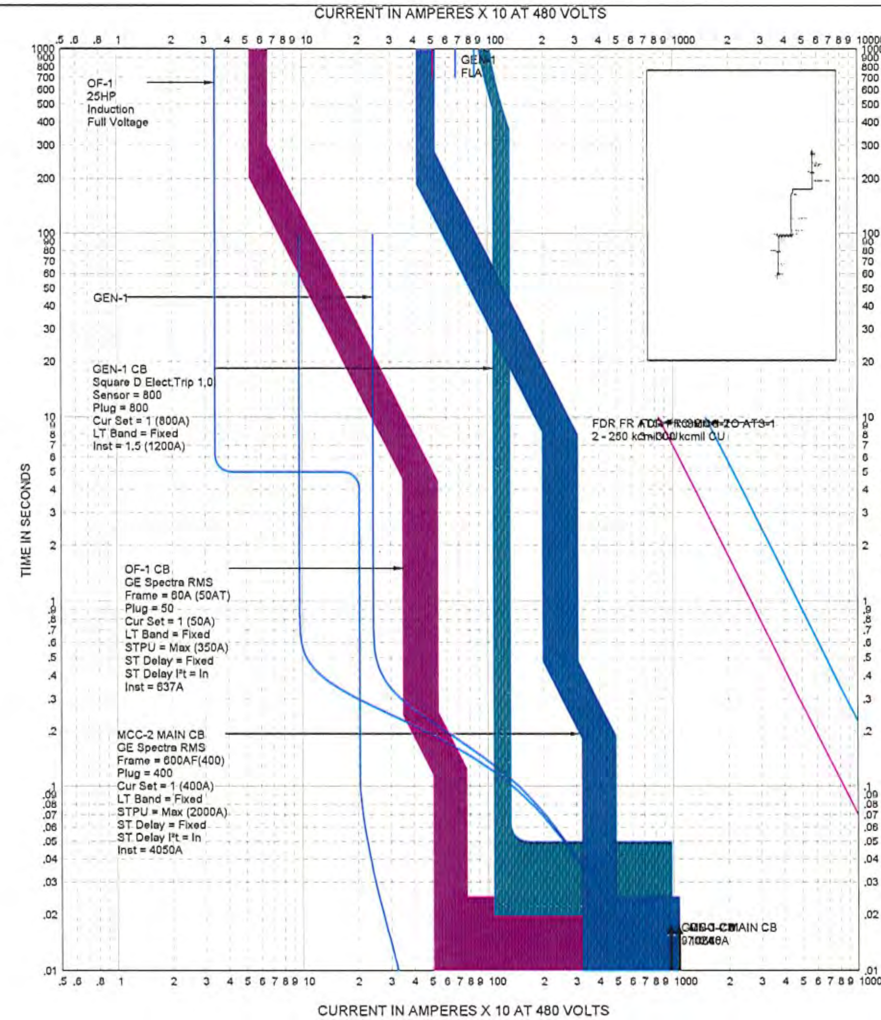

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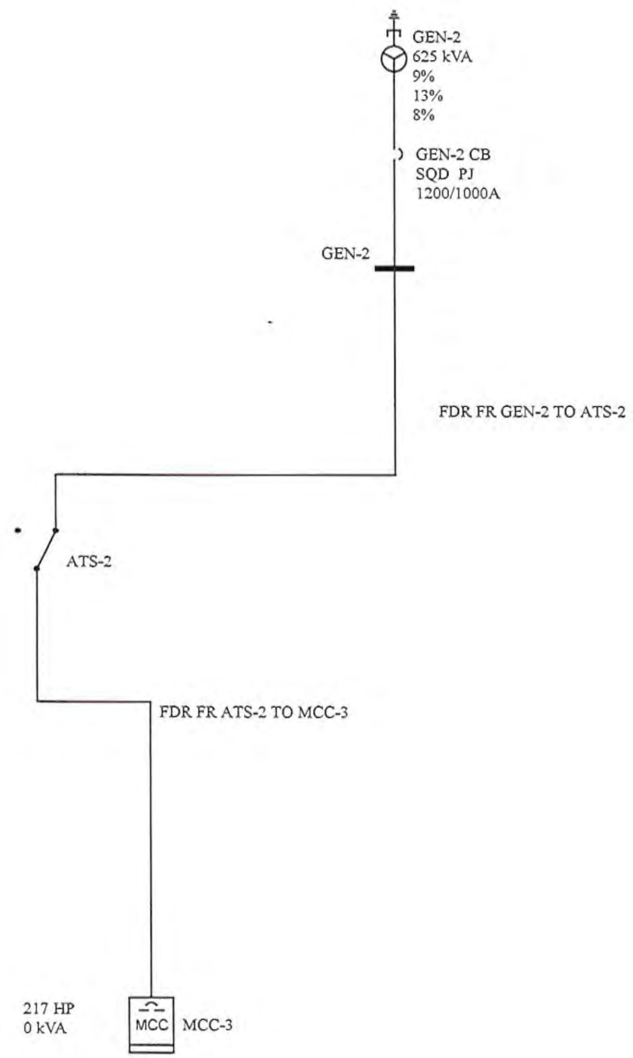

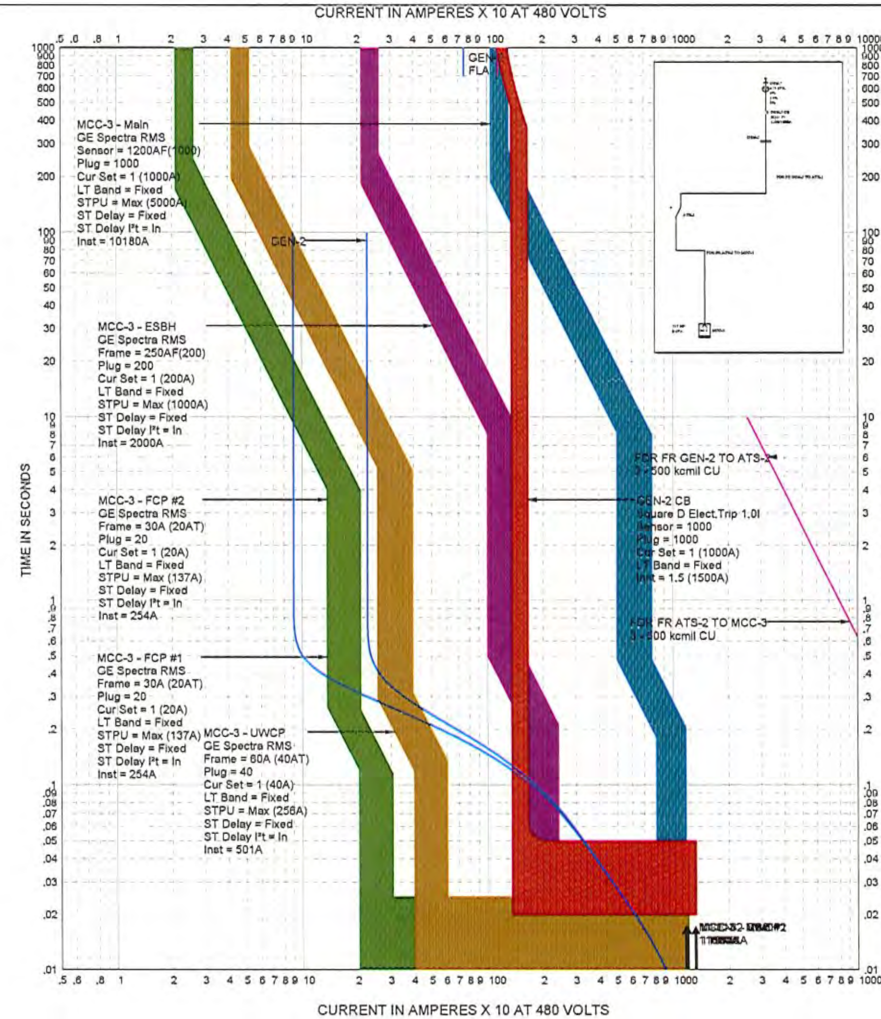

Pennoni Associates Inc.	*EasyPower*® TIME-CURRENT CURVES	~MCC-3 GENERATOR
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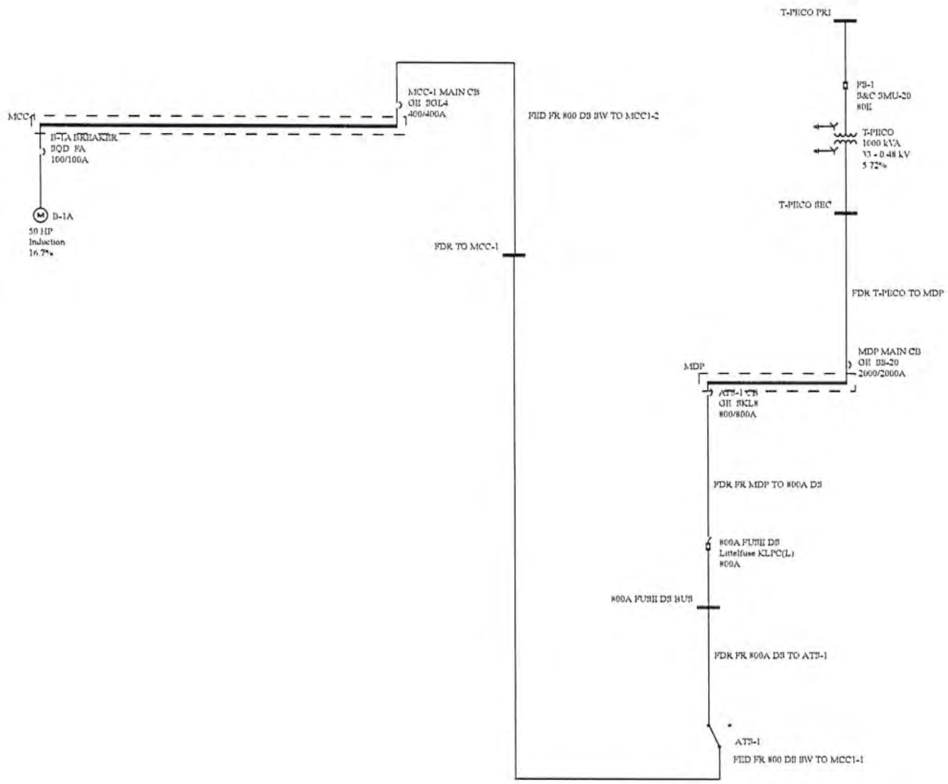

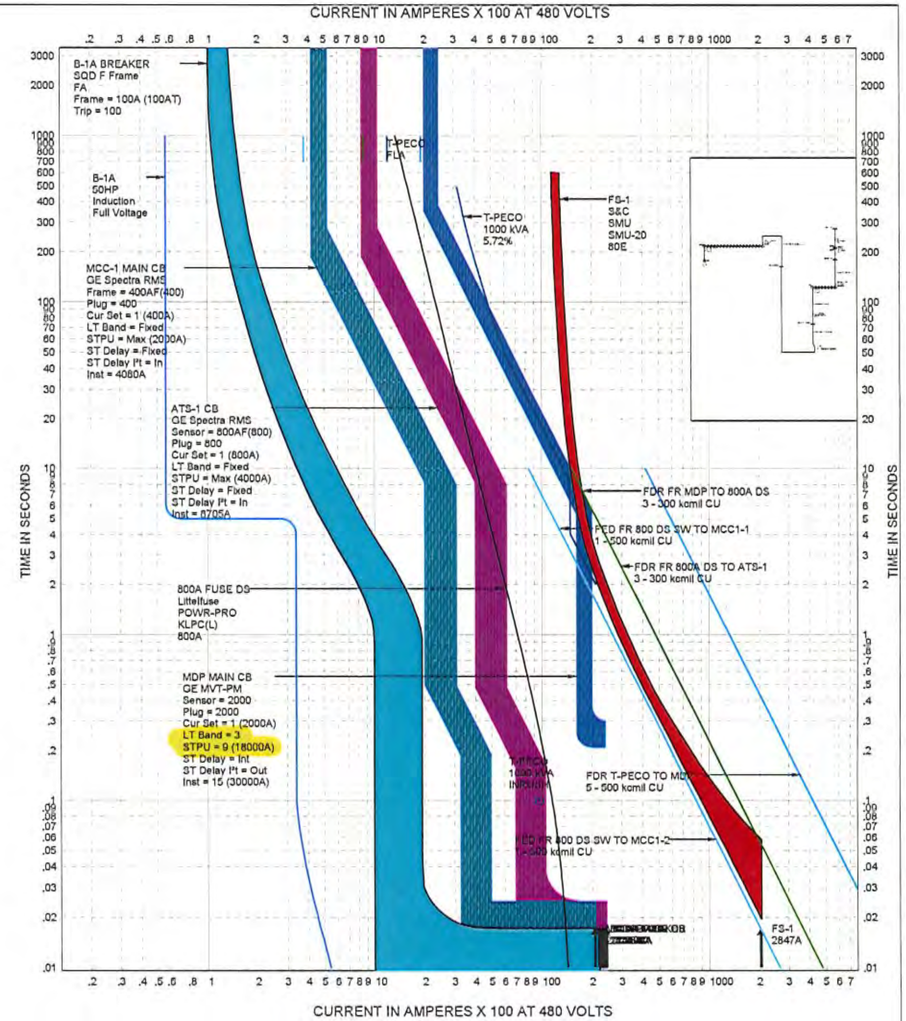

Pennoni Associates Inc.	*EasyPower®* TIME-CURRENT CURVES	MCC-1
		FAULT: DATE: 5/7/2025 BY: REVISION: 1

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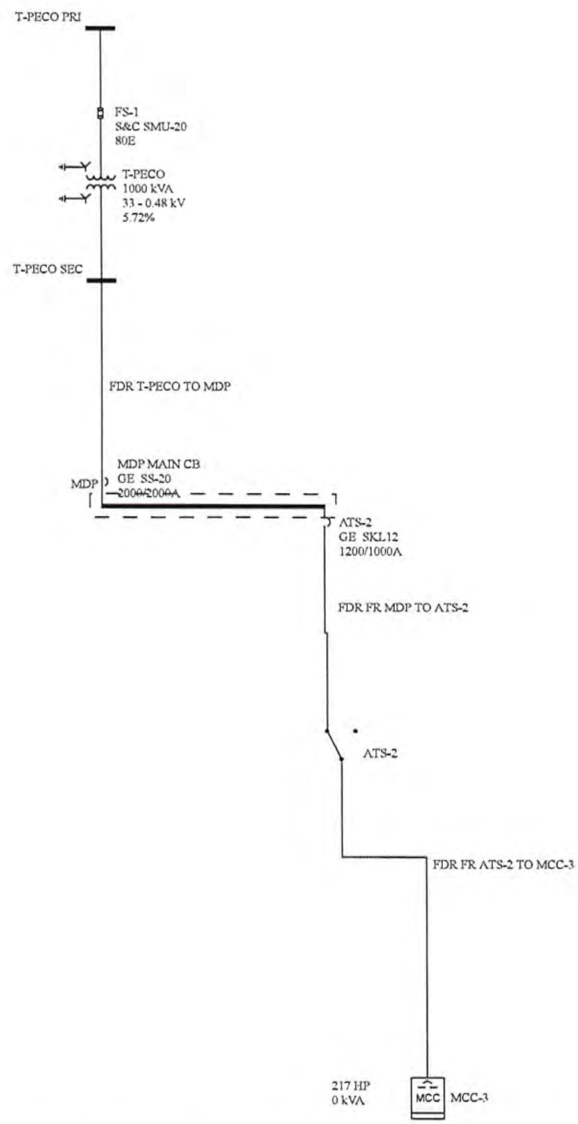

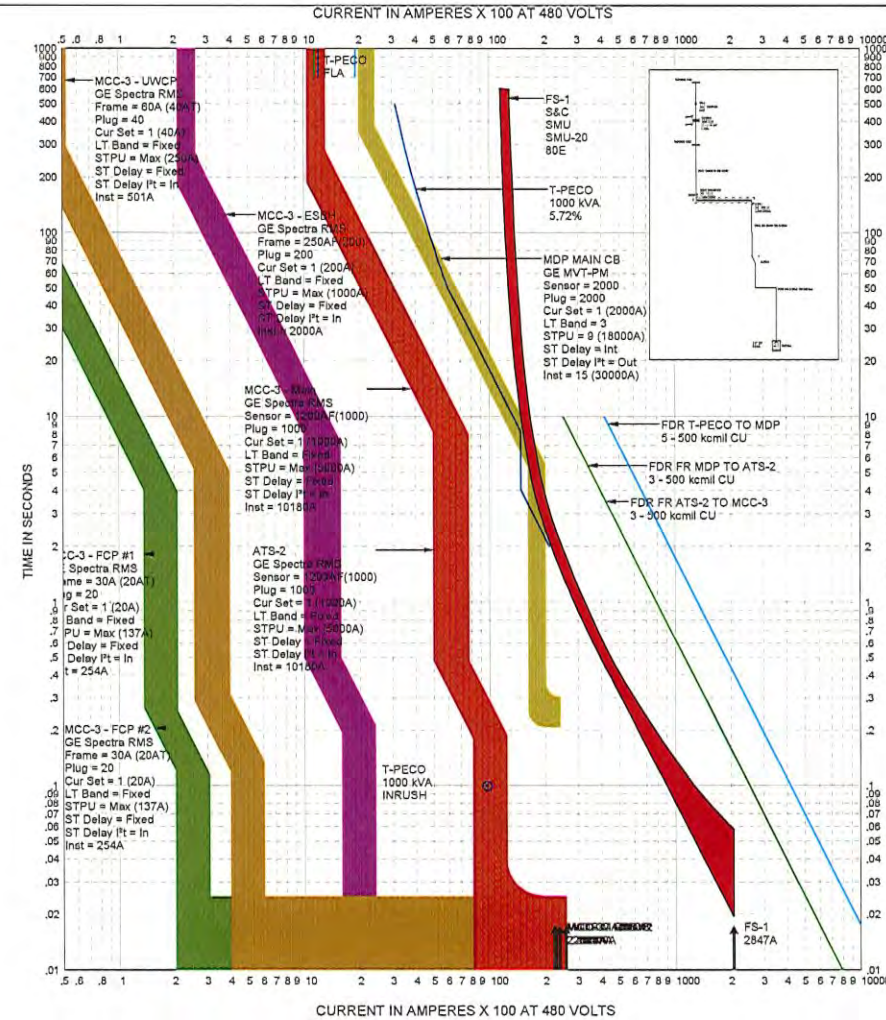

Pennoni Associates Inc.	*EasyPower®* TIME-CURRENT CURVES	MCC-3
		FAULT:
		DATE: 5/8/2025
		BY:
		REVISION: 1

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Appendix F:
Arc Flash Hazard Scenario Comparison Report

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Arc Fault Bus Name	Worst Case	Scenario	Arc Fault Bus kV	Upstream Trip Device Name	Equip Type	Electrode Configuration	Electrode Gap (mm)	Bus Bolted Fault (kA)	Bus Arc Fault (kA)	Trip Time (sec)	Arc Time (sec)	Est Arc Flash Boundary (inches)	Working Distance (inches)	Incident Energy (cal/cm2)	PPE Level	Comments
Bus: 800A FUSE DS BUS																
800A FUSE DS BUS	X	50 Percent Utility	0.48	ATS-1 CB	Other	VCB	32	15.816	10.402	0.167	0.167	41.2	18	4.5	2	
800A FUSE DS BUS		Base Case	0.48	ATS-1 CB	Other	VCB	32	18.211	13.630	0.026	0.026	15.6	18	1		
800A FUSE DS BUS		Generator	0.48	ATS-1 CB	Other	VCB	32	17.743	13.288	0.026	0.026	14.9	18	0.9		
Bus: ATS-1																
ATS-1	X	50 Percent Utility	0.48	ATS-1 CB	ATS	VCB	32	15.544	10.224	0.173	0.173	41.6	18	4.6	2	
ATS-1		Base Case	0.48	ATS-1 CB	ATS	VCB	32	17.869	13.380	0.027	0.027	15.5	18	0.9		
ATS-1		Generator	0.48	GEN-1 CB	ATS	VCB	32	6.536	4.773	0.05	0.05	11.6	18	0.6		
Bus: ATS-2																
ATS-2	X	50 Percent Utility	0.48	ATS-2	ATS	VCB	32	15.132	9.953	0.284	0.284	55.4	18	7.2	2	
ATS-2		Base Case	0.48	ATS-2	ATS	VCB	32	16.885	11.098	0.229	0.229	52	18	6.5	2	
ATS-2		Generator	0.48	GEN-2 CB	ATS	VCB	32	7.897	5.818	0.05	0.05	13	18	0.7		
Bus: CBH																
CBH	X	50 Percent Utility	0.48	ATS-1 CB	Panelboard	VCB	25	14.844	10.032	0.179	0.179	40	18	4.3	2	
CBH		Base Case	0.48	ATS-1 CB	Panelboard	VCB	25	16.948	11.445	0.031	0.031	14.7	18	0.9		
CBH		Generator	0.48	GEN-1 CB	Panelboard	VCB	25	6.418	4.810	0.05	0.05	11.1	18	0.6		
Bus: CSPP																
CSPP		50 Percent Utility	0.48	CSPP CB	Panelboard	VCB	25	11.387	8.739	0.022	0.022	9.8	18	0.5		
CSPP	X	Base Case	0.48	CBH MAIN CB	Panelboard	VCB	25	12.215	8.234	0.025	0.025	10.2	18	0.5		
CSPP		Generator	0.48	CSPP CB	Panelboard	VCB	25	5.841	4.357	0.025	0.025	6.9	18	0.3		
Bus: CV-51																
CV-51		50 Percent Utility	0.48	CV-51 CB	Other	VCB	32	4.527	3.245	0.016	0.016	4.3	18	0.1		
CV-51	X	Base Case	0.48	CV-51 CB	Other	VCB	32	4.581	3.286	0.016	0.016	4.3	18	0.1		
CV-51		Generator	0.48	CV-51 CB	Other	VCB	32	3.935	2.801	0.016	0.016	3.9	18	0.1		
Bus: CV-52																
CV-52		50 Percent Utility	0.48	CV-52 CB	Other	VCB	32	4.527	3.245	0.016	0.016	4.3	18	0.1		
CV-52	X	Base Case	0.48	CV-52 CB	Other	VCB	32	4.581	3.286	0.016	0.016	4.3	18	0.1		
CV-52		Generator	0.48	CV-52 CB	Other	VCB	32	3.935	2.801	0.016	0.016	3.9	18	0.1		
Bus: EF-3																
EF-3		50 Percent Utility	0.48	EF-3 CB	Other	VCB	32	3.512	2.485	0.016	0.016	3.6	18	0.1		
EF-3	X	Base Case	0.48	EF-3 CB	Other	VCB	32	3.541	2.507	0.016	0.016	3.6	18	0.1		
EF-3		Generator	0.48	EF-3 CB	Other	VCB	32	3.207	2.259	0.016	0.016	3.4	18	0.1		

The test results are a function of specific humidity, barometric pressure, temperature, arc distance, and many other variables. These parameters will NOT be the same in your application. These results should be applied only by experienced engineers in the application of Arc-flash hazards. EasyPower makes no warranty concerning the accuracy of these results as applied to real world scenarios.

For integrated calculations, the fault currents displayed are just before 'Arc Time'.

EasyPower v11.0.1.8039 5/22/2025 12:49:04 PM
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Pennoni Associates Inc. (Serial #C2-49329-2L)

Arc Fault Bus Name	Worst Case	Scenario	Arc Fault Bus kV	Upstream Trip Device Name	Equip Type	Electrode Configuration	Electrode Gap (mm)	Bus Bolted Fault (kA)	Bus Arc Fault (kA)	Trip Time (sec)	Arc Time (sec)	Est Arc Flash Boundary (inches)	Working Distance (inches)	Incident Energy (cal/cm2)	PPE Level	Comments
Bus: EF-4																
EF-4		50 Percent Utility	0.48	EF-4 CB	Other	VCB	32	2.428	1.686	0.016	0.016	2.8	18	0.1		
EF-4	X	Base Case	0.48	EF-4 CB	Other	VCB	32	2.440	1.695	0.016	0.016	2.8	18	0.1		
EF-4		Generator	0.48	EF-4 CB	Other	VCB	32	2.321	1.608	0.016	0.016	2.7	18	0.1		
Bus: FDR TO CBH																
FDR TO CBH	X	50 Percent Utility	0.48	ATS-1 CB	Other	VCB	32	15.186	9.989	0.181	0.181	42.1	18	4.7	2	
FDR TO CBH		Base Case	0.48	ATS-1 CB	Other	VCB	32	17.398	11.428	0.031	0.031	15.5	18	0.9		
FDR TO CBH		Generator	0.48	GEN-1 CB	Other	VCB	32	6.477	4.728	0.05	0.05	11.6	18	0.6		
Bus: FDR TO MCC-1																
FDR TO MCC-1	X	50 Percent Utility	0.48	ATS-1 CB	Other	VCB	32	15.186	9.989	0.181	0.181	42.2	18	4.7	2	
FDR TO MCC-1		Base Case	0.48	ATS-1 CB	Other	VCB	32	17.422	11.444	0.031	0.031	15.5	18	0.9		
FDR TO MCC-1		Generator	0.48	GEN-1 CB	Other	VCB	32	6.486	4.735	0.05	0.05	11.6	18	0.6		
Bus: GEN-1																
GEN-1		50 Percent Utility	0.48	[Manual Time]	Other	VCB	32	4.096	2.921	0	1000	4000.3	18	6751.5	Extreme Danger	
GEN-1		Base Case	0.48	[Manual Time]	Other	VCB	32	4.096	2.921	0	1000	4000.3	18	6751.5	Extreme Danger	
GEN-1	X	Generator	0.48	[Manual Time]	Other	VCB	32	4.096	2.921	0	1000	4000.4	18	6751.7	Extreme Danger	
Bus: GEN-2																
GEN-2		50 Percent Utility	0.48	[Manual Time]	Other	VCB	32	5.562	4.030	0	1000	4945.3	18	9474.9	Extreme Danger	
GEN-2		Base Case	0.48	[Manual Time]	Other	VCB	32	5.562	4.030	0	1000	4945.3	18	9474.9	Extreme Danger	
GEN-2	X	Generator	0.48	[Manual Time]	Other	VCB	32	5.562	4.030	0	1000	4945.3	18	9474.9	Extreme Danger	
Bus: MCC-1																
MCC-1	X	50 Percent Utility	0.48	ATS-1 CB	Switchgear	VCB	32	14.844	9.763	0.189	0.189	42.7	18	4.8	2	
MCC-1		Base Case	0.48	ATS-1 CB	Switchgear	VCB	32	16.995	11.169	0.033	0.033	15.7	18	1		
MCC-1		Generator	0.48	GEN-1 CB	Switchgear	VCB	32	6.436	4.697	0.05	0.05	11.5	18	0.6		
Bus: MCC-2																
MCC-2	X	50 Percent Utility	0.48	ATS-1 CB	Panel	VCB	25	15.335	10.364	0.168	0.168	30.5	18	2.8	1	
MCC-2		Base Case	0.48	ATS-1 CB	Panel	VCB	25	17.593	13.541	0.027	0.027	11.5	18	0.6		
MCC-2		Generator	0.48	GEN-1 CB	Panel	VCB	25	6.504	4.877	0.05	0.05	8.7	18	0.4		

The test results are a function of specific humidity, barometric pressure, temperature, arc distance, and many other variables. These parameters will NOT be the same in your application. These results should be applied only by experienced engineers in the application of Arc-flash hazards. EasyPower makes no warranty concerning the accuracy of these results as applied to real world scenarios.

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Arc Fault Bus Name	Worst Case	Scenario	Arc Fault Bus kV	Upstream Trip Device Name	Equip Type	Electrode Configuration	Electrode Gap (mm)	Bus Bolted Fault (kA)	Bus Arc Fault (kA)	Trip Time (sec)	Arc Time (sec)	Est Arc Flash Boundary (inches)	Working Distance (inches)	Incident Energy (cal/cm2)	PPE Level	Comments
Bus: MDP																
MDP	X	50 Percent Utility	0.48	[Manual Time]	Switchgear	VCB	32	16.238	12.179	0	1000	10281.7	18	30516.7	Extreme Danger	
MDP		Base Case	0.48	[Manual Time]	Switchgear	VCB	32	18.276	11.991	0	1000	10266.6	18	30444.9	Extreme Danger	
MDP		Generator	0.48	[Manual Time]	Switchgear	VCB	32	18.276	11.991	0	1000	10266.6	18	30444.7	Extreme Danger	
Bus: ME-10																
ME-10		50 Percent Utility	0.48	SCCP CB	Other	VCB	32	3.502	2.478	0.025	0.025	4.8	18	0.1		
ME-10	X	Base Case	0.48	SCCP CB	Other	VCB	32	3.535	2.502	0.025	0.025	4.8	18	0.1		
ME-10		Generator	0.48	SCCP CB	Other	VCB	32	3.138	2.208	0.025	0.025	4.5	18	0.1		
Bus: ME-11																
ME-11		50 Percent Utility	0.48	SCCP CB	Other	VCB	32	3.502	2.478	0.025	0.025	4.8	18	0.1		
ME-11	X	Base Case	0.48	SCCP CB	Other	VCB	32	3.535	2.502	0.025	0.025	4.8	18	0.1		
ME-11		Generator	0.48	SCCP CB	Other	VCB	32	3.138	2.208	0.025	0.025	4.5	18	0.1		
Bus: ME-61A																
ME-61A		50 Percent Utility	0.48	ME-61A VFD	Other	VCB	32	0.054	0.032	0.2	0.2	1.1	18	0		Out of IEEE 158-2018 range.
ME-61A	X	Base Case	0.48	ME-61A VFD	Other	VCB	32	0.054	0.032	0.2	0.2	1.1	18	0		Out of IEEE 158-2018 range.
ME-61A		Generator	0.48	ME-61A VFD	Other	VCB	32	0.054	0.032	0.2	0.2	1.1	18	0		Out of IEEE 158-2018 range.
Bus: ME-61B																
ME-61B		50 Percent Utility	0.48	ME-61B VFD	Other	VCB	32	0.054	0.032	0.2	0.2	1.1	18	0		Out of IEEE 158-2018 range.
ME-61B	X	Base Case	0.48	ME-61B VFD	Other	VCB	32	0.054	0.032	0.2	0.2	1.1	18	0		Out of IEEE 158-2018 range.
ME-61B		Generator	0.48	ME-61B VFD	Other	VCB	32	0.054	0.032	0.2	0.2	1.1	18	0		Out of IEEE 158-2018 range.
Bus: ME-63																
ME-63		50 Percent Utility	0.48	CBH MAIN CB	Other	VCB	32	7.315	5.370	0.025	0.025	8	18	0.3		
ME-63	X	Base Case	0.48	CBH MAIN CB	Other	VCB	32	7.561	5.560	0.025	0.025	8.1	18	0.3		
ME-63		Generator	0.48	ME-63 CB	Other	VCB	32	4.976	3.585	0.025	0.025	6.3	18	0.2		
Bus: ME-64																
ME-64		50 Percent Utility	0.48	CBH MAIN CB	Other	VCB	32	7.315	5.370	0.025	0.025	8	18	0.3		
ME-64	X	Base Case	0.48	CBH MAIN CB	Other	VCB	32	7.561	5.560	0.025	0.025	8.1	18	0.3		
ME-64		Generator	0.48	ME-64 CB	Other	VCB	32	4.976	3.585	0.025	0.025	6.3	18	0.2		

The test results are a function of specific humidity, barometric pressure, temperature, arc distance, and many other variables. These parameters will NOT be the same in your application. These results should be applied only by experienced engineers in the application of Arc-flash hazards. EasyPower makes no warranty concerning the accuracy of these results as applied to real world scenarios.

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Arc Fault Bus Name	Worst Case	Scenario	Arc Fault Bus kV	Upstream Trip Device Name	Equip Type	Electrode Configuration	Electrode Gap (mm)	Bus Bolted Fault (kA)	Bus Arc Fault (kA)	Trip Time (sec)	Arc Time (sec)	Est Arc Flash Boundary (inches)	Working Distance (inches)	Incident Energy (cal/cm2)	PPE Level	Comments
Bus: ME-65																
ME-65		50 Percent Utility	0.48	ME-65 CB	Other	VCB	32	3.518	2.489	0.016	0.016	3.6	18	0.1		
ME-65	X	Base Case	0.48	ME-65 CB	Other	VCB	32	3.547	2.511	0.016	0.016	3.6	18	0.1		
ME-65		Generator	0.48	ME-65 CB	Other	VCB	32	3.215	2.264	0.016	0.016	3.4	18	0.1		
Bus: OF-1 CB																
OF-1 CB		50 Percent Utility	0.48	MCC-2 MAIN CB	Other	VCB	32	15.791	11.846	0.025	0.025	13.8	18	0.8		
OF-1 CB	X	Base Case	0.48	MCC-2 MAIN CB	Other	VCB	32	17.593	13.178	0.025	0.025	14.8	18	0.9		
OF-1 CB		Generator	0.48	GEN-1 CB	Other	VCB	32	6.504	4.748	0.05	0.05	11.6	18	0.6		
Bus: OH DOOR																
OH DOOR		50 Percent Utility	0.48	OH DOOR CB	Other	VCB	32	2.414	1.676	0.016	0.016	2.8	18	0.1		
OH DOOR	X	Base Case	0.48	OH DOOR CB	Other	VCB	32	2.426	1.685	0.016	0.016	2.8	18	0.1		
OH DOOR		Generator	0.48	OH DOOR CB	Other	VCB	32	2.304	1.596	0.016	0.016	2.7	18	0.1		
Bus: P-11																
P-11		50 Percent Utility	0.48	P11- VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
P-11	X	Base Case	0.48	P11- VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
P-11		Generator	0.48	P11- VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
Bus: P-12																
P-12		50 Percent Utility	0.48	P12- VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
P-12	X	Base Case	0.48	P12- VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
P-12		Generator	0.48	P12- VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
Bus: P-13																
P-13		50 Percent Utility	0.48	P13 VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
P-13	X	Base Case	0.48	P13 VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
P-13		Generator	0.48	P13 VFD	VFD	VCB	32	0.054	0.032	0.2	0.2	1.2	18	0		Out of IEEE 158 -2018 range.
Bus: P-41																
P-41		50 Percent Utility	0.48	P-41 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158 -2018 range.
P-41	X	Base Case	0.48	P-41 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158 -2018 range.
P-41		Generator	0.48	P-41 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158 -2018 range.

The test results are a function of specific humidity, barometric pressure, temperature, arc distance, and many other variables. These parameters will NOT be the same in your application. These results should be applied only by experienced engineers in the application of Arc-flash hazards. EasyPower makes no warranty concerning the accuracy of these results as applied to real world scenarios.

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Arc Fault Bus Name	Worst Case	Scenario	Arc Fault Bus kV	Upstream Trip Device Name	Equip Type	Electrode Configuration	Electrode Gap (mm)	Bus Bolted Fault (kA)	Bus Arc Fault (kA)	Trip Time (sec)	Arc Time (sec)	Est Arc Flash Boundary (inches)	Working Distance (inches)	Incident Energy (cal/cm2)	PPE Level	Comments
Bus: P-42																
P-42		50 Percent Utility	0.48	P-42 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158-2018 range.
P-42	X	Base Case	0.48	P-42 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158-2018 range.
P-42		Generator	0.48	P-42 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158-2018 range.
Bus: P-43																
P-43		50 Percent Utility	0.48	P-43 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158-2018 range.
P-43	X	Base Case	0.48	P-43 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158-2018 range.
P-43		Generator	0.48	P-43 VFD	VFD	VCB	32	0.027	0.015	0.2	0.2	0.7	18	0		Out of IEEE 158-2018 range.
Bus: P-61																
P-61		50 Percent Utility	0.48	P-61 VFD	Other	VCB	32	0.014	0.007	0.2	0.2	0.5	18	0		Out of IEEE 158-2018 range.
P-61	X	Base Case	0.48	P-61 VFD	Other	VCB	32	0.014	0.007	0.2	0.2	0.5	18	0		Out of IEEE 158-2018 range.
P-61		Generator	0.48	P-61 VFD	Other	VCB	32	0.014	0.007	0.2	0.2	0.5	18	0		Out of IEEE 158-2018 range.
Bus: SCCP																
SCCP		50 Percent Utility	0.48	SCCP CB	Panel	VCB	25	6.260	4.686	0.025	0.025	5.4	18	0.2		
SCCP	X	Base Case	0.48	SCCP CB	Panel	VCB	25	6.407	4.801	0.025	0.025	5.4	18	0.2		
SCCP		Generator	0.48	SCCP CB	Panel	VCB	25	4.696	3.464	0.025	0.025	4.5	18	0.1		
Bus: T-PECO PRI																
T-PECO PRI		50 Percent Utility	33	[Manual Time]	Transformer Terminal	VCB	254	1.059	1.059	0	1000	4808	31	28866.2	Extreme Danger	Out of IEEE 158-2018 range.
T-PECO PRI	X	Base Case	33	[Manual Time]	Transformer Terminal	VCB	254	2.119	2.119	0	1000	6799.6	31	57732.4	Extreme Danger	Out of IEEE 158-2018 range.
T-PECO PRI		Generator	33	[Manual Time]	Transformer Terminal	VCB	254	2.119	2.119	0	1000	6799.6	31	57732.4	Extreme Danger	Out of IEEE 158-2018 range.
Bus: T-PECO SEC																
T-PECO SEC	X	50 Percent Utility	0.48	[Manual Time]	Transformer Terminal	VCB	32	16.317	12.237	0	1000	10314.7	18	30673	Extreme Danger	
T-PECO SEC		Base Case	0.48	[Manual Time]	Transformer Terminal	VCB	32	18.376	12.054	0	1000	10302.9	18	30617.4	Extreme Danger	
T-PECO SEC		Generator	0.48	[Manual Time]	Transformer Terminal	VCB	32	18.376	12.054	0	1000	10302.9	18	30617.2	Extreme Danger	
MCC: FCP #1																
FCP #1		50 Percent Utility	0.48	MCC-3	MCC	VCB	25	2.083	1.473	0.025	0.025	3.2	18	0.1		
FCP #1	X	Base Case	0.48	MCC-3	MCC	VCB	25	2.093	1.481	0.025	0.025	3.2	18	0.1		
FCP #1		Generator	0.48	MCC-3	MCC	VCB	25	2.035	1.437	0.025	0.025	3.1	18	0.1		

The test results are a function of specific humidity, barometric pressure, temperature, arc distance, and many other variables. These parameters will NOT be the same in your application. These results should be applied only by experienced engineers in the application of Arc-flash hazards. EasyPower makes no warranty concerning the accuracy of these results as applied to real world scenarios.

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Pennoni Associates Inc. (Serial #C2-49329-2L)

Arc Fault Bus Name	Worst Case	Scenario	Arc Fault Bus kV	Upstream Trip Device Name	Equip Type	Electrode Configuration	Electrode Gap (mm)	Bus Bolted Fault (kA)	Bus Arc Fault (kA)	Trip Time (sec)	Arc Time (sec)	Est Arc Flash Boundary (inches)	Working Distance (inches)	Incident Energy (cal/cm2)	PPE Level	Comments
MCC: FCP #2																
FCP #2		50 Percent Utility	0.48	MCC-3	MCC	VCB	25	2.083	1.473	0.025	0.025	3.2	18	0.1		
FCP #2	X	Base Case	0.48	MCC-3	MCC	VCB	25	2.093	1.481	0.025	0.025	3.2	18	0.1		
FCP #2		Generator	0.48	MCC-3	MCC	VCB	25	2.035	1.437	0.025	0.025	3.1	18	0.1		
MCC: MCC-3																
MCC-3	X	50 Percent Utility	0.48	ATS-2	MCC	VCB	25	15.017	10.149	0.274	0.274	52.1	18	6.6	2	
MCC-3		Base Case	0.48	ATS-2	MCC	VCB	25	16.742	11.308	0.22	0.22	49	18	5.9	2	
MCC-3		Generator	0.48	GEN-2 CB	MCC	VCB	25	7.868	5.954	0.05	0.05	12.5	18	0.7		
Panel: ECBL																
ECBL		50 Percent Utility	0.208	ECBL	Panel	VCB	25	0.903	0.000	0	0	48	18	2	1	
ECBL	X	Base Case	0.208	ECBL	Panel	VCB	25	0.905	0.000	0	0	48	18	2	1	
ECBL		Generator	0.208	ECBL	Panel	VCB	25	0.851	0.000	0	0	48	18	2	1	
Panel: ESBH																
ESBH		50 Percent Utility	0.48	MCC-3	Panel	VCB	25	10.408	7.965	0.025	0.025	7.7	18	0.3		
ESBH	X	Base Case	0.48	MCC-3	Panel	VCB	25	11.019	8.448	0.025	0.025	8	18	0.3		
ESBH		Generator	0.48	MCC-3	Panel	VCB	25	6.826	5.131	0.025	0.025	5.7	18	0.2		
Panel: ESBL																
ESBL		50 Percent Utility	0.208	ESBL	Panel	VCB	25	0.000	0.000	0	0	48	18	2	1	
ESBL	X	Base Case	0.208	ESBL	Panel	VCB	25	0.000	0.000	0	0	48	18	2	1	
ESBL		Generator	0.208	ESBL	Panel	VCB	25	0.000	0.000	0	0	48	18	2	1	
Panel: PNL-1																
PNL-1		50 Percent Utility	0.208	PNL-1	Panel	VCB	25	0.902	0.000	0	0	18	18	2	1	
PNL-1	X	Base Case	0.208	PNL-1	Panel	VCB	25	0.905	0.000	0	0	18	18	2	1	
PNL-1		Generator	0.208	PNL-1	Panel	VCB	25	0.850	0.000	0	0	18	18	2	1	
Panel: UWCP																
UWCP		50 Percent Utility	0.48	MCC-3	Panel	VCB	25	4.287	3.147	0.025	0.025	4.1	18	0.1		
UWCP	X	Base Case	0.48	MCC-3	Panel	VCB	25	4.345	3.192	0.025	0.025	4.2	18	0.1		
UWCP		Generator	0.48	MCC-3	Panel	VCB	25	3.874	2.829	0.025	0.025	3.8	18	0.1		

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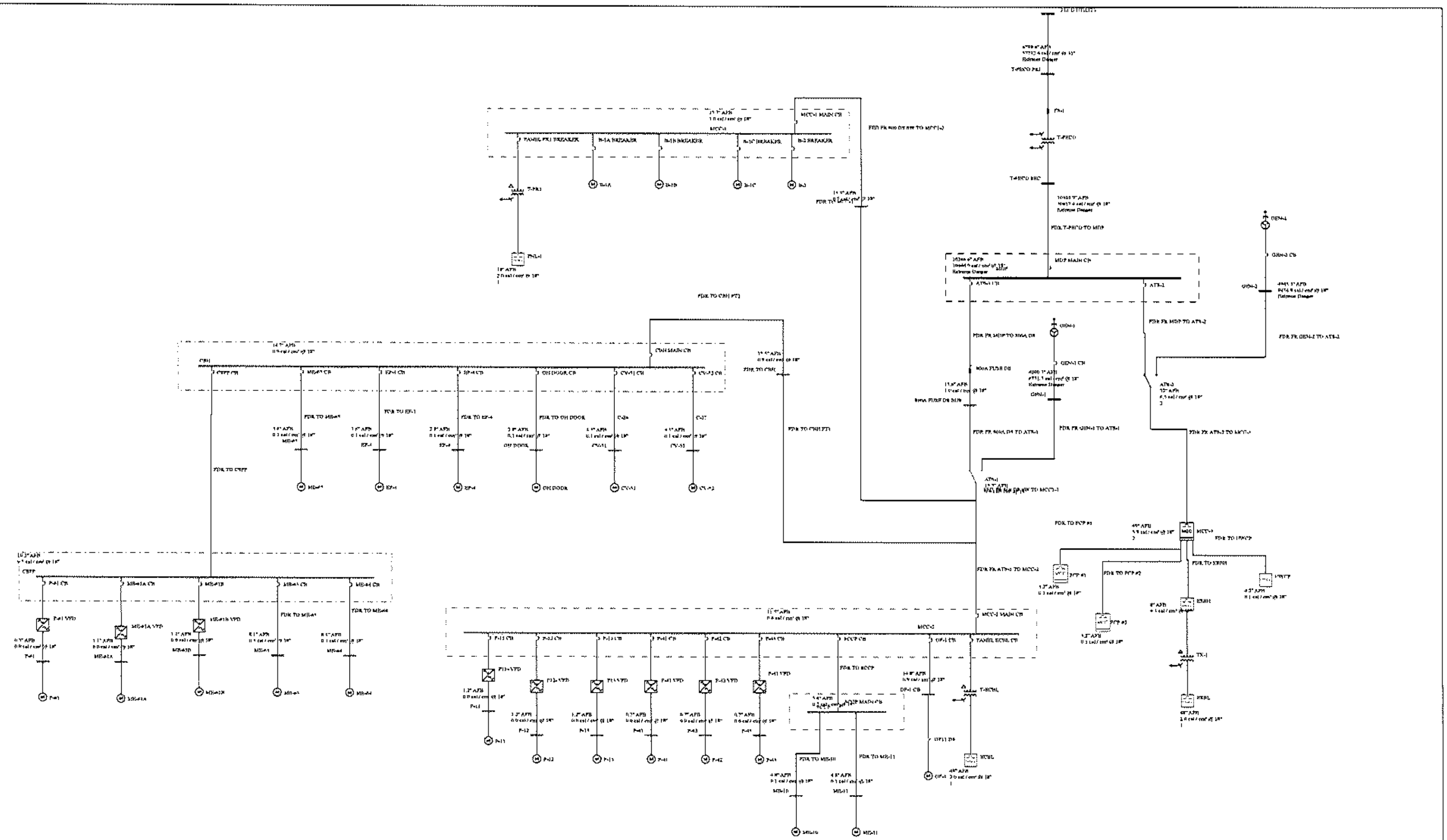
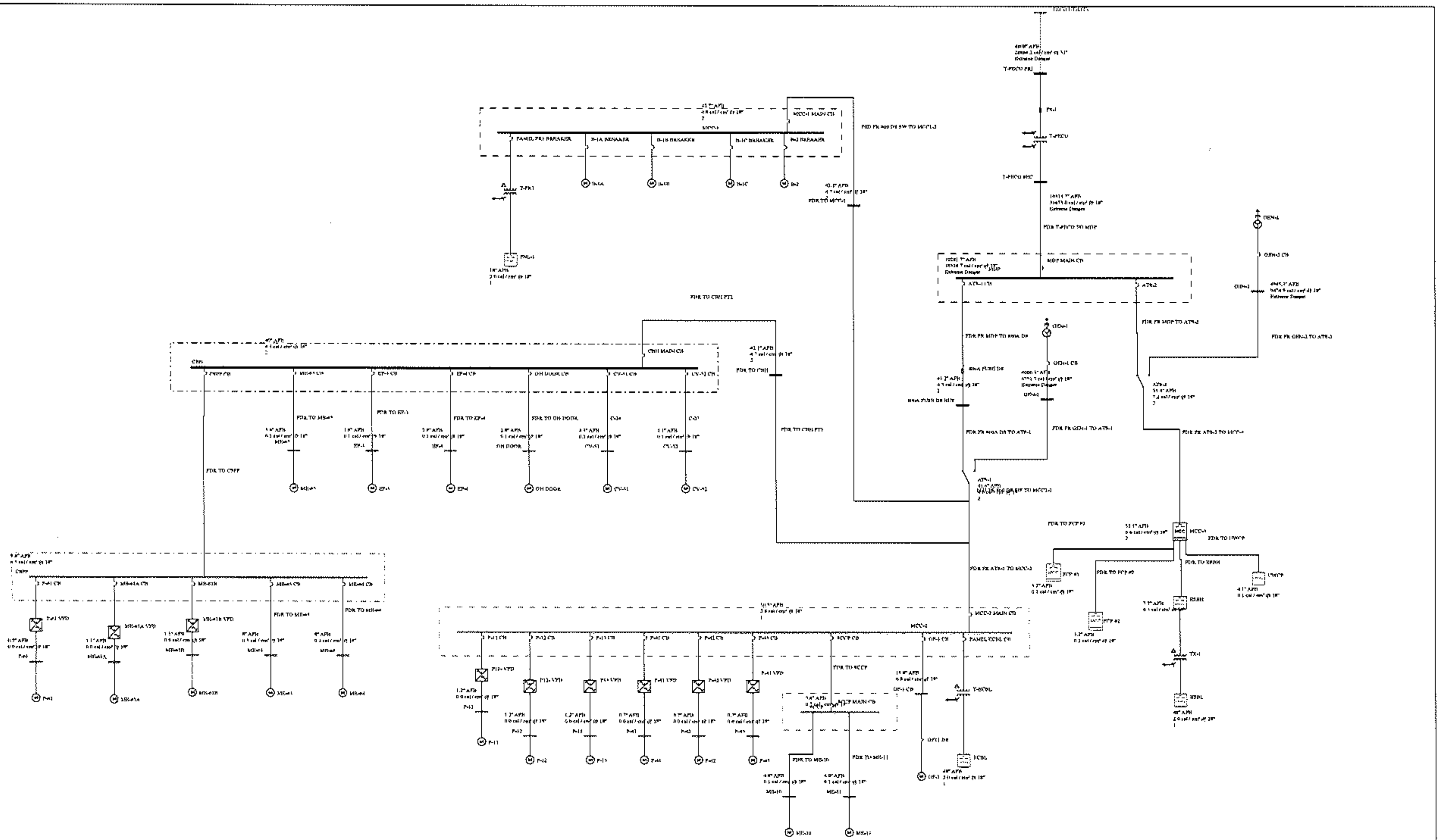
Appendix G:
Arc Flash One-Line Results



RCSTP
ARC FLASH ONE-LINE DIAGRAM

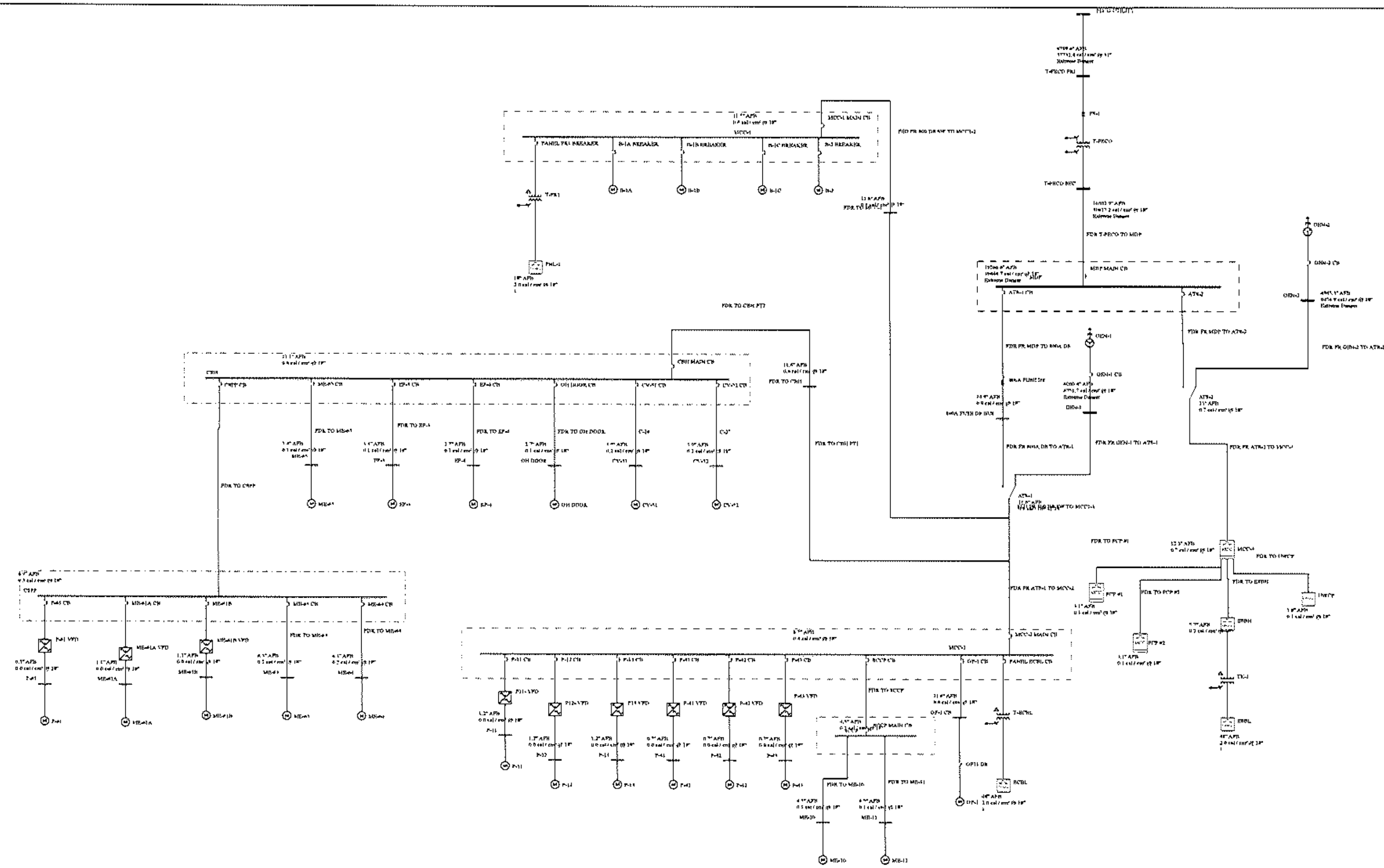
100% UTILITY



RCSTP

ARC FLASH ONE-LINE DIAGRAM

58% UTILITY



RCSTP
ARC FLASH ONE-LINE DIAGRAM

GENERATOR

Appendix H:
Arc Flash Sample Labels

Pennoni

DANGER

Arc Flash and Shock Hazard
Appropriate PPE Required

333' - 4"	Flash Hazard Boundary
6751.5	cal/cm2 Flash Hazard at 18.0 Inches
Extreme Danger	PPE Level - Do not Work on Energized Equipment!

0.48	kV Shock Hazard when cover is removed	
3' - 6"	Limited Approach	**Fault Current : 6.144 KA**
1' - 0"	Restricted Approach - Class 00 Voltage Gloves	

Equipment Name: GEN-1

Report: EGMAU25005.RPT.ARC FLASH STUDY

Date: MAY 19TH, 2025

Fed From:

Pennoni

WARNING

Arc Flash and Shock Hazard
Appropriate PPE Required

3' - 7"	Flash Hazard Boundary
4.8	cal/cm2 Flash Hazard at 18.0 Inches
2	PPE Level - Arc-rated long-sleeve shirt and pants or arc-rated-coverall, Arc-rated face shield and arc-rated balaclava or arc flash suit hood, Arc-rated jacket, parka, rainwear, or hard hat liner, hard hat, Safety glasses or goggles, hearing protection, leather gloves and footwear. Refer to NFPA 70E-2018 Table 130.7(C)(15)(c).

0.48	kV Shock Hazard when cover is removed	
3' - 6"	Limited Approach	**Fault Current : 16.65 KA**
1' - 0"	Restricted Approach - Class 00 Voltage Gloves	

Equipment Name: MCC-1

Report: EGMAU25005.RPT.ARC FLASH STUDY

Date: MAY 19TH, 2025

Fed From: **MDP**

Pennoni

WARNING

Arc Flash and Shock Hazard
Appropriate PPE Required

2' - 6"	Flash Hazard Boundary
2.8	cal/cm2 Flash Hazard at 18.0 Inches
1	PPE Level - Arc-rated long-sleeve shirt and pants or arc-rated-coverall, Arc-rated face shield or arc flash suit hood, Arc-rated jacket, parka, rainwear, or hard hat liner, hard hat, Safety glasses or goggles, hearing protection, leather gloves and footwear. Refer to NFPA 70E-2018 Table 130.7(C)(15)(c).

0.48	kV Shock Hazard when cover is removed	
3' - 6"	Limited Approach	**Fault Current : 17.157 KA**
1' - 0"	Restricted Approach - Class 00 Voltage Gloves	

Equipment Name: MCC-2

Fed From: **MDP**

Report: EGMAU25005.RPT.ARC FLASH STUDY

Date: MAY 19TH, 2025

Pennoni

WARNING

Arc Flash and Shock Hazard
Appropriate PPE Required

0' - 8"	Flash Hazard Boundary
0.3	cal/cm2 Flash Hazard at 18.0 Inches
	PPE Level - Shirt (long sleeve) and pants (long) or coverall or untreated natural fiber. Refer to NFPA 70E-2018 Table 130.7(C)(15)(c).

0.48	kV Shock Hazard when cover is removed	
3' - 6"	Limited Approach	**Fault Current : 10.836 KA**
1' - 0"	Restricted Approach - Class 00 Voltage Gloves	

Equipment Name: ESBH

Fed From: **MCC-3**

Report: EGMAU25005.RPT.ARC FLASH STUDY

Date: MAY 19TH, 2025

Pennoni

Appendix I:
Utility, Transformer, & Generator Information

peco
AN EXELON COMPANY

Thursday, April 17, 2025

Subject: EAST GOSHEN MUNICIPAL AUTHORITY
34.5 kV Service Fault Duty

Hello,

As requested, the following 34.5 kV fault current information is provided to assist in your electrical system studies for EAST GOSHEN MUNICIPAL AUTHORITY, 1751 TOWNE DRIVE, WEST CHESTER. The maximum fault current from PECO-Energy's circuit is **10,000** Amps, symmetrical (X/R=26) and the minimum is estimated at 1,200 Amps, symmetrical. An estimation of the actual fault currents at the customer's 34.5 kV service substation, at this time is:

	GOSHEN_351
3 PHASE Amps @ 34.5 kV	2,215 Sym Amps X/R = 5.3
1 PHASE Amps @ 34.5 kV	1,639 Sym Amps X/R = 4.4
Circuit Length	39,530 Ft

The estimated values of fault current may change at any time, without notice to the customer. The value may range from the guaranteed maximum to the estimated minimum. Arc flash analysis SHALL be conducted using the worst case scenario and NOT solely from the values listed in the table above. It is the responsibility of the recipient of this letter to determine the worst case conditions.

This customer receives 34,500 Volt service and owns, operates, and maintains all of the 34,500 Volt service equipment and transformers. You should verify service switch, fuse, circuit breaker, and transformer ratings with the customer.

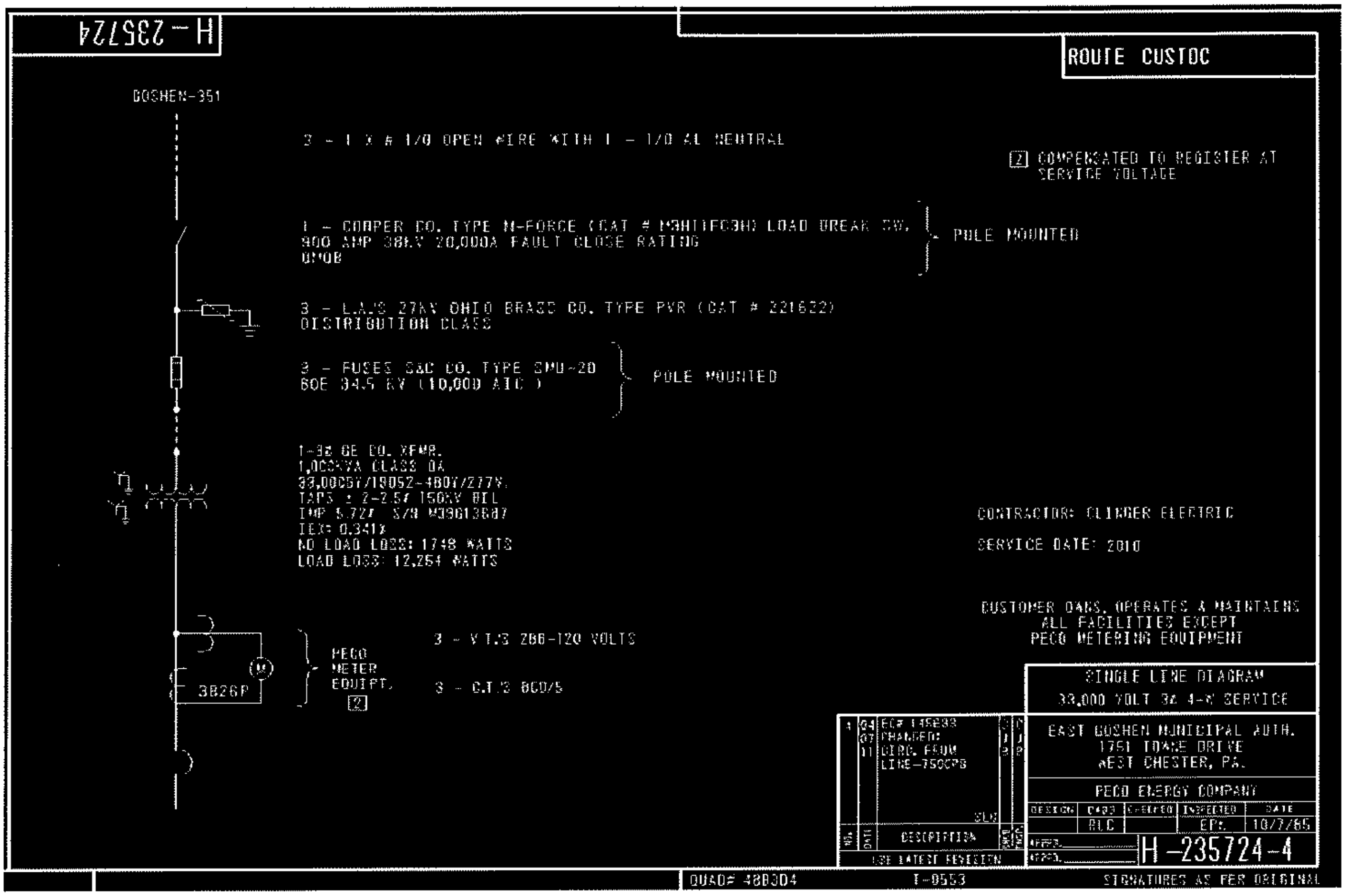
The next available upstream overcurrent device for GOSHEN_351 from the customer service fuse is:

- PECO's PLANEBROOK-351 Recloser with a RM-2 controller set as follows:
  - Phase Elements
    - 680 Amp primary pick-up, Kyle-162 Curve
    - No Instantaneous
  - Ground Element
    - 400 Amp primary pick-up, Kyle-162 Curve
    - No Instantaneous

Our comments do not relieve the designer of the responsibility for an adequate design. He has the responsibility that the installation is in accordance with the National Electrical Code, the National Electrical Safety Code and other codes which apply.

If you have any questions concerning these comments, please contact me at PECOCustomerEngineering@exeloncorp.com.

Sincerely,
Uday Arora
Grid Connection Engineering - Customer Engineering
peco
AN EXELON COMPANY


H-235724
ROUTE CUSTOC
GOSHEN-351
3 - 1 X # 1/0 OPEN WIRE WITH 1 - 1/0 AL NEUTRAL
2 COMPENSATED TO REGISTER AT SERVICE VOLTAGE
1 - COOPER CO. TYPE M-FORCE (CAT # M3H11FC3H) LOAD BREAK SW.
900 AMP 38KV 20,000A FAULT CLOSE RATING
GMOB
POLE MOUNTED
3 - L.A.'S 27KV OHIO BRASS CO. TYPE PVR (CAT # 221622)
DISTRIBUTION CLASS
3 - FUSES S&C CO. TYPE SMU-20
80E 34.5 KV (10,000 AIC)
POLE MOUNTED
1-3Ø GE CO. XFMR.
1,000KVA CLASS OA
33,000GY/19052-480Y/277V.
TAPS ± 2-2.5% 150KV BIL
IMP 5.72% S/N M39613687
IEX= 0.341%
NO LOAD LOSS: 1748 WATTS
LOAD LOSS: 12,254 WATTS
CONTRACTOR: CLINGER ELECTRIC
SERVICE DATE: 2010
CUSTOMER OWNS, OPERATES & MAINTAINS
ALL FACILITIES EXCEPT
PECO METERING EQUIPMENT
3 - V.T.'S 286-120 VOLTS
PECO
METER
EQUIPT.
2
3 - C.T.'S 800/5
3B26P
M
SINGLE LINE DIAGRAM
33,000 VOLT 3Ø 4-W SERVICE
4 04 07 11 EC# 145233 CHANGED: CIRC. FROM LINE-750CPB
SLW
NO. DATE DESCRIPTION
USE LATEST REVISION
EAST GOSHEN MUNICIPAL AUTH.
1751 TOWNE DRIVE
WEST CHESTER, PA.
PECO ENERGY COMPANY
DESIGN DRAWN CHECKED INSPECTED DATE
RLC EPK 10/7/65
APPR.
APPR.
H-235724-4
QUAD# 48B3D4
T-0553
SIGNATURES AS PER ORIGINAL

Our energy working for you.™

Power Generation

Bill of Material

Cummins Sales and Service - East Region
2727 Ford Road
Bristol PA 19007 United States

P# 96095
January 8, 2020

Project Name: Ridley Creek Pump Station, East Goshen MUA
Premium Power Services
505 Schoolhouse Rd
Kennett Square, PA 19348

Item	Description	Qty
	Diesel Genset: 60Hz-450/410kW	
450DFEJ	Genset-Diesel,60Hz,450kW-Standby Rating	1
A331-2	Duty Rating-Standby Power	1
L170-2	Emissions Certification, EPA, Tier 2, NSPS CI Stationary Emergency	1
F202-2	Enclosure-Steel, SndAtt, Level 2,Base Mtd,w/ExhSys	1
C207-2	Fuel Tank-Subbase,850 Gallon,UL142 Compliant	1
R002-2	Voltage-277/480,3 Phase,Wye,4 Wire	1
B246-2	Alternator-60 Hz, 12 Lead, Limited Range, 125/105C	1
H703-2	Generator Set Control-PowerCommand 2.3	1
H536-2	Display Language-English	1
H678-2	Display-Control, LCD	1
K631-2	Relays-Genset Status, User Configured	1
KU32-2	Relay - Alarm Shutdown	1
H609-2	Control Mounting-Left Facing	1
A292-2	Heater-Alternator, 120 Volt AC	1
KU94-2	CB -Right Only	1
KC62-2	Circuit Breaker-800A,Right CB on Right side,3-Pole,UL 600,IEC 690 100%	1
KB72-2	CB -Bottom Entry, Right	1
KM69-2	Auxiliarycontacts/Tripalarm-Single Circuit Breaker	1
KM72-2	Shunttrip-24vdc,Single Circuit Breaker	1
P175-2	Enclosure Color-Green,Steel Enclosure	1
L163-2	Listing, ULC-S601-07	1
C127-2	Separator-Fuel/Water	1
B786-2	Battery Charger-12 Amp, Regulated	1
E074-2	Engine Cooling-Radiator, 50C Ambient	1
H389-2	Shutdown-Low Coolant Level	1
H557-2	Coolant Heater-208/240/480V, Below 40F Ambient Temp	1
D041-2	Engine Air Cleaner-Normal Duty	1

Alternator data sheet

Frame size: HC5C

Characteristics

Weights:	Wound stator assembly:	1288 lb	580 kg
	Rotor assembly:	1052 lb	474 kg
	Complete assembly:	2804 lb	1263 kg
Maximum speed:		2250 rpm	
Excitation current:	Full load:	1.72 Amps	
	No load:	0.40 Amps	
Insulation system:	Class H throughout		

3 Ø Ratings (0.8 power factor)		60 Hz (winding no)				50 Hz (winding no)		
(Based on specific temperature rise at 40 °C ambient temperature)		110/190 220/380	120/208 240/416	139/240 277/480	347/600	110/190 220/380	120/208 240/415	127/220 254/440
		(311/312)	(311/312)	(311/312)	(07/17)	(311/312)	(311/312)	(311/312)
150 °C Rise ratings	kW	400	440	500	476	382	382	382
	kVA	500	550	625	595	477	477	477
125 °C Rise ratings	kW	384	420	475	450	360	360	360
	kVA	480	525	594	562	450	450	450
105 °C Rise ratings	kW	350	385	430	412	320	320	320
	kVA	438	481	538	515	400	400	400
80 °C Rise ratings	kW	304	336	376	358	280	280	280
	kVA	380	420	470	448	350	350	350

Reactances (per unit ±10%)	110/190 220/380	120/208 240/416	139/240 277/480	347/600	110/190 220/380	120/208 240/415	127/220 254/440
(Based on full load at 125 °C rise rating)							
Synchronous	4.32	3.94	3.35	3.35	3.26	2.73	2.43
Transient	0.19	0.18	0.15	0.15	0.16	0.13	0.12
Subtransient	0.14	0.13	0.11	0.11	0.12	0.10	0.09
Negative sequence	0.26	0.24	0.20	0.20	0.19	0.16	0.15
Zero sequence	0.12	0.11	0.09	0.09	0.11	0.09	0.08

Motor starting		Broad range	600	Broad range
Maximum kVA	(90% sustained voltage)	1749	1749	1749
Time constants	(sec)	Broad range	600	Broad range
Transient		0.080	0.080	0.080
Subtransient		0.012	0.012	0.012
Open circuit		2.000	2.000	2.000
DC		0.017	0.017	0.017
Windings	(@ 20 °C)	Broad range	600	Broad range
Stator resistance	(Ohms per phase)	0.0136	0.0210	0.0136
Rotor resistance	(Ohms)	1.5500	1.5500	1.5500
Number of leads		12	6	12

Single phase power can be taken up to 40% of 3 phase-ratings

Sales and Service

Bill of Material

Feature Code	Description	Qty
DFEK	DFEK Commercial Diesel Generator Set, 500kW Standby 60Hz	1
Install-US-Stat 500DFEK A331-2 L170-2 L090-2 0170 R002-2 B258-2 A292-2 F202-2 P175-2 C209-2 L163-2 C127-2 H609-2 H703-2 H678-2 KP74-2 H536-2 KU94-2 3250 KC62-2 3251 KB72-2 KM69-2 KM72-2 D041-2 B786-2 E074-2 H389-2 H557-2 L026-2 L189-2 L050-2 A412-2	U.S. EPA, Stationary Emergency Application 500DFEK, Diesel Genset, 60Hz, 500kW-Standby Rating Duty Rating - Standby Power (ESP) Emission Certification, EPA, Tier 2, NSPS CI Stationary Emergency Listing - UL 2200 None-Vibration Isolators-Normal Duty Voltage - 277/480, 3 Phase, Wye, 4 Wire Alternator - 60Hz, 12 Lead, Extended Range, 125/105C Alternator Heater, 120 Volt AC Steel Sound Attenuated Level 2 Enclosure, with Exhaust System Enclosure Color - Green, Steel Fuel Tank - Sub Base, 1700 Gallon, UL142 Compliant Listing, ULC - S601 - 07 Fuel Water Separator Control Mounting - Left Facing PowerCommand 2.3 Controller LCD Control Display Stop Switch - Emergency, Externally Mounted Control Display Language - English Circuit Breaker or Entrance Box or Terminal Box - Right Only Circuit Breaker or Terminal Box, Left-None Circuit Breaker - 800A, Right Circuit Breaker on Right side, 3 - Pole, UL 600, IEC 690 100% Circuit Breaker or Entrance Box or Terminal Box, Left-None Bottom Entry, Right Auxiliary contacts/Trip Alarm - Single Circuit Breaker Shunt Trip - 24 Volts DC, Single Circuit Breaker Engine Air Cleaner - Normal Duty External Battery Charger - 12 Amp, Regulated Engine Cooling - Radiator, 50C Ambient Shutdown - Low Coolant Level Coolant Heater - 208/240/480 Volts AC, Below 40F Ambient Temperature Cummins Certified Test Record Standby 5 Year 2500 Hour Parts+Labor+Travel Literature - English Packing - None, Base Mounted Housing	
OTECD	OTECD, OTEC Transfer Switch-Electronic Control: 800A/1000A	1
OTEC1000 A046-7 A035-7 B001-7 A028-7 A044-7 A042-7 R026-7 M034-7 C110-7 G007-7	OTEC1000, Transfer Switch, PowerCommand, 1000 Amp Listing - UL 1008/CSA Certification Application - Utility to Genset Cabinet - Type 1 Poles - 3 (Solid Neutral) Frequency - 60 Hz System - 3 Phase, 3 or 4 Wire Voltage - 480 Volts AC Genset Starting Battery - 24V DC PC40 Control Transfer Switch Warranty - 5 Year Comprehensive	
A053C813	Emergency Stop Switch Kit-Remote	1
0300-5929-02	Annunciator-Panel Mounted With Enclosure (RS485)	1
NSBOP26	Equipment ships direct genset on open truck ATS in enclosed trailer	1
NSBOP34	Equipment supply only proposal based on 011923 email trail	1

NOTES:

Proposal is for equipment only, offloading, rigging, and installation by others.

Alternator data sheet

Frame size: HC5F

Characteristics

Weights:	Wound stator assembly:	1776 lb	800 kg
	Rotor assembly:	1512 lb	681 kg
	Complete assembly:	3738 lb	1684 kg
Maximum speed:		2250 rpm	
Excitation current:	Full load:	1.72 Amps	
	No load:	0.40 Amps	
Insulation system:	Class H throughout		

3 Ø Ratings (0.8 power factor)

(Based on specific temperature rise at 40° C ambient temperature)		60 Hz (winding no)				50 Hz (winding no)		
		110/190 220/380 (311/312)	120/208 240/416 (311/312)	139/240 277/480 (311/312)	347/600 (07/17)	110/190 220/380 (311/312)	120/208 240/415 (311/312)	127/220 254/440 (311/312)
150° C rise ratings	kW	570	625	700	700	568	568	552
	kVA	713	781	875	875	710	710	690
125° C rise ratings	kW	538	590	660	660	536	536	520
	kVA	673	738	825	825	670	670	650
105° C rise ratings	kW	500	550	600	600	496	496	480
	kVA	625	688	750	750	620	620	600
80° C rise ratings	kW	440	484	528	528	432	432	416
	kVA	550	605	660	660	540	540	520

Reactances (per unit ± 10%)

(Based on full load at 125° C rise rating)	110/190 220/380	120/208 240/416	139/240 277/480	347/600	110/190 220/380	120/208 240/415	127/220 254/440
Synchronous	3.64	3.33	2.80	2.80	2.90	2.43	2.10
Transient	0.17	0.15	0.13	0.13	0.17	0.14	0.12
Subtransient	0.12	0.11	0.09	0.09	0.11	0.09	0.08
Negative sequence	0.23	0.21	0.18	0.18	0.18	0.15	0.13
Zero sequence	0.10	0.09	0.08	0.08	0.08	0.07	0.06

Motor starting

	Broad range	600	Broad range
Maximum kVA (90% sustained voltage)	2429	2429	1769

Time constants (sec)

	Broad range	600	Broad range
Transient	0.080	0.080	0.080
Subtransient	0.012	0.012	0.012
Open circuit	2.500	2.500	2.500
DC	0.019	0.019	0.019

Windings (@ 20° C)

	Broad range	600	Broad range
Stator resistance (Ohms per phase)	0.0062	0.0098	0.0062
Rotor resistance (Ohms)	2.1600	2.1600	2.1600
Number of leads	12	6	12

Single phase power can be taken up to 40% of 3 phase- ratings