North Stonington School Modernization
297/298/311 Norwich-Westerly Road
North Stonington, CT 06359

DOWNES CONSTRUCTION COMPANY

DCC Job #: 25-01-0345

Date: 06/11/18

Architect: QA&M Architecture
MEP Engineer: RZ Design Associates, Inc.
Structural Engineer: Perrone & Zajda Engineers, LLC
Civil Engineer: CLA Engineers, Inc.
Landscape Architect: TO Design, LLC
Food Service Consultant: Crabtree McGrath Associates, Inc.

Subcontractor/ Vendor: Banton Construction Company

Submittal Description:

Downes Construction Company, LLC
P.O. Box 727
200 Stanley Street
New Britain, CT 06050
Attn: Travis Burton

Overcurrent Protective Device Coordination &
ARC Flash Hazard Analysis
COORDINATION STUDY

Spec. Section: 267500-001-002-A

Construction Manager's Stamp Area:

SUBMITTAL REVIEW
DOWNES CONSTRUCTION COMPANY, LLC
[X] REVIEWED FOR SUBMISSION TO ARCHITECT / ENGINEER ☐ REJECTED
DOWNES CONSTRUCTION COMPANY'S REVIEW IS FOR GENERAL CONFORMANCE WITH THE CONTRACT DOCUMENTS. MARKINGS AND/OR COMMENTS SHALL NOT BE CONSTRUED AS RELIEVING THE TRADE CONTRACTOR FROM COMPLIANCE WITH THE CONTRACT DOCUMENTS.
BY: TB DATE: 6/13/2018
SPECS SECTION: 267500 SUBMITTAL NUMBER: 001
CONTRACT DWG. NO.: 000 REVIEW NUMBER: 1

Page: 567
Paragraph:

First Submission: ☐
Resubmission #: 1

Submitted as Specified: ☐
Submitted as Substitution (As equal): ☐

Elementary School: ☐
High School/Middle School: X
Board of Education: ☐

Provide submittal for EACH SCHOOL

Comments:

CONTRACTOR HAS DETERMINED AND VERIFIED MATERIALS, FIELD MEASUREMENTS AND FIELD CRITERIA AND HAS CHECKED AND COORDINATED THE INFORMATION CONTAINED IN THIS SUBMITTAL WITH THE REQUIREMENTS OF THE WORK AND OF THE CONTRACT DOCUMENTS AND RECOMMENDS APPROVAL BY THE CONSTRUCTION MANAGER / ARCHITECT / ENGINEER.

Architect's Stamp Area:

[X] No Exception Taken ☐ Make Corrections Noted
☐ Rejected ☐ Revise and Resubmit
☐ Reviewed ☐ Provide Record Copy

Review is only for GENERAL COMPLIANCE with design and information given in contract documents. Any action shown is subject to the requirements of the PLANS and SPECIFICATIONS. Submitting contractor is responsible for, dimensions which shall be verified in the field fabrication processes, techniques of construction, coordination with other trades and satisfactory completions of his work in a safe manner.

QUISENBERRY ARCARI MALIK, LLC

DATE: 06-29-18 BY: [signature]

Engineer's Stamp Area (As Required):

SHOP DRAWING REVIEW
REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS

x NO EXCEPTIONS TAKEN
MAKE CORRECTIONS NOTED
AMEND AND RESUBMIT
REJECTED – SEE REMARKS

RZ Design Associates, Inc.

DATE 6/29/18 BY BJZ

Received Stamp Area:

RECEIVED
06-29-18
Quisenberry Arcari Architects, LLC

Short Circuit Study
Protective Device Coordination
and
Arc Flash Hazard Analysis
for
North Stonington High School/Middle School
297 Norwich-Westerly Road
North Stonington, CT

Prepared By
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Date: 6/11/2018
PAA#2018.10115.2 REV 1

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I. INTRODUCTION

A short circuit, protective device coordination and arc flash hazard analysis study has been prepared as called for by the RZ Design Associates, Inc. specifications for the North Stonington High School/Middle School project in North Stonington, CT. The scope of this study includes all new equipment presented in the engineering electrical power riser drawing E5.1 dated 02/14/18 and in equipment submittal from Yale Electric and shown on the one line diagrams on page 3-2 of this report.

SHORT CIRCUIT ANALYSIS

A short circuit study determines the short circuit currents available at various points in the system. This information is necessary to evaluate the equipment being utilized in the system, to set the protective devices and to ensure that its ratings comply with the NEC 110.9, *Interrupting Rating*, and 110.10, *Circuit Impedance and Other Characteristics*. The calculated short circuit currents and a protective device evaluation are included in the short circuit section of this study.

PROTECTIVE DEVICE COORDINATION

Properly engineered systems will allow only the protective device nearest the fault to open, leaving the remainder of the system undisturbed and preserving continuity of service. A protective device coordination study is required to properly select and set the power systems protective devices to achieve this goal. This is accomplished by performing a time current evaluation among the protective devices.

Coordination is generally a compromise between the mutually desirable but somewhat inconsistent goals of maximum protection and maximum service continuity. With the use of molded circuit breakers it is usually impossible to coordinate the system in the instantaneous region due to the overlap of curves unless a zone interlock is utilized. For this and other reasons, such as established system design, many combinations of device settings may be classified as acceptable. The settings suggested in this study result from an exercise of judgment as to the best balance between competing objectives.

A recommendation of protective device settings is included in the coordination study section of this study. Plots of the time current characteristics for these devices are included to show how these recommendations were derived.

ARC FLASH HAZARD ANALYSIS

An arc flash hazard analysis has been prepared for this facility and is included in this final study. The arc flash study has been prepared in accordance with requirements of IEEE 1584 and NFPA 70E Standard for Electrical Safety in the Workplace.

The analysis considers three different utility feed scenarios to determine the highest possible incident energy at each panel. Whichever is greater will be the data that is incorporated on the equipment label. The analysis is based on a 1500 kva utility transformer with an impedance of 5.75%, the generator is a 250 kW gen set with a subtransient reactance of 0.12.

The first scenario models the utility available fault current as an infinite source.

The second scenario models the utility available fault current as an utility provided low level of 1,418 amp source.

The third scenario utilizes the generator supply feeding the transfer switches for the emergency system.

NFPA 70E 130.5 Flash Risk Assessment states "*An arc flash risk assessment shall be performed and shall:*
(1) Determine if an arc flash hazard exists. If an arc flash hazard exists the risk assessment shall determine
a. Appropriate safety related work practices
b. The arc flash boundary
c. The PPE to be used within the arc flash boundary." The arc flash hazard analysis incorporates the results of the short circuit and coordination study.

DATA SOURCES

RZ Design Associates, Inc.
Contact: (860) 436-4336
Contract One Line Diagrams
Conductor Data

Yale Electric
Contact: Sean Govey (781) 562-9304

New Equipment Data
- Switchgear
- Panelboards
- Transformers

Banton Construction Company
Contact: Nick Pullano (203) 234-2353

Installation Contractor
Conductor Lengths and Data
Generator System
Transfer Switches
Utility Data

NOTE: Data Input for the Study is based on the electrical submittals and drawings as supplied by the companies listed above. Any changes to the input data will render the findings in this study to be inaccurate and a study revision will be required.

WARRANTY

It is the intent of Power Analysis Associates LLC to provide a study, which is accurate and based on sound professional judgment. If it is found that any portion of this study does not satisfy this goal, Power Analysis Associates LLC will correct that portion of the study at no charge providing we are notified in writing within one year of the submission of the study. The warranty does not include modifications to the study resulting from design changes to the system after the study has been initiated or inaccurate supplied data.

LIMITATION OF LIABILITY

The foregoing warranty represents the sole responsibility of the company. Power Analysis Associates LLC shall not be liable for any consequential damages. It does not assume responsibility or liability for loss, injury or damage to equipment that may result from the failure of the equipment or the system to operate in accordance of the predictions or recommendations of the study.

II. EXECUTIVE SUMMARY

Short circuit calculations were performed on the system based on an infinite bus primary on the utility specified 1500 kVA transformer. The impedance value used for this transformer was 5.75 %, which will produce an available fault current of 31,370 amps at the secondary of the transformer. There is a resulted fault current level of 30,611 amps at the main switch board, MSWB1.

The 250 KW generator system is capable of providing a fault current level of 3,128 amps.

There are no areas of concern on this project based on the utilization of a 1500 KVA utility transformer.

SHORT CIRCUIT STUDY SUMMARY

After the short circuit calculations were performed, the calculated available fault currents were utilized to evaluate the new equipment AIC ratings. This comparison of available fault and equipment AIC ratings is shown on the equipment evaluation forms in the short circuit study portion of this study, page 3-6.

As a result of this evaluation, all of the new equipment reviewed for this installation is adequately rated to withstand the calculated available fault currents at the respective locations in this system.

For further discussion, refer to equipment evaluation forms and respective comments.

COORDINATION STUDY SUMMARY

As a result of this coordination study, the following should be noted.

1) The time current curves provided in this study show that all cables and all transformers are adequately protected by the over current protective devices. The settings chosen for the circuit breakers is an attempt to provide the best possible protection for downstream devices while trying to maintain some selective coordination.

2) Complete coordination of the system is not possible due to the number of fixed curve molded case breakers and several "same size" protective devices in a single circuit.

3) Adjustments to circuit breakers at significantly elevated arc flash locations were made in this study, successfully lowering arc flash hazard levels at some locations. Some coordination was lost. See TCC1-2, TCC2, TCC2-1, and TCC4.

The settings of the adjustable trip circuit breakers in this system are summarized on page 4-4 of this study. After this report is reviewed the settings recommended in this study should be made on the respective devices.

For further discussion of system coordination, refer to the time current curves and respective comments in this study.

Protective device coordination as established in this report requires that the individual protective device operating characteristics do not depart appreciably from those shown on the time current plots. The specified settings will provide operation of the protective devices essentially as shown. For low voltage direct acting trips and fuses the tolerance bands permit a deviation in operating characteristics. However, the protective relay tolerance and the difficulty in exact field settings may result in deviations from the specified operating times. Therefore, it is recommended that the relay settings be calibrated by field test to obtain the desired relay response and be calibrated and checked at regular future intervals.

The calibration, testing and setting of the protective devices are to be performed by others and no interpretation should be made that personnel involved in this report will perform this task.

ARC FLASH HAZARD ANALYSIS SUMMARY

The Arc Flash Hazard Analysis was prepared in accordance with 2015 NFPA 70E, Standard for Electrical Safety in the Workplace and IEEE 1584 Guide for Performing Arc-Flash Hazard Calculations.

Article 130.2 of NFPA 70E states:

"Energized electrical conductors and circuit parts shall be put into an electrically safe work condition before an employee performs work if either of the following conditions exist:

(1) The employee is within the limited approach boundary.

(2) *The employee interacts with equipment where conductors or circuit parts are not exposed, but an increased likelihood of injury from an exposure to an arc flash exists.*

Considering the number of electrical accidents involving employees annually, it is highly recommended that equipment be placed in an electrically safe work condition prior to working on the equipment.

2015 NFPA 70E defines an electrically safe work condition as:

> *"A state in which the conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary."*

3. For those conditions, where this cannot be done, as outlined in 2015 NFPA 70E Article 130.2 above, the preparation of an Arc Flash Hazard Analysis is necessary, to prepare an employee for the hazard that might be encountered, The Arc Flash Hazard Analysis calculates arc flash boundary distances, arc flash incident energies (AFIE), recommends personal protective equipment (PPE), and prepares arc flash warning labels, to be installed on equipment. The purpose of the analysis is to give warning to the dangers involved in working on energized equipment, and prevent serious injury. The analysis includes all equipment buses shown on the oneline diagram, both for utility and generator electrical service supply.

For analysis' results, see the ARC FLASH HAZARD TABLE on page 5-8.

III. SHORT CIRCUIT STUDY

SHORT CIRCUIT CALCULATIONS

Short circuit calculations were performed on the system as defined on the accompanying one line diagram and the corresponding system data.

An available fault current of 31,370 amps at the secondary of the utility transformer was used for these calculations.

The calculations were performed using the following computer program; Power Tools for Windows A-Fault study, developed by SKM Systems Analysis, version 7.0.4.1. The A-Fault Study follows the specifications of the American National Standards Institute (ANSI) C37.010, C37.5, and C37.13, and IEEE Standard 141, also popularly known as the IEEE *Red Book.* The program analyzes system data, converts it to per unit impedances, and simulates a bolted fault at each node to determine the equivalent impedance to the point of fault and the resultant fault current generated by the driving voltage at that point.

The calculated fault currents are listed in the "Short Circuit Program" summary report, page 3-4 for the Utility. The worst case values are also shown in the equipment evaluation portion of this study, page 3-6.

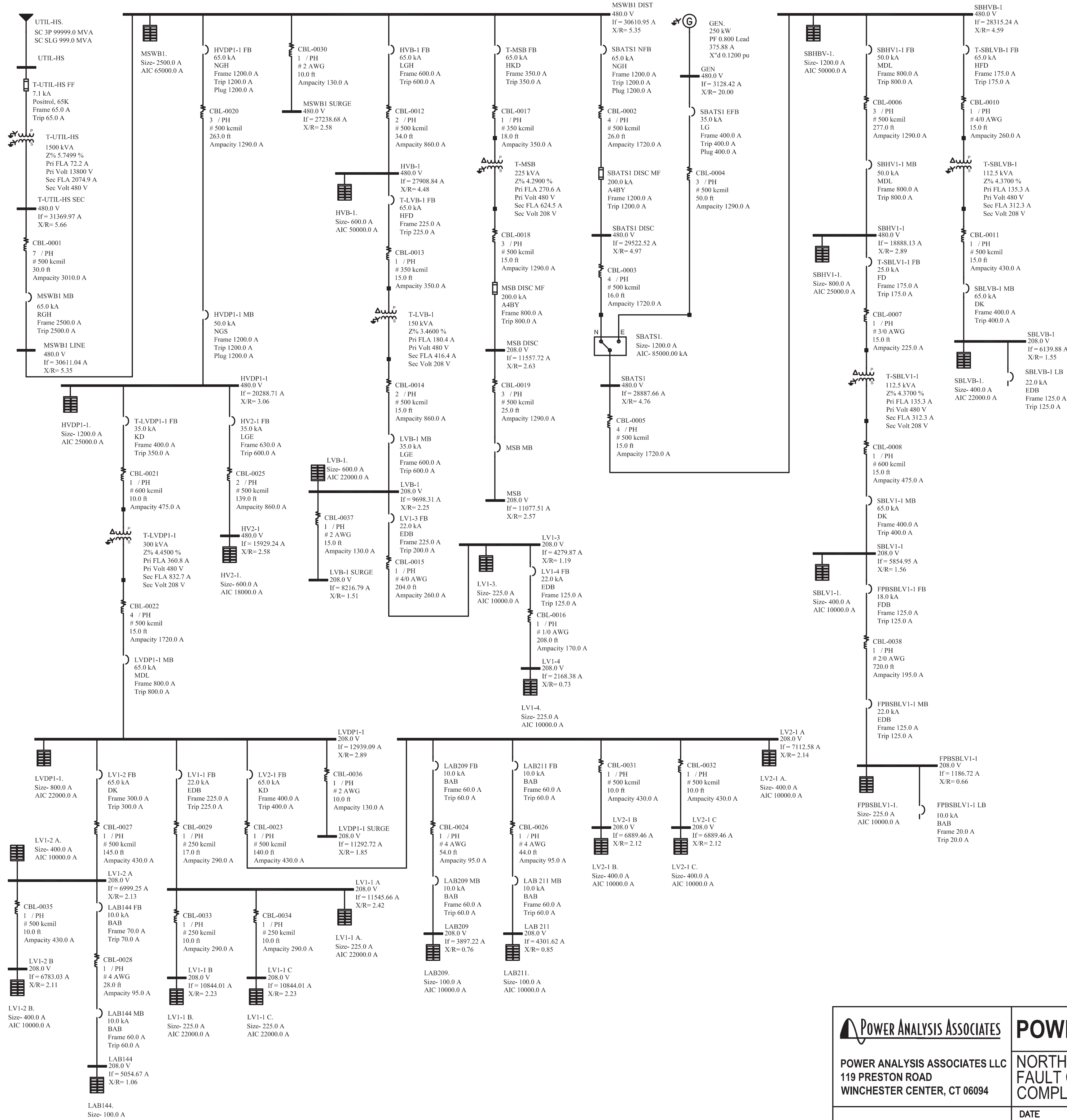
The data used in this study is included for verification and to serve as a record for this electrical system.

ONE LINE DIAGRAMS

The following drawings represent the one line diagram for this system.

The one-line diagrams include:

- All components
- Utility service and Generator service
- Available fault current and X/R ratio at each node
- OCPD AIC ratings, type, frame, trip
- Panelboard ratings
- Conductor - quantity, size, insulation type, length and ampacity



POWER ANALYSIS ASSOCIATES	POWER ANALYSIS ASSOCIATES LLC		
POWER ANALYSIS ASSOCIATES LLC 119 PRESTON ROAD WINCHESTER CENTER, CT 06094	NORTH STONINGTON HS/MS FAULT CURRENT AND COMPONENT DATA COMPLETE ONE LINE NEW SERVICE		
	DATE June-11-18	DWG NO. E-1	REV 1
PAA # 2018.10115.2	SCALE NTS	SHEET 1 OF 1	

SHORT CIRCUIT ANALYSIS RESULTS

The following computer generated report calculates the available fault current for three phase bolted fault, unbalanced fault (line to line and line to ground), for the utility system.

See page 3-4 for summary results of fault currents for this system.

See page 3-5 for the complete detailed fault current report.

See page 3-6 for equipment evaluation table.

ANSI Summary Fault Report

Project: North Stonington H

ANSI Summary Fault Report Long

A_FAULT Settings

Fault Type	3 Phase+Unbalanced	**LV Duty**	Yes	**Int Duty**	Yes
Faulted Bus	All Buses	**LV Report**	Complete	**Int Report**	Complete
Include Tap	No	**Mom Duty**	Yes	**Solution Method**	E/Z
Pre-fault Voltage	1.0000	**Mom Report**	Complete	**NACD Option**	Interpolated

Low Voltage Summary

Fault Location Bus Name	Bus Voltage	3 Phase Amps	X/R 3 Ph	SLG Amps	X/R SLG
BUS-0006	480	28,888	4.76	27,540	4.28
BUS-0009	480	3,100	18.16	2,590	17.44
BUS-0012	480	17,509	2.44	13,941	1.91
BUS-0013	208	6,090	1.55	6,406	1.51
BUS-0014	480	25,784	3.39	23,276	2.70
BUS-0015	208	6,411	1.55	6,639	1.52
BUS-0016	480	25,709	3.82	23,289	3.16
BUS-0017	208	10,029	2.28	10,620	2.22
BUS-0018	480	27,548	4.18	25,682	3.54
BUS-0019	208	11,866	2.67	12,646	2.61
BUS-0020	480	19,544	2.99	16,145	2.39
BUS-0021	208	13,226	2.94	14,658	2.93

Low Voltage Summary

Fault Location Bus Name	Bus Voltage	3 Phase Amps	X/R 3 Ph	SLG Amps	X/R SLG
FPBSBLV1-1	208	1,187	0.66	771	0.54
GEN	480	3,128	20.00	2,619	20.00
HV2-1	480	15,929	2.58	12,488	2.06
HVB-1	480	27,909	4.48	26,198	3.91
HVDP1-1	480	20,289	3.06	16,939	2.45
LAB 211	208	4,302	0.85	2,962	0.64
LAB144	208	5,055	1.06	3,649	0.81
LAB209	208	3,897	0.76	2,625	0.57
LV1-1 A	208	11,546	2.42	11,686	2.09
LV1-1 B	208	10,844	2.23	10,569	1.86
LV1-1 C	208	10,844	2.23	10,569	1.86
LV1-2 A	208	6,999	2.13	5,796	1.78
LV1-2 B	208	6,783	2.11	5,567	1.76
LV1-3	208	4,280	1.19	3,182	0.94
LV1-4	208	2,168	0.73	1,418	0.58
LV2-1 A	208	7,113	2.14	5,918	1.79
LV2-1 B	208	6,889	2.12	5,679	1.77
LV2-1 C	208	6,889	2.12	5,679	1.77
LVB-1	208	9,698	2.25	10,060	2.16
LVB-1 SURGE	208	8,217	1.51	7,569	1.19

Low Voltage Summary

Fault Location Bus Name	Bus Voltage	3 Phase Amps	X/R 3 Ph	SLG Amps	X/R SLG
LVDP1-1	208	12,939	2.89	14,128	2.83
LVDP1-1 SURGE	208	11,293	1.85	11,025	1.41
MSB	208	11,078	2.57	11,325	2.41
MSB DISC	208	11,558	2.63	12,118	2.52
MSWB1 DIST	480	30,611	5.35	29,992	5.15
MSWB1 LINE	480	30,611	5.35	29,992	5.15
MSWB1 SURGE	480	27,239	2.58	24,672	1.90
SBATS1	480	28,888	4.76	27,540	4.28
SBATS1 DISC	480	29,523	4.97	28,430	4.56
SBHV1-1	480	18,888	2.89	15,448	2.30
SBHVB-1	480	28,315	4.59	26,751	4.05
SBLV1-1	208	5,855	1.56	6,013	1.52
SBLVB-1	208	6,140	1.55	6,199	1.51
T-UTIL-HS SEC	480	31,370	5.66	31,108	5.68
UTIL-HS	13,800	4,183,658	8.00	125,386	8.00

ANSI Complete Fault Report

Project: North Stonington H

ANSI Complete Fault Report

A_FAULT Settings

Fault Type	3 Phase+Unbalanced	**LV Duty**	Yes	**Int Duty**	Yes
Faulted Bus	All Buses	**LV Report**	Complete	**Int Report**	Complete
Include Tap	No	**Mom Duty**	Yes	**Solution Method**	E/Z
Pre-fault Voltage	1.0000	**Mom Report**	Complete	**NACD Option**	Interpolated

Low Voltage 3 Phase and Unbalanced

Fault Location Bus Name	Bus Voltage		Fault Duty kA	Fault Duty MVA	X/R	Asym kA Max RMS	Asym kA Avg RMS	Sequence Impedance pu		Equivalent R	Equivalent +jX
BUS-0006	480	3 Phase:	28.89	24.0	4.76	35.79	32.43	Z1:	4.16	0.00	0.01
		SLG:	27.54	13.2	4.28	33.28	---	Z2:	4.16	---	---
		LL:	25.02	12.0	---	---	---	Z0:	4.78	---	---
LLG Gnd Return kA:	26.301	LLG:	28.77	13.8	---	---	---				
BUS-0009	480	3 Phase:	3.10	2.6	18.16	4.82	4.01	Z1:	38.80	0.00	0.09
		SLG:	2.59	1.2	17.44	4.01	---	Z2:	74.04	---	---
		LL:	1.85	0.9	---	---	---	Z0:	26.50	---	---
LLG Gnd Return kA:	4.557	LLG:	3.22	1.5	---	---	---				
BUS-0012	480	3 Phase:	17.51	14.6	2.44	18.79	18.16	Z1:	6.87	0.01	0.01
		SLG:	13.94	6.7	1.91	14.45	---	Z2:	6.87	---	---
		LL:	15.16	7.3	---	---	---	Z0:	12.27	---	---
LLG Gnd Return kA:	11.526	LLG:	17.03	8.2	---	---	---				
BUS-0013	208	3 Phase:	6.09	2.2	1.55	6.19	6.14	Z1:	45.58	0.01	0.02
		SLG:	6.41	1.3	1.51	6.51	---	Z2:	45.58	---	---
		LL:	5.27	1.1	---	---	---	Z0:	38.84	---	---
LLG Gnd Return kA:	6.756	LLG:	6.32	1.3	---	---	---				
BUS-0014	480	3 Phase:	25.78	21.4	3.39	29.55	27.70	Z1:	4.66	0.00	0.01
		SLG:	23.28	11.2	2.70	25.45	---	Z2:	4.66	---	---
		LL:	22.33	10.7	---	---	---	Z0:	6.23	---	---
LLG Gnd Return kA:	21.141	LLG:	25.85	12.4	---	---	---				

Low Voltage 3 Phase and Unbalanced

Fault Location Bus Name	Bus Voltage		Fault Duty kA	Fault Duty MVA	X/R	-----Asym kA----- Max RMS	Avg RMS	Sequence Impedance pu		Equivalent R	+jX
BUS-0015	208	3 Phase:	6.41	2.3	1.55	6.52	6.47	Z1:	43.30	0.01	0.02
		SLG:	6.64	1.4	1.52	6.74	---	Z2:	43.30	---	---
		LL:	5.55	1.2	---	---	---	Z0:	38.84	---	---
LLG Gnd Return kA:	6.884	LLG:	6.60	1.4	---	---	---				
BUS-0016	480	3 Phase:	25.71	21.4	3.82	30.27	28.04	Z1:	4.68	0.00	0.01
		SLG:	23.29	11.2	3.16	26.28	---	Z2:	4.68	---	---
		LL:	22.27	10.7	---	---	---	Z0:	6.17	---	---
LLG Gnd Return kA:	21.243	LLG:	25.54	12.3	---	---	---				
BUS-0017	208	3 Phase:	10.03	3.6	2.28	10.65	10.34	Z1:	27.68	0.00	0.01
		SLG:	10.62	2.2	2.22	11.23	---	Z2:	27.68	---	---
		LL:	8.69	1.8	---	---	---	Z0:	23.07	---	---
LLG Gnd Return kA:	11.283	LLG:	10.45	2.2	---	---	---				
BUS-0018	480	3 Phase:	27.55	22.9	4.18	33.11	30.39	Z1:	4.37	0.00	0.01
		SLG:	25.68	12.3	3.54	29.73	---	Z2:	4.37	---	---
		LL:	23.86	11.5	---	---	---	Z0:	5.34	---	---
LLG Gnd Return kA:	24.022	LLG:	27.50	13.2	---	---	---				
BUS-0019	208	3 Phase:	11.87	4.3	2.67	12.95	12.41	Z1:	23.39	0.00	0.01
		SLG:	12.65	2.6	2.61	13.74	---	Z2:	23.39	---	---
		LL:	10.28	2.1	---	---	---	Z0:	19.07	---	---
LLG Gnd Return kA:	13.536	LLG:	12.40	2.6	---	---	---				
BUS-0020	480	3 Phase:	19.54	16.2	2.99	21.80	20.69	Z1:	6.15	0.00	0.01
		SLG:	16.14	7.7	2.39	17.27	---	Z2:	6.15	---	---
		LL:	16.93	8.1	---	---	---	Z0:	10.12	---	---
LLG Gnd Return kA:	13.708	LLG:	19.04	9.1	---	---	---				
BUS-0021	208	3 Phase:	13.23	4.8	2.94	14.70	13.97	Z1:	20.99	0.00	0.01
		SLG:	14.66	3.0	2.93	16.29	---	Z2:	20.99	---	---
		LL:	11.45	2.4	---	---	---	Z0:	14.83	---	---
LLG Gnd Return kA:	16.439	LLG:	14.11	2.9	---	---	---				
FPBSBLV1-1	208	3 Phase:	1.19	0.4	0.66	1.19	1.19	Z1:	233.90	0.08	0.06
		SLG:	0.77	0.2	0.54	0.77	---	Z2:	233.90	---	---
		LL:	1.03	0.2	---	---	---	Z0:	614.84	---	---
LLG Gnd Return kA:	0.570	LLG:	1.10	0.2	---	---	---				
GEN	480	3 Phase:	3.13	2.6	20.00	4.91	4.07	Z1:	38.45	0.00	0.09
		SLG:	2.62	1.3	20.00	4.11	---	Z2:	73.69	---	---
		LL:	1.86	0.9	---	---	---	Z0:	25.63	---	---
LLG Gnd Return kA:	4.659	LLG:	3.26	1.6	---	---	---				

Low Voltage 3 Phase and Unbalanced

Fault Location Bus Name	Bus Voltage		Fault Duty kA	Fault Duty MVA	X/R	-----Asym kA----- Max RMS	-----Asym kA----- Avg RMS	Sequence Impedance pu		Equivalent R	Equivalent +jX
HV2-1	480	3 Phase:	15.93	13.2	2.58	17.27	16.61	Z1:	7.55	0.01	0.02
		SLG:	12.49	6.0	2.06	13.07	---	Z2:	7.55	---	---
		LL:	13.80	6.6	---	---	---	Z0:	13.90	---	---
LLG Gnd Return kA:	10.233	LLG:	15.35	7.4	---	---	---				
HVB-1	480	3 Phase:	27.91	23.2	4.48	34.09	31.08	Z1:	4.31	0.00	0.01
		SLG:	26.20	12.6	3.91	31.01	---	Z2:	4.31	---	---
		LL:	24.17	11.6	---	---	---	Z0:	5.17	---	---
LLG Gnd Return kA:	24.665	LLG:	27.76	13.3	---	---	---				
HVDP1-1	480	3 Phase:	20.29	16.9	3.06	22.75	21.54	Z1:	5.93	0.00	0.01
		SLG:	16.94	8.1	2.45	18.19	---	Z2:	5.93	---	---
		LL:	17.57	8.4	---	---	---	Z0:	9.52	---	---
LLG Gnd Return kA:	14.492	LLG:	19.82	9.5	---	---	---				
LAB 211	208	3 Phase:	4.30	1.5	0.85	4.30	4.30	Z1:	64.53	0.02	0.02
		SLG:	2.96	0.6	0.64	2.96	---	Z2:	64.53	---	---
		LL:	3.73	0.8	---	---	---	Z0:	154.24	---	---
LLG Gnd Return kA:	2.242	LLG:	4.10	0.9	---	---	---				
LAB144	208	3 Phase:	5.05	1.8	1.06	5.07	5.06	Z1:	54.91	0.02	0.02
		SLG:	3.65	0.8	0.81	3.65	---	Z2:	54.91	---	---
		LL:	4.38	0.9	---	---	---	Z0:	120.27	---	---
LLG Gnd Return kA:	2.833	LLG:	4.88	1.0	---	---	---				
LAB209	208	3 Phase:	3.90	1.4	0.76	3.90	3.90	Z1:	71.22	0.02	0.02
		SLG:	2.63	0.5	0.57	2.63	---	Z2:	71.22	---	---
		LL:	3.38	0.7	---	---	---	Z0:	176.96	---	---
LLG Gnd Return kA:	1.966	LLG:	3.70	0.8	---	---	---				
LV1-1 A	208	3 Phase:	11.55	4.2	2.42	12.38	11.96	Z1:	24.04	0.00	0.01
		SLG:	11.69	2.4	2.09	12.25	---	Z2:	24.04	---	---
		LL:	10.00	2.1	---	---	---	Z0:	23.40	---	---
LLG Gnd Return kA:	11.792	LLG:	12.16	2.5	---	---	---				
LV1-1 B	208	3 Phase:	10.84	3.9	2.23	11.48	11.16	Z1:	25.60	0.00	0.01
		SLG:	10.57	2.2	1.86	10.92	---	Z2:	25.60	---	---
		LL:	9.39	2.0	---	---	---	Z0:	27.99	---	---
LLG Gnd Return kA:	10.256	LLG:	11.32	2.4	---	---	---				
LV1-1 C	208	3 Phase:	10.84	3.9	2.23	11.48	11.16	Z1:	25.60	0.00	0.01
		SLG:	10.57	2.2	1.86	10.92	---	Z2:	25.60	---	---
		LL:	9.39	2.0	---	---	---	Z0:	27.99	---	---
LLG Gnd Return kA:	10.256	LLG:	11.32	2.4	---	---	---				

Low Voltage 3 Phase and Unbalanced

Fault Location Bus Name	Bus Voltage		Fault Duty kA	Fault Duty MVA	X/R	Asym kA Max RMS	Asym kA Avg RMS	Sequence Impedance pu		Equivalent R	Equivalent +jX
LV1-2 A	208	3 Phase:	7.00	2.5	2.13	7.36	7.18	Z1:	39.66	0.01	0.02
		SLG:	5.80	1.2	1.78	5.96	---	Z2:	39.66	---	---
		LL:	6.06	1.3	---	---	---	Z0:	64.82	---	---
LLG Gnd Return kA:	4.930	LLG:	6.82	1.4	---	---	---				
LV1-2 B	208	3 Phase:	6.78	2.4	2.11	7.12	6.95	Z1:	40.92	0.01	0.02
		SLG:	5.57	1.2	1.76	5.72	---	Z2:	40.92	---	---
		LL:	5.87	1.2	---	---	---	Z0:	68.22	---	---
LLG Gnd Return kA:	4.706	LLG:	6.59	1.4	---	---	---				
LV1-3	208	3 Phase:	4.28	1.5	1.19	4.30	4.29	Z1:	64.86	0.02	0.02
		SLG:	3.18	0.7	0.94	3.19	---	Z2:	64.86	---	---
		LL:	3.71	0.8	---	---	---	Z0:	133.63	---	---
LLG Gnd Return kA:	2.517	LLG:	4.12	0.9	---	---	---				
LV1-4	208	3 Phase:	2.17	0.8	0.73	2.17	2.17	Z1:	128.01	0.04	0.03
		SLG:	1.42	0.3	0.58	1.42	---	Z2:	128.01	---	---
		LL:	1.88	0.4	---	---	---	Z0:	333.47	---	---
LLG Gnd Return kA:	1.050	LLG:	2.03	0.4	---	---	---				
LV2-1 A	208	3 Phase:	7.11	2.6	2.14	7.48	7.30	Z1:	39.03	0.01	0.02
		SLG:	5.92	1.2	1.79	6.09	---	Z2:	39.03	---	---
		LL:	6.16	1.3	---	---	---	Z0:	63.12	---	---
LLG Gnd Return kA:	5.050	LLG:	6.94	1.4	---	---	---				
LV2-1 B	208	3 Phase:	6.89	2.5	2.12	7.23	7.06	Z1:	40.29	0.01	0.02
		SLG:	5.68	1.2	1.77	5.84	---	Z2:	40.29	---	---
		LL:	5.97	1.2	---	---	---	Z0:	66.52	---	---
LLG Gnd Return kA:	4.815	LLG:	6.70	1.4	---	---	---				
LV2-1 C	208	3 Phase:	6.89	2.5	2.12	7.23	7.06	Z1:	40.29	0.01	0.02
		SLG:	5.68	1.2	1.77	5.84	---	Z2:	40.29	---	---
		LL:	5.97	1.2	---	---	---	Z0:	66.52	---	---
LLG Gnd Return kA:	4.815	LLG:	6.70	1.4	---	---	---				
LVB-1	208	3 Phase:	9.70	3.5	2.25	10.28	9.99	Z1:	28.62	0.01	0.01
		SLG:	10.06	2.1	2.16	10.59	---	Z2:	28.62	---	---
		LL:	8.40	1.7	---	---	---	Z0:	25.56	---	---
LLG Gnd Return kA:	10.446	LLG:	10.03	2.1	---	---	---				
LVB-1 SURGE	208	3 Phase:	8.22	3.0	1.51	8.35	8.28	Z1:	33.78	0.01	0.01
		SLG:	7.57	1.6	1.19	7.61	---	Z2:	33.78	---	---
		LL:	7.12	1.5	---	---	---	Z0:	43.61	---	---
LLG Gnd Return kA:	6.942	LLG:	8.55	1.8	---	---	---				

Low Voltage 3 Phase and Unbalanced

Fault Location Bus Name	Bus Voltage		Fault Duty kA	Fault Duty MVA	X/R	Asym kA Max RMS	Asym kA Avg RMS	Sequence Impedance pu		Equivalent R	Equivalent +*j*X
LVDP1-1	208	3 Phase:	12.94	4.7	2.89	14.33	13.65	Z1:	21.45	0.00	0.01
		SLG:	14.13	2.9	2.83	15.59	---	Z2:	21.45	---	---
		LL:	11.21	2.3	---	---	---	Z0:	16.04	---	---
LLG Gnd Return kA:	15.557	LLG:	13.73	2.9	---	---	---				
LVDP1-1 SURGE	208	3 Phase:	11.29	4.1	1.85	11.67	11.48	Z1:	24.58	0.01	0.01
		SLG:	11.03	2.3	1.41	11.15	---	Z2:	24.58	---	---
		LL:	9.78	2.0	---	---	---	Z0:	27.39	---	---
LLG Gnd Return kA:	10.625	LLG:	12.17	2.5	---	---	---				
MSB	208	3 Phase:	11.08	4.0	2.57	12.00	11.54	Z1:	25.06	0.00	0.01
		SLG:	11.33	2.4	2.41	12.13	---	Z2:	25.06	---	---
		LL:	9.59	2.0	---	---	---	Z0:	23.45	---	---
LLG Gnd Return kA:	11.578	LLG:	11.43	2.4	---	---	---				
MSB DISC	208	3 Phase:	11.56	4.2	2.63	12.57	12.07	Z1:	24.02	0.00	0.01
		SLG:	12.12	2.5	2.52	13.08	---	Z2:	24.02	---	---
		LL:	10.01	2.1	---	---	---	Z0:	20.70	---	---
LLG Gnd Return kA:	12.731	LLG:	12.02	2.5	---	---	---				
MSWB1 DIST	480	3 Phase:	30.61	25.4	5.35	38.94	34.91	Z1:	3.93	0.00	0.01
		SLG:	29.99	14.4	5.15	37.82	---	Z2:	3.93	---	---
		LL:	26.51	12.7	---	---	---	Z0:	4.17	---	---
LLG Gnd Return kA:	29.396	LLG:	30.49	14.6	---	---	---				
MSWB1 LINE	480	3 Phase:	30.61	25.4	5.35	38.94	34.91	Z1:	3.93	0.00	0.01
		SLG:	29.99	14.4	5.15	37.82	---	Z2:	3.93	---	---
		LL:	26.51	12.7	---	---	---	Z0:	4.17	---	---
LLG Gnd Return kA:	29.396	LLG:	30.49	14.6	---	---	---				
MSWB1 SURGE	480	3 Phase:	27.24	22.6	2.58	29.52	28.39	Z1:	4.42	0.00	0.01
		SLG:	24.67	11.8	1.90	25.56	---	Z2:	4.42	---	---
		LL:	23.59	11.3	---	---	---	Z0:	5.94	---	---
LLG Gnd Return kA:	22.328	LLG:	28.10	13.5	---	---	---				
SBATS1	480	3 Phase:	28.89	24.0	4.76	35.79	32.43	Z1:	4.16	0.00	0.01
		SLG:	27.54	13.2	4.28	33.28	---	Z2:	4.16	---	---
		LL:	25.02	12.0	---	---	---	Z0:	4.78	---	---
LLG Gnd Return kA:	26.301	LLG:	28.77	13.8	---	---	---				
SBATS1 DISC	480	3 Phase:	29.52	24.5	4.97	36.92	33.33	Z1:	4.07	0.00	0.01
		SLG:	28.43	13.6	4.56	34.86	---	Z2:	4.07	---	---
		LL:	25.57	12.3	---	---	---	Z0:	4.55	---	---
LLG Gnd Return kA:	27.408	LLG:	29.41	14.1	---	---	---				

Low Voltage 3 Phase and Unbalanced

Fault Location Bus Name	Bus Voltage		Fault Duty kA	Fault Duty MVA	X/R	-----Asym kA----- Max RMS	Avg RMS	Sequence Impedance pu		Equivalent R	+jX
SBHV1-1	480	3 Phase:	18.89	15.7	2.89	20.93	19.92	Z1:	6.37	0.00	0.01
		SLG:	15.45	7.4	2.30	16.43	---	Z2:	6.37	---	---
		LL:	16.36	7.9	---	---	---	Z0:	10.70	---	---
LLG Gnd Return kA:	13.024	LLG:	18.37	8.8	---	---	---				
SBHVB-1	480	3 Phase:	28.32	23.5	4.59	34.79	31.64	Z1:	4.25	0.00	0.01
		SLG:	26.75	12.8	4.05	31.93	---	Z2:	4.25	---	---
		LL:	24.52	11.8	---	---	---	Z0:	5.00	---	---
LLG Gnd Return kA:	25.334	LLG:	28.18	13.5	---	---	---				
SBLV1-1	208	3 Phase:	5.85	2.1	1.56	5.96	5.91	Z1:	47.41	0.01	0.02
		SLG:	6.01	1.3	1.52	6.11	---	Z2:	47.41	---	---
		LL:	5.07	1.1	---	---	---	Z0:	43.69	---	---
LLG Gnd Return kA:	6.179	LLG:	6.00	1.2	---	---	---				
SBLVB-1	208	3 Phase:	6.14	2.2	1.55	6.25	6.19	Z1:	45.21	0.01	0.02
		SLG:	6.20	1.3	1.51	6.29	---	Z2:	45.21	---	---
		LL:	5.32	1.1	---	---	---	Z0:	43.94	---	---
LLG Gnd Return kA:	6.258	LLG:	6.25	1.3	---	---	---				
T-UTIL-HS SEC	480	3 Phase:	31.37	26.1	5.66	40.41	36.04	Z1:	3.83	0.00	0.01
		SLG:	31.11	14.9	5.68	40.09	---	Z2:	3.83	---	---
		LL:	27.17	13.0	---	---	---	Z0:	3.93	---	---
LLG Gnd Return kA:	30.850	LLG:	31.23	15.0	---	---	---				
UTIL-HS	13,800	3 Phase:	4,183.66	99,999.1	8.00	5,784.77	5,018.97	Z1:	0.00	0.00	0.00
		SLG:	125.39	1,730.3	8.00	173.37	---	Z2:	0.00	---	---
		LL:	3,623.15	49,999.5	---	---	---	Z0:	0.10	---	---
LLG Gnd Return kA:	63.647	LLG:	3,623.29	50,001.4	---	---	---				

Equipment Evaluation Table

Equipment Evaluation							
Panels shown on oneline							
Panel	Status	Bus	Rated Volts	Ampacity	Calc Isc kA	Dev Isc kA	Isc kA%
FPBSBLV1-1.	Pass	FPBSBLV1-1	208	225.0	1.19	10.00	11.87
HV2-1.	Pass	HV2-1	480	600.0	15.93	18.00	88.50
HVB-1.	Pass	HVB-1	480	600.0	27.91	50.00	55.82
HVDP1-1.	Pass	HVDP1-1	480	1200.0	20.29	25.00	81.15
LAB144.	Pass	LAB144	208	100.0	5.05	10.00	50.55
LAB209.	Pass	LAB209	208	100.0	3.90	10.00	38.97
LAB211.	Pass	LAB 211	208	100.0	4.30	10.00	43.02
LV1-1 A.	Pass	LV1-1 A	208	225.0	11.69	22.00	53.12
LV1-1 B.	Pass	LV1-1 B	208	225.0	10.84	22.00	49.29
LV1-1 C.	Pass	LV1-1 C	208	225.0	10.84	22.00	49.29
LV1-2 A.	Pass	LV1-2 A	208	400.0	7.00	10.00	69.99
LV1-2 B.	Pass	LV1-2 B	208	400.0	6.78	10.00	67.83
LV1-3.	Pass	LV1-3	208	225.0	4.28	10.00	42.80
LV1-4.	Pass	LV1-4	208	225.0	2.17	10.00	21.68
LV2-1 A.	Pass	LV2-1 A	208	400.0	7.11	10.00	71.13
LV2-1 B.	Pass	LV2-1 B	208	400.0	6.89	10.00	68.89
LV2-1 C.	Pass	LV2-1 C	208	400.0	6.89	10.00	68.89
LVB-1.	Pass	LVB-1	208	600.0	10.06	22.00	45.73
LVDP1-1.	Pass	LVDP1-1	208	800.0	14.13	22.00	64.22
MSWB1.	Pass	MSWB1 DIST	480	2500.0	30.61	65.00	47.09
SBHBV-1.	Pass	SBHVB-1	480	1200.0	28.32	50.00	56.63
SBHV1-1.	Pass	SBHV1-1	480	800.0	18.89	25.00	75.55
SBLV1-1.	Pass	SBLV1-1	208	400.0	6.01	10.00	60.13
SBLVB-1.	Pass	SBLVB-1	208	400.0	6.20	22.00	28.18
SBATS1.	Pass	SBATS1	480	1200.0	28.89	85000.00	

EQUIPMENT EVALUATION COMMENTS

The following comments refer to the respective notes on the equipment evaluation forms.

As a result of this evaluation, all of the new equipment reviewed for this installation is adequately rated to withstand the calculated available fault currents at the respective locations in this system.

IV. COORDINATION STUDY

COORDINATION COMMENTS

The time current curves on the following pages were generated using the CAPTOR computer program (7.0.2.6) developed by SKM Systems Analysis, Inc. This program comes with a large user defined library of protective device curves. In some cases, the standard library devices have been modified by Power Analysis Associates LLC to more accurately reflect the manufacturer's published time current curves, which are included in the appendix of this report.

Note: It is an inherent characteristic of molded case circuit breakers that they cannot be fully coordinated in the instantaneous (fault or short circuit) region. The only exception is breakers that have a zone interlocking feature. This is true for all manufacturers' products. Breaker coordination is thus limited to the overload region.

Any circuit breakers that are not specifically mentioned are to have any of their adjustments left at the minimum setting.

All breaker coordination was analyzed and provided with arc flash incident energy level consideration. The settings suggested provide the best possible coordination while minimizing the corresponding arc flash incident energy level.

Overcurrent protective device coordination is reviewed for each one-line diagram included on page 3-2. The TCC's selection represents those conditions which potentially pose the "worst" coordination conditions. The number of devices shown on each TCC is limited. If additional associated devices must be reviewed, the TCC and associated one-line is extended, and the TCC designation is given an extension of "-1". Example TCC1-1 is an extension of TCC1. This enables greater review process, with ease of clarity.

In general, coordination can be obtained in the overload regions of the overcurrent protective devices (OCPDs), however only limited coordination is achieved in the instantaneous region. This is especially true with the use of molded case circuit breakers, which have instantaneous trip characteristics extending to the interrupting rating of the OCPD. At higher levels of fault current, the instantaneous region of the OCPD characteristic operates. Fault currents can flow through a multiplicity of OCPDs thus causing multiple OCPDs to open. This is shown in the following TCCs:

TCC1, TCC1-1 through TCC4-1, TCC4-2, TCC4-2-1 and TCC4-2-1 SB

In each of these examples, the instantaneous regions of the circuit breakers overlap. The value of available fault current will cause the load side OCPD to trip, however in the time needed to clear the fault, the upstream OCPD unlatches and also opens. In some cases multiple devices can trip open. This is true for circuit breaker combinations with other circuit breakers and/or current-limiting fuses, which may be seeing fault currents in their current-limiting range. Some of the branch panelboard circuit breakers have “fixed” characteristics and cannot be adjusted to improve coordination. Where circuit breakers have “fixed” characteristics, it is noted in the recommended circuit breaker settings table.

Where electronic trip type circuit breakers are provided, the ability to set short-time delays and pick-up settings improves the coordination. These OCPD are shown in TCC1 through TCC1-2, TCC1-2-3, TCC2, TCC3, TCC4, TCC4-1 SB and TCC4-2 SB.

If adjustment to the instantaneous region of the circuit breaker can be made, it is set to consider maximum coordination with other OCPDs. If the OCPD is on the primary side of a transformer the transformer excitation inrush current must be considered. The transformer damage curves and the inrush current are plotted where applicable. This is shown in TCC1-2, TCC2-1, TCC3, TCC4-1, TCC4-1 SB, TCC4-2-1 and TCC4-2-1 SB. OCPDs located on the primary and secondary of the same transformer are unable to coordinate due to the selection and sizing of the OCPD with respect to the transformer kVA, inrush current, and feeder sizing.

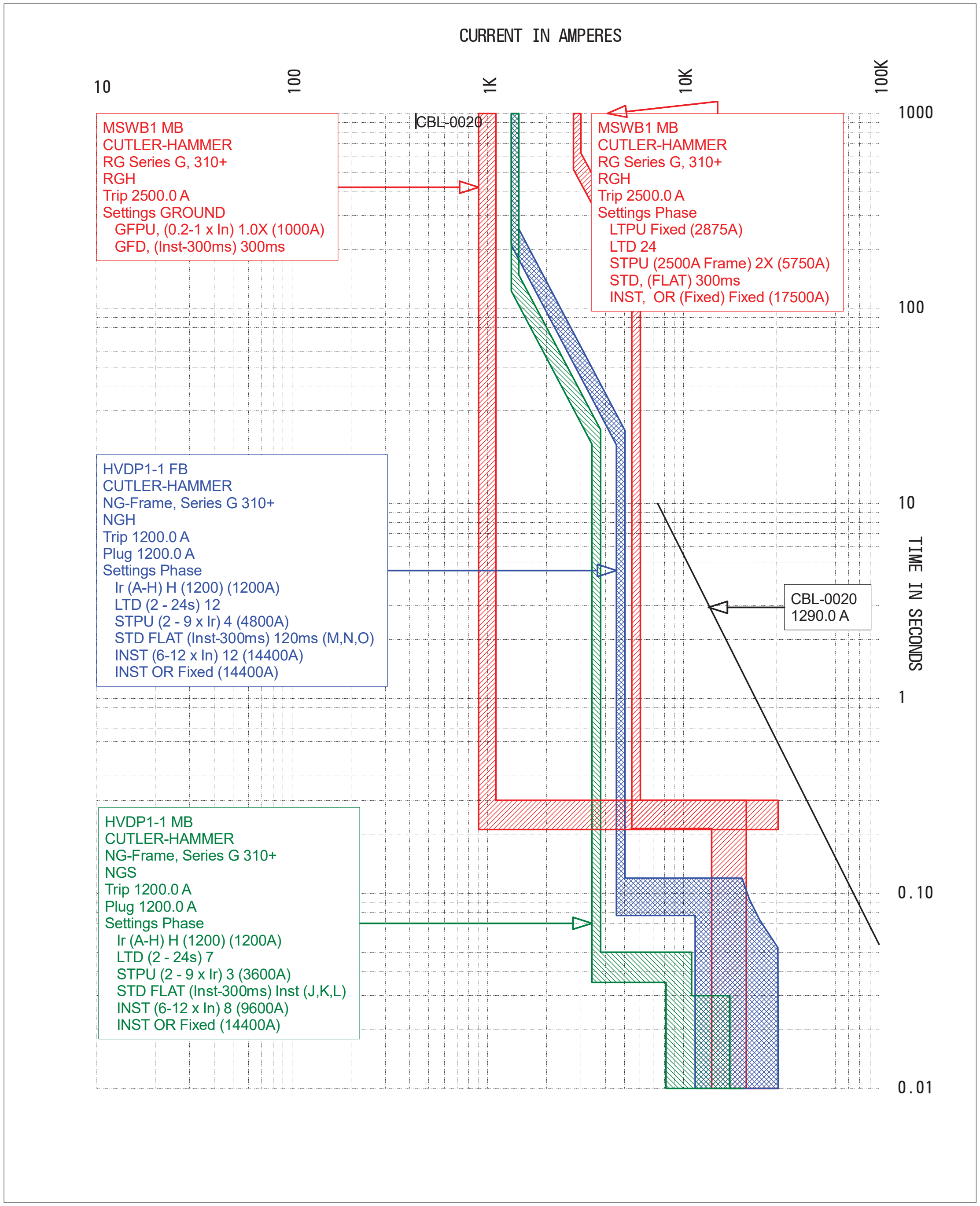
Additional coordination problems exist where ampere ratings of OCPDs in series are identical. This is typical to circuit breakers protecting feeders to panelboards, and the panelboard having a main circuit breaker of the same ampere rating. These devices cannot coordinate. In this case there is no coordination in both the overload and instantaneous region.

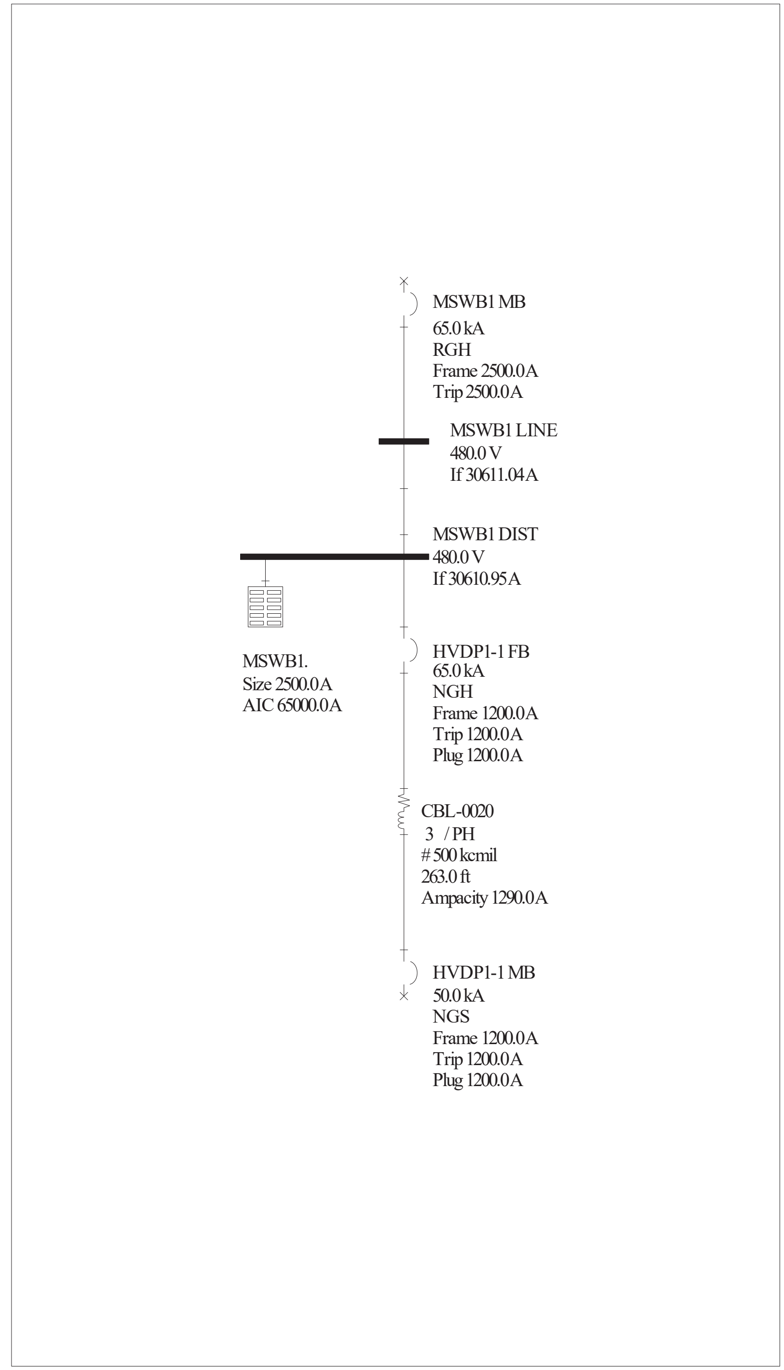
Adjustments to circuit breakers at significantly elevated arc flash locations were made in this study, successfully lowering arc flash hazard levels at some locations. Some coordination was lost. See TCC1-2, TCC2, TCC2-1, and TCC4.

A recommendation of protective device settings is included after the TCC’s.

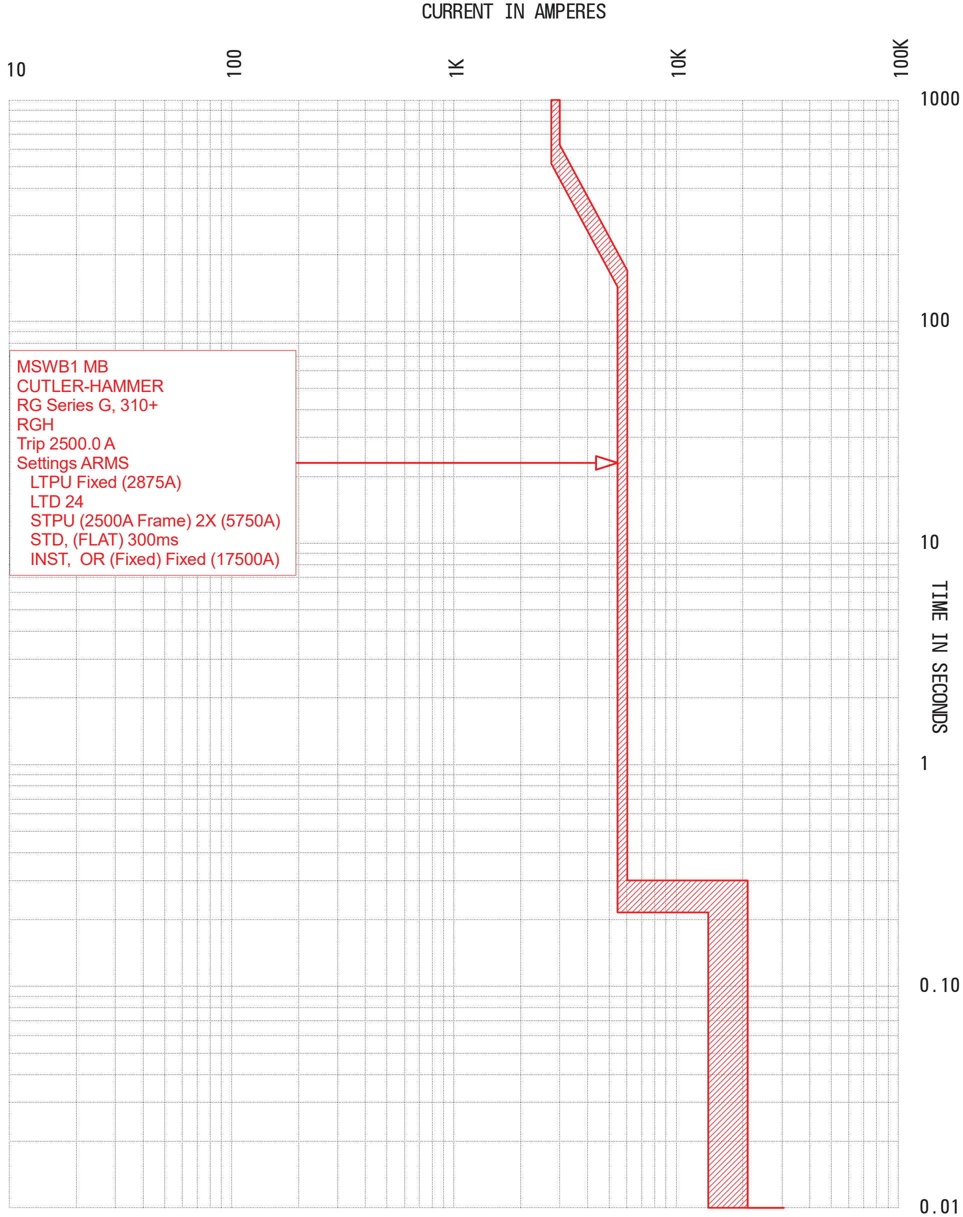
Similar circuit designs are only represented once.

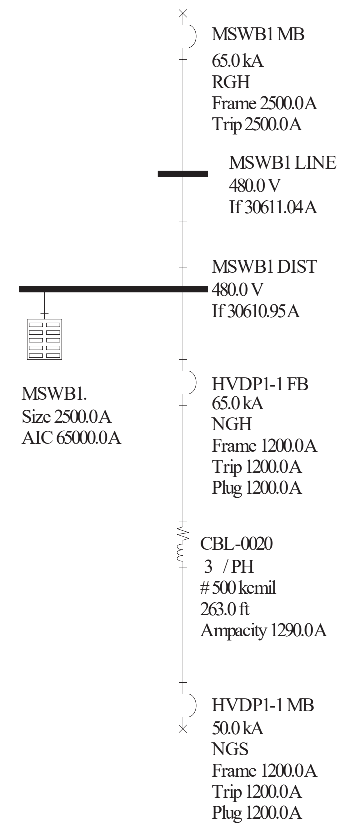
TIME CURRENT CURVES





TCC: TCC1 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018





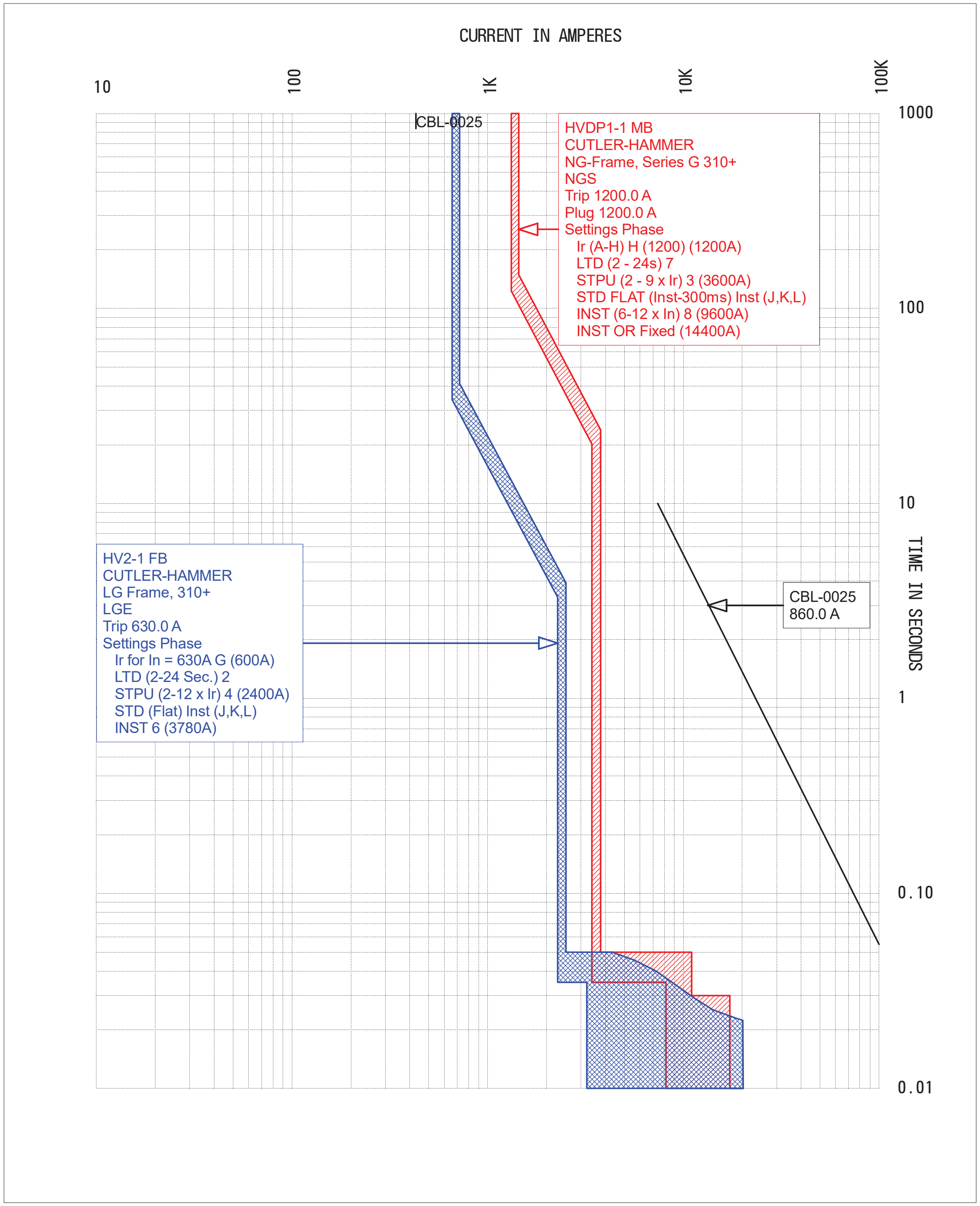
TCC: TCC1 ARMS

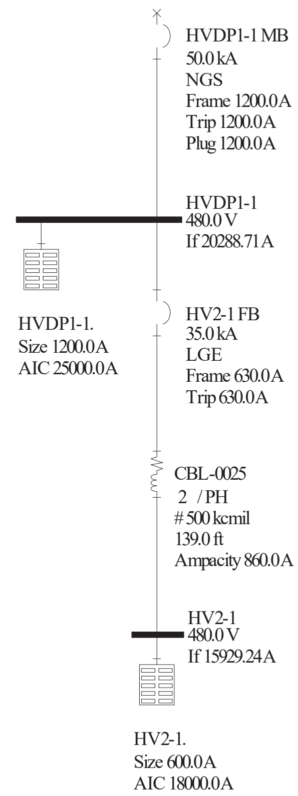
Current Scale x 1

Reference Voltage: 480

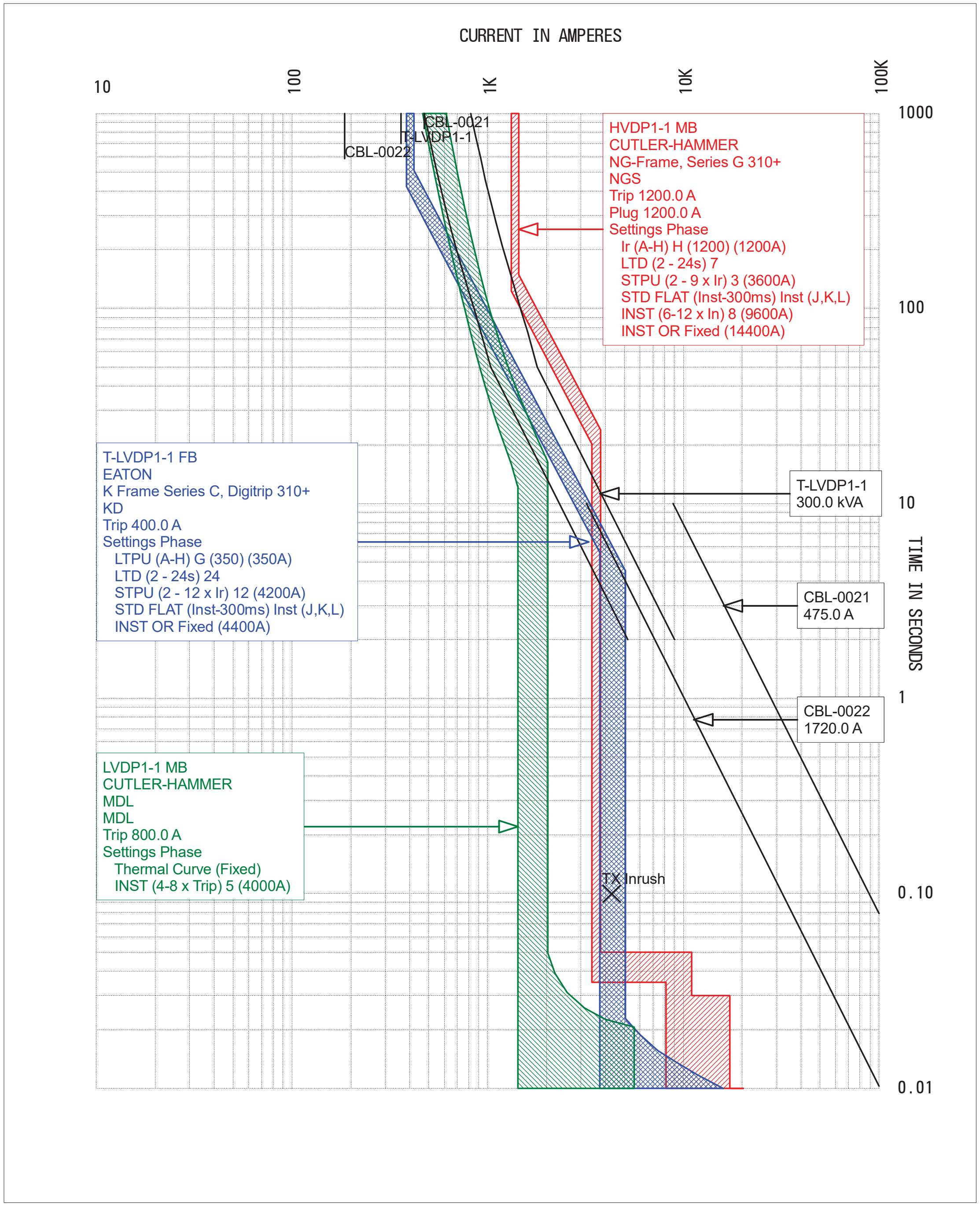
North Stonington HS MS

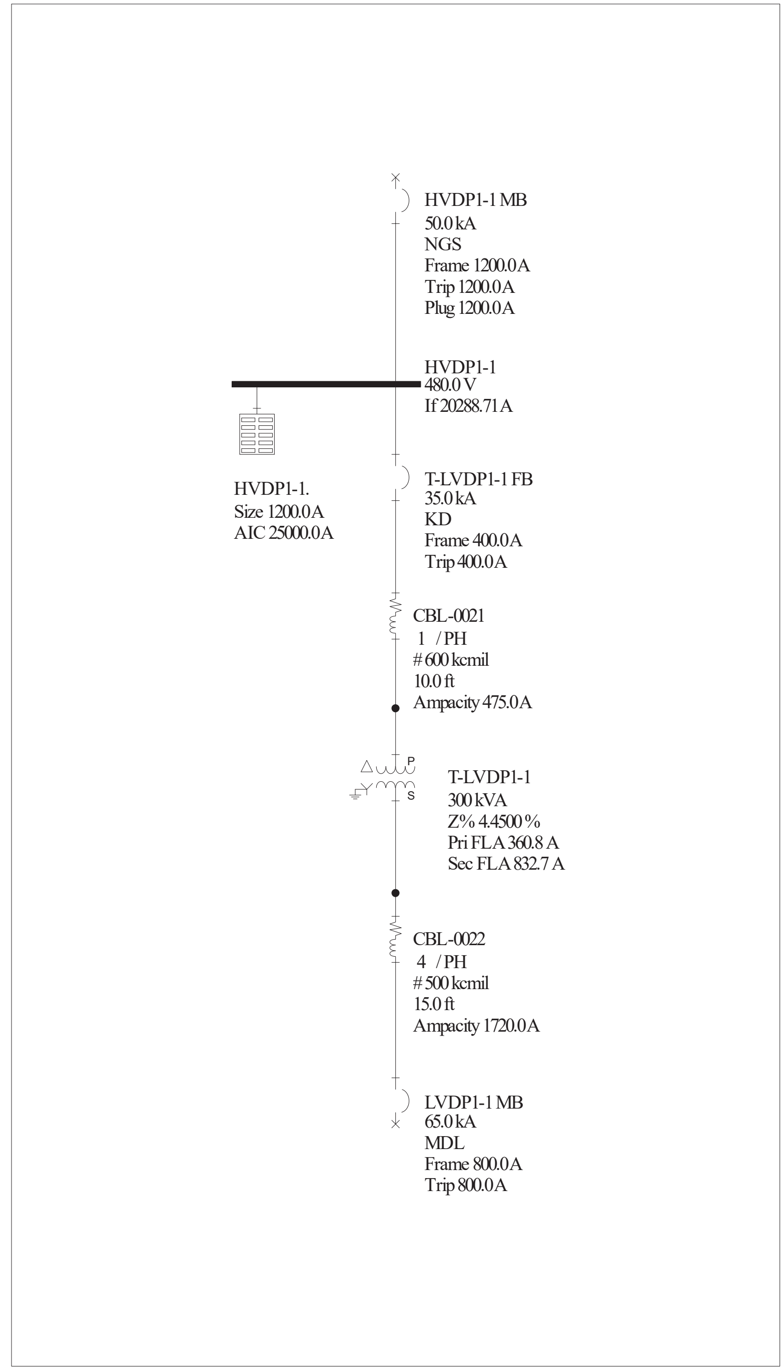
May 10, 2018



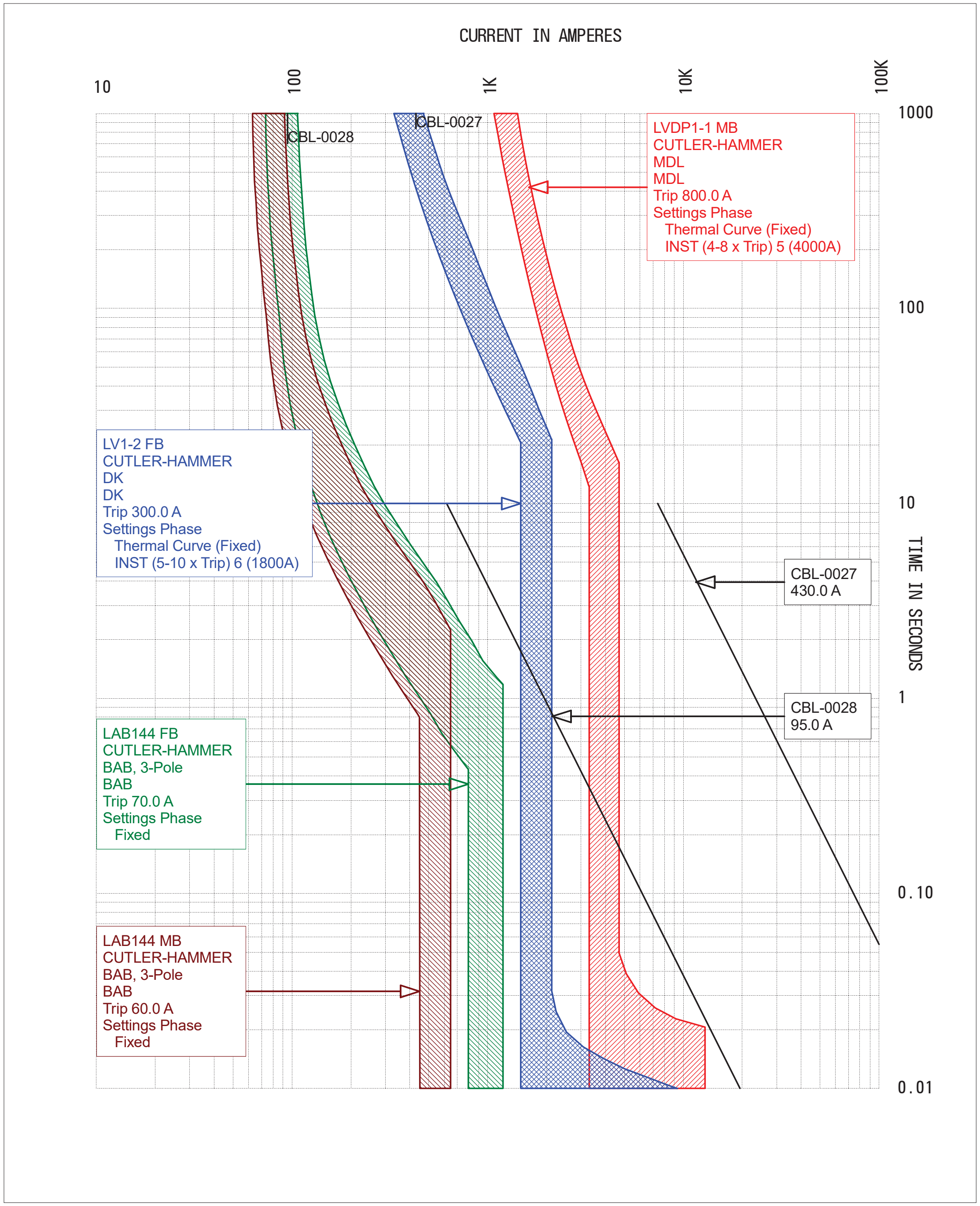


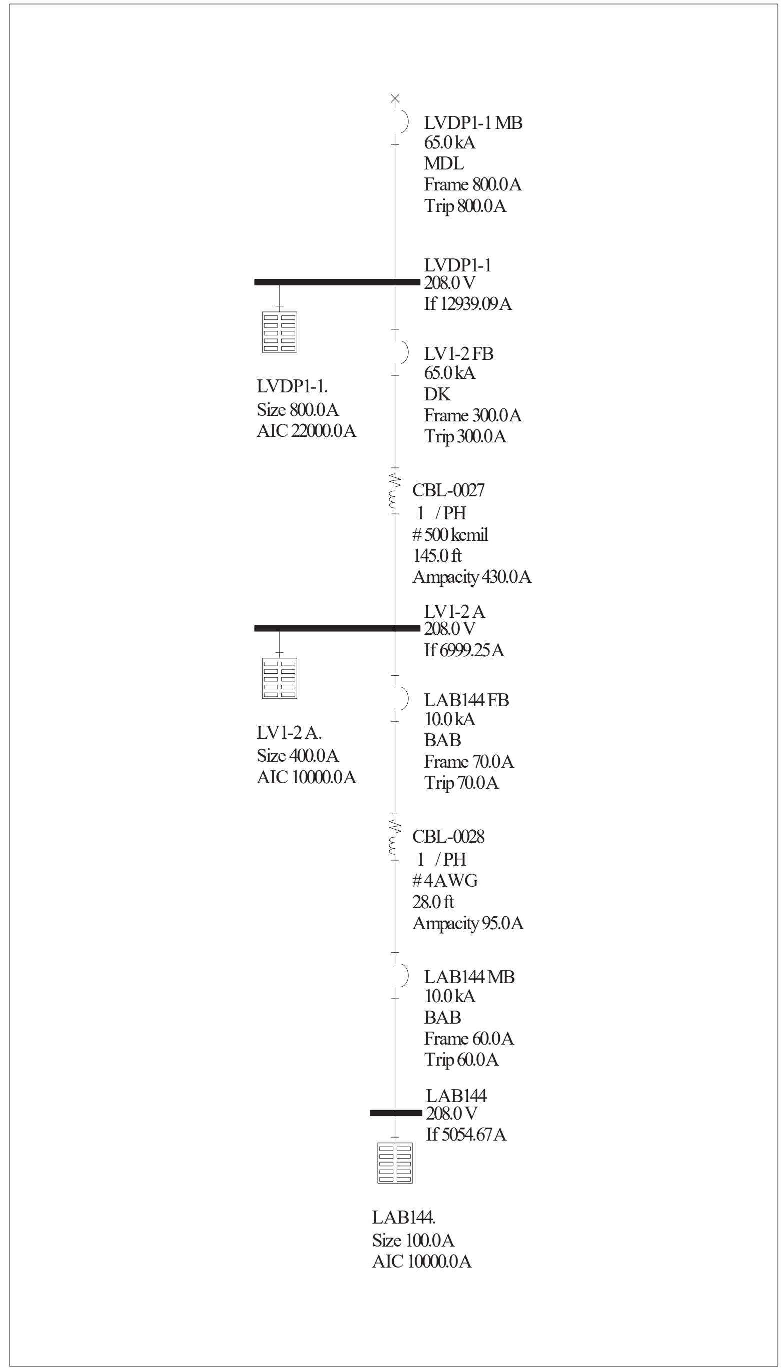
TCC: TCC1-1 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | June 11, 2018



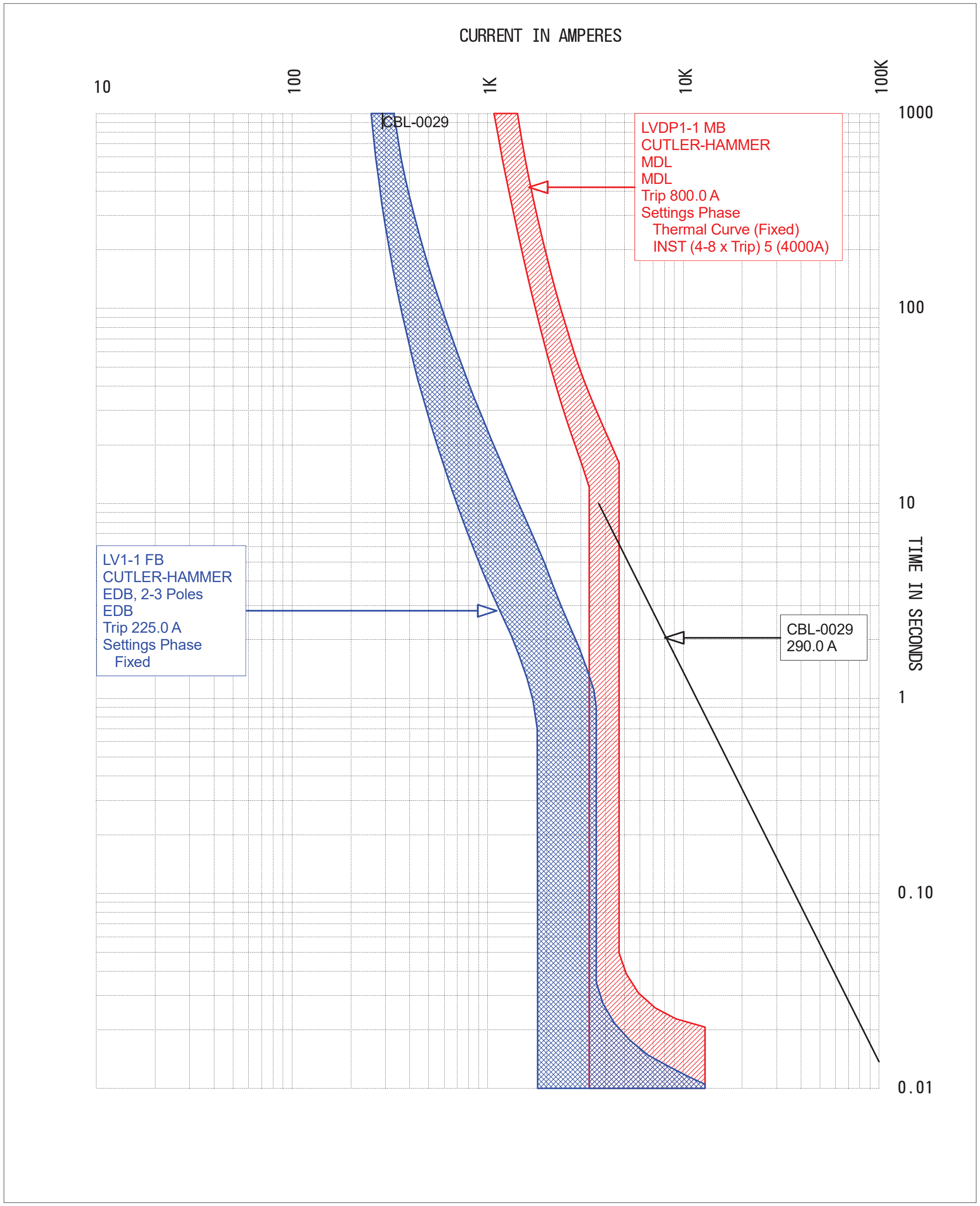


TCC: TCC1-2 Current Scale x 1 Reference Voltage: 480 North Stonington HS MS June 11, 2018

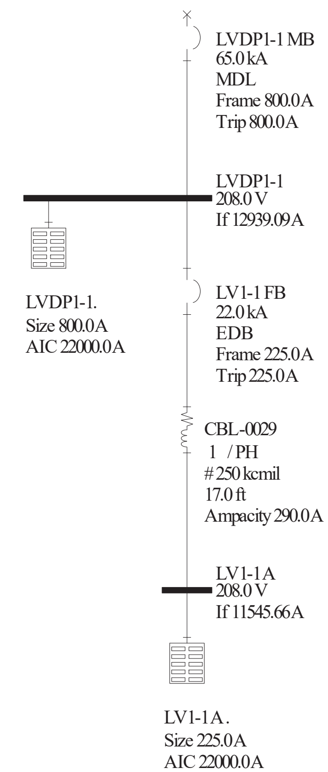




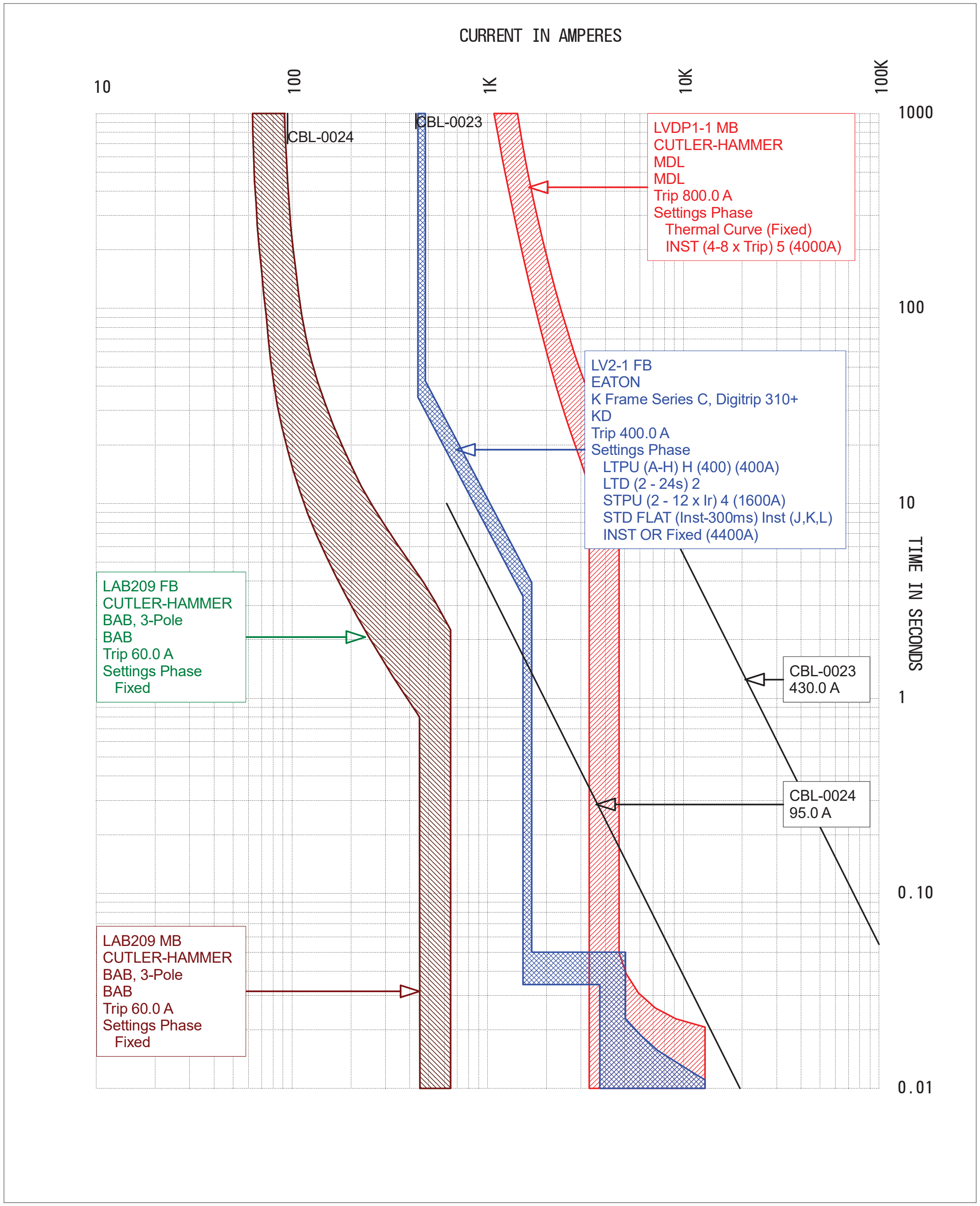
TCC: TCC1-2-1 | Current Scale x 1 | Reference Voltage: 208 | North Stonington HS MS | June 11, 2018

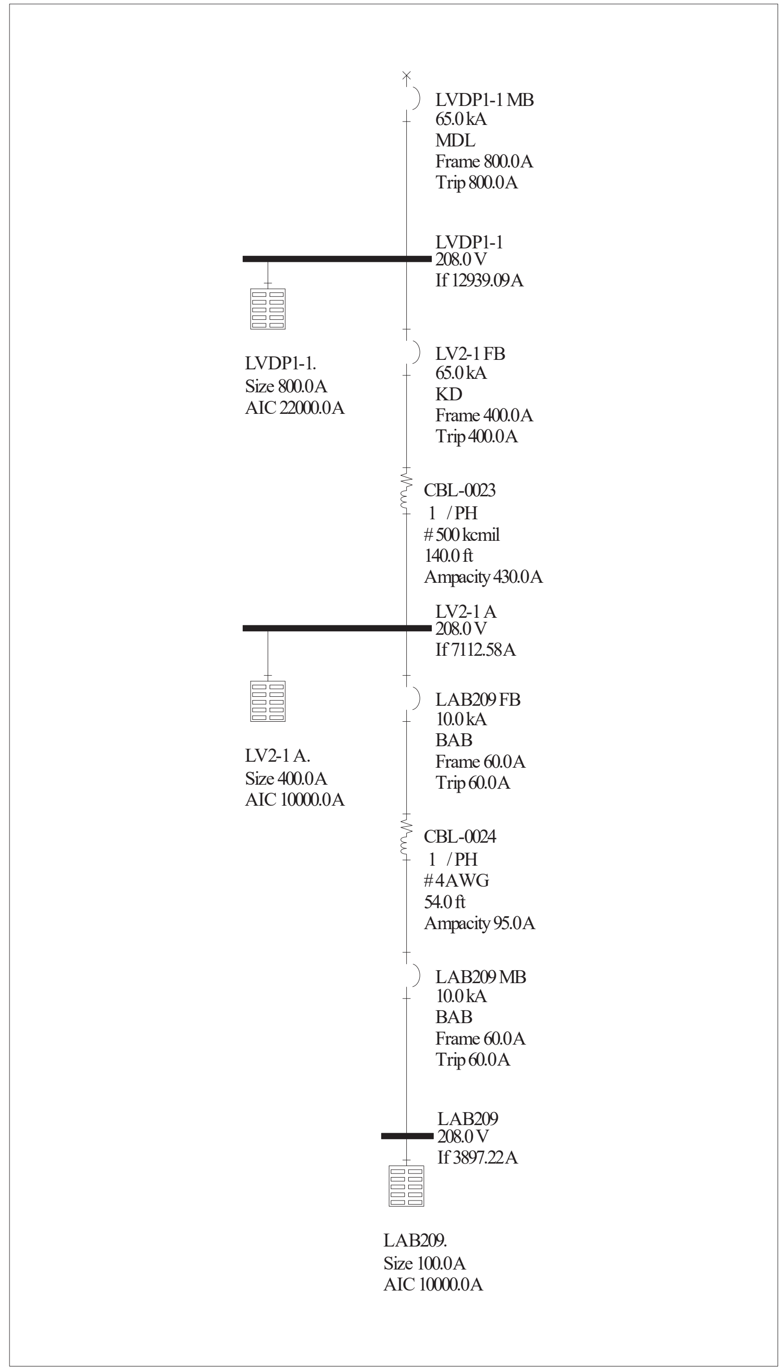


CURRENT IN AMPERES
10
100
1K
10K
100K
1000
100
10
1
0.10
0.01
TIME IN SECONDS
CBL-0029
LVDP1-1 MB
CUTLER-HAMMER
MDL
MDL
Trip 800.0 A
Settings Phase
Thermal Curve (Fixed)
INST (4-8 x Trip) 5 (4000A)
LV1-1 FB
CUTLER-HAMMER
EDB, 2-3 Poles
EDB
Trip 225.0 A
Settings Phase
Fixed
CBL-0029
290.0 A

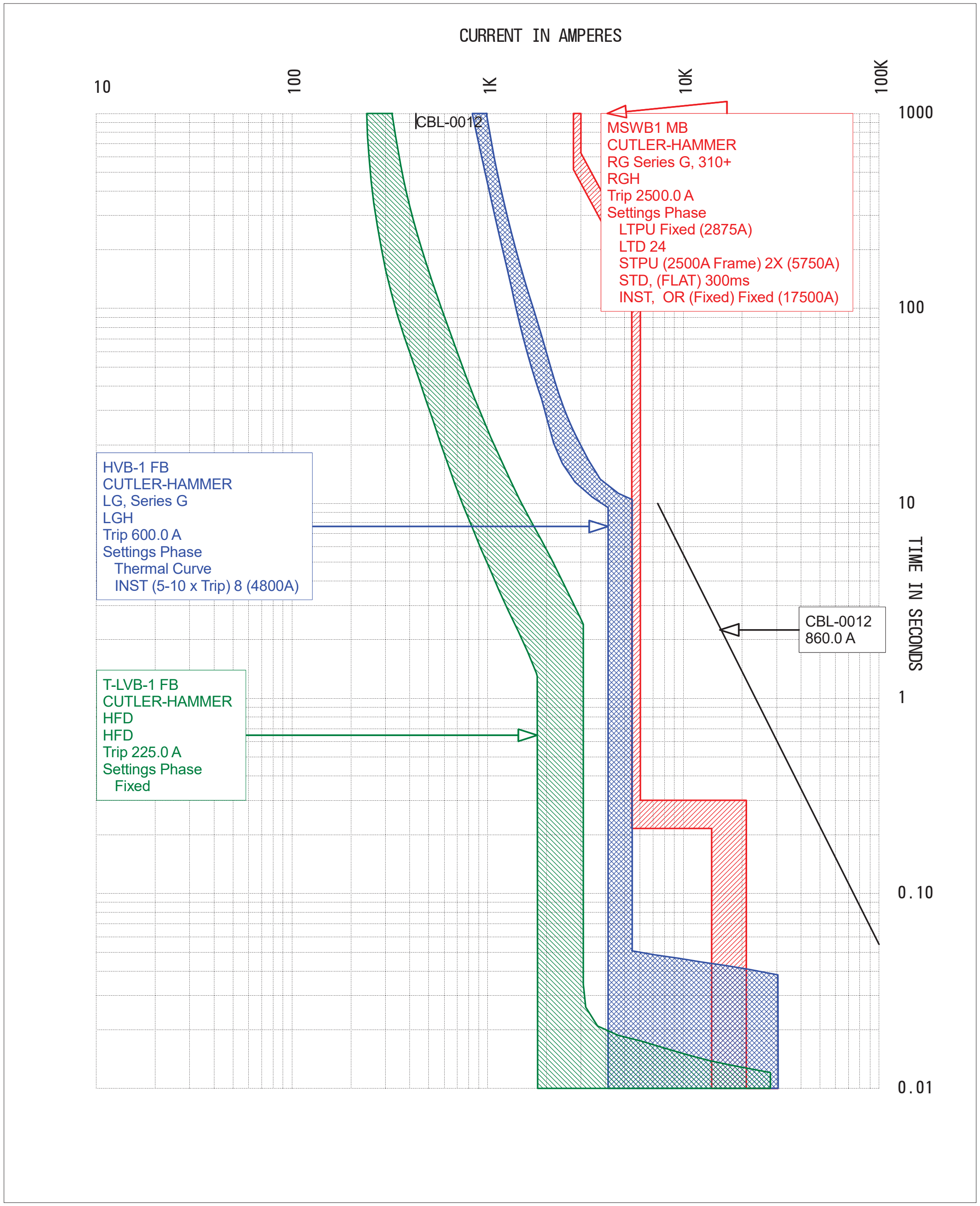


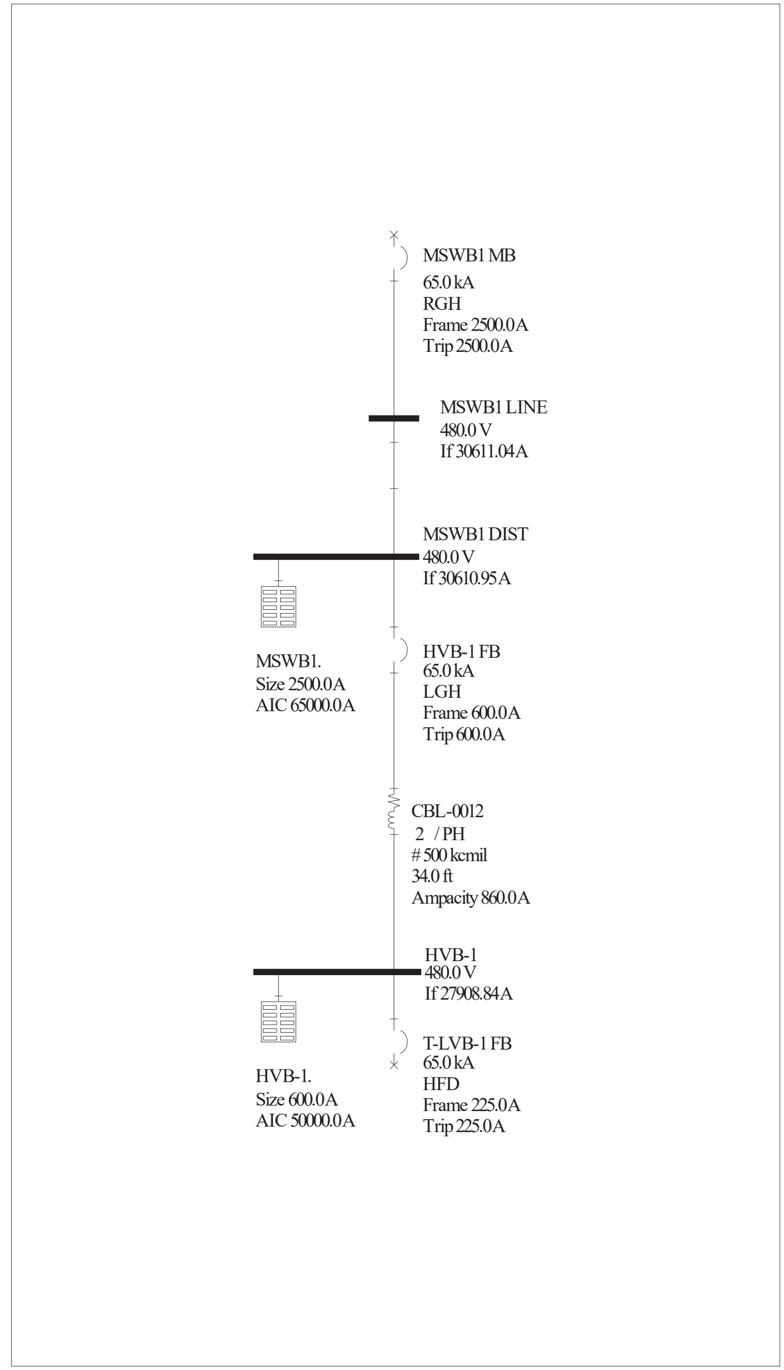
LVDP1-1 MB
65.0 kA
MDL
Frame 800.0 A
Trip 800.0 A
LVDP1-1
208.0 V
If 12939.09 A
LVDP1-1.
Size 800.0 A
AIC 22000.0 A
LV1-1 FB
22.0 kA
EDB
Frame 225.0 A
Trip 225.0 A
CBL-0029
1 / PH
250 kcmil
17.0 ft
Ampacity 290.0 A
LV1-1A
208.0 V
If 11545.66 A
LV1-1A.
Size 225.0 A
AIC 22000.0 A



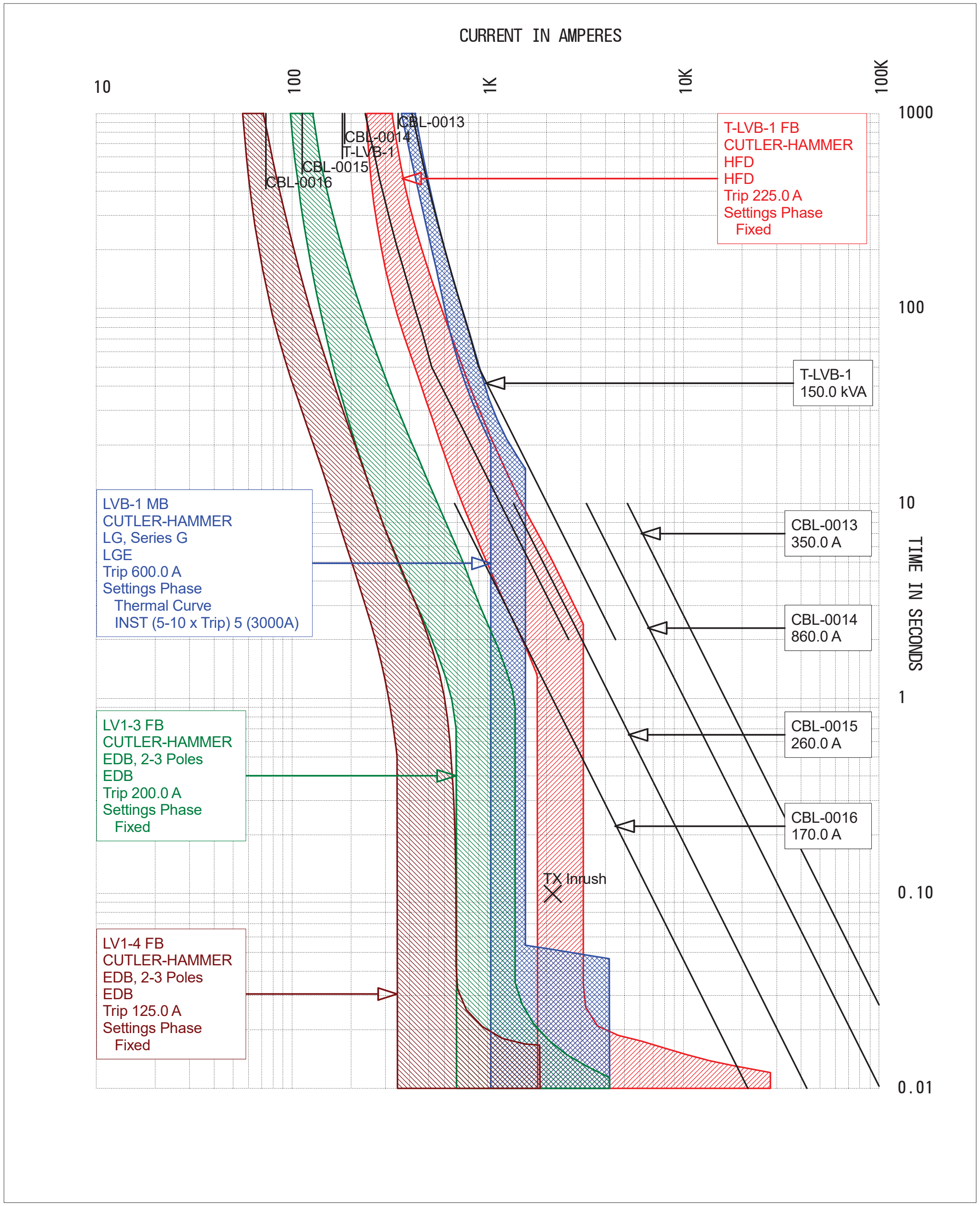


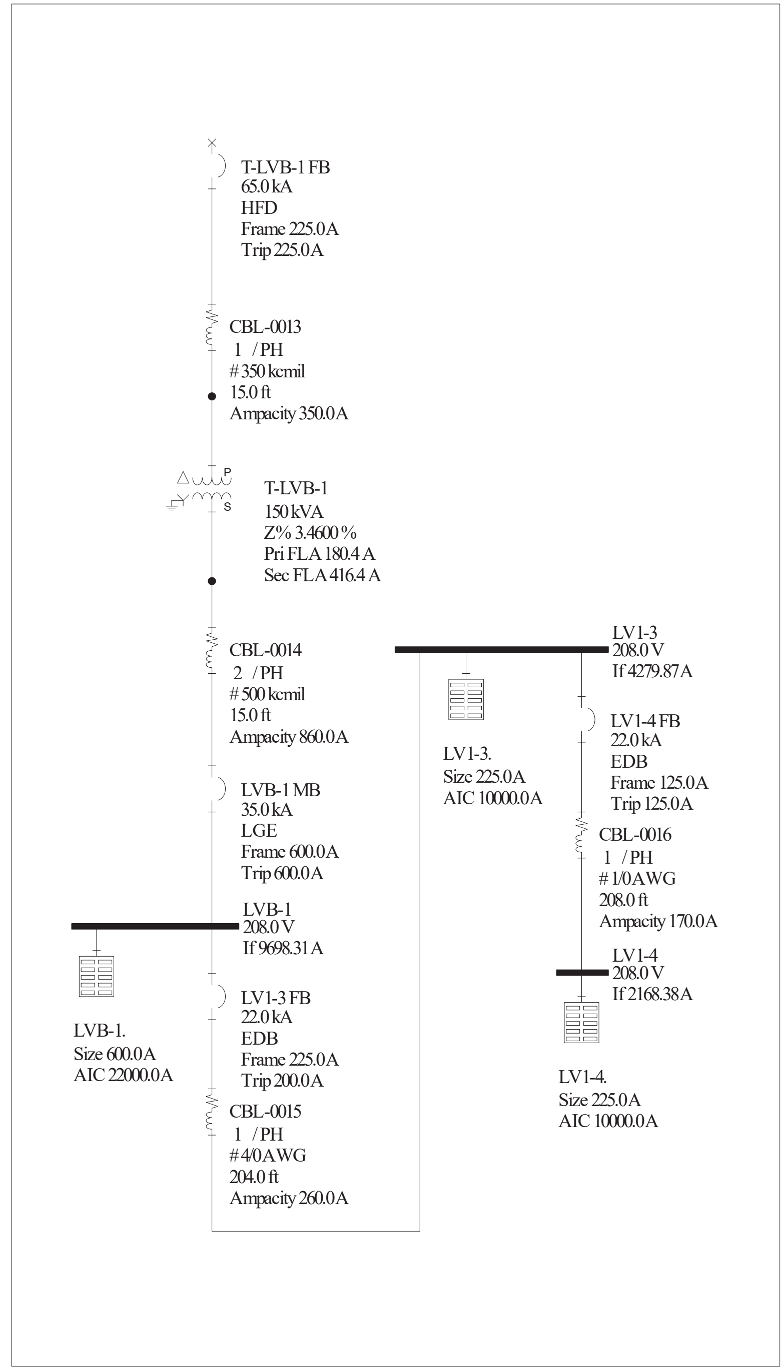
TCC: TCC1-2-3 | Current Scale x 1 | Reference Voltage: 208 | North Stonington HS MS | June 11, 2018



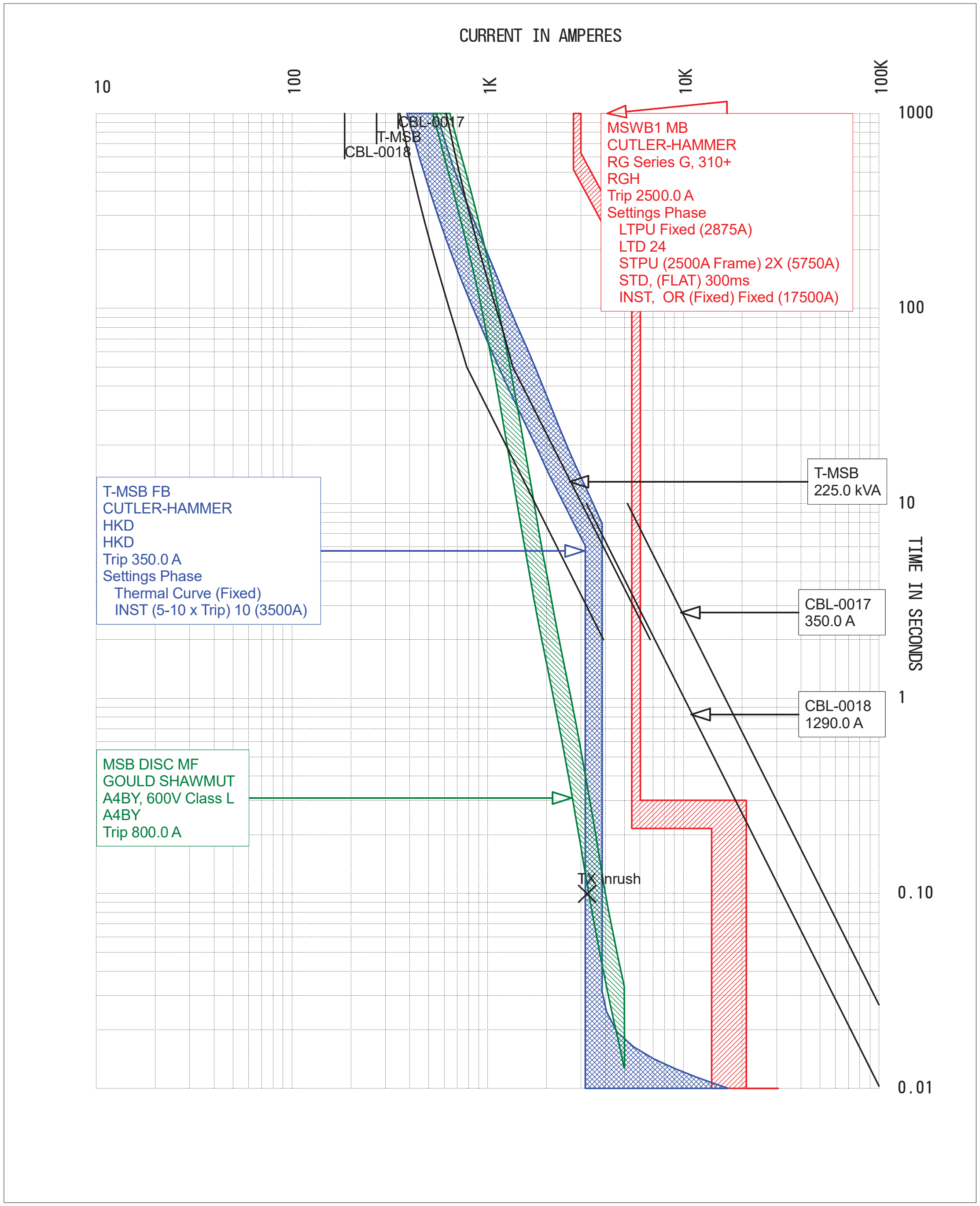


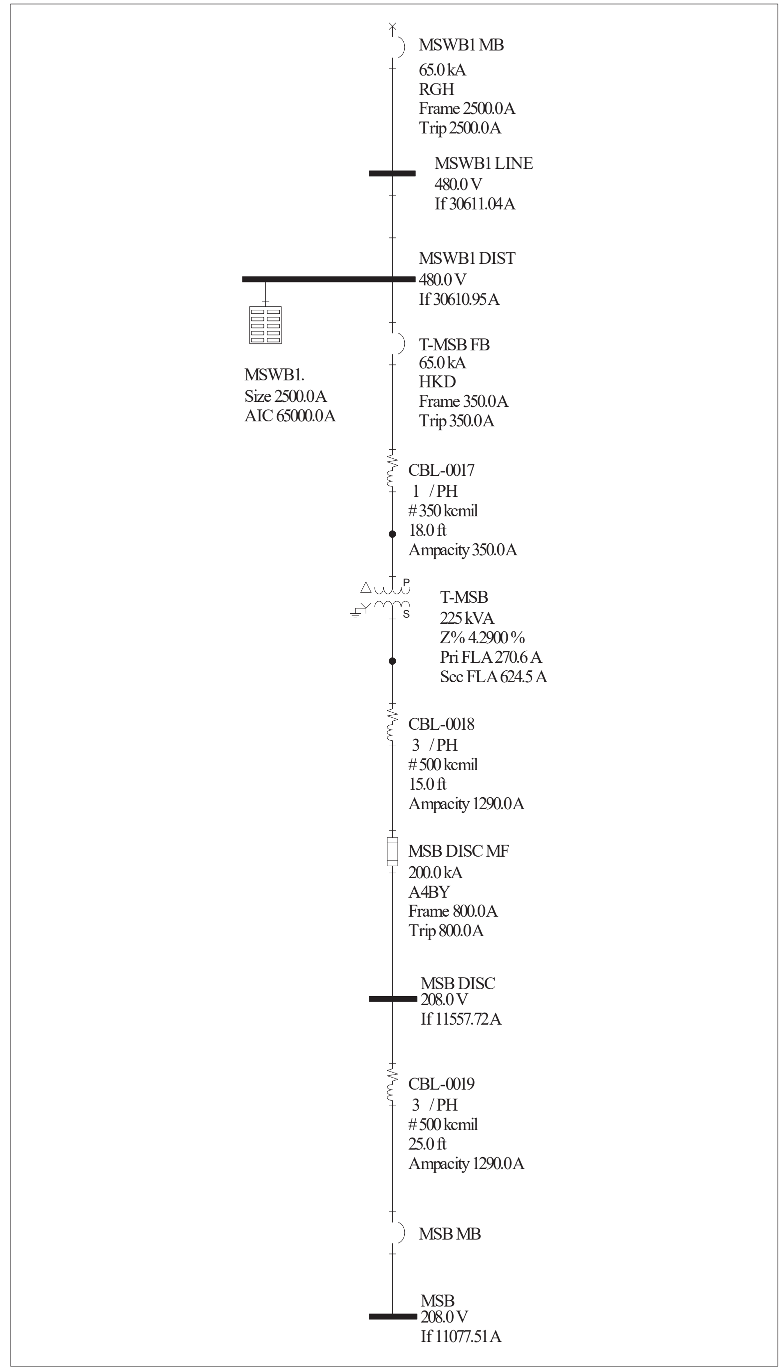
TCC: TCC2 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018



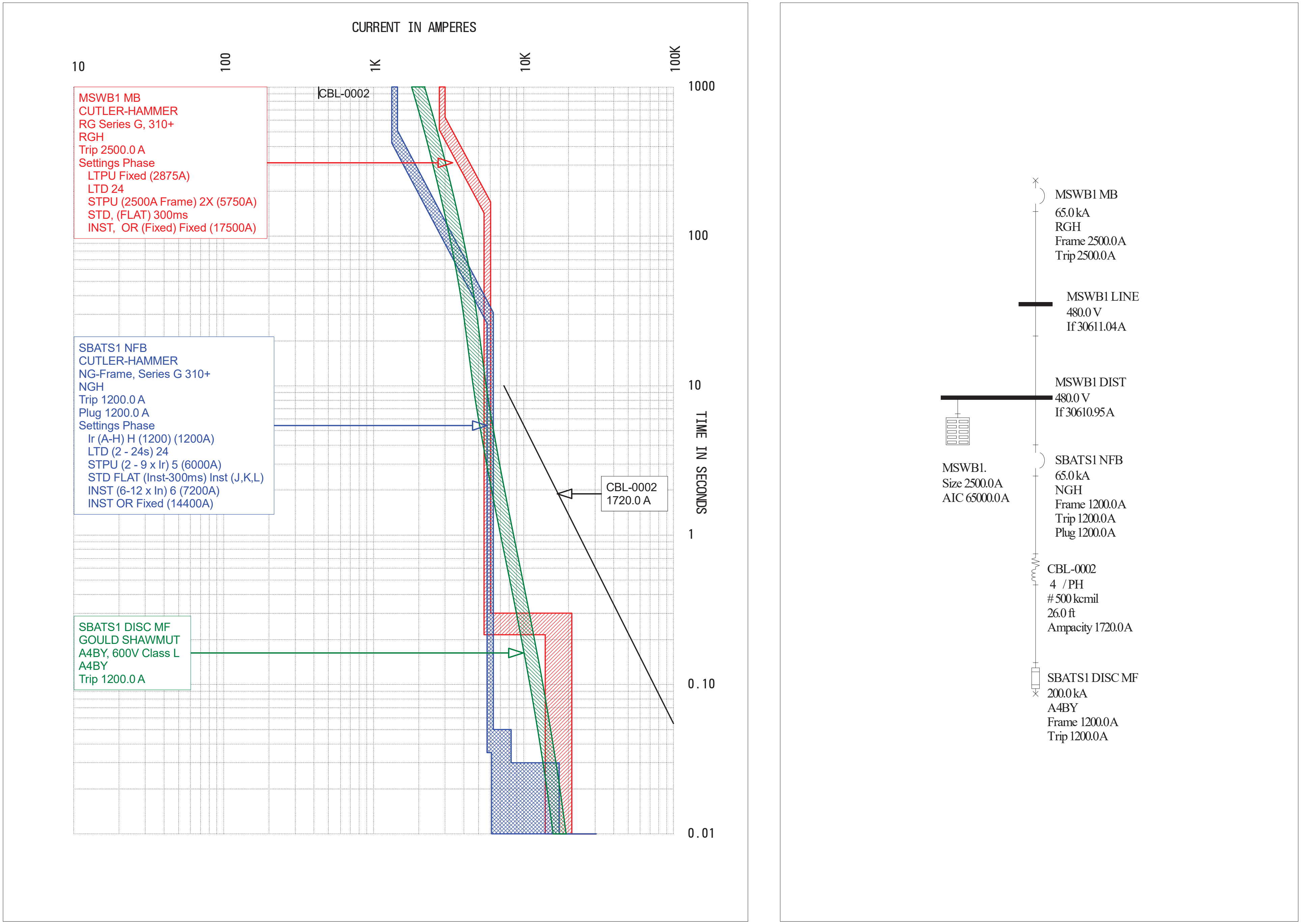


TCC: TCC2-1 Current Scale x 1 Reference Voltage: 480 North Stonington HS MS June 11, 2018

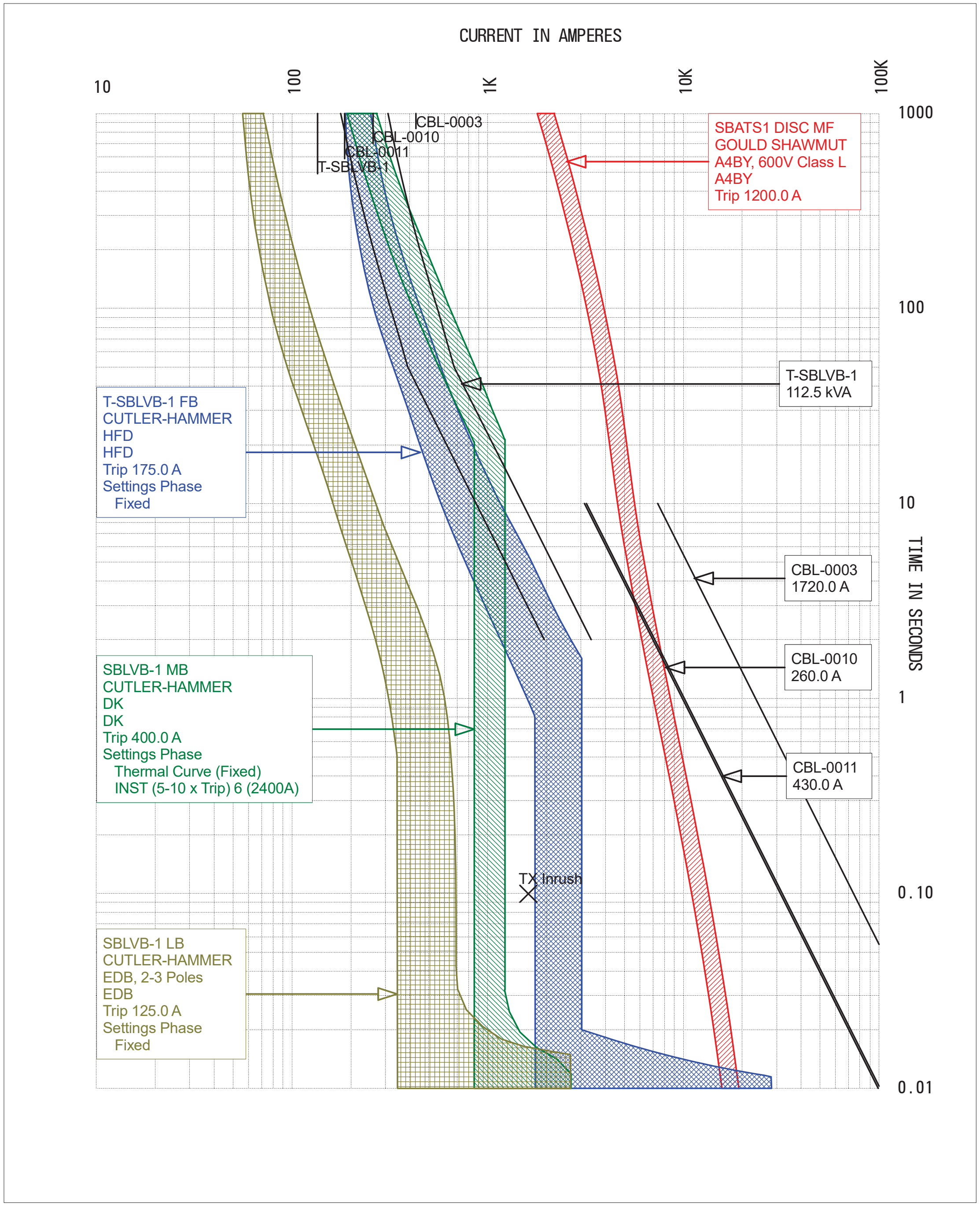


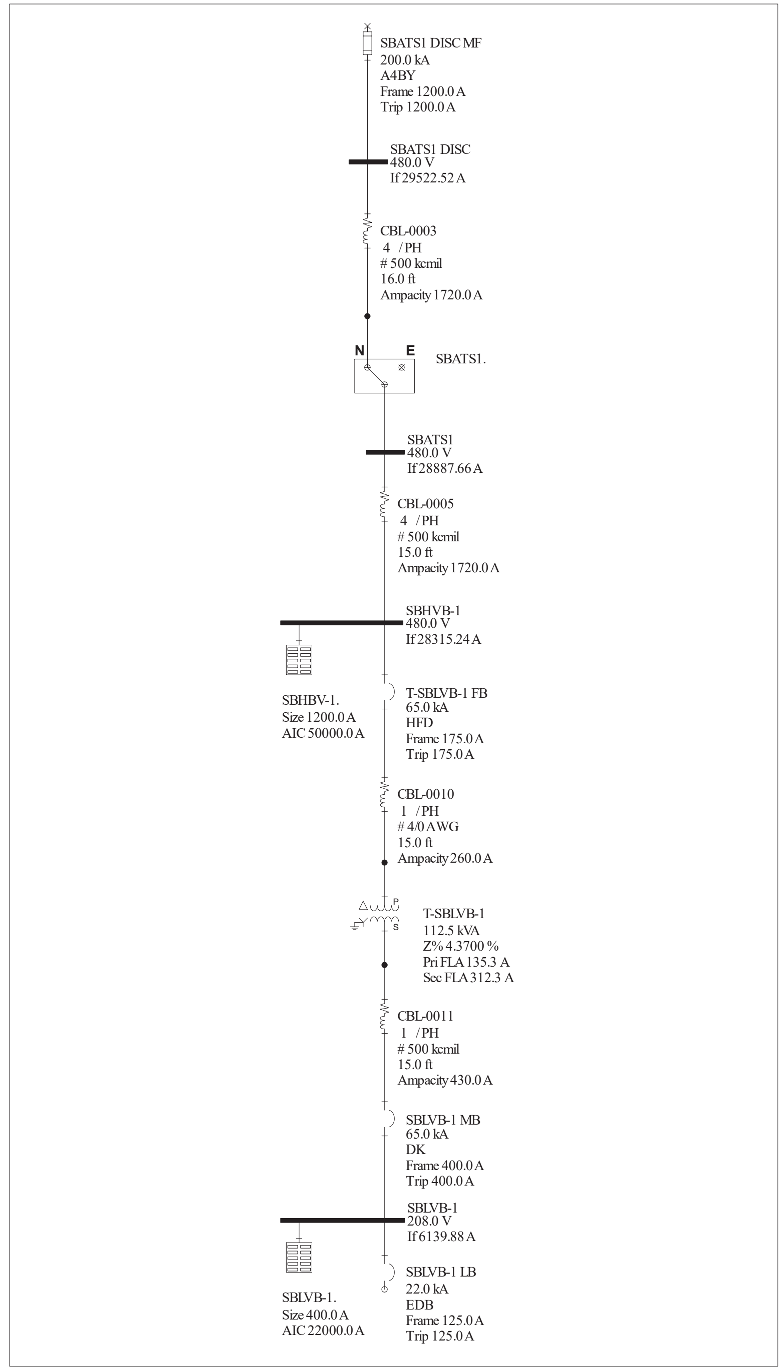


TCC: TCC3 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018

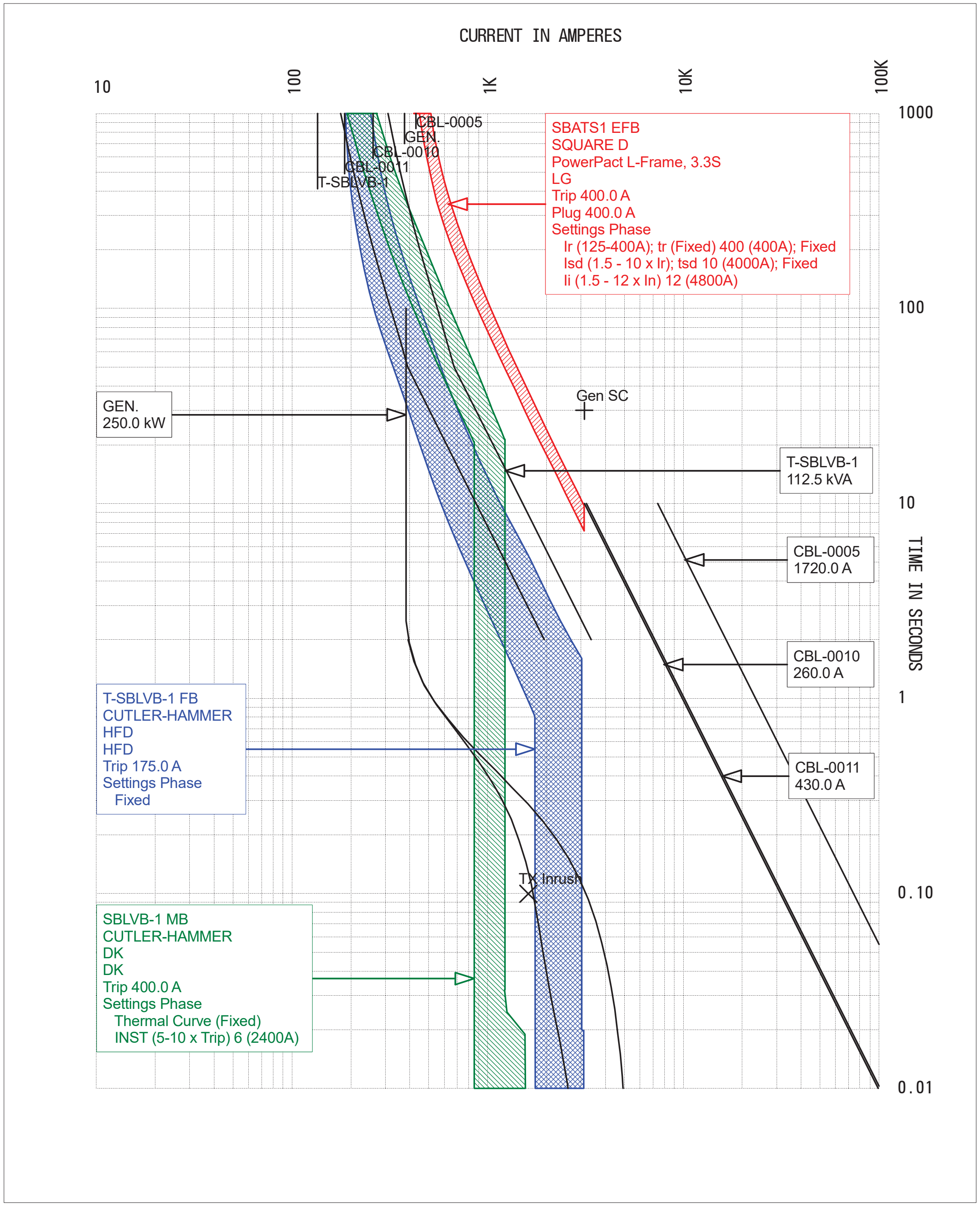


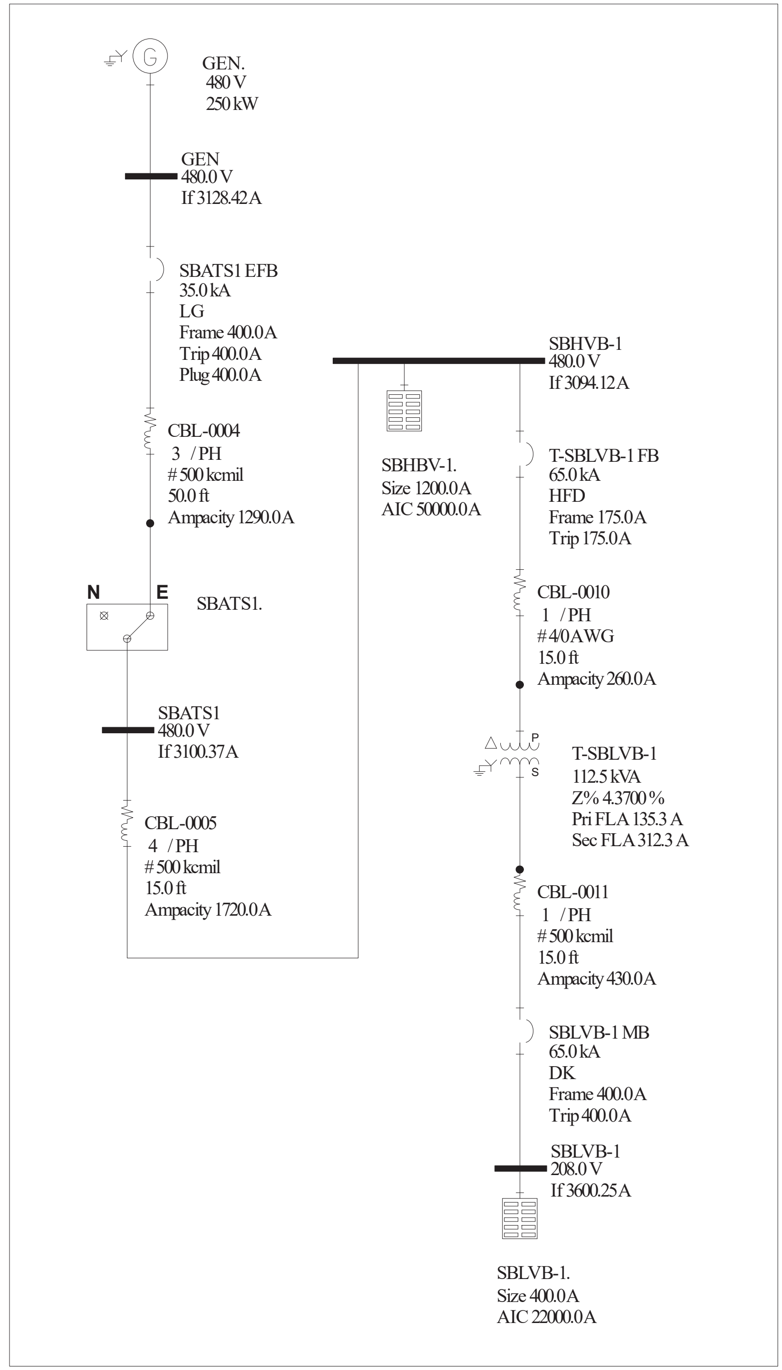
TCC: TCC4 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018



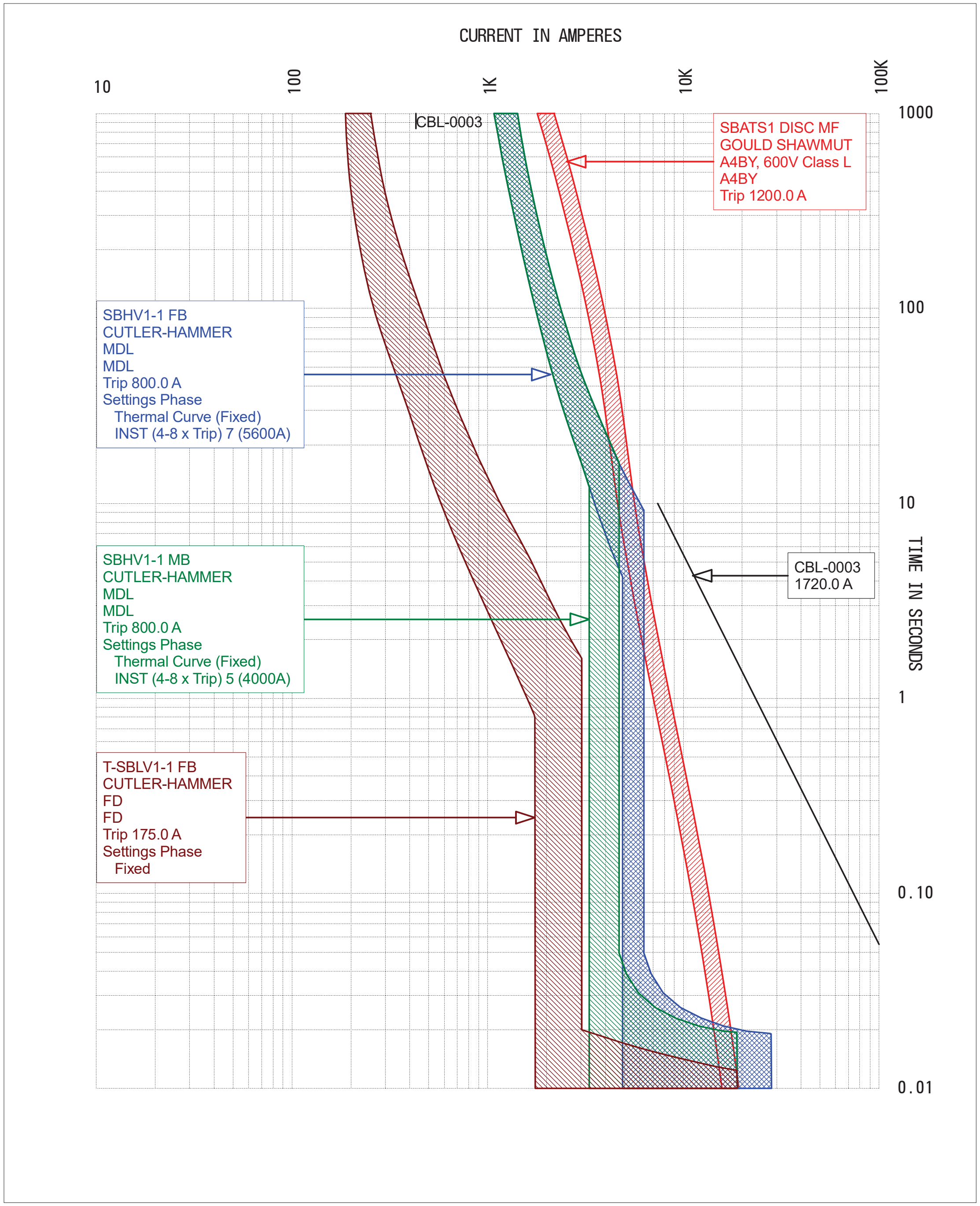


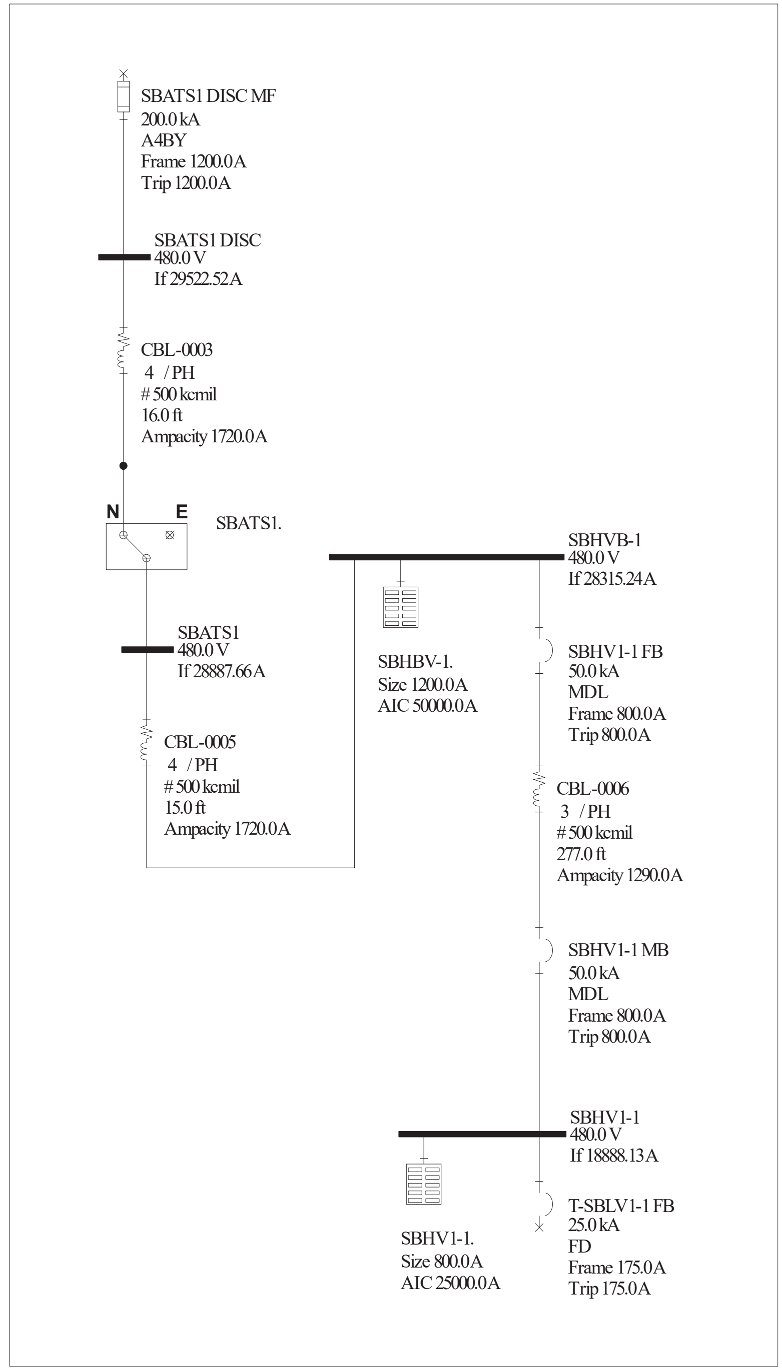
TCC: TCC4-1 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018



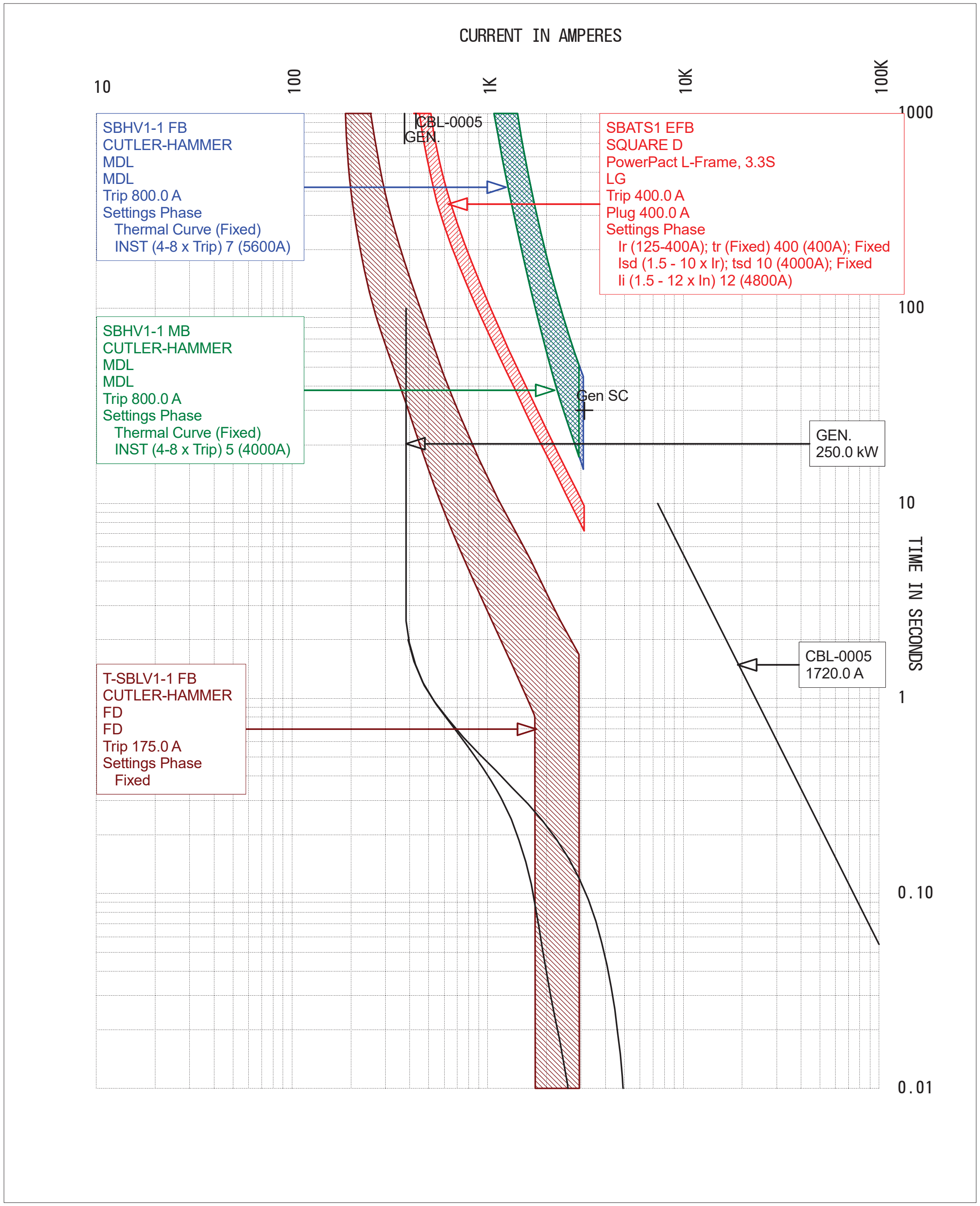


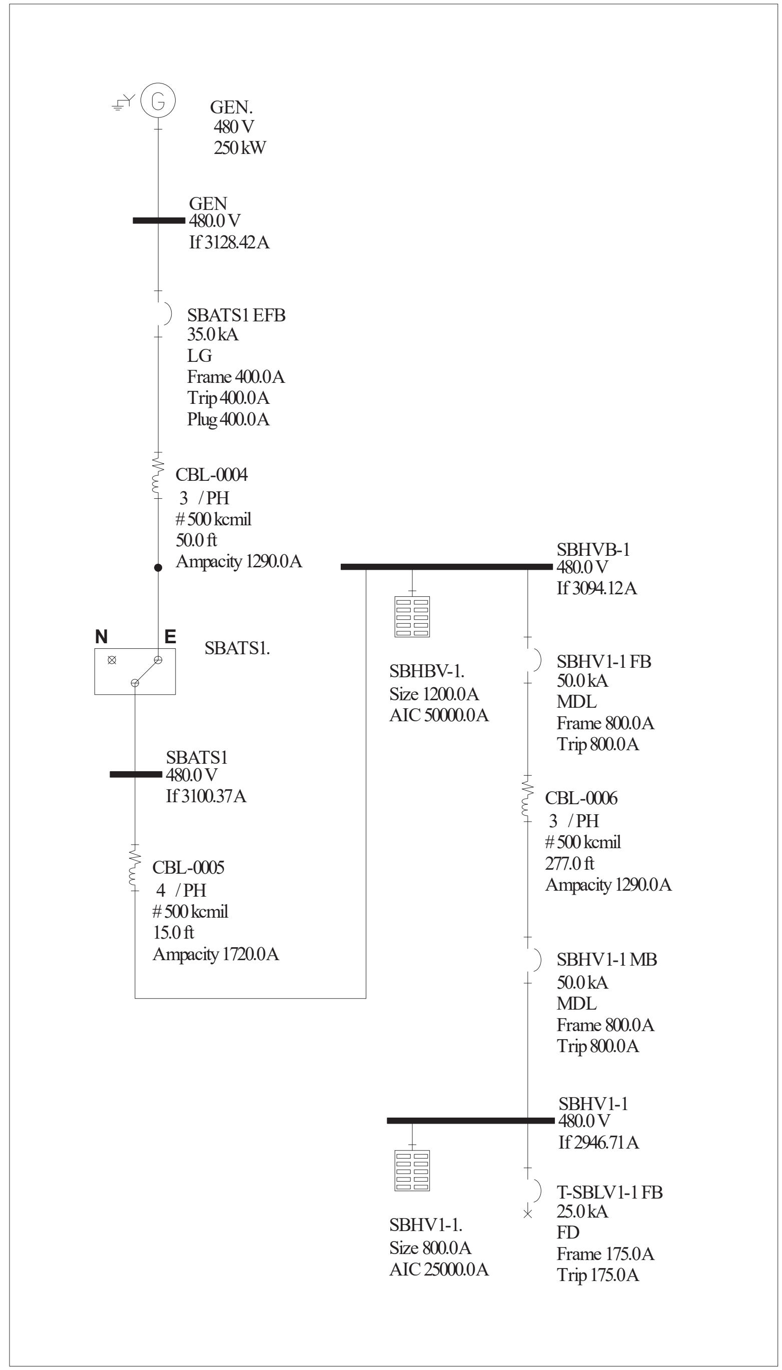
TCC: TCC4-1 SB | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018



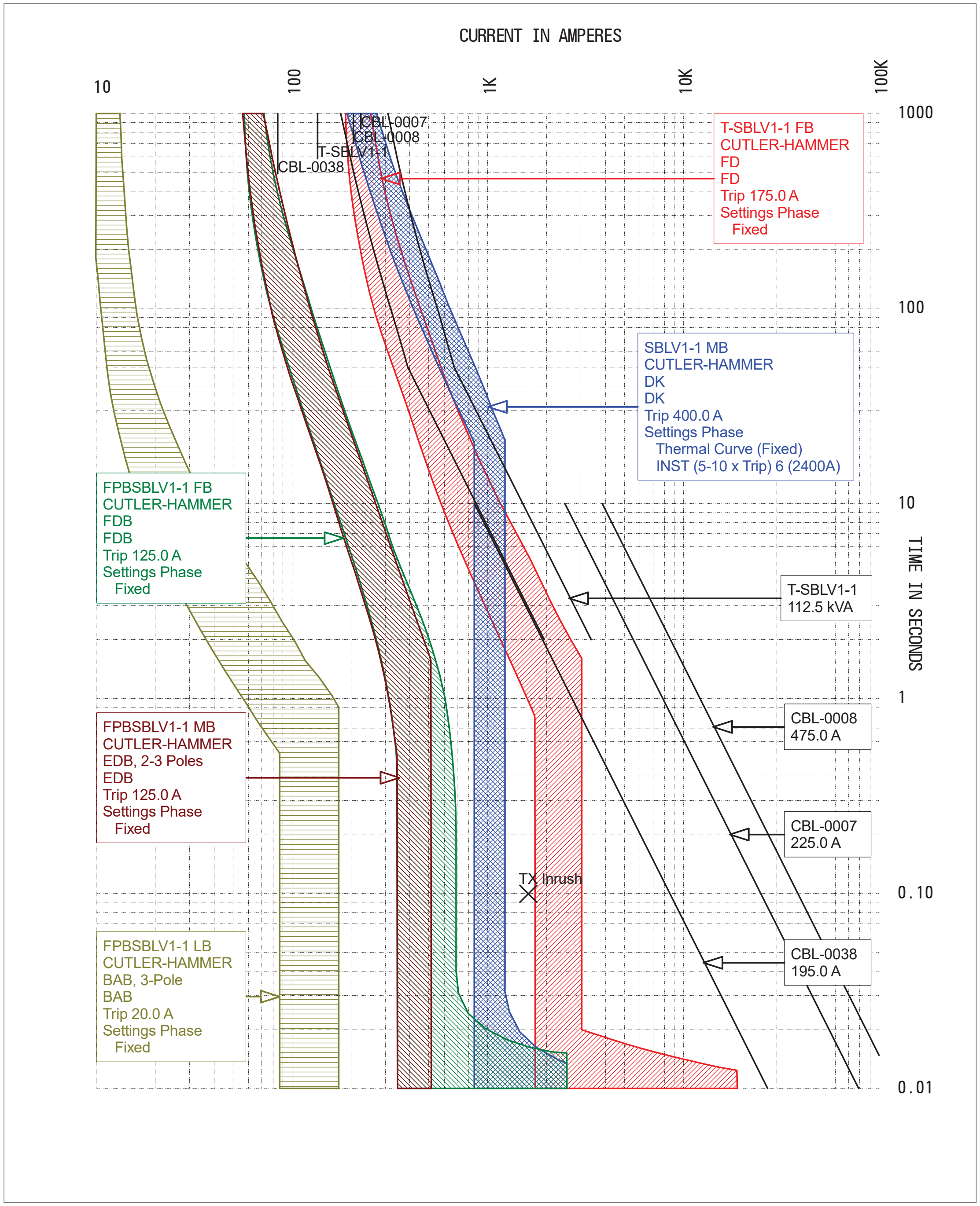


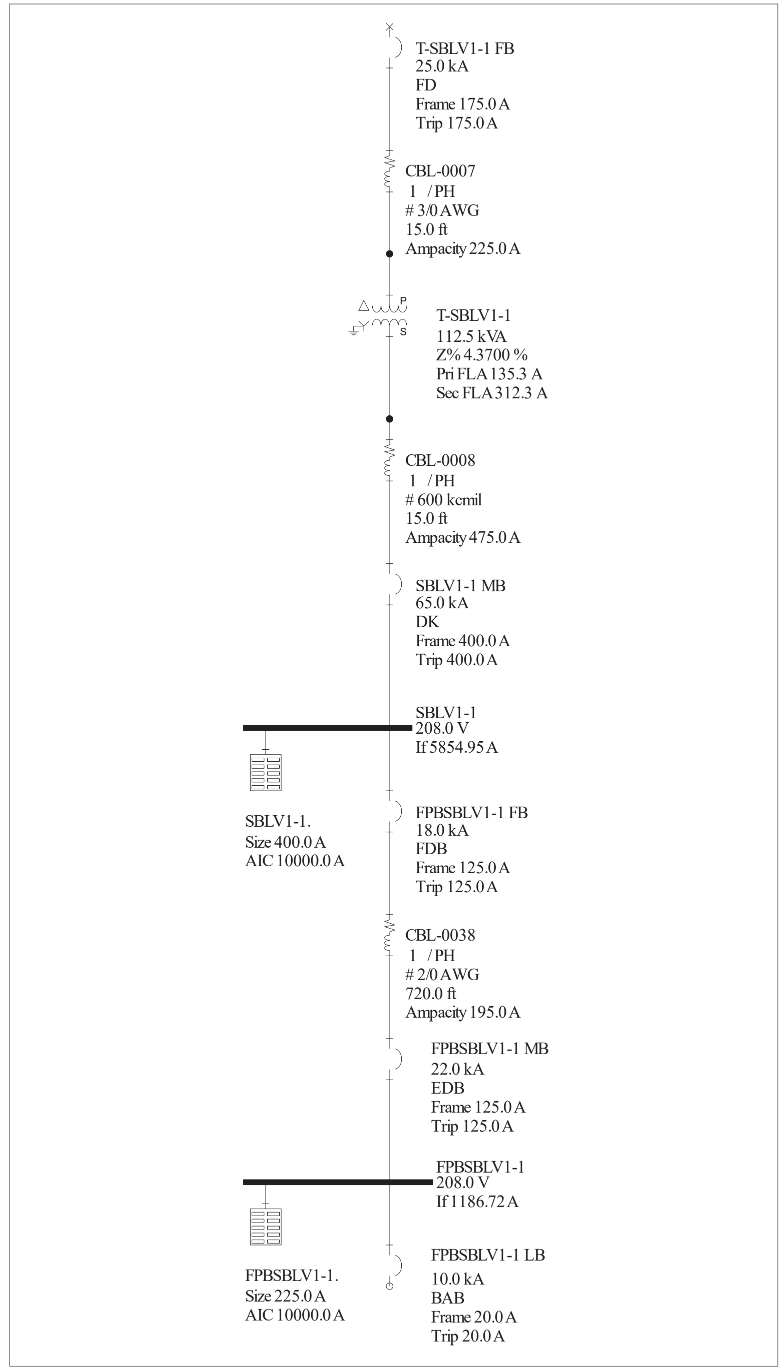
TCC: TCC4-2 Current Scale x 1 Reference Voltage: 480 North Stonington HS MS May 10, 2018



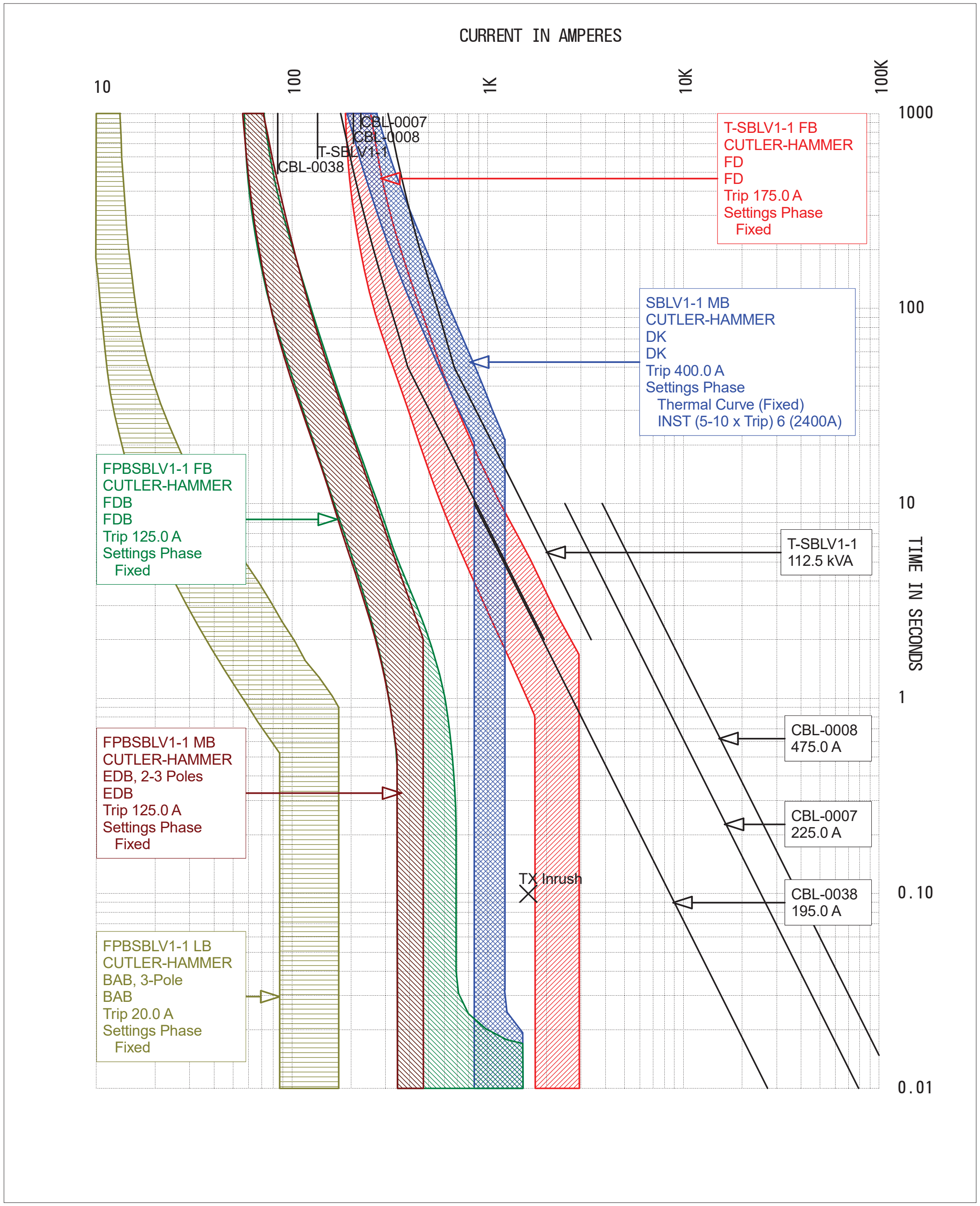


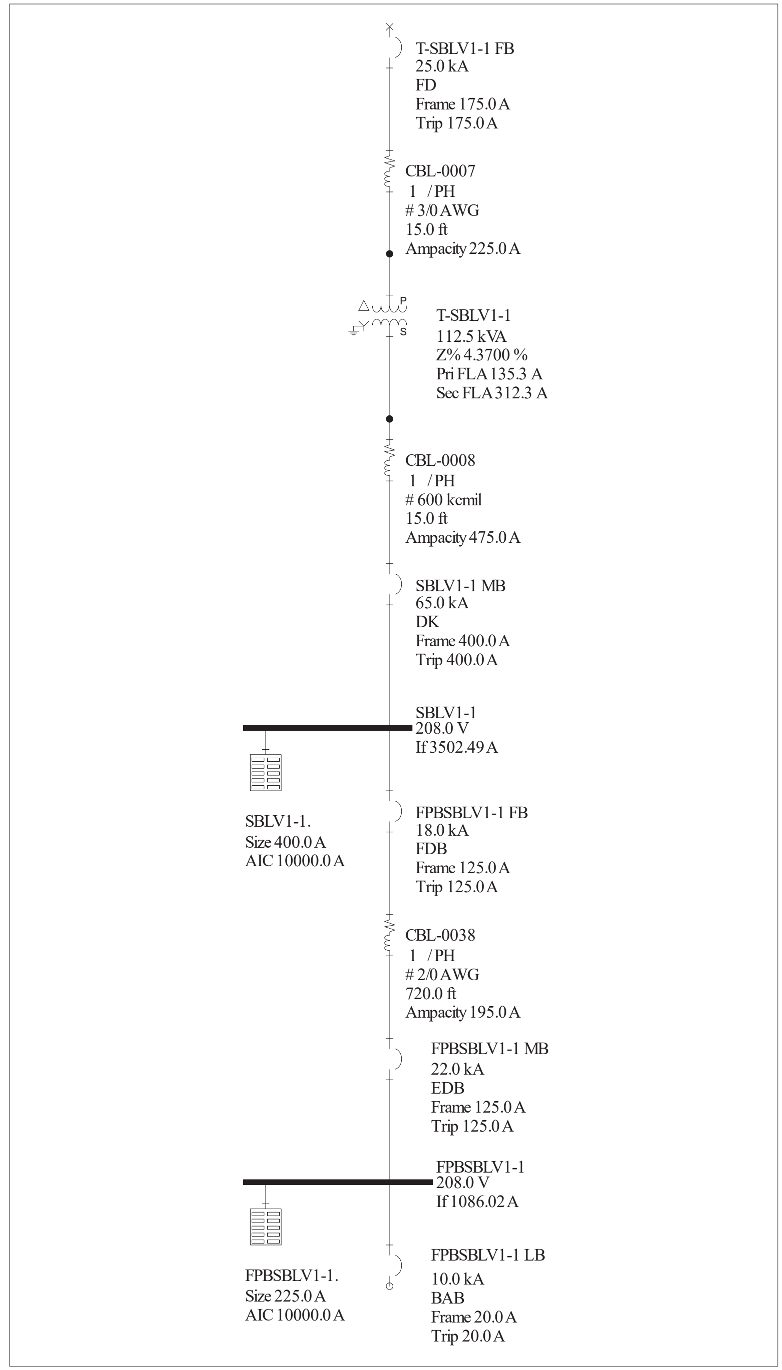
TCC: TCC4-2 SB | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018





TCC: TCC4-2-1 | Current Scale x 1 | Reference Voltage: 480 | North Stonington HS MS | May 10, 2018





TCC: TCC4-2-1 SB Current Scale x 1 Reference Voltage: 480 North Stonington HS MS May 10, 2018

OCPD SETTINGS

High Voltage Fuses

Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Description	Cartridge	Cartridge Size	Trip
T-UTIL-HS FF	Phase	UTIL-HS	13,800	S&C	Positrol, 14.4kV	6K-200K K-Speed	Positrol, 65K	65	65

Low Voltage Fuses

Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Description	Cartridge	Cartridge Size	Trip
MSB DISC MF	Phase	MSB DISC	208	GOULD SHAWMUT	A4BY, 600V Class L	200-6000A	A4BY	800	800
SBATS1 DISC MF	Phase	SBATS1 DISC	480	GOULD SHAWMUT	A4BY, 600V Class L	200-6000A	A4BY	1,200	1,200

Project: North Stonington HS MS

ADJUSTABLE LOW VOLTAGE CIRCUIT BREAKER SETTINGS

DESIGNATION						TRIP UNIT										
										SETTINGS						
Location/Name	Function	Frame Amps	AIC kA	MFR	TYPE MODEL	Amps Sensor	Plug	Description	TYPE/MODEL	L.T. P.U.	L.D. TIME	S.D. P.U.	S.D. TIME (I2T)	INST P.U.	GFPU	GFD
HVDP1-1, HV2-1 FB	Phase Ground	630	35	CUTLER-HAMMER	LGE	630	0	LSI, 250-630A	LG Frame, 310+	G (600A)	2	4 (2400A)	Inst (J,K,L)	6 (3780A)		
MSWB1 DIST, HVDP1-1 FB	Phase Ground	1,200	65	CUTLER-HAMMER	NGH	1,200	1,200	LSI, 1200AF	NG-Frame, Series G 310+	H (1200) (1200A)	12	4 (4800A)	120ms (M,N,O)	12 (14400A)		
HVDP1-1, HVDP1-1 MB	Phase Ground	1,200	50	CUTLER-HAMMER	NGS	1,200	1,200	LSI, 1200AF	NG-Frame, Series G 310+	H (1200) (1200A)	7	3 (3600A)	Inst (J,K,L)	8 (9600A)		
LVDP1-1, LV2-1 FB	Phase Ground	400	65	EATON	KD	400	0	LSI, 400AS	K Frame Series C, Digitrip 310+	H (400) (400A)	2	4 (1600A)	Inst (J,K,L)	Fixed (4400A)		
MSWB1 LINE, MSWB1 MB	Phase Ground	2,500	65	CUTLER-HAMMER	RGH	2,500	0	LSI, 800-2500A	RG Series G, 310+	Fixed (2875A)	24	2X (5750A)	300ms	Fixed (17500A)	1.0X (1000A)	300ms
MSWB1 LINE, MSWB1 MB	ARMS Ground	2,500	65	CUTLER-HAMMER	RGH	2,500	0	LSI, 800-2500A	RG Series G, 310+	Fixed (2875A)	24	2X (5750A)	300ms	Fixed (17500A)	1.0X (1000A)	300ms
GEN, SBATS1 EFB	Phase Ground	400	35	SQUARE D	LG	400	400	LSI, 400AS	PowerPact L-Frame, 3.3S	400	Fixed	10	Fixed	12 (4800A)		
MSWB1 DIST, SBATS1 NFB	Phase Ground	1,200	65	CUTLER-HAMMER	NGH	1,200	1,200	LSI, 1200AF	NG-Frame, Series G 310+	H (1200) (1200A)	24	5 (6000A)	Inst (J,K,L)	6 (7200A)		
HVDP1-1, T-LVDP1-1 FB	Phase Ground	400	35	EATON	KD	400	0	LSI, 400AS	K Frame Series C, Digitrip 310+	G (350) (350A)	24	12 (4200A)	Inst (J,K,L)	Fixed (4400A)		

Project: North Stonington HS MS

LOW VOLTAGE THERMAL MAGNETIC MOLDED CASE BREAKERS SETTINGS

DESIGNATION		FRAME		TRIP UNIT				
Location/Name	Amps Frame	MFR	TYPE MODEL	Amps Sensor/Plug	Description	TYPE/MODEL	LT SETTING	INST SETTING
SBLV1-1 FPBSBLV1-1 FB	125	CUTLER-HAMMER	FDB	125 0	15-150A	FDB	Fixed	
FPBSBLV1-1 FPBSBLV1-1 LB	20	CUTLER-HAMMER	BAB	20 0	15-100A	BAB, 3-Pole	Fixed	
FPBSBLV1-1 FPBSBLV1-1 MB	125	CUTLER-HAMMER	EDB	125 0	100-225A, UL	EDB, 2-3 Poles	Fixed	
MSWB1 DIST HVB-1 FB	600	CUTLER-HAMMER	LGH	600 0	250-600A, Adj. T, UL	LG, Series G	Thermal Curve	INST (5-10 x Trip) 8.00
LAB 211 LAB 211 MB	60	CUTLER-HAMMER	BAB	60 0	15-100A	BAB, 3-Pole	Fixed	
LV1-2 A LAB144 FB	70	CUTLER-HAMMER	BAB	70 0	15-100A	BAB, 3-Pole	Fixed	
LAB144 LAB144 MB	60	CUTLER-HAMMER	BAB	60 0	15-100A	BAB, 3-Pole	Fixed	
LV2-1 A LAB209 FB	60	CUTLER-HAMMER	BAB	60 0	15-100A	BAB, 3-Pole	Fixed	
LAB209 LAB209 MB	60	CUTLER-HAMMER	BAB	60 0	15-100A	BAB, 3-Pole	Fixed	
LV2-1 A LAB211 FB	60	CUTLER-HAMMER	BAB	60 0	15-100A	BAB, 3-Pole	Fixed	
LVDP1-1 LV1-1 FB	225	CUTLER-HAMMER	EDB	225 0	100-225A, UL	EDB, 2-3 Poles	Fixed	
LVDP1-1 LV1-2 FB	300	CUTLER-HAMMER	DK	300 0	250-400A	DK	Thermal Curve (Fixed)	INST (5-10 x Trip) 6.00
LVB-1 LV1-3 FB	225	CUTLER-HAMMER	EDB	200 0	100-225A, UL	EDB, 2-3 Poles	Fixed	
LV1-3 LV1-4 FB	125	CUTLER-HAMMER	EDB	125 0	100-225A, UL	EDB, 2-3 Poles	Fixed	

DESIGNATION		FRAME		TRIP UNIT				
Location/Name	Amps Frame	MFR	TYPE MODEL	Amps Sensor/Plug	Description	TYPE/MODEL	LT SETTING	INST SETTING
LVB-1 LVB-1 MB	600	CUTLER-HA MMER	LGE	600 0	250-600A, Adj. T, UL	LG, Series G	Thermal Curve	INST (5-10 x Trip) 5
LVDP1-1 LVDP1-1 MB	800	CUTLER-HA MMER	MDL	800 0	300-800A	MDL	Thermal Curve (Fixed)	INST (4-8 x Trip) 5.00
SBHVB-1 SBHV1-1 FB	800	CUTLER-HA MMER	MDL	800 0	300-800A	MDL	Thermal Curve (Fixed)	INST (4-8 x Trip) 7.00
SBHV1-1 SBHV1-1 MB	800	CUTLER-HA MMER	MDL	800 0	300-800A	MDL	Thermal Curve (Fixed)	INST (4-8 x Trip) 5.00
SBLV1-1 SBLV1-1 MB	400	CUTLER-HA MMER	DK	400 0	250-400A	DK	Thermal Curve (Fixed)	INST (5-10 x Trip) 6.00
SBLVB-1 SBLVB-1 LB	125	CUTLER-HA MMER	EDB	125 0	100-225A, UL	EDB, 2-3 Poles	Fixed	
SBLVB-1 SBLVB-1 MB	400	CUTLER-HA MMER	DK	400 0	250-400A	DK	Thermal Curve (Fixed)	INST (5-10 x Trip) 6.00
HVB-1 T-LVB-1 FB	225	CUTLER-HA MMER	HFD	225 0	15-225A	HFD	Fixed	
MSWB1 DIST T-MSB FB	350	CUTLER-HA MMER	HKD	350 0	100-400A	HKD	Thermal Curve (Fixed)	INST (5-10 x Trip) 10
SBHV1-1 T-SBLV1-1 FB	175	CUTLER-HA MMER	FD	175 0	15-225A	FD	Fixed	
SBHVB-1 T-SBLVB-1 FB	175	CUTLER-HA MMER	HFD	175 0	15-225A	HFD	Fixed	