Engineering Connection Assessment

P2348 Wheatcrest Solar Project Connection

BER Wheatcrest Solar LP

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NOTE:

The conclusions and recommendations in this report are based on the results presented in *Attachment A: Engineering Connection Assessment: Study Results*, which was prepared by a third party consultant in accordance with the AESO Connection Process.

The AESO has reviewed the *Engineering Connection Assessment: Study Results*, and finds it acceptable for the purpose of assessing the potential impacts of the proposed connection on the performance of the Alberta interconnected electric system.

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Attachments

Attachment A: Engineering Connection Assessment Results

1 Introduction

This AESO Engineering Connection Assessment describes the engineering studies that were completed to assess the impact of the Project (as defined below) on the performance of the Alberta interconnected electric system (AIES). This report also provides the AESO's conclusions and recommendations based on the results of the engineering studies.

Attached to this Engineering Connection Assessment are the results of the engineering studies (see Attachment A) and the scope and methodology used to perform the studies (see Attachment A1 to Attachment A). These attachments provide details regarding the technical criteria, assumptions, and methods for performing these engineering studies, and the results of the engineering studies.

1.1 Project Overview

BER Wheatcrest Solar LP (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its approved Wheatcrest Solar Project (Facility) to the AIES. The Facility includes an approved collector substation, designated as the Wheatcrest 1039S substation.

The Market Participant's request includes: a request for a new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 50 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 0.15 MW; and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is March 15, 2023.

2 Assessment Scope

2.1 Objectives

The objectives of the AESO Engineering Connection Assessment are as follows:

- Assess the impact of the Project on the performance of the AIES.
- Evaluate Project connection alternatives and identify the AESO's preferred alternative.
- Recommend mitigation measures, if required, to reliably connect the Project to the AIES.
- Identify Project dependencies, including any TFO projects or AESO plans to expand or enhance the transmission system that must be completed prior to connection.

2.2 Existing System

Geographically, the Project is located in the AESO planning area of Vauxhall (Area 52), which is part of the AESO South planning region. The Vauxhall (Area 52) is surrounded by the planning areas of Medicine Hat (Area 4), Empress (Area 48), Brooks (Area 47), Stavely (Area 49), Lethbridge (Area 54), and Glenwood (Area 55).

From a transmission system perspective, the Vauxhall Area (Area 52) consists primarily of a 138 kV transmission system. The Vauxhall Area (Area 52) is connected to the Medicine Hat Area (Area 4) with one 138 kV transmission line, the Brooks Area (Area 47) with two 138 kV transmission lines, and the Lethbridge Area (Area 54) with one 138 kV transmission line.

Existing constraints in the South planning region are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, Real Time Transmission Constraint Management (TCM Rule).

2.3 Study Area

The Study Area for the Project consists of the AESO Planning areas of Medicine Hat (Area 4), Brooks (Area 47), and Vauxhall (Area 52), including the tie lines connecting these planning areas to the rest of the AIES. All transmission facilities within the Study Area will be studied and monitored for violations of the Reliability Criteria (defined in Section 3.1 of Attachment A1).

3 Connection Alternatives

3.1 Overview

The AESO, in consultation with the TFO in the Study Area and the Market Participant, examined two 138 kV transmission alternatives and a number of 240 kV transmission alternatives to meet the Market Participant's request for system access service, as detailed in Section 3.2.

3.2 Connection Alternatives Examined

Below is a description of the developments associated with the transmission alternatives that were examined for the Project.

Alternative 1 – Radial 138kV connection to Enchant 447S substation

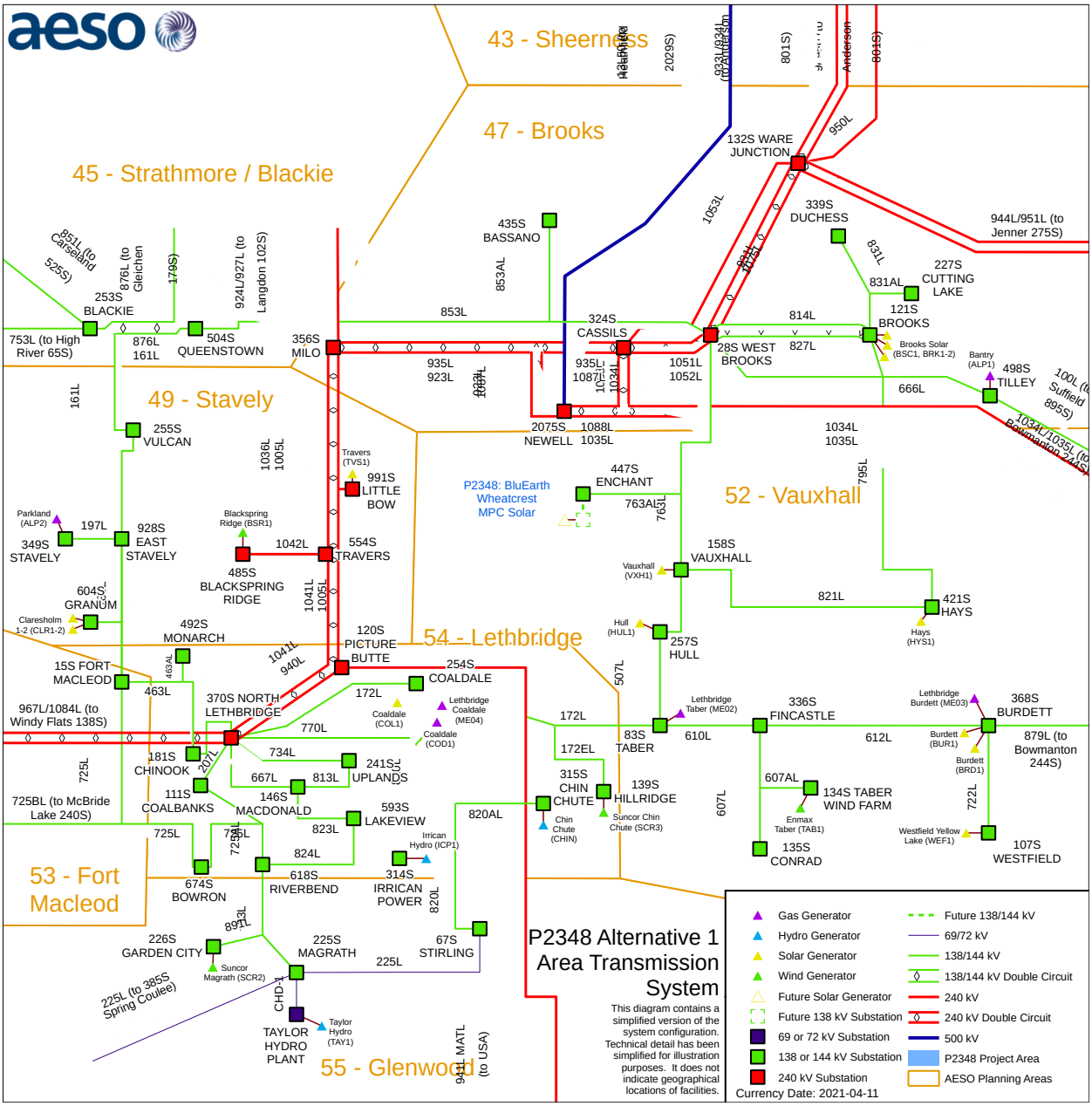
This alternative includes the following developments:

- Modify the existing Enchant 447S substation, including adding one 138 kV circuit breaker;
- Add one 138 kV circuit, approximately 1 km in length,[1] to connect the Facility to the Enchant 447S substation; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-1.

[1] Exact line length to be determined by the Market Participant

Figure 3-1: Connection Alternative 1



Alternative 2 – T-tap connection to 138kV transmission line 763AL

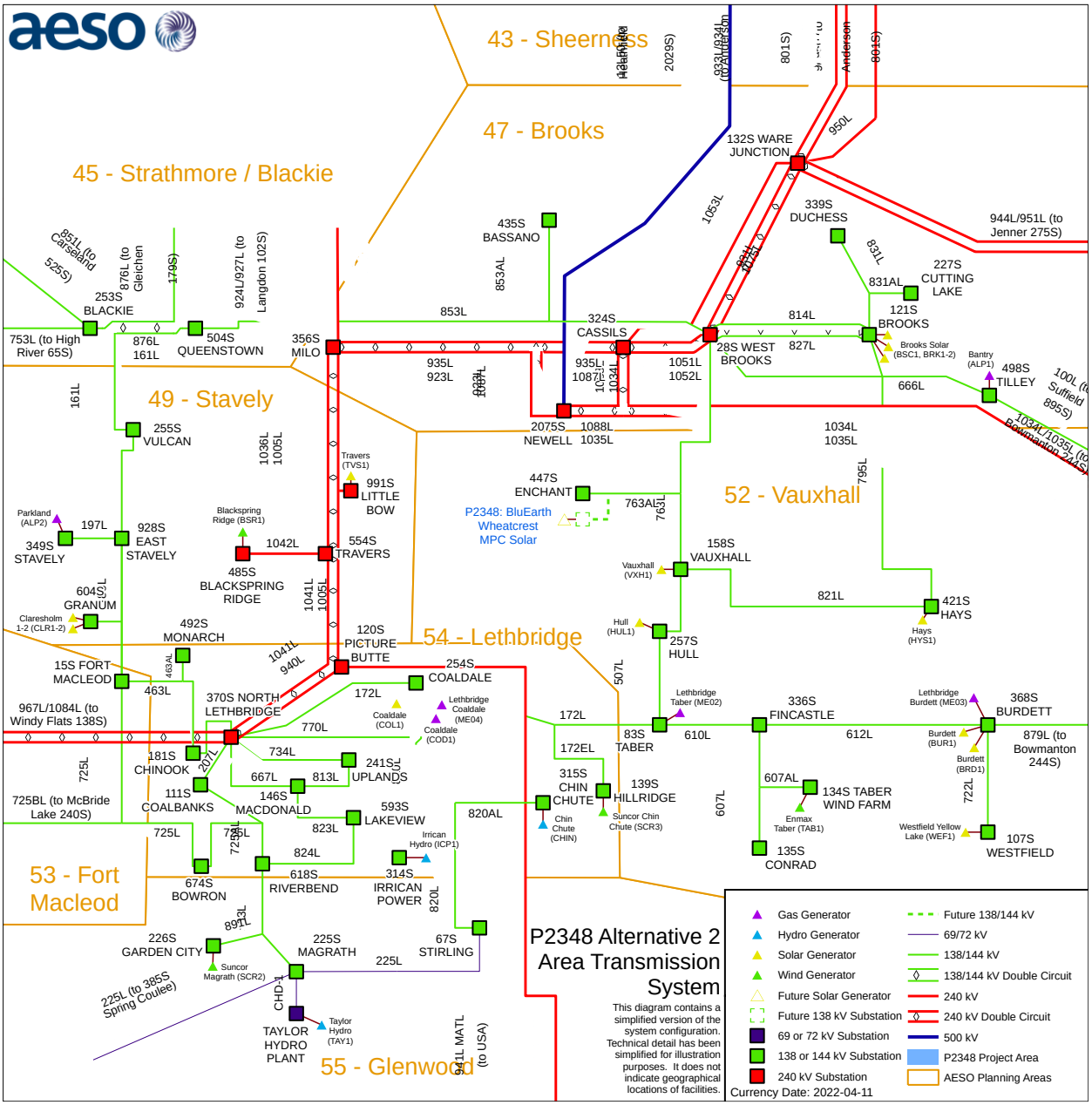
This alternative includes the following developments:

- Add one 138 kV circuit, approximately 1 km in length,[2] to connect the Facility to the existing 138 kV transmission line 763AL using a T-tap configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-2.

[2] Exact line length to be determined by the Market Participant

Figure 3-2: Connection Alternative 2



240 kV Connection Alternatives

Table 3-1 below outlines possible 240 kV alternatives.

Table 3-1 Summary of 240 kV Connection Alternatives

Point of Connection	Connection Configuration	Approx. Length of Transmission Line	Other Major Equipment Additions
Travers 554S	Radial	28	-Modify the Travers 554S substation including adding two 240 kV circuit breakers
Milo 356S	Radial	38	-Modify the Milo 356S substation including adding two 240 kV circuit breakers
Newell 2075S	Radial	38	-Modify the Newell 2075S substation including adding one 240 kV circuit breaker
Approved Little Bow 991S	Radial	25	-Modify the approved Little Bow 991S substation including adding one 240 kV circuit breaker
1005L (Picture Butte - Milo 356S)	T-Tap or In-and-out	25	For In-and-Out configuration only: -Add a new switching substation with three 240 kV circuit breakers
935L (Milo 356S – Newell 2075S)	T-Tap or In-and-out	27	For In-and-Out configuration only: -Add a new switching substation with three 240 kV circuit breakers

3.3 Connection Alternatives Selected for Further Study

Alternative 2 is considered technically feasible and was selected for further study.

3.4 Connection Alternatives Not Selected for Further Study

Alternative 1 is technically equivalent to Alternative 2 in terms of system impact. Alternative 1 and all of the 240 kV alternatives would involve increased transmission development and hence, increased cost, compared to Alternative 2. Therefore, these alternatives were not selected for further study.

4 Assessment Approach

4.1 Standards, Criteria and Assumptions

A detailed description of the standards, criteria, and assumptions that were used for the connection assessment is provided in Attachment A (see Attachment A1).

4.2 Studies Performed

The original scheduled ISD for the project was March 31, 2022, and therefore studies were performed using scenarios for 2022 Summer Light and Summer Peak. A change proposal was submitted and approved to change the ISD to March 15, 2023. It was decided that the change does not materially alter the results and conclusions, and therefore the study scenarios were kept the same.

Short-circuit studies were performed using the 2031 Summer Peak scenario.

Table 4-1 lists the study scenarios. Post-Project scenarios reflect the requested Rate STS contract capacity of 50 MW at the Wheatcrest 1039S substation.

Note: With the exception of Category A Power Flow study results, post-project studies were performed with an STS of 60 MW, the original STS of this project before it was reduced to 50 MW. Since a 60 MW Project dispatch results in a more stressed case, the results are considered more conservative than for a 50 MW dispatch.

A sensitivity study under Category A conditions was performed with P1926 Vauxhall Solar Farm project included to evaluate the impact to the transmission system if both projects are energized.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project					
1	2022 Summer Light (SL)	High renewables	2022 SL Pre-Project	0	0
2	2022 Summer Peak (SP)	High Solar	2022 SP Pre-Project	0	0
Post-Project					
3	2022 SL	High renewables	2022 SL Post-Project	0	50
4	2022 SP	High Solar	2022 SP Post-Project	0	50
5	2031 SP	All generation in the Study Area on	2029 SP Post-Project	0	50
Pre-Project Sensitivity with additional generation in the Study Area					
6	2022 SL	High renewables	2022 SL Pre-Project Sensitivity	0	0
7	2022 SP	High Solar	2022 SP Pre-Project Sensitivity	0	0
Post-Project Sensitivity with additional generation in the Study Area					

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
8	2022 SL	High renewables	2022 SL Post-Project Sensitivity	0	50
9	2022 SP	High Solar	2022 SP Post-Project Sensitivity	0	50

The AESO Planning Region load forecasts used for the connection studies were based on the *AESO's 2021 Long-term Outlook* (2021 LTO).

4.2.1 Power Flow Studies

The purpose of the power flow studies is to identify and quantify any thermal and voltage criteria violations in the Study Area.

In addition, power flow studies are also used to identify point of delivery (POD) low voltage bus voltage deviations beyond the limits listed in Table 3-1 of Attachment A1.[3]

Power flow studies were performed for the 2022 Summer Light and 2022 Summer Peak pre-Project scenarios, and for 2022 Summer Light and 2022 Summer Peak post-Project scenarios.

4.2.2 Transient Stability Studies

The purpose of the transient stability studies is to assess the post-Project stability of the transmission system after three-phase to ground faults are applied on select transmission lines in the Study Area.

Transient stability studies were performed for the 2022 Summer Light and 2022 Summer Peak post-Project scenarios.

4.2.3 Short-Circuit Current Level Studies

The purpose of short-circuit current level studies is to determine the expected system short-circuit current levels in the vicinity of the Project.

Short circuit studies were performed for the 2022 Summer Peak pre-Project scenario and for the 2022 Summer Peak and 2031 Summer Peak post-Project scenarios.

4.3 Mitigation Measure Development and Evaluation

As explained in Section 6 of Attachment A1, mitigation measures were developed to address system performance issues that were identified in the post-Project scenarios. Studies performed to assess the effectiveness of mitigation measures are briefly outlined below.

[3] The AESO's desired post-contingency voltage deviations for low voltage busses represent guidelines rather than criteria. A POD bus voltage deviation that exceeds the desired limits shown in Table 3-1 of Attachment A1 does not represent a Reliability Criteria violation. Mitigation measures would not be developed to specifically address POD bus voltage deviations that exceed the desired values in Table 3-1 of Attachment A1.

4.3.1 Post-Mitigation Studies

Power flow, transient stability, and short-circuit current level studies were performed to assess the impact of the Project on the performance of the AIES following implementation of the AESO's proposed mitigation measures.

4.3.2 Constraint Effective Factor Studies

Constraint effective factor studies were used to determine the generator and load constraint effective factors and to identify the most effective generators or loads to manage thermal criteria violations that were observed under Category B conditions.

5 Interpretation of Results

5.1 Results Overview

This section provides an assessment of the impact of the Project on the performance of the AIES. The Reliability Criteria violations observed during the connection assessment studies, and the proposed mitigation measures are summarized in Table 5-1.

- Section 5.2 includes an overview of the pre-Project studies results.
- Section 5.3 includes an overview of the post-Project studies results.
- Section 5.4 includes a description of the proposed mitigation measures to address observed Reliability Criteria violations.
- Section 5.5 includes an overview of the post-mitigation studies results.

Detailed study results are provided in Attachment A.

Table 5-1: Summary of Reliability Criteria Violations, Project Impact and Mitigation Measures

Scenario	Type of Reliability Criteria Violation		Contingency (System Element Lost)	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
2022 Summer Light	Thermal - above emergency rating	Thermal - above emergency rating	System Normal	610L (Fincastle 336S to Taber 83S)	Marginally reduced violation	Real-time operational practices	Real-time operational practices. Longer term, system project P7075 will increase rating of this line.
	Thermal - above normal rating	Thermal - above emergency rating	System Normal	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally increased violation	Real-time operational practices	Real-time operational practices. Longer term, system project P7075 will increase rating of this line.
	None	Thermal - above emergency rating	System Normal	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	None	763AL rating restored to 120MVA before project energization.
	Thermal - above normal rating	Thermal - above normal rating	158S Vauxhall Transformer T1	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally reduced violation	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 or Real-time operational practices*
	Thermal - above normal rating	Thermal - above normal rating	257S Hull Transformer T1	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally reduced violation	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 and/or Real-time operational practices*
	None	Thermal - above normal rating		763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation		
	None	Thermal - above normal rating	421S Hays Transformer T2	763L (Vauxhall 158S to Hull 257S)	New violation	None	New RAS 195 and planned RAS 180 or Real-time operational practices*
	None	Thermal - above normal rating		879L (Bowmanton 244S – Rattlesnake 719S)	New violation		
	Thermal - above normal rating	Thermal - above normal rating	336S Fincastle Transformer T1	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally increased violation	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 or Real-time operational practices*
	Thermal - above normal rating	Thermal - above normal rating	172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	879L (Bowmanton 244S – Rattlesnake 719S)	Materially increased violation	Planned RAS 180 or Real-time operational practices*	New RAS 195 and planned RAS 180 and/or Real-time operational practices*
	None	Thermal - above normal rating		763L (West Brooks 28S – Enchant 447S tap point)	New violation		
	None	Thermal - above normal rating		763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation		
	Thermal - above emergency rating	Thermal - above emergency rating	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	Marginally reduced violation	Planned RAS 181	New RAS 195 and planned RAS 181 and real-time operational practices
	None	Thermal - above normal rating		763L (West Brooks 28S – Enchant 447S tap point)	New violation		
	None	Thermal - above normal rating		763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation		
	None	Thermal - above emergency rating	121S Brooks Transformer T2	763L (West Brooks 28S – Enchant 447S tap point)	New violation	None	New RAS 195 and planned RAS 180 or Real-time operational practices*
	None	Thermal - above normal rating		879L (Bowmanton 244S – Rattlesnake 719S)	New violation		
	None	Thermal - above emergency rating	795L (Brooks 121S - Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	New violation	None	New RAS 195 and planned RAS 180
	None	Thermal - above normal rating		879L (Bowmanton 244S – Rattlesnake 719S)	New violation		
	Thermal - above normal rating	Thermal - above normal rating	612L (Fincastle 336S – Burdett 368S)	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally reduced violation	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 and/or Real-time operational practices*
	None	Thermal - above normal rating		763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation		
	Thermal - above normal rating	Thermal - above normal rating	610L (Fincastle 336S – Taber 83S)	674L (Chappice Lake 649S – Bowmanton 244S)	Marginally increased violation	Planned RAS 180	Planned RAS 180

Scenario	Type of Reliability Criteria Violation		Contingency (System Element Lost)	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
	None	Thermal - above normal rating		658L (Chappice Lake 649S - Cypress 562S)	New violation		
	Thermal - above emergency rating	Thermal - above emergency rating		879L (Bowmanton 244S – Rattlesnake 719S)	No impact		
	Thermal - above normal rating	Thermal - above normal rating	507L (Taber 83S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally reduced violation	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 or Real-time operational practices*
	None	Thermal - above emergency rating	821L (Vauxhall 158S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	New violation	None	New RAS 195 and planned RAS 180 or Real-time operational practices*
	None	Thermal - above normal rating		879L (Bowmanton 244S – Rattlesnake 719S)	New violation		
	Thermal - above normal rating	Thermal - above normal rating	763L (Vauxhall 158S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally reduced violation	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 and/or Real-time operational practices*
	None	Thermal - above normal rating		763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation		
	Thermal - above emergency rating	Thermal - above emergency rating	MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)	MH-15L (Brier Park MHS-7 – MHS-9A)	Marginally reduced violation	CMH RAS	CMH RAS
	None	Thermal - above normal rating	1005L (Travers 554S - Travers 554S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	895S Suffield Transformer T2	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	100L (Suffield 895S - Tilley 498S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	1034L (Bowmanton 244S - Cassils 324S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	935L (Cassils 324S - Milo 356S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	923L (Milo 356S - Newell 2075S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	1035L (Bowmanton 244S - Newell 2075S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	163SAmoco Empress Transformer T1 or T5	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	28S West Brooks Transformer 28ST1A or 28ST2A	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
	None	Thermal - above normal rating	1036L (Milo 356S – Travers 554S)	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	Real-time operational practices	Real-time operational practices
2022 Summer Peak	Thermal - above normal rating	Thermal - above normal rating	172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	610L (Fincastle 336S – Taber 83S)	Materially reduced violation	Planned RAS 181 or Real-time operational practices*	Planned RAS 181 or Real-time operational practices*
	Thermal - above emergency rating	Thermal - above emergency rating	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	Marginally increased violation	Planned RAS 181	Planned RAS 181
	Thermal - above normal rating	Thermal - above normal rating	879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)	610L (Fincastle 336S – Taber 83S)	Marginally increased violation	Planned RAS 181 or Real-time operational practices*	Planned RAS 181 or Real-time operational practices*
	Thermal - above normal rating	Thermal - above normal rating	610L (Fincastle 336S – Taber 83S)	879L (Rattlesnake 719S – Burdett 368S)	No impact	Planned RAS 180 or Real-time operational practices*	Planned RAS 180 or Real-time operational practices*
	Thermal - above emergency rating	Thermal - above emergency rating		879L (Bowmanton 244S – Rattlesnake 719S)	No impact	Planned RAS 180	Planned RAS 180
	Thermal - above emergency rating	Thermal - above emergency rating	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	No impact	CMH RAS	CMH RAS
	Thermal - above emergency rating	Thermal - above emergency rating	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	No impact	CMH RAS	CMH RAS
	Thermal - above emergency rating	Thermal - above emergency rating	MH138-T63 (Riverview MH69S-6 - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	No impact	CMH RAS	CMH RAS

Scenario	Type of Reliability Criteria Violation		Contingency (System Element Lost)	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
	Thermal - above emergency rating	Thermal - above emergency rating	MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	No impact	CMH RAS	CMH RAS
	Thermal - above emergency rating	Thermal - above emergency rating	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	No impact	CMH RAS	CMH RAS
	Thermal - above emergency rating	Thermal - above emergency rating		MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	No impact	CMH RAS	CMH RAS
	Thermal - above normal rating	Thermal - above normal rating	2075L (Newell 2075S - Newell 2075S)	610L (Fincastle 336S – Taber 83S)	Marginally reduced violation	Planned RAS 181 or Real-time operational practices*	Planned RAS 181 or Real-time operational practices*
	Thermal - above emergency rating	Thermal - above emergency rating	MH-20L (MH69S-3A - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	No impact	CMH RAS	CMH RAS
	Thermal - above normal rating	Thermal - above normal rating	1036L (Milo 356S – Travers 554S)	1005L (Milo 356S – Travers 554S)	Marginally reduced violation	Planned RAS 170	Planned RAS 170
	Voltage – below emergency level	Voltage – below emergency level	MH138-T63 (Riverview MH69S-6 - MH69S-3B)	South Ridge MH69S-3	No impact	CMH RAS	CMH RAS
	Voltage – below emergency level	Voltage – below emergency level		South Ridge MH69S-3A	No impact	CMH RAS	CMH RAS
	Voltage – below emergency level	Voltage – below emergency level		South Ridge MH69S-3B	No impact	CMH RAS	CMH RAS
	Voltage – below emergency level	Voltage – below emergency level	MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	South Ridge MH69S-3	No impact	CMH RAS	CMH RAS
	Voltage – below emergency level	Voltage – below emergency level	MH-20L (MH69S-3A - MH69S-3B)	South Ridge MH69S-3	No impact	CMH RAS	CMH RAS
	Voltage – below emergency level	Voltage – below emergency level		South Ridge MH69S-3A	No impact	CMH RAS	CMH RAS
2022 Summer Light - Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	System Normal	610L (Fincastle 336S - Taber 83S)	Marginally reduced violation	Real-time operational practices	Real-time operational practices. Longer term, system project P7075 will increase rating of this line.
	Thermal - above emergency rating	Thermal - above emergency rating	System Normal	879L (Bowmanton 244S – Rattlesnake 719S)	Marginally increased violation	Real-time operational practices	Real-time operational practices. Longer term, system project P7075 will increase rating of this line.
	None	Thermal - above emergency rating	System Normal	763AL-1 (Enchant 447S tap point - 763CL TAP)	New violation	None	763AL rating restored to 120MVA before project energization.
	None	Thermal - above emergency rating	System Normal	763L (Vauxhall 158S - Hull 257S)	New violation	None	Real-time operational practices

Notes:

- Marginally increased (or marginally decreased) refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) between 0% and 3% (or -3%).
- Materially increased (or materially decreased) refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) above or equal to 3% (or below or equal to -3%).
- RAS 170 was proposed for the approved P2009 Travers project in the *Travers Solar Project Connection* NID. This RAS is referred to herein as “Planned 170”.
- RAS 180 was proposed for the approved P2212 Rattlesnake project in the *Rattlesnake Ridge Wind Project Connection* NID. This RAS is referred to herein as “Planned 180”.
- RAS 181 was proposed for the approved P2212 Rattlesnake project in the *Rattlesnake Ridge Wind Project Connection* NID. This RAS is referred to herein as “Planned 181”.
- *Whether RAS or real-time operational practices will be used in this case will depend on the final design of the RAS.

5.2 Pre-Project Study Results

5.2.1 Category A Conditions

The pre-Project power flow studies identified two thermal criteria violations under Category A conditions (i.e. all elements in service). The short-circuit fault levels were found to be within the typical capabilities of the nearby facilities.

5.2.2 Category B Conditions

The pre-Project power flow studies identified a number of thermal violations under Category B conditions (i.e., loss of a single system element).

5.3 Post-Project Study Results

5.3.1 Category A Conditions

The post-Project power flow studies identified three thermal criteria violations under Category A conditions. Post-Project short-circuit fault levels were not significantly higher than pre-Project levels. The long term short circuit levels were found to be within the designed capabilities of the nearby facilities.

In the sensitivity scenario, an additional thermal criteria violation under Category A conditions was found on 763L.

5.3.2 Category B Conditions

Post-Project power flow studies and voltage stability studies identified a number of system performance issues under Category B conditions, namely: thermal criteria violations.

Results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied.

5.4 Mitigation Measures

This section discusses the AESO's proposed mitigation measures to address the system performance issues that were identified in the pre-Project and post-Project scenarios.

Category A thermal criteria violations were observed on 610L and 879L in both pre- and post-project scenarios. These violations can be mitigated in the near term by applying the TCM Rule to dispatch down effective generation. Longer term, the system project P7075 Vauxhall Area Transmission Development will increase the ratings of 610L and 879L, which will remove these violations.[4]

[4] Refer to the AESO 2022 Long-term Transmission Plan for more details.

A Category A thermal criteria violation was identified on the 138 kV transmission line 763AL in post-Project scenarios. Before this Project can be energized, the rating of this line needs to be increased to 120 MVA or higher.

Should the AESO determine that mitigation is required to address potential thermal criteria violations on 763L under Category A conditions seen in the sensitivity analysis with P1926 included, the AESO may develop operational procedures or other mitigation measures.

5.4.1 Pre-Project

Prior to connection of the Project, some of the observed thermal criteria violations can be managed by using real-time operational practices. The remaining thermal criteria violations can be mitigated by the planned RAS 170, RAS 180, and RAS 181, and the existing CMH RAS.

5.4.2 Post-Project

After connection of the Project, some of the thermal criteria violations observed can be mitigated by using real-time operational practices.

The thermal criteria violation observed on 138kV transmission line 763AL under Category A conditions can be mitigated by increasing the rating on this line to 120 MVA or higher before the Project is energized.

Some of the remaining thermal criteria violations can be mitigated by the planned RAS 170, RAS 180, and RAS 181, and the existing CMH RAS.

After the Project is connected, one new RAS is required to mitigate observed Reliability Criteria violations. The thermal criteria violations observed on 138 kV transmission lines 763L and 879L can be mitigated by a new RAS, referred to as the “new RAS 195 – 763L Overload Mitigation Scheme”, in combination with real time operational practices, if necessary. The new RAS will monitor the loading on 138 kV transmission line 763L and trip the Project if necessary.

5.4.3 Post-Project Mitigation Study Results

Under Category A conditions, the violation on 138 kV transmission line 763AL is mitigated by increasing the rating on this line to 120MVA or higher.

Under Category B conditions, all of the thermal criteria violations observed can be alleviated by new RAS 195, the existing CMH RAS, and planned RAS’s 170, RAS 180 and RAS 181, alone or in combination.

6 Project Dependencies

The Project is dependent on increasing the rating of 138 kV transmission line 763AL to 120 MVA or higher prior to the energization of the Project.

7 Conclusions and Recommendations

Based on the study results, Alternative 2 is technically viable. The connection assessment identified a number of pre-Project and post-Project system performance issues.

The connection assessment uses credible worst-case conditions to assess the impact of the Facility connection on the Alberta interconnected electric system. Category A thermal criteria violations were observed under these credible worst-case load and generation forecast conditions. The probability of Category A thermal criteria violations materializing is highly dependent upon the production profile of the Facility and other generation facilities in the area. Closer to the ISD, if the AESO determines that congestion will arise under Category A conditions, the AESO will make an application to the AUC to obtain approval for an "exception" under Section 15(2) of the *Transmission Regulation.*

Prior to the connection of the Project, the rating of 138kV transmission line 763AL must be increased to 120MVA or higher. The remaining identified system performance issues can be mitigated through the use of new RAS 195, planned RAS 170, RAS 180, and RAS 181, the existing CMH RAS, and real-time operational practices, alone or in combination, as appropriate. With implementation of these mitigation measures and increasing the rating of 763AL, connecting the project with the preferred alternative does not adversely affect the performance of the AIES.

The AESO recommends proceeding with the Project using Alternative 2 as the preferred alternative to respond to the Market Participant's request for system access service. Real-time operational practices and the RASs mentioned above are recommended to mitigate the identified system performance issues.

Alternative 2 involves adding one 138 kV circuit to connect the Facility to the existing 138 kV transmission line 763AL in a T-tap configuration. The conductor used for the 138 kV circuit should have a minimum thermal rating of 56 MVA based on the Rate STS requested by the MP.

Attachment A:
Engineering Connection Assessment Results

Engineering Connection Assessment: Study Results

P2348 Wheatcrest MPC Solar Project

BER Wheatcrest Solar LPBluEarth

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1 Introduction

This report presents the results of the engineering studies that were completed by Power Grid Specialists Corp. (the Studies Consultant) to assess the impact of the Project (as defined in Attachment A1: Engineering Connection Assessment: Study Scope) on the performance of the Alberta Interconnected Electric System (AIES). The studies were performed in accordance with Attachment A1: Engineering Connection Assessment: Study Scope, which was prepared by the AESO.

The power system network analysis tool that was used for the studies in this connection assessment was PSS/E version 33.

2 Pre-Project Study Results

This section describes the results of the pre-Project power flow studies.

2.1 Power Flow Studies

Power flow diagrams illustrating the pre-Project power flow studies results for Category A and Category B conditions are provided in Attachment A2.

2.1.1 *Scenario 1 2022 Summer Light High Renewables Pre-Project*

Category A condition

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category A conditions as shown in Table 2-1.

Table 2-1: Thermal Criteria Violations under Category A Conditions for Scenario 1

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings[a] (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Observed Power Flow (MVA)	% Loading[b]
CATEGORY A	610L (Fincastle 336S – Taber 83S)	85	94	116.57	137.14
CATEGORY A	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	93.23	109.69

Figure A2-SL-Pre-1 in Attachment A2 shows the N-0 violations before any generators were curtailed. Following that, all figures in Figure A2-SL-Pre in Attachment A2 shows the power flow results after curtailing generators.

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

Category B conditions

To address the Category A violations observed in Scenario 1, the AESO provided guidance on generator re-dispatch. Following these directions, total generation at Burdett was scaled down from 16.2 MW to 11.8 MW, Westfield from 13.3 MW to 9.3 MW, Conrad from 32.2 MW to 22.2 MW, Taber from 81 MW to 59.9 MW and Rattlesnake from 114 MW to 84.3 MW.

As a result, the 610L and 879L Category A violations were resolved in both the Summer Light pre and post-Project scenarios.

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-2.

Table 2-2: Thermal Criteria Violations under Category B Conditions for Scenario 1

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings[a] (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Observed Power Flow (MVA)	% Loading[b]
158S VAUXHALL TRANSFORMER T1 (Hull 257S - Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	89.54	105.34
257S HULL TRANSFORMER T1 (Taber 83S - Hull 257S – Vauxhall 158S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	87.55	103
336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	92.25	108.53
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	85.46	100.54
674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	85	94	115.71	130.01
EATL (Heathfield 2029S-Newell 207S)	610L (Fincastle 336S – Taber 83S)	85	94	85.48	100.56
612L (Fincastle 336S – Burdett 368S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	92.33	108.62
610L (Fincastle 336S – Taber 83S)	674L (Chappice Lake 649S – Bowmanton 244S)	121	149	125.93	104.08
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	156.8	184.47
507L (Taber 83S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	87.27	102.67
763L (Vauxhall 158S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	89.16	104.89
MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)	MH-15L (Brier Park MHS-7 – MHS-9A)	88.4	88.4	96.96	109.63
2075L (Newell 2075S - Newell 2075S)	610L (Fincastle 336S – Taber 83S)	85	94	85.49	100.58

Notes: [a] The facility ratings shown in Attachment A1 have been adjusted from a [72/144] kV voltage base to a [69/138] kV voltage base, as is used by the power system network analysis tool.

[b] Reported as a percentage of the observed power flow (in MVA) relative to the transmission line's Normal Rating (also in MVA, as shown in Attachment A1).

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No voltage deviations beyond the limits listed in Table 3-1 of Attachment A1 (hereafter referred to as point of delivery (POD) bus voltage deviations) were observed.

2.1.2 *Scenario 2 2022 Summer Peak High Solar Pre-Project*

Category A condition

No Reliability Criteria violations were observed under the Category A condition.

Category B conditions

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-3.

Table 2-3: Thermal Criteria Violations under Category B Conditions for Scenario 2

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings[a] (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Observed Power Flow (MVA)	% Loading[b]
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	610L (Fincastle 336S – Taber 83S)	85	94	88.06	103.6
674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	85	94	107.99	127.05
100L (Suffield 895S – Tilley 498S)	610L (Fincastle 336S – Taber 83S)	85	94	85.36	100.42
EATL (Heathfield 2029S-Newell 207S)	610L (Fincastle 336S – Taber 83S)	85	94	86.63	101.92
610L (Fincastle 336S – Taber 83S)	879L (Rattlesnake 719S– Burdett 368S)	85	94	87.16	102.54
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	138.63	163.09
879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)	610L (Fincastle 336S – Taber 83S)	85	94	87.59	103.05
498S TILLEY TRANSFORMER T1 or T2 (West Brooks 28S – Tilley 498S - Suffield 895S)	610L (Fincastle 336S – Taber 83S)	85	94	85.49	100.58
MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	156.9	145.22

MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	156.9	145.22
MH138-T63 (Riverview MH69S-6 - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	98	98	98.81	100.83
MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	98	98	99.39	101.42
MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	116.52	107.85
	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	116.52	107.85
2075L (Newell 2075S - Newell 2075S)	610L (Fincastle 336S – Taber 83S)	85	94	86.74	101.93
MH-20L (MH69S-3A - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	98	98	99.51	101.54
1036L (Milo 356S – Travers 554S)	1005L (Milo 356S – Travers 554S)	481	697	587.51	122.15

Notes:

a The facility ratings shown in Attachment A1 have been adjusted from a [72/144] kV voltage base to a [69/138] kV voltage base, as is used by the power system network analysis tool.

b Reported as a percentage of the observed power flow (in MVA) relative to the transmission line's Normal Rating (also in MVA, as shown in Attachment A1).

Voltage Criteria Violations

Voltage criteria violations were observed under certain Category B conditions as shown in Table 2-4.

Table 2-4: Voltage Criteria Violations under Category B Conditions for Scenario 2

Contingency (System Element Lost)	Violation Location Details		Voltage Ratings (kV)			Pre-Project Results	
	Substation Name and No.	Bus No.	Nominal Voltage	Emergency Minimum Voltage	Emergency Maximum Voltage	Initial Voltage (kV)	Post-contingency Steady State (kV)
MH138-T63 (Riverview MH69S-6 - MH69S-3B)	South Ridge MH69S-3	704	69	62	75.9	65.7	60.2
	South Ridge MH69S-3A	549016	138	124.1	150	133.1	119.7
	South Ridge MH69S-3B	549017	138	124.1	150	134.4	119.7
MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	South Ridge MH69S-3	704	69	62	75.9	65.7	59.9
MH-20L (MH69S-3A - MH69S-3B)	South Ridge MH69S-3	704	69	62	75.9	65.7	59.9
	South Ridge MH69S-3A	549016	138	124.1	150	133.1	119

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

2.1.3 *Scenario 6: 2022 Summer Light Pre-Project Sensitivity*

Category A condition

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category A conditions as shown in Table 2-5.

Table 2-5:Thermal Criteria Violations under Category A Conditions for Scenario 6

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings[a] (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Observed Power Flow (MVA)	% Loading[b]
CATEGORY A	610L (Fincastle 336S – Taber 83S)	85	94	112.2	131.8
CATEGORY A	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	96.7	113.7

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

2.1.4 *Scenario 7: 2022 Summer Peak Pre-Project Sensitivity*

Category A condition

Thermal Criteria Violations

No thermal criteria violations were observed under Category A conditions.

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3 Post-Project Study Results

This section describes the results of the post-Project power flow studies, voltage stability studies and transient stability studies. As described in Section 2 of Attachment A1, the post-Project studies were performed using Alternative 2.

Category B conditions in post-project studies were performed with the original STS of the Project, 60 MW before it was changed to an STS of 50 MW. Since the 60 MW Project dispatch results in a more stressed base case compared to 50 MW dispatch, the results can be a safe representative of the result of the 50 MW dispatch.

Thus, Category A conditions in Power flow studies are shown with the Project's STS at 50 MW while Category B conditions are shown with the Project's original STS of 60 MW. Transient studies were performed with a Project STS of 60 MW.

3.1 Power Flow Studies

Power flow diagrams illustrating the post-Project power flow studies results for Category A and Category B conditions are included in Attachment A3.

3.1.1 *Scenario 3 2022 Summer Light High Renewables Post-Project*

As previously mentioned, Power flow studies were initially performed with the Project's original STS of 60 MW and existing line ratings. However, because Category A violations were observed, the Project's STS was reduced to 50 MW and a transmission line restoration for 763AL was tested as shown in Table 3-2.

Attachment A3 shows the Category A power flow results of scenario 3 under various conditions. First, when the project is dispatched to its original STS of 60 MW with no curtailment. Then, with certain generators curtailed with the Project's STS still at 60 MW. Finally, with the Project was reduced to an STS of 50 MW with no generation curtailment.

Category B power flow results in Attachment A3 show the project dispatched at 60 MW with generation curtailed.

Category A condition

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category A conditions with the Project dispatched to 50 MW as shown in Table 3-1. With the assumption that the 763AL line restoration work will be completed prior to project energization, Table 3-2 shows that 763AL-1 is no longer a Category A violation.

Table 3-1: Thermal Criteria Violations under Category A Conditions for Scenario 3 with Project STS at 50 MW prior to 763AL restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	610L (Fincastle 336S – Taber 83S)	85	94	116.57	137.14	114.5	134.6	-2.54
CATEGORY A	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	93.23	109.69	94.7	111.4	1.71
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	96	125	69.2[1]	72.1[1]	113.1	117.8	45.71
CATEGORY A	763L (West Brooks 28S – Enchant 447S tap point)	120	132	93.2	77.7	119.3	99.5	21.8

Table 3-2: Thermal Criteria Violations under Category A Conditions for Scenario 3 with 50 MW project STS and updated 763AL rating.

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	610L (Fincastle 336S – Taber 83S)	85	94	116.57	137.14	114.5	134.6	-2.54
CATEGORY A	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	93.23	109.69	94.7	111.4	1.71
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.2[1]	57.7[1]	113.1	94.25	36.55
CATEGORY A	763L (West Brooks 28S – Enchant 447S	120	132	93.2	77.7	119.3	99.5	21.8

[1] This is the tap line that connects the project to the system and thus, only appears in post-Project scenarios. Instead, the pre-existing 763AL line ratings are recorded in the pre-Project result columns.

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	tap point)							

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

Category B conditions

763AL-1 line was restored to its full summer and emergency ratings of 120 MVA and 132 MVA in order to accommodate the full STS of the project. It also resolved the Category A violation in the post-Project scenarios.

The curtailments applied in the pre-Project scenario to mitigate Category A violations on 610L and 879L were also applied in this post-Project scenario as outlined in Section 2.1.1.

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-3.

Table 3-3: Thermal Criteria Violations under Category B Conditions for Scenario 3 with Project STS at 60 MW

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
158S VAUXHALL TRANSFORMER T1 (Hull 257S – Vauxhall 158S – Hays 421S, Stone 2020S – Vauxhall 158S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	89.54	105.34	88.26	103.83	-1.51
257S HULL TRANSFORMER T1 (Taber 83S – Hull 257S – Vauxhall 158S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	87.55	103	86.26	101.49	-1.51
	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	70.02[1]	58.35[1]	120.35	100.29	42.54
421S HAYS TRANSFORMER T2 (Hays 421S – Vauxhall 158S – West Brooks 28S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	108.03	90.03	142.04	118.38	28.35
	879L (Bowmanton 244S – Rattlenake 719S)	85	94	82.9	97.53	85.38	100.45	2.91
336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	92.25	108.53	92.27	108.55	0.03
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	85.46	100.54	90.18	106.1	5.55
	763L (West Brooks 28S – Enchant 447S tap point)	120	132	95.4	79.5	129.99	108.33	28.83
	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.53[1]	57.94[1]	120.17	100.14	42.2
674L AND 658L (Bowmanton 244S – Chappice Lake 649S – Cypress 562S)	610L (Fincastle 336S – Taber 83S)	85	94	115.98	136.45	115.71	136.13	-0.32
	763L (West	120	132	93.03	77.53	122.92	102.43	24.90

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	Brooks 28S – Enchant 447S tap point)							
	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	31.36[1]	26.13[1]	120.5	100.42	74.29
121S BROOKS TRANSFORMER T2 (Brooks 121S – West Brooks 28S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	106.63	88.86	140.39	117	28.14
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	82.66	97.25	85.14	100.16	2.91
795L (Brooks 121S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	107.27	89.4	141.05	117.55	28.16
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	82.77	97.37	85.25	100.29	2.92
612L (Fincastle 336S – Burdett 368S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	92.33	108.62	92.3	108.59	-0.03
	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.45[1]	57.88[1]	120.01	100.01	42.14
610L (Fincastle 336S – Taber 83S)	674L (Chappice Lake 649S – Bowmanton 244S)	121	149	125.93	104.08	127.16	105.09	1.01
	658L (Chappice Lake 649S – Cypress 562S)	121	149	120.85	99.87	122.06	100.88	1
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	156.8	184.47	156.8	184.47	0
507L (Taber 83S – Hull	879L (Bowmanton	85	94	87.27	102.67	85.99	101.17	-1.5

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
257S)	244S – Rattlesnake 719S)							
821L (Vauxhall 158S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	108.29	90.25	142.37	118.65	28.4
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	82.93	97.56	85.41	100.48	2.92
763L (Vauxhall 158S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	89.16	104.89	87.86	103.36	-1.53
	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	70.01[1]	58.34[1]	120.34	100.28	41.94
MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)	MH-15L (Brier Park MHS-7 – MHS-9A)	88.4	88.4	96.96	109.63	96.95	109.62	-0.01
1005L (Travers 554S – Travers 554S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.58[1]	57.98[1]	120.21	100.18	42.2
895S SUFFIELD TRANSFORMER T2 (Suffield 895S- Tilley 498S – Bowmanton 244S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.49[1]	57.9[1]	120.09	100.08	42.17
100L (Suffield 895S – Tilley 498S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.47[1]	57.89[1]	120.07	100.06	42.17
1034L (Bowmanton 244S – Cassils 324S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.44[1]	57.87[1]	120.02	100.01	42.14
935L (Cassils 324S – Milo 356S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.48[1]	57.9[1]	120.06	100.05	42.15
923L (Milo 356S – Newell 2075S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.49[1]	57.91[1]	120.08	100.07	42.16
1035L (Bowmanton 244S – Newell 2075S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.45[1]	57.88[1]	120.04	100.03	42.16
163S AMOCO EMPRESS	763AL-1 (ENCH 447S tap point –	120	132	69.44[1]	57.87[1]	120.03	100.02	42.15

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
TRANSFORMER T1 OR T5 (Amoco Empress 163S – Empress 394S, Cypress 562S – Amoco Empress 163S – Empress Liquid Tap 164S, Sandy point 204S – Amoco Empress 163S – Sandhills 341S)	763AAL TAP)							
28S WEST BROOKS TRANSFORMER 28ST1A (West Brooks 28S – West Brooks 28S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.4[1]	57.83[1]	120.23	100.2	42.37
28S WEST BROOKS TRANSFORMER 28ST2A (West Brooks 28S – West Brooks 28S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.4[1]	57.83[1]	120.23	100.19	42.36
1036L (Milo 356S – Travers 554S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	69.45[1]	57.88[1]	120.03	100.03	42.16

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.1.2 *Scenario 4 2022 Summer Peak High Solar Post-Project*

Category A condition

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category A conditions as shown in Table 3-4. With the assumption that the 763AL line restoration work will be completed prior to project energization, Table 3-5 shows that the 763AL-1 loading is below its rated values and no longer a Category A violation.

Table 3-4: Thermal Criteria Violations under Category A Conditions for Scenario 4 with Project's STS at 50 MW prior to 763AL line restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	96	125	50.6[1]	52.7[1]	95.9	99.9	47.2

Table 3-5: Thermal Criteria Violations under Category A Conditions for Scenario 4 with Project's STS at 50 MW after 763AL line restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	50.6	42.17	95.9	79.9	37.73

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

Category B conditions

The 763AL-1 Category A violation observed in this scenario was resolved by restoring the line to its full summer normal rating of 120 MVA and emergency rating of 132 MVA.

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-6.

Table 3-6: Thermal Criteria Violations under Category B Conditions for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	610L (Fincastle 336S – Taber 83S)	85	94	88.06	103.6	85.16	100.18	-3.3
674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	85	94	107.56	120.85	107.68	126.68	0.14
879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)	610L (Fincastle 336S – Taber 83S)	85	94	87.59	102.94	88.48	104.09	1.15
610L (Fincastle 336S – Taber 83S)	879L (Rattlesnake 719S – Burdett 368S)	85	94	87.16	102.54	87.18	102.56	0.02
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	138.63	163.09	138.64	163.12	0.03
MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	156.9	145.22	156.86	145.24	-0.04
MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	156.9	145.22	156.86	145.24	-0.04
MH138-T63 (Riverview MH69S-6 - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	98	98	98.81	100.83	98.8	100.81	-0.01

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	98	98	99.39	101.42	99.21	101.23	-0.19
MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	116.52	107.89	116.5	107.87	-0.02
	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	108	108	116.52	107.89	116.5	107.87	-0.02
2075L (Newell 2075S - Newell 2075S)	610L (Fincastle 336S – Taber 83S)	85	94	86.74	101.93	85.51	100.6	-1.33
MH-20L (MH69S-3A - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	98	98	99.51	101.54	99.49	101.52	-0.02
1036L (Milo 356S – Travers 554S)	1005L (Milo 356S – Travers 554S)	481	697	587.51	122.15	586.89	122.01	-0.14

Voltage Criteria Violations

Voltage criteria violations were observed under certain Category B conditions as shown in Table 3-7.

Table 3-7: Voltage Criteria Violations under Category B Conditions for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)		Voltage Ratings (kV)			Pre-Project Results		Post-Project Results		% Voltage Difference (kV)
	Substation Name and Number	Bus No.	Nominal Voltage	Emergency Minimum Voltage	Emergency Maximum Voltage	Initial Voltage (kV)	Post-contingency Steady State (kV)	Initial Voltage (kV)	Post-contingency Steady State (kV)	
MH138-T63 (Riverview MH69S-6 - MH69S-3B)	South Ridge MH69S-3	704	69	62	75.9	65.7	60.2	65.8	60.2	0
	South Ridge MH69S-	549 016	138	124.1	150	133.1	119.7	133.1	119.7	-0.1

	3A									
	South Ridge MH69S-3B	549 017	138	124.1	150	134.4	119.7	134.5	119.8	0.1
MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	South Ridge MH69S-3	704	69	62	75.9	65.7	59.9	65.8	60	-0.1
MH-20L (MH69S-3A - MH69S-3B)	South Ridge MH69S-3	704	69	62	75.9	65.7	59.9	65.8	59.9	0
	South Ridge MH69S-3A	549 016	138	124.1	150	133.1	119	133.1	119.1	-0.1

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.1.3 *Scenario 8: 2022 Summer Light Post-Project Sensitivity*

Category A condition

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category A conditions with the Project's STS dispatched to 50 MW. With the assumption that the 763AL line restoration work will be completed prior to project energization, Table 3-9 shows that the 763AL-1 loading is below its rated values and no longer a Category A violation.

Table 3-8: Thermal Criteria Violations under Category A Conditions for Scenario 8 prior to 763AL line restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	610L (Fincastle 336S – Taber 83S)	85	94	112.2	131.8	110.2	129.5	-2.3
CATEGORY A	763L (West Brooks 28S – Enchant 447S tap point)	120	132	113.3	94.4	142.8	119	24.6
CATEGORY A	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	96.7	113.7	98.5	115.9	2.2
CATEGORY	763AL-1 (ENCH	96	125	65.4	68.13	115.5	120.31	54.91

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
A	447S tap point – 763AAL TAP)							

Table 3-9:Thermal Criteria Violations under Category A Conditions for Scenario 8 after 763AL line restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	610L (Fincastle 336S – Taber 83S)	85	94	112.2	131.8	110.2	129.5	-2.3
CATEGORY A	763L (West Brooks 28S – Enchant 447S tap point)	120	132	113.3	94.4	142.8	119	24.6
CATEGORY A	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	96.7	113.7	98.5	115.9	2.2
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	65.4	54.5	115.5	96.3	41.8

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.1.4 *Scenario 9: 2022 Summer Peak Post-Project Sensitivity*

Category A condition

Thermal Criteria Violations

No thermal criteria violations were observed under Category A conditions.

Table 3-10: 763AL-1 Thermal Loading under Category A Conditions for Scenario 9 prior to 763AL line restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	96	125	49.9	52.0	95.9	99.9	47.9

Table 3-11: 763AL-1 Thermal Loading under Category A Conditions for Scenario 9 after 763AL line restoration

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
CATEGORY A	763AL-1 (ENCH 447S tap point – 763AAL TAP)	120	132	49.9	41.6	95.9	79.9	38.3

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.2 Transient Stability Studies

Transient stability studies were completed for:

- Scenario 3 – 2022 Summer Light High Wind and No Import Post-Project;
- Scenario 4 – 2022 Summer Peak High Wind and Import Post-Project;

The results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied, as shown in Table 3-12. The post-Project transient stability plots are provided in Attachment A4. The dynamic data and assumptions of all equipment proposed for the Facility are provided in Attachment A5.

Table 3-12: Transient Stability Study Results under Category B Conditions for Scenario 3 with Project's STS at 60 MW

Table 3-12	Fault Description and Location	Results
Category A (Flat Start)		All monitored generators – Stable All monitored bus voltages – Acceptable
612L (Fincastle 336S – Burdett 368S)	3-phase fault at 336S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 368S	All monitored generators – Stable All monitored bus voltages – Acceptable
610L (Fincastle 336S – Taber 83S)	3-phase fault at 336S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 83S	All monitored generators – Stable All monitored bus voltages – Acceptable
507L (Taber 83S – Hull 257S)	3-phase fault at 83S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 257S	All monitored generators – Stable All monitored bus voltages – Acceptable
879L (Burdett 368S – Bowmanton 244S)	3-phase fault at 368S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 244S	All monitored generators – Stable All monitored bus voltages – Acceptable
763L (Vauxhall 158S – West Brooks 28S)	3-phase fault at 158S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 28S	All monitored generators – Stable All monitored bus voltages – Acceptable
795L (Brooks 121S – Hays 421S)	3-phase fault at 121S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 421S	All monitored generators – Stable All monitored bus voltages – Acceptable
821L (Vauxhall 158S – Hays 421S)	3-phase fault at 158S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 421S	All monitored generators – Stable All monitored bus voltages – Acceptable

Table 3-13: Transient Stability Study Results under Category B Conditions for Scenario 4 with Project's STS at 60 MW.

Table 3-12	Fault Description and Location	Results
Category A (Flat Start)		All monitored generators – Stable

		All monitored bus voltages – Acceptable
612L (Fincastle 336S – Burdett 368S)	3-phase fault at 336S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 368S	All monitored generators – Stable All monitored bus voltages – Acceptable
610L (Fincastle 336S – Taber 83S)	3-phase fault at 336S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 83S	All monitored generators – Stable All monitored bus voltages – Acceptable
507L (Taber 83S – Hull 257S)	3-phase fault at 83S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 257S	All monitored generators – Stable All monitored bus voltages – Acceptable
879L (Burdett 368S – Bowmanton 244S)	3-phase fault at 368S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 244S	All monitored generators – Stable All monitored bus voltages – Acceptable
763L (Vauxhall 158S – West Brooks 28S)	3-phase fault at 158S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 28S	All monitored generators – Stable All monitored bus voltages – Acceptable
795L (Brooks 121S – Hays 421S)	3-phase fault at 121S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 421S	All monitored generators – Stable All monitored bus voltages – Acceptable
821L (Vauxhall 158S – Hays 421S)	3-phase fault at 158S	All monitored generators – Stable All monitored bus voltages – Acceptable
	3-phase fault at 421S	All monitored generators – Stable All monitored bus voltages – Acceptable

4 Short-Circuit Studies

4.1 Pre-Project Results

Pre-Project short-circuit current levels are provided in Table 4-1.[2]

Table 4-1: Short-Circuit Current Levels for the 2022 SP Pre-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Vauxhall 158S	138	139.4	6.1	0.03047+j0.07166	4.2	0.04328+j0.17511
West Brook 28S	138	138.1	15.3	0.00621+j0.03067	16.8	0.00180+j0.02214
	240	248.5	13.7	0.00448+j0.02044	13.6	0.00273+j0.02119
Enchant 447S	138	138.9	3.4	0.05622+j0.12650	2.4	0.07209+j0.32413
Hays 421S	138	137.3	4.8	0.03723+j0.09102	3.3	0.04990+j0.22116
Hull 257S	138	140.8	5.7	0.03351+j0.07607	3.9	0.04827+j0.18733

4.2 Post-Project Results

4.2.1 *Scenario 4 2022 Summer Peak High Solar Post-Project*

Post-Project short-circuit current levels for scenario 4 are provided in Table 4-2.

Table 4-2: Short-Circuit Current Levels for the 2022 SP Post-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Vauxhall 158S	138	141.1	6.3	0.02916+j0.07033	4.3	0.04323+j0.175
West Brook 28S	138	138.5	15.5	0.00605+j0.03036	17.0	0.00180+j0.02213
	240	248.8	13.8	0.00440+j0.02033	13.6	0.00273+j0.02119

[2] Short-circuit current studies were based on modeling information provided to the AESO by third parties. The authenticity of the modeling information has not been validated. Fault levels could change as a result of system developments, new customer connections, or additional generation in the area. It is recommended that these changes be monitored and fault levels reviewed to ensure that the fault levels are within equipment operating limits. The information provided in this study should not be used as the sole source of information for electrical equipment specifications or for the design of safety-grounding systems.

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Enchant 447S	138	144.5	3.8	0.04853+j0.11914	2.5	0.07154+j0.32303
Hays 421S	138	138.6	4.8	0.03644+j0.09020	3.3	0.04989+j0.22112
Hull 257S	138	142.1	5.8	0.03263+j0.07522	4.0	0.04824+j0.18727
Wheatcrest 1039S	138	144.6	3.8	0.04819+j0.11896	2.5	0.07304+j0.32584

4.2.2 *Scenario 5 2029 Summer Peak Post Project*

Post-Project short-circuit current levels for Scenario 5 are provided in Table 4-3.

Table 4-3: Short-Circuit Current Levels for the 2029 SP Post-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Vauxhall 158S	138	140.9	5.7	0.02802+j0.07147	3.9	0.04435+j0.17531
West Brook 28S	138	138.0	15.4	0.00424+j0.02768	17.6	0.00105+j0.01753
	240	251.6	14.7	0.00291+j0.01735	16.2	0.00150+j0.01333
Enchant 447S	138	143.1	3.4	0.04581+j0.12071	2.3	0.07179+j0.32186
Hays 421S	138	138.4	4.4	0.03527+j0.09069	3.0	0.05027+j0.21992
Hull 257S	138	140.8	5.2	0.03171+j0.07676	3.6	0.04877+j0.18658
Wheatcrest 1039S	138	143.1	3.5	0.04545+j0.12034	2.3	0.07330+j0.32467

5 Mitigation Measure Development and Evaluation

The Studies Consultant, in consultation with the AESO, developed mitigation measures to address the system performance issues that were identified in the post-Project scenarios. Existing remedial action schemes (RASs) are described in Section 1.2.2 of Attachment A1.

5.1 Pre-Project

Pre-Project mitigation measures are summarized in Table 5-1.

Table 5-1: Pre-Project Mitigation Measures

Mitigation Measure	Location of Observed Violation	Contingency
ISO TCM Rule 302.1	610L (Fincastle 336S – Taber 83S)	Category A
	879L (Bowmanton 244S – Rattlesnake 719S)	
Planned RAS 170	1005L (Milo 356S – Travers 554S)	1036L (Milo 356S – Travers 554S)
Planned RAS 180	674L (Chappice Lake 649S – Bowmanton 244S)	610L (Fincastle 336S – Taber 83S)
	879L (Rattlesnake 719S– Burdett 368S)	
	879L (Bowmanton 244S – Rattlesnake 719S)	
	879L (Bowmanton 244S – Rattlesnake 719S)	158S VAUXHALL TRANSFORMER T1 (Hull 257S - Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)
		257S HULL TRANSFORMER T1 (Taber 83S - Hull 257S – Vauxhall 158S)
		336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)
		172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
		EATL (Heathfield 2029S- Newell 207S)
		612L (Fincastle 336S – Burdett 368S)
		507L (Taber 83S – Hull 257S)
		763L (Vauxhall 158S – Hull 257S)
Planned RAS 181	610L (Fincastle 336S – Taber 83S)	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)
		EATL (Heathfield 2029S- Newell 207S)

		172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
		100L (Suffield 895S – Tilley 498S)
		879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)
		498S TILLEY TRANSFORMER T1 or T2 (West Brooks 28S – Tilley 498S - Suffield 895S)
		2075L (Newell 2075S - Newell 2075S)
CMH RAS	MH-15L (Brier Park MHS-7 – MHS-9A)	MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)
	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
		MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)
	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
		MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)
	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH138-T63 (Riverview MH69S-6 - MH69S-3B)
		MH138-T34 (South Ridge MH69S-3 - MH69S-3A)
		MH-20L (MH69S-3A - MH69S-3B)

5.2 Post-Project

Post-Project mitigation measures are summarized in Table 5-2.

Table 5-2: Post-Project Mitigation Measures

Mitigation Measure	Location of Observed Violation	Contingency
ISO TCM Rule 302.1	610L (Fincastle 336S – Taber 83S)	Category A
	879L (Bowmanton 244S – Rattlesnake 719S)	
	763L (West Brooks 28S – Enchant 447S tap poin[3]	

[3] This violation is observed only in the Summer Light Sensitivity Scenario.

Rating Restoration	763AL-1 (ENCH 447S tap point - 763AAL TAP)	Category A
Planned RAS 170	1005L (Milo 356S – Travers 554S)	1036L (Milo 356S – Travers 554S)
Planned RAS 181	610L (Fincastle 336S – Taber 83S)	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)
		172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
		879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)
		2075L (Newell 2075S - Newell 2075S)
New RAS 195: 763L Overload Mitigation Scheme	763L (West Brooks 28S – Enchant 447S tap point)	421S HAYS TRANSFORMER T2 (Hays 421S - Vauxhall 158S – West Brooks 28S)
		121S BROOKS TRANSFORMER T2 (Brooks 121S - West Brooks 28S - Hays 421S)
		795L (Brooks 121S - Hays 421S)
		172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
		674L (Chappice Lake 649S – Bowmanton 244S)
		821L (Vauxhall 158S – Hays 421S)
Planned RAS 180	674L (Chappice Lake 649S – Bowmanton 244S)	610L (Fincastle 336S – Taber 83S)
	658L (Chappice Lake 649S – Cypress 562S)	
	879L (Bowmanton 244S – Rattlesnake 719S)	
	879L (Rattlesnake 719S– Burdett 368S)	
	879L (Bowmanton 244S – Rattlesnake 719S)	821L (Vauxhall 158S – Hays 421S)
		121S BROOKS TRANSFORMER T2 (Brooks 121S - West Brooks 28S - Hays 421S)
		795L (Brooks 121S - Hays 421S)
		421S HAYS TRANSFORMER T2 (Hays 421S - Vauxhall 158S – West Brooks 28S)
		158S VAUXHALL TRANSFORMER T1 (Hull 257S - Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)
		257S HULL TRANSFORMER T1 (Taber 83S – Hull 257S – Vauxhall 158S

		336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)
		172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
		612L (Fincastle 336S – Burdett 368S)
		610L (Fincastle 336S – Taber 83S)
		507L (Taber 83S – Hull 257S)
		821L (Vauxhall 158S – Hays 421S)
		763L (Vauxhall 158S – Hull 257S)
CMH RAS	MH-15L (Brier Park MHS-7 – MHS-9A)	MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)
	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
		MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)
	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
		MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)
	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH138-T63 (Riverview MH69S-6 - MH69S-3B)
		MH138-T34 (South Ridge MH69S-3 - MH69S-3A)
		MH-20L (MH69S-3A - MH69S-3B)
Real time operational practices	763AL-1 (ENCH 447S tap point - 763AAL TAP)	257S HULL TRANSFORMER T1 (Taber 83S - Hull 257S – Vauxhall 158S)
		172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
		1005L (Travers 554S - Travers 554S)
		895S SUFFIELD T2 (Suffield 895S - Tilley 498S - Bowmanton 244S)
		100L (Suffield 895S - Tilley 498S)
		1034L (Bowmanton 244S - Cassils 324S)
		935L (Cassils 324S - Milo 356S)
		923L (Milo 356S - Newell 2075S)
		1035L (Bowmanton 244S - Newell 2075S)
		612L (Fincastle 336S – Burdett 368S)
		674L AND 658L (Bowmanton 244S – Chappice Lake 649S – Cypress 562S)

		163S AMOCO EMPRESS TRANSFORMER T1 OR T5 (Amoco Empress 163S - Empress 394S, Cypress 562S - Amoco Empress 163S - Empress Liquid Tap 164S, Sandy point 204S - Amoco Empress 163S – Sandhills 341S)
		763L (Vauxhall 158S – Hull 257S)
		28S WEST BROOKS TRANSFORMER 28ST1A (West Brooks 28S - West Brooks 28S)
		28S WEST BROOKS TRANSFORMER 28ST2A (West Brooks 28S - West Brooks 28S)
		1036L (Milo 356S – Travers 554S)

5.3 Evaluation of Mitigation Measures

This section describes the results of the power flow studies that were performed to assess the impact of the Project on the performance of the AIES following the implementation of proposed mitigation measures.

The post-mitigation measures studies were performed under Category B conditions for Scenario 3 2022 Summer Light Post-Project and Scenario 4 2022 Summer Peak Post-Project using Alternative 2 and the RASs described in the previous section.

The post-mitigation power flow diagrams for selected Category B conditions are provided in Attachment A6. Post-mitigation power flow diagrams present only those post-Project contingencies that result in thermal criteria violations that require RAS mitigation. Post-Project contingencies that result in thermal criteria violations that can be mitigated by real-time operational practices as well as those that required CMH RAS were not included because the project had no impact.

5.3.1 *Scenario 3: 2022 Summer Light High Renewables Post-Project*

Category B Conditions

Thermal violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-3.

Table 5-3: Post-RAS Power Flow Study Results for Scenario 3 under Category B conditions

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
158S VAUXHALL TRANSFORMER T1 (Hull 257S -	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	88.26	108.33	47.4	55.8

Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)							
421S HAYS TRANSFORMER T2 (Hays 421S - Vauxhall 158S – West Brooks 28S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	142.04	118.38	107.7	89.8
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	85.38	100.45	83	97.7
674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	85	94	115.71	135.99	59.6	70
	763L (West Brooks 28S – Enchant 447S tap point)	120	132	122.75	102.3	110.4	92
	763AL-1 (ENCH 447S tap point - 763AAL TAP)	120	132	120.5	100.42	119.7	99.9
121S BROOKS TRANSFORMER T2 (Brooks 121S - West Brooks 28S - Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	117	28.14	106.4	88.7
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	100.16	2.91	82.8	97.4
795L (Brooks 121S - Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	141.05	117.54	107	89.2
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	85.25	100.29	82.9	97.5
821L (Vauxhall 158S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	120	132	142.37	118.65	108.1	90.1
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	85.41	100.48	83.1	97.7
610L (Fincastle 336S – Taber 83S)	674L (Chappice Lake 649S – Bowmanton 244S)	121	149	127.16	105.09	76.4	63.2
	658L (Chappice Lake 649S – Cypress 562S)	121	149	122.06	100.88	71.5	59.1
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	156.8	184.47	78.1	91.9

5.3.2 *Scenario 4: 2022 Summer Peak High Solar Post-Project*

Category B Conditions

Thermal violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-4.

Table 5-4: Post-RAS Power Flow Study Results for Scenario 4 under Category B conditions

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
610L (Fincastle 336S – Taber 83S)	879L (Rattlesnake 719S – Burdett 368S)	85	94	87.19	102.57	84.7	99.7
	879L (Bowmanton 244S – Rattlesnake 719S)	85	94	138.65	163.12	80.8	95.1
674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	85	94	107.99	126.91	64.5	75.9
1036L (Milo 356S – Travers 554S)	1005L (Milo 356S – Travers 554S)	480.96	697	586.88	122.02	418.2	87

5.4 Constraint Effective Factor Studies

Constraint effective factor studies were conducted for all post-Project scenarios. The constraint effective factors were calculated for all Category A and B conditions when the loadings of the monitored transmission elements in the Study Area exceeded 100% (i.e., for all of the contingencies that resulted in thermal criteria violations). The results of the constraint effective factor studies are provided in Attachment A7.

Attachment A1
Engineering Connection Assessment: Study Scope

Engineering Connection Assessment: Study Scope

P2348 Wheatcrest MPC Solar Project Connection

BER Wheatcrest Solar LPBlueEarth

Date: June 29, 2022

Version: V2 Final

Classification: Public

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Attachments

Attachment A: Transmission Planning Criteria – Basis and Assumptions

1 Introduction

This Study Scope provides an overview of the engineering studies to be completed by Power Grid Specialists Corporation (the Studies Consultant) to assess the impact of the Project (as defined in section 1.1) on the performance of the Alberta interconnected electric system (AIES). Technical criteria, assumptions and methods for performing these engineering studies are provided in this document.

1.1 Project Overview

BER Wheatcrest Solar LPBlueEarth (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its approved Wheatcrest Solar Project facility (Facility) to the AIES.

The Facility includes a proposed collector substation, to be designated the Wheatcrest 1039S.

The Market Participant's request includes: a request for a new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 50 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 0.15 MW; and a request for transmission development (collectively, the Project).

The Project in-service date (ISD) used for the purpose of the studies is March 15, 2023.

Load and generation components of the Project are listed in Table 1-1.

Table 1-1: Project Load and Generation Details

Project Component		Description
Load	Existing Rate DTS, *Demand Transmission Service,* contract capacity	No existing contract
	Requested Rate DTS	0.15 MW
	Type	station service
	Motors (number and size)	Not applicable
	Power factor	Not applicable
	Future load expansion plans	No
Generation	Generation type	Solar
	Existing Rate STS, *Supply Transmission Service,* contract capacity	No existing contract
	Requested Rate STS	50 MW
	Number and size of generating units	136,000 575-watt photovoltaic solar panels
	Maximum authorized real power (MARP)	50 MW
	Maximum capability (MC)	50 MW
	Reactive power capability	16.4 MVAr (0.95 pf absorbing)

Project Component		Description
		24.2 MVAr (0.9 pf producing)
	Future generation expansion plans	No

Note:

MARP and MC are defined in the AESO's *Consolidated Authoritative Document Glossary*, which can be found on the AESO's website.

1.2 Existing System Overview

1.2.1 Study Area

Geographically, the Project is located in the AESO planning area of Vauxhall (Area 52).

The Study Area consists of the AESO planning areas of Medicine Hat (Area 4), Brooks (Area 47), and Vauxhall (Area 52), including the tie lines connecting these planning areas to the rest of the AIES.

The existing transmission system in the Study Area is shown in Figure 1-1.

1.2.2 Existing Constraints

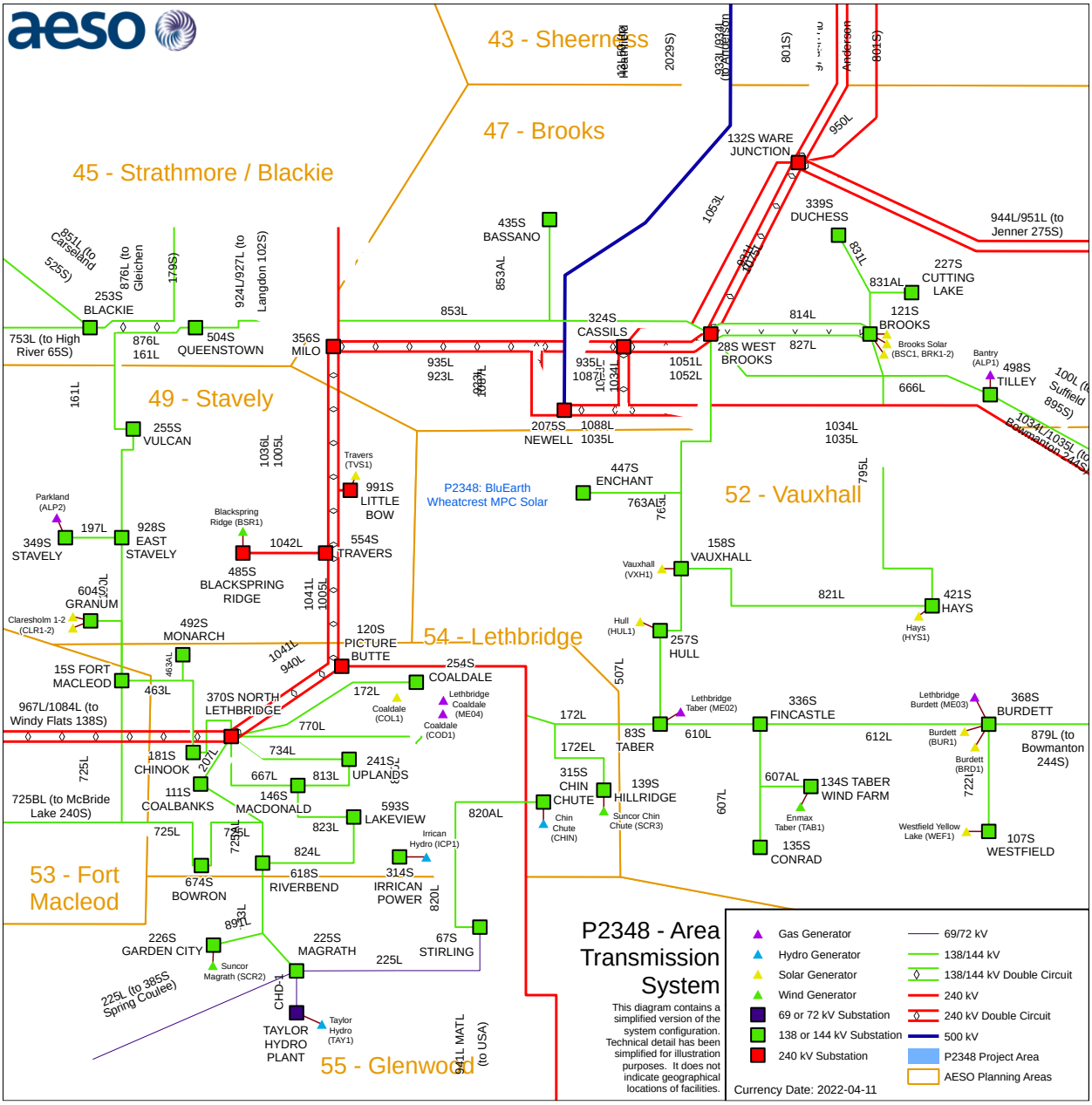
Existing constraints in the Study Area are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (TCM Rule).

There are a number of constraints in the Study Area that are mitigated by existing remedial action schemes (RASs) and/or other protection schemes.

The following existing RASs and/or other protection schemes are used to manage constraints in the area:

- RAS 141: 498S Voltage Instability Mitigation
- RAS 164: 1034L and 1035L Contingency Mitigation
- RAS 168: 172L-83S Overload Mitigation
- RAS 173: 880L-321S Overload Mitigation Scheme

Figure 1-1: Transmission System in the Study Area



2 Connection Alternative to be Studied

The following alternative will be studied:

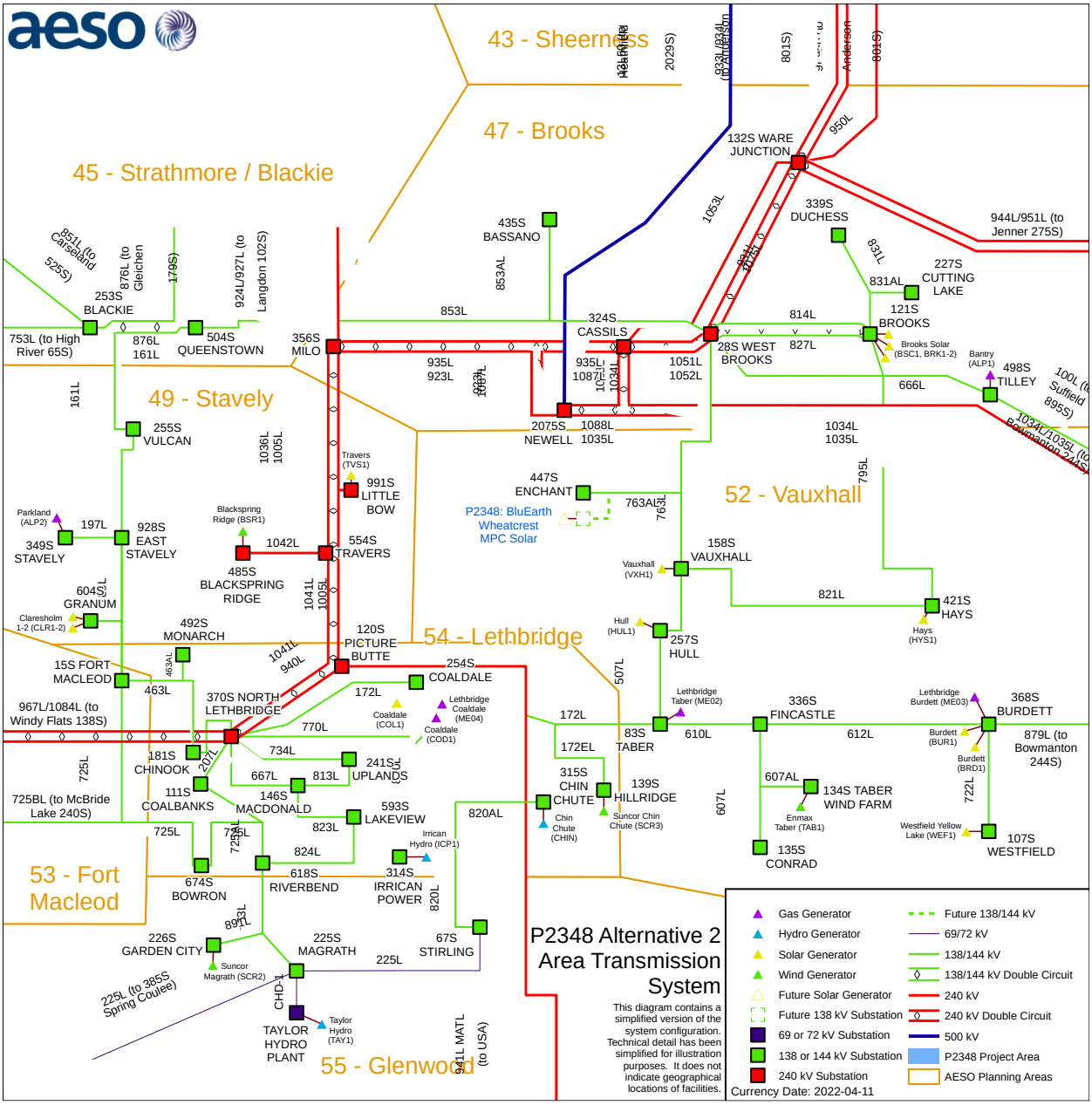
2.1 Alternative 2 – T-tap connection onto 763AL transmission line

This alternative includes the following developments:

- Add one new 138 kV circuit, approximately 1 km in length, to connect the Facility to 763AL using a T-tap configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 2-1.

Figure 2-1: Connection Alternative 2



3 Criteria, Standards and Requirements

3.1 AESO Reliability Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and *Transmission Planning Criteria – Basis and Assumptions (see Attachment A),* (collectively, the Reliability Criteria) will be applied to evaluate system performance under Category A system conditions (i.e., all elements in-service) and following Category B contingencies (i.e., single element outage), prior to and following the studied alternatives. Below is a summary of Category A and Category B system conditions.

Category A, often referred to as the N-0 condition, represents a normal system with no contingencies and all facilities in service. Under this condition, the system must be able to supply all firm load and firm transfers to other areas. All equipment must operate within its applicable rating, voltages must be within their applicable range, and the system must be stable with no cascading outages.

Category B events, often referred to as an N-1 or N-G-1 with the most critical generator out of service, result in the loss of any single specified system element under specified fault conditions with normal clearing. These elements are a generator, a transmission circuit, a transformer, or a single pole of a DC transmission line. The acceptable impact on the system is the same as Category A. Planned or controlled interruptions of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) transmission service electric power transfers.

The TPL standards, TPL-001-AB-0 and TPL-002-AB1-0, have referenced Applicable Ratings when specifying the required system performance under Category A and Category B. For the purpose of applying the TPL standards to the studies documented in this report, Applicable Ratings are defined as follows:

- Normal thermal rating of the line's loading limits for each season;
- The highest specified loading limits for transformers;
- For Category A conditions: Voltage range under normal operating condition per AESO Information Document #2010-007RS, *General Operating Practices – Voltage Control* (ID #2010-007RS). For the busses not listed in ID #2010-007RS, Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions* applies;
- For Category B conditions: The extreme voltage range values per Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions; and*
- Desired post-contingency voltage deviation limits for three defined post-event timeframes as provided in Table 3-1.

Table 3-1: Post-Contingency Voltage Deviation Guidelines for Low Voltage Busses

Parameter and reference point	Time Period		
	Post Transient (up to 30 sec)	Post Auto Control (30 sec to 5 min)	Post Manual Control (Steady State)
Voltage deviation from steady state at point of delivery (POD) low voltage bus.	±10%	±7%	±5%

3.2 ISO Rules and Information Documents

ID #2010-007RS will be used to establish system normal (i.e., pre-contingency) voltage profiles for the Study Area.

The TCM Rule will be followed to set up the study scenarios and assess the impact of the Project. In addition, due regard will be given to the following:

- The AESO's *Connection Study Requirements*;
- Section 502.1 of the ISO rules, *Aggregated Generating Facilities Technical Requirements*;
- Section 502.16 of the ISO rules, *Aggregated Generating Facilities Operating Requirements*;

4 Scenarios and Assumptions

4.1 Scenarios

The following section describes the scenarios to be studied and the assumptions to be used in the studies.

Connection scenarios must be studied as outlined in Table 4-1.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project					
1	2022 Summer Light (SL)	High renewables	2022 SL Pre-Project	0	0
2	2022 Summer Peak (SP)	High Solar	2022 SP Pre-Project	0	0
Post-Project					
3	2022 SL	High renewables	2022 SL Post-Project	0	50
4	2022 SP	High Solar	2022 SP Post-Project	0	50
5	2031 SP	All generation in the Study Area on	2029 SP Post-Project	0	50
Pre-Project Sensitivity with additional generation in the Study Area					
6	2022 SL	High renewables	2022 SL Pre-Project Sensitivity	0	0
7	2022 SP	High Solar	2022 SP Pre-Project Sensitivity	0	0
Post-Project Sensitivity with additional generation in the Study Area					
8	2022 SL	High renewables	2022 SL Pre-Project Sensitivity	0	50
9	2022 SP	High Solar	2022 SP Pre-Project Sensitivity	0	50

Note: The 138 kV bus-tie breaker and switch at the Bowmanton 244S substation will be assumed to be open for all of the above scenarios.

4.2 Assumptions

4.2.1 System Project Assumptions

The pre-Project and post-Project connection assessment will not include any system transmission projects because there are no planned system transmission developments in the Study Area that are expected to be in service before the scheduled Project ISD.

Table 4-2 summarizes the connection projects in the Study Area that should be included in the studies.

Table 4-2: Planned Connection Projects Included in the Studies

AESO Project No.	AESO Project Name	AESO Planning Area	Generation (MW)	Load (MW)	Scheduled ISD	AUC decision No.
1812	Suncor Forty Mile Granlea WAGF	04-Medicine Hat	200.0	0.3	Nov 16, 2021	24120-D02-2019
1918	FortisAlberta Conrad DER Solar 1	52-Vauxhall	18.4	0.0	Apr 15, 2021	N/A
1926*	Solar Krafte Vauxhall	52-Vauxhall	60	0.4	Dec 21, 2021	N/A
1959	FortisAlberta Conrad DER Solar 2	52-Vauxhall	18.0	0.0	Apr 15, 2021	N/A
2122	Cypress Wind Project Connection	04-Medicine Hat	202.0	3.0	Nov 1, 2022	25466-D02-2020
2195	FortisAlberta Bassano 435S DER Solar	47-Brooks	9.0	0.0	Feb 1, 2023	N/A
2212	RESC Rattlesnake Ridge MPC Wind*	04-Medicine Hat	114	1.0	Oct. 15, 2021	25018-D04-2020
2362	Fortis Enchant 447S DER Solar	52-Vauxhall	22.0	0.0	Nov 30, 2021	N/A
2363	Fortis Enchant 447S DER Solar	52-Vauxhall	18.0	0.0	Nov 30, 2021	N/A
2364	Fortis Enchant 447S DER Solar	52-Vauxhall	9.0	0.0	Nov 30, 2021	N/A
2365	Fortis Enchant 447S DER Solar	52-Vauxhall	23.0	0.0	Nov 30, 2021	N/A

*Sensitivity scenarios only

4.2.2 Load Assumptions

The load forecast to be used for the studies is shown in Table 4-3 and is a forecast for the AESO South Planning Region peak based on the AESO's *2021 Long-term Outlook* (2021 LTO)[1] with modifications to incorporate the latest forecast intelligence.

[1] The 2021 LTO is available on the AESO website.

Table 4-3: Forecast Load (at AESO South Planning Region Peak)

AESO Planning Region Name	Forecast Peak Load by Year/Season (MW)	
	2022 SL	2022 SP
South Planning Region[1]	835	1,566

Note:
[1] The South Region comprises the following AESO planning areas: Medicine Hat (Area 4), Sheerness (Area 43), Seebe (Area 44), Strathmore/Blackie (Area 45), High River (Area 46), Brooks (Area 47), Empress (Area 48), Stavely (Area 49), Vauxhaul (Area 52), Fort Macleod (Area 53), Lethbridge (Area 54), and Glenwood (Area 55).

IDEV files contain non-motor loads in zones 34, 36, and 351. These loads are not accounted for in the forecasted peak loads shown above and should not be considered when scaling load. The AESO engineer will provide guidance to load scaling procedures as required.

4.2.3 Generation Assumptions

The generation forecast to be used for the studies is based on the 2021 LTO with modifications to incorporate the latest forecast intelligence. The generation assumptions for the studies will assume high wind and solar generation conditions. Additional studies may be required in the event of changes to the AESO's corporate forecast.

The existing generation (excluding wind and solar) dispatch conditions for the study scenarios are described in Table 4-4.

Table 4-4: Existing Generation (excluding Wind and Solar) Dispatch Conditions

Facility Name	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation[a] (MW) by Scenario	
				2022 SL	2022 SP
Medicine Hat # 1 (CMH1)	683, 686, 687, 689, 712, 713, 1715, 557004	297	4	230.0	246.1
Bantry (ALP1)	4275	7	47	0.0	5.1
Lethbridge Taber (ME02)	3272	8	52	0.0	7.2
Lethbridge Burdett (ME03)	4269	7	52	0.0	6.7
Ralston (NAT1)	3270	20	4	13.0	16.9

Notes:
[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Pre-Project dispatch levels for the existing and under construction wind and solar generation facilities are shown in Table 4-5 and Table 4-6.

Table 4-5: Dispatch Conditions for Existing and Under Construction Wind Generation Facilities

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation (MW) by Scenario	
				2022 SL	2022 SP

Ardenville Wind (ARD1)	4735, 4740	68	53	13.6	40.8
BUL1 Bull Creek (BUL1)	550003	13	37	2.6	7.8
BUL2 Bull Creek (BUL2)	550004	16	37	3.2	9.6
Blackspring Ridge (BSR1)	61736, 61737	300	49	60.0	180.0
Blue Trail Wind (BTR1)	66328, 67328	66	53	13.2	39.6
Castle River #1 (CR1)	2234, 3234	39	53	7.8	23.4
Castle Rock Ridge 2 (CRR2)	567221	29	53	5.8	17.4
Castle Rock Wind Farm (CRR1)	67221	77	53	15.4	46.2
Cowley Ridge (CRE3)	4264	20	53	4.0	12.0
Enmax Taber (TAB1)	15343, 16343	81	52	81.0	48.6
Ghost Pine (NEP1)	2621, 2622, 2623, 2624, 2625	82	42	16.4	49.2
Halkirk Wind Power Facility (HAL1)	66435, 67435	150	42	30.0	90.0
Kettles Hill (KHW1)	2402, 3402	63	53	12.6	37.8
McBride Lake Windfarm (AKE1)	2901, 3901, 4901	73	53	14.6	43.8
Oldman 2 Wind Farm 1 (OWF1)	61543	46	53	9.2	27.6
Riverview (RIV1)	69221	105	53	21.0	63.0
Soderglen Wind (GWW1)	12358, 13358	71	53	14.2	42.6
Summerview 1 (IEW1)	2338, 3338	66	53	13.2	39.6
Summerview 2 (IEW2)	4339, 5337	66	53	13.2	39.6
Suncor Chin Chute (SCR3)	2389	30	54	6.0	18.0
Suncor Magrath (SCR2)	11002	30	55	6.0	18.0
Whitla 1 (WHT1)	60990	202	4	40.4	121.2
Whitla 2 (WHT2)	60990	151	4	30.2	90.6
Windrise (WRW1)	567031	207	53	41.4	124.2
Wintering Hills (SCR4)	60789, 60791, 60793, 60846, 60848, 60850	88	43	17.6	52.8
Total		**2139**		**492.6**	**1283.4**

Note:
[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Table 4-6 lists the pre-Project dispatch levels for the planned wind and solar generation projects in the AESO South and Central planning regions that are included in the study scenarios.

Table 4-6: Dispatch Conditions for Existing and Under Construction Solar Generation Facilities

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation[s] (MW) by Scenario	
				2022 SL	2022 SP
BRD1 Burdett (BRD1)	2269	11	52	2.2	10.5
BUR1 Burdett (BUR1)	557269	20	52	14.0	19.0
Brooks Solar (BSC1)	553257	15	47	10.5	14.3
Claresholm 1 (CLR1)	60894	58	49	40.6	55.1
Claresholm 2 (CLR2)	61894	75	49	52.5	71.3
Hays (HYS1)	554401	24	52	16.8	22.8
Hull (HUL1)	2401	25	52	17.5	23.8
Innisfail (INF1)	557120	22	39	15.4	20.9
Jenner (JER1)		23	48		
Suffield (SUF1)	3270	23	4	16.1	21.9
Vauxhall (VXH1)	4274	22	52	15.4	20.9
Westfield Yellow Lake (WEF1)	557277	19	52	13.3	18.1
Total		**337**		**214.3**	**298.6**

Table 4-7 and Table 4-8 list the pre-Project dispatch levels for the planned wind and solar generation projects in the AIES that are included in the study scenarios.

Table 4-7: Dispatch Conditions for Planned Wind Generation Projects

Project Number	Project Name	Planned ISD	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation Dispatch[a] (MW) by Scenario	
						2022 SL	2022 SP
P1533	Joss MPC WAGF	June 30, 2022	60798, 60799	122.4	48	24.5	73.4
P1698	Joss Jenner WAGF - Phase 2	June 30, 2022	61798, 61799	71.4	48	14.3	42.8
P1718	Wheatland WAGF Project	June 30, 2022	61632, 60632	120	43	24.0	72.0
P1719	Stirling WAGF Project	June 30, 2023	61630	113	54	22.6	67.8
P1812	Suncor Forty Mile Granlea WAGF	November 16, 2021	61994, 62994	200	4	40.0	120.0

P1853	Fortis Buffalo Atlee Cluster 1 WAGF	December 1, 2021	553260	17.3	47	3.5	10.4
P1892	Fortis Buffalo Atlee Cluster 3 WAGF	December 1, 2021	552260	17.3	47	3.5	10.4
P1898	Pattern Lanfine North Wind	September 30, 2022	60996	145	42	29.0	87.0
P1909	TransAlta Garden Plain Wind	July 1, 2022	565002	130	42	26.0	78.0
P2122	Cypress Wind Project Connection	November 1, 2022	560003	201.6	4	40.3	121.0
P2199	FortisAlberta Buffalo Atlee Cluster 2	December 1, 2021	557261	13.8	47	2.8	8.3
P2212	RESC Rattlesnake Ridge MPC Wind	July 30, 2021	60873	114	4	114.0	68.4
P2234	Jenner Wind Phase 3	June 30, 2022	61798, 61799	109	48	21.8	65.4
Total				**1374.8**		**341.7**	**751.4**

Table 4-8: Dispatch Conditions for Planned Solar Generation Projects

Project Number	Project Name	Planned ISD	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation Dispatch[a] (MW) by Scenario	
						2022 SL	2022 SP
P1831	Fortis 255S Vulcan Faribault Farms DG PV	September 1, 2021	4244	22	49	15.4	20.9
P1850	Fortis Coaldale 254S DER Solar 3	September 1, 2021	554691	22	54	15.4	20.9
P1851	Fortis Monarch 492S DER Solar	September 1, 2021	2005	23.6	54	16.5	22.4
P1862	Fortis Spring Coulee 385S Solar DG	October 15, 2021	553246, 554246	29.5	55	20.7	28.0
P1870	Fortis Stavely 349S DER Solar	February 1, 2022	2004	17	49	11.9	16.2
P1918	FortisAlberta Conrad DER Solar 1	December 21, 2021	554291	23	52	16.1	21.9
P1932	FortisAlberta Namaka DER Solar	August 15, 2021	552340	20.1	45	14.1	19.1

P1959	FortisAlberta Conrad DER Solar 2	December 21, 2021	553291	23	52	16.1	21.9
P2009	Greengate Travers MPC Solar	December 10, 2021	560026, 561026, 562026	400	49	280.0	380.0
P2029	FortisAlberta Strathmore 151S DER Solar 1	November 8, 2021	557259	18	45	12.6	17.1
P2030	FortisAlberta Strathmore 151S DER Solar 2	November 8, 2021	558259	23	45	16.1	21.9
P2195	FortisAlberta Bassano 435S DER Solar	February 1, 2023	557399	11.3	47	7.9	10.7
P2249	FortisAlberta Empress 394S DER Solar 1	November 8, 2021	557259	17.5	45	12.3	16.6
P2250	FortisAlberta Empress 394S DER Solar 1	November 8, 2021	558259	22.5	45	15.8	21.4
P2341	Travers Solar Phase 2	April 1, 2022	560026, 561026, 562026	65	49	45.5	61.8
P2362	Fortis Enchant 447S DER Solar	November 30, 2021	993287	23	52	23*	21.9
P2363	Fortis Enchant 447S DER Solar	November 30, 2021	993289	17.9	52	17.9*	17.0
P2364	Fortis Enchant 447S DER Solar	November 30, 2021	994287	10	52	10*	9.5
P2365	Fortis Enchant 447S DER Solar	November 30, 2021	994289	24	52	24*	22.8
Total				**812.4**		**591.3**	**700.6**

*To test the most conservative condition for the flow on the 763AL radial line where the Project connects to, P2362-P2365 are assumed at full dispatch in the SL scenario, when loading is the lowest at Enchant 447S.

The post-Project scenario wind and solar generation dispatch levels are identical to the pre-Project scenario dispatch levels shown in Table 4-4 to Table 4-8. The Facility will be dispatched to 50.0 MW in all post-Project scenarios.

4.2.4 Intertie Flow Assumptions

The intertie flow assumptions for the Alberta-British Columbia (AB-BC), Alberta-Saskatchewan (AB-SK), and Alberta-Montana (MATL) interties are shown in Table 4-9.

For the 2031 WP scenario, the intertie flow values should be set to the AESO planning base cases.

Table 4-9: Intertie Flows by Scenario

Scenario Number	Scenario Name	Import (-) / Export (+) by Intertie		
		AB-BC*	AB-SK	MATL
1,3,6, 8	2022 SL	227	150	0
2, 4, 7, 9	2022 SP	-138	150	-300

*Generation in Areas 40 and 25 will be scaled to achieve the desired AB-BC interchange.

4.2.5 HVDC Power Order Assumptions

The Western Alberta Transmission Line (WATL) and the Eastern Alberta Transmission Line (EATL) are high-voltage direct current (HVDC) transmission lines. The HVDC power order assumptions for the studies will be set to minimize losses for the pre-Project and post-Project study scenarios.

For the 2031 WP scenario, the HVDC power order should be as per the AESO base cases and will not be adjusted.

Table 4-10: HVDC Power Order by Scenario

Scenario Number	Scenario Name	WATL (MW)*	EATL (MW)*
1, 3, 6, 8	2022 SL Pre-Project and Post-Project	250 S->N	450 S->N
2, 4, 7, 9	2022 SP Pre-Project and Post-Project	500 S->N	900 S->N

Notes:
N → S: HVDC flow direction is North to South
S → N: HVDC flow direction is South to North

The reactive power limits of the MVAr exchanges between the HVDC terminals (WATL and EATL) and the connected alternating current (AC) transmission systems are shown in Table 4-11. These limits must be maintained when performing the studies.

Table 4-11: HVDC to Adjacent AC System MVAr Exchange Limits

HVDC Facility	North Terminal Reactive Power Limit (MVAr)	South Terminal Reactive Power Limit (MVAr)
EATL	-85 to 75	-35 to 35
WATL	-75 to 75	-35 to 35

4.2.6 Transmission Facility Ratings

The legal owner of transmission facilities (TFO) provided the thermal ratings assumptions for the existing transmission lines in the Study Area. Table 4-12 shows the normal ratings and emergency ratings for the key transmission lines in the Study Area, which will be used to perform the engineering studies.

Table 4-12: Thermal Rating Assumptions for Key Transmission Lines in the Study Area

Line ID	Line Description	Voltage Class (kV)	Summer Normal Rating (MVA)	Summer Emergency Rating (MVA)
892L	Suffield 895S-Bowmanton 244S	138	80	88
507L	Hull 257S – Taber 83S	138	120	132
172L	North Lethbridge 370S - Coaldale 254S	138	119	131
172L	Fort Macleod 15S - North Lethbridge 370S	138	85	94
172L	Coaldale 254S - Taber 83S	138	119	131
100L	Tilley 498S - Suffield 895S	138	78	86
612L	Fincastle 336S - Burdett 368S	138	85	94
610L	Taber 83S - Fincastle 336S	138	85	94
658L	Cypress 562S – Chappice Lake 649S	138	121	149
674L	Bowmanton 244S - Chappice Lake 649S	138	121	149
763L	West Brooks 28S - Vauxhall 158S	138	120	132
763L	Vauxhall 158S - Hull 257S	138	120	132
763AL	Enchant 447S – Enchant 447S tap point	138	96	96
821L	Hays 421S - Vauxhall 158S	138	85	94
795L	Hays 421S - Brooks 121S	138	96	131
814L/827L	Brooks 121S - West Brooks 28S	138	167	184
879L	Burdett 368S-Bowmanton 244S	138	85	94
1087L	Cassils 324S-Newell 2075S	240	547	656

The TFO provided the details of the substation transformers in the Study Area. The key transformers in the Study Area are shown in Table 4-13.

Table 4-13: Summary of Key Transformer Ratings in the Study Area

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	Transformer Rating (MVA)
Bowmanton 244S	T1	240/138	200
	T2	240/138	200

The TFO provided the details of the shunt elements in the Study Area. The key shunt elements in the Study Area are shown in Table 4-14.

Table 4-14: Summary of Key Shunt Elements in the Study Area

Substation Name and Number	Voltage Class (kV)	Capacitors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
Taber 83S	138	1 x 24.46 MVAr + 1 x 24.50 MVAr	48.96
Hays 421S	138	1 x 22.96 MVAr	22.96
Burdett 368S	138	1 × 22.96 MVAr + 1 × 24.50 MVAr	47.46

4.2.7 Protection Fault Clearing Times

The transient stability studies will be performed using the actual fault clearing times for the selected contingencies, as provided by the TFO and as shown in Table 4-15. Only those contingencies shown in Table 4-15 will be studied for transient stability studies. If the TFO did not specify the fault clearing times (e.g. for new transmission lines) for a selected contingency, then the studies for that contingency will be performed using the standard fault clearing times that are specified in Table 2-3 of the AESO's *Transmission Planning Criteria – Basis and Assumptions*.

Table 4-15: Protection Fault Clearing Times

Contingency (System Element Lost)	Fault Location	Clearing Times (Cycles)	
		Near End	Far End
612L (Burdett 368S – Fincastle 336S)	Burdett 368S	9	30
	Fincastle 336S	30	9
610L (Taber 83S – Fincastle 336S)	Taber 83S	9	30
	Fincastle 336S	30	9
507L (Taber 83S – Hull 257S)	Taber 83S	9	30
	Hull 257S	30	9
879L (Burdett 368S – Bowmanton 244S)	Burdett 368S	9	30
	Bowmanton 244S	30	9
763L (Vauxhall 158S – West Brooks 28S)	Vauxhall 158S	9	60
	West Brooks 28S	60	9
795L (Hays 421S – Brooks 121S)	Hays 421S	9	30
	Brooks 121S	30	9
821L (Vauxhall 158S – Hays 421S)	Vauxhall 158S	9	30
	Hays 421S	30	9

4.2.8 Project Dynamic Data

Dynamic data for the Project can be found in Attachment A7.

4.2.9 Voltage Profile Assumption

ID #2010-007RS will be used to establish system normal (i.e., pre-contingency) voltage profiles for key area busses prior to commencing any studies. Table 2-1 of the *Transmission Planning Criteria – Basis and Assumptions* applies for the busses not included in ID #2010-007RS. These voltages will be used to set the voltage profile for the study base cases prior to the power flow studies.

5 Study Methodology

The studies to be performed for this connection assessment are identified in Table 5-1.

Table 5-1: Summary of the Studies to be Performed

Scenario No. and Name		Power Flow			Voltage Stability			Transient Stability			Short Circuit
		Category			Category			Category			Category A
		A	B	C5	A	B	C5	A	B	C5	
Post-Project											
1	2022 SL	X	X								
2	2022 SP	X	X								X
Post-Project											
3	2022 SL	X	X					X	X		
4	2022 SP	X	X					X	X		X
5	2029 SP										X
Pre-Project Sensitivity											
6	2022 SL	X									
7	2022 SP	X									
Post-Project Sensitivity											
8	2022 SL	X									
9	2022 SP	X									

For the engineering studies, all transmission facilities 69 kV and above within the Study Area and the transmission lines connecting these planning areas to neighbouring planning areas will be studied and monitored to assess the impact of the Project on the performance of the AIES, including any violations of the Reliability Criteria (as defined in Section 3.1).

5.1 Power Flow Studies

Power flow studies will be performed to identify thermal and voltage criteria violations as per the Reliability Criteria, and any deviations from the limits listed in Table 3-1.

For information purposes, the Studies Consultant must also provide, as a separate file, a list of any transmission elements where the thermal loading exceeds 95% of the element's normal rating under Category A and Category B conditions.

For the Category B power flow studies, the transformer taps and switched shunt reactive compensating devices such as shunt capacitors and reactors will be locked and continuous shunt devices will be enabled.

Voltage deviations at point-of-delivery (POD) low voltage busses will also be assessed for both the pre-Project and post-Project networks by first locking all tap changers and area shunt reactive compensating devices to identify any post-transient voltage deviations above 10%. Second, tap changers will be allowed to move while shunt reactive compensating devices remained locked to determine if any voltage deviations

above 7% would occur in the area. Third, all the taps and shunt reactive compensating devices will be allowed to adjust, and voltage deviations above 5% will be reported.

The scenarios to be studied are shown in Table 5-1.

5.1.1 Contingencies to be Studied

Power flow studies will be performed for the Category A and all Category B conditions in the Study Area.

5.2 Transient Stability Studies

The Keephills generating Unit 3 in Wabamun planning area (Area 40) will be used as the reference for the studies.

The report presenting the results of the transient stability studies must provide response plots for several variables as applicable, including rotor angle, and active and reactive power output for the Sheerness#1 Power Plant and other generators in the vicinity of the Project. The results report must also provide the 500 kV, 240 kV and 138 kV bus voltage levels for substations near the point of connection. Other busses will be monitored and will be reported as determined by the results. The results report must also provide the key branch active and reactive power flow surrounding the Facility.

Transient stability studies will be performed for the post-Project scenarios as shown in Table 5-1. If any transient stability issues are observed, transient stability analysis will be performed for the corresponding pre-Project scenarios.

5.2.1 Contingencies to be Studied

Transient stability studies will be performed for the contingencies shown in Table 4-15.

5.3 Short-Circuit Current Level Studies

A maximum fault level must be provided for the substations in the vicinity of the Project assuming normal system operation with all transmission elements in service and generation dispatched. Three-phase faults and single line-to-ground faults will be simulated. Polar coordinates and per-unit values will be used for reporting the results.

Winter peak scenarios will be used for the short-circuit studies because winter peak scenarios generally produce higher short-circuit current levels than summer peak scenarios.

Estimated maximum three-phase faults and single line-to-ground short-circuit current levels will be reported for the following substations:

- Enchant 447S substation
- Hays 421S substation
- Hull 257S substation
- Vauxhall 158S substation
- West Brooks 28S substation
- Wheatcrest 1039S

Further sensitivity studies, in consultation with the TFO, may be required if the primary short-circuit analysis indicates a potential to exceed or approach the existing fault rating of the transmission facilities.

The scenarios to be studied are as shown in Table 5-1.

6 Mitigation Measures

6.1 Development

Mitigation measures may be required if the post-Project study results identify system performance issues. Mitigation measures for the Project may involve modifying or adding real-time operational practices and/or remedial action schemes (RASs).

The Studies Consultant must notify the AESO of any system performance issues in a timely manner, following which the AESO Studies Engineer may instruct the Studies Consultant as follows:

- Develop tables showing the constraint effective factors[2] for generation or load based on thermal criteria violations that are observed.
- Collaborate with the AESO to propose changes, if any, to the connection alternatives that could remove the requirement for a RAS.
- Collaborate with the AESO to study modifications to existing and/or planned RASs, proposed by the AESO, to ensure the coordination of existing protection schemes with the addition of any proposed protection schemes.
- Collaborate with the AESO to identify and study new RASs, if any, that may be required to ensure system reliability is maintained after connecting the Project to the AIES.

The AESO Studies Engineer will work closely with the Studies Consultant and guide the development and/or modifications of the proposed mitigation measures to ensure system reliability, security and compliance with AESO ID #2018-018T, *Provision of System Access Service and the Connection Process*.

6.2 Evaluation

6.2.1 Post-Mitigation Studies

Studies to evaluate the effectiveness of mitigation measures, if required, will be performed in accordance with the technical criteria, assumptions, and methods provided in this Study Scope and in accordance with further instructions from the AESO.

6.2.2 Constraint Effective Factor Studies

Constraint effective factor analysis are used to determine the generator- and load- constraint effective factors and to identify the most effective generators or loads to manage the thermal criteria violations, if any, that are observed under Category A and Category B conditions.

[2] Constraint effective factor studies are performed to determine the generator- and load- constraint effective factors. Constraint effective factors are used to estimate the ability of generators and loads to manage transmission constraints. A generator's or load's constraint effective factor is defined as the change in power flow over a specific transmission line following a change in the generator's energy production or in the load's energy consumption. The greater the constraint effective factor, the more effective a generator or load can be in managing a thermal criteria violation on the specific transmission line.

7 Changes to Study Assumptions

This study will utilize the AESO's planning base cases, which are based on the AESO's current corporate forecast (2021 LTO) with modifications to incorporate the latest forecast intelligence. Sensitivity studies or restudy may be required in the event of revisions to the AESO's corporate forecast, forecast intelligence, or other study assumptions. Additional engineering studies may also be required to assess new connection alternatives, changes to project ISD, or delays in proposed system developments. Any additional or revised study requirements shall be captured in a signed Study Scope Amendment document.

Attachment A: Transmission Planning Criteria – Basis and Assumptions

Transmission Planning Criteria – Basis and Assumptions

Date: July 9, 2019

Version: V1.2

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1. Introduction

This document presents the reliability standards, criteria, and assumptions to be used as the basis for planning the Alberta Transmission System. The criteria, standards and assumptions identified in this document supersede those previously established.

2. Transmission Reliability Standards and Criteria[1]

The AESO applies the following Alberta Reliability Standards to ensure that the transmission system is planned to meet applicable performance requirements under a defined set of system conditions and contingencies. A brief description of each of these standards is given below:

1. **TPL-001-AB-0: System Performance Under Normal Conditions**

   Category A represents a normal system condition with all elements in service (N-0). All equipment must be within its applicable rating, voltages must be within their applicable ratings and the system must be stable with no cascading outages. Under Category A, electric supply to load cannot be interrupted and generating units cannot be removed from service.

2. **TPL-002-AB1-0: System Performance Following Loss of a Single BES Element**

   Category B events result in the loss of any single element (N-1) under specified fault conditions with normal clearing. The specified elements are a generating unit, a transmission circuit, a transformer or a single pole of a direct current transmission line. The acceptable impact on the system is the same as Category A with the exception that radial customers or some local network customers, including loads or generating units, are allowed to be disconnected from the system if they are connected through the faulted element. The loss of opportunity load or opportunity interchanges is allowed. No cascading can occur.

3. **TPL-003-AB-0: System Performance Following Loss of Two or More BES Elements**

   Category C events result in the loss of two or more bulk electric system elements (sequential, N-1-1 or concurrent, N-2) under specified fault conditions and include both normal and delayed fault clearing. All of the system limits for Category A and B events apply with the exception that planned and controlled loss of firm load, firm transfers and/or generation is acceptable provided there is no cascading.

4. **TPL-004-AB-0: System Performance Following Extreme BES Events**

   Category D represents a wide variety of extreme, rare and unpredictable events, which may result in the loss of load and generation in widespread areas. The system may not be able to reach a new stable steady state, which means a blackout is a possible outcome. The AESO needs to evaluate these events, at its discretion, for risks and consequences prior to creating mitigation plans.

5. **FAC-014-AB1-2: Establishing and Communicating System Operating Limits**

   The AESO is required to establish system operating limits where a contingency is not mitigated through construction of transmission facilities

[1] A complete description of the *Alberta Reliability Standards* can be found on the AESO's website: https://www.aeso.ca/rules-standards-and-tariff/alberta-reliability-standards/

2.1 Thermal Loading Criteria

The AESO Thermal Loading Criteria require that the continuous thermal rating of any transmission element is not exceeded under normal and post-contingency operating conditions. Thermal limits are assumed to be 100% of the respective normal summer and winter ratings. Emergency limits are not considered in the planning evaluations.

2.2 Voltage Range and Voltage Stability Criteria

The normal minimum and maximum voltage limits as specified in the following table are used to identify Category A system voltage violations, while the extreme minimum and maximum limits are used to identify Category B and C system violations. Table 2-1 presents the acceptable steady state and contingency state voltage ranges for the AIES. Table 2-2 provides voltage stability criteria used to test the system performance.

Table 2-1: Acceptable Range of Steady State Voltage (kV)

Nominal Voltage	Extreme Minimum	Normal Minimum	Normal Maximum	Extreme Maximum
500	475	500	525	550
240	216	234	252	264
260 (Northeast & Northwest)*	234	247	266	275
144	130	137	151	155
138	124	135	145	150
72	65	68.5	75.5	79
69	62	65.5	72.5	76

Table 2-2: Voltage Stability Criteria

Performance Level	Disturbance (1)(2)(3)(4) Initiated by: Fault of No Fault DC Disturbance	MW Margin (P-V method) (5)(6)(7)	MVAr Margin (V-Q method) (6)(7)
A	Any element such as: One Generator One Circuit One Transformer One Reactive Power Source One DC Monopole	≥5%	Worst Case Scenario(8)
B	Bus Section	≥5%	50% of Margin Requirement in Level A
C	Any combination of two elements such as: A Line and a Generator A Line and a Reactive Power Source Two Generators Two Circuits Two Transformers Two Reactive Power Sources DC Bipole	≥2.5%	50% of Margin Requirement in Level A
D	Any combination of three or more elements such as: Three or More Circuits on ROW Entire Substation Entire Plant Including Switchyard	> 0	> 0

2.3 Transient Stability Analysis Assumptions

Standard fault clearing times as shown in Table 2-3 are used for the new facilities or when the actual clearing times are not available for the existing facilities. Double line-to-ground faults are applied for the Category C5 events with normal clearing times. Single line-to-ground faults are applied for Category C6 to C9 events with delayed clearing times as depicted in Table 2-4 and Table 2-5.

Table 2-3: Fault Clearing Times

Nominal (kV)	Near End (Cycles)	Far End (Cycles)
500	4	5
240	5	6
144/138 with telecommunications	6	8
144/138 without telecommunications	6	30

Table 2-4: Stuck Breaker Clearing Times for Lines

Voltage (kV)	Fault Clearing Times (Cycles)		
	Near End	Far End	2nd Ckt (C5 and C7 only)
138/144	15	24	24
240	12	6	14
500	9	5	11

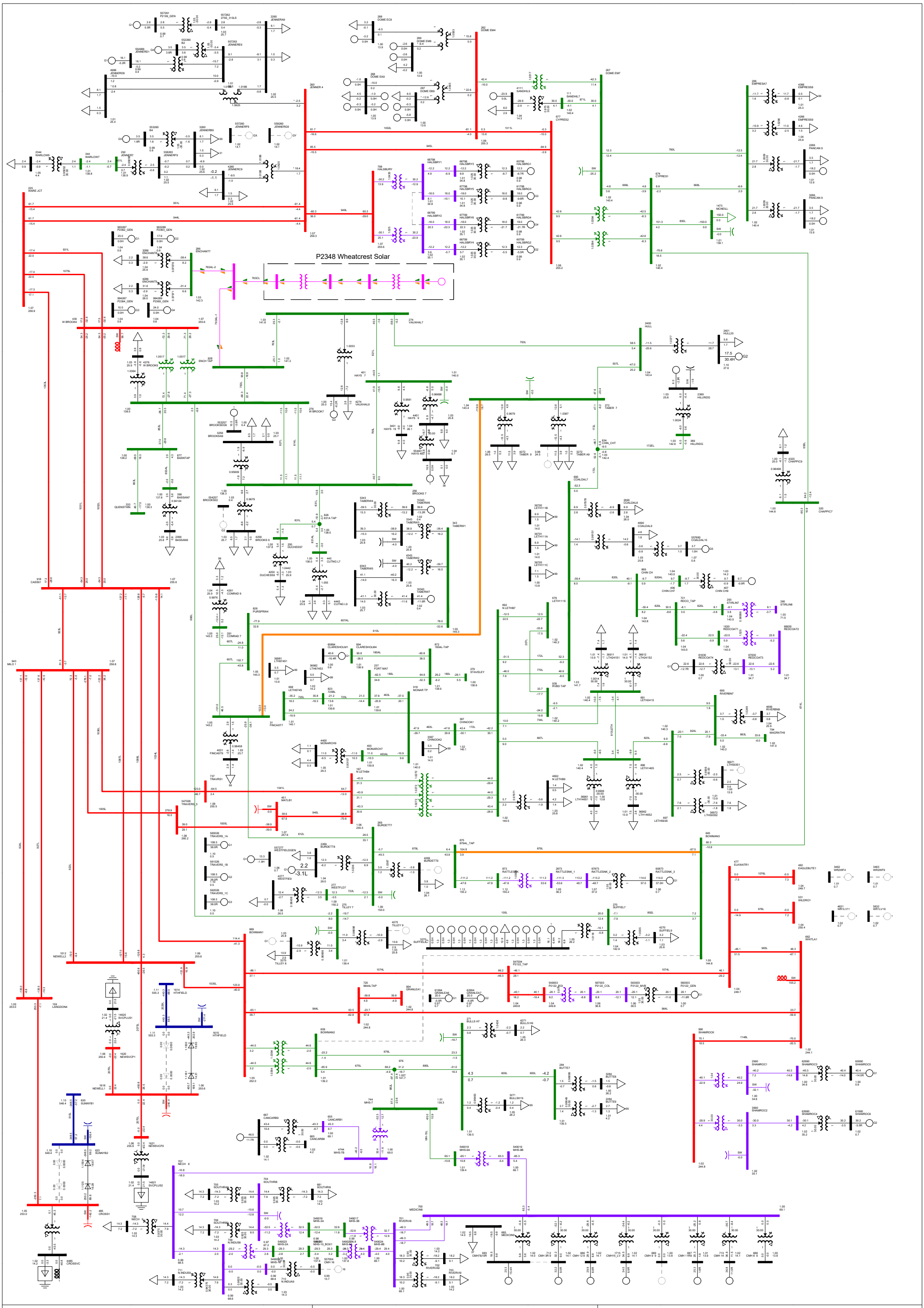
Table 2-5: Stuck Breaker Clearing Times for Transformers

Voltage (kV)	Fault Location	Fault Clearing Times (Cycles)		
		High Side	Low Side	2nd Ckt (breaker fail)
240/138	240 kV side	12	6	14
	138 kV side	5	15	24
500/240	500 kV side	9	5	11
	240 kV side	4	12	14

Attachment A2
Pre-Project Power Flow Diagrams

Table A2: List of 2022 Summer Light Pre-Project Scenario 1 Load Flow Diagrams

Figure	Category	Contingency
A2-SL-Pre-1	A (N-0)	System Normal without N-0 generation curtailment
A2-SL-Pre-2	A (N-0)	System Normal with N-0 generation curtailment
A2-SL-Pre-3	B (N-1)	158S VAUXHALL TRANSFORMER T1 (Hull 257S - Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)
A2-SL-Pre-4	B (N-1)	257S HULL TRANSFORMER T1 (Taber 83S - Hull 257S – Vauxhall 158S)
A2-SL-Pre-5	B (N-1)	336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)
A2-SL-Pre-6	B (N-1)	172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
A2-SL-Pre-7	B (N-1)	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)
A2-SL-Pre-8	B (N-1)	EATL (Heathfield 2029S- Newell 207S)
A2-SL-Pre-9	B (N-1)	612L (Fincastle 336S – Burdett 368S)
A2-SL-Pre-10	B (N-1)	610L (Fincastle 336S – Taber 83S)
A2-SL-Pre-11	B (N-1)	507L (Taber 83S – Hull 257S)
A2-SL-Pre-12	B (N-1)	763L (Vauxhall 158S – Hull 257S)
A2-SL-Pre-13	B (N-1)	MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)
A2-SL-Pre-14	B (N-1)	2075L (Newell 2075S - Newell 2075S)

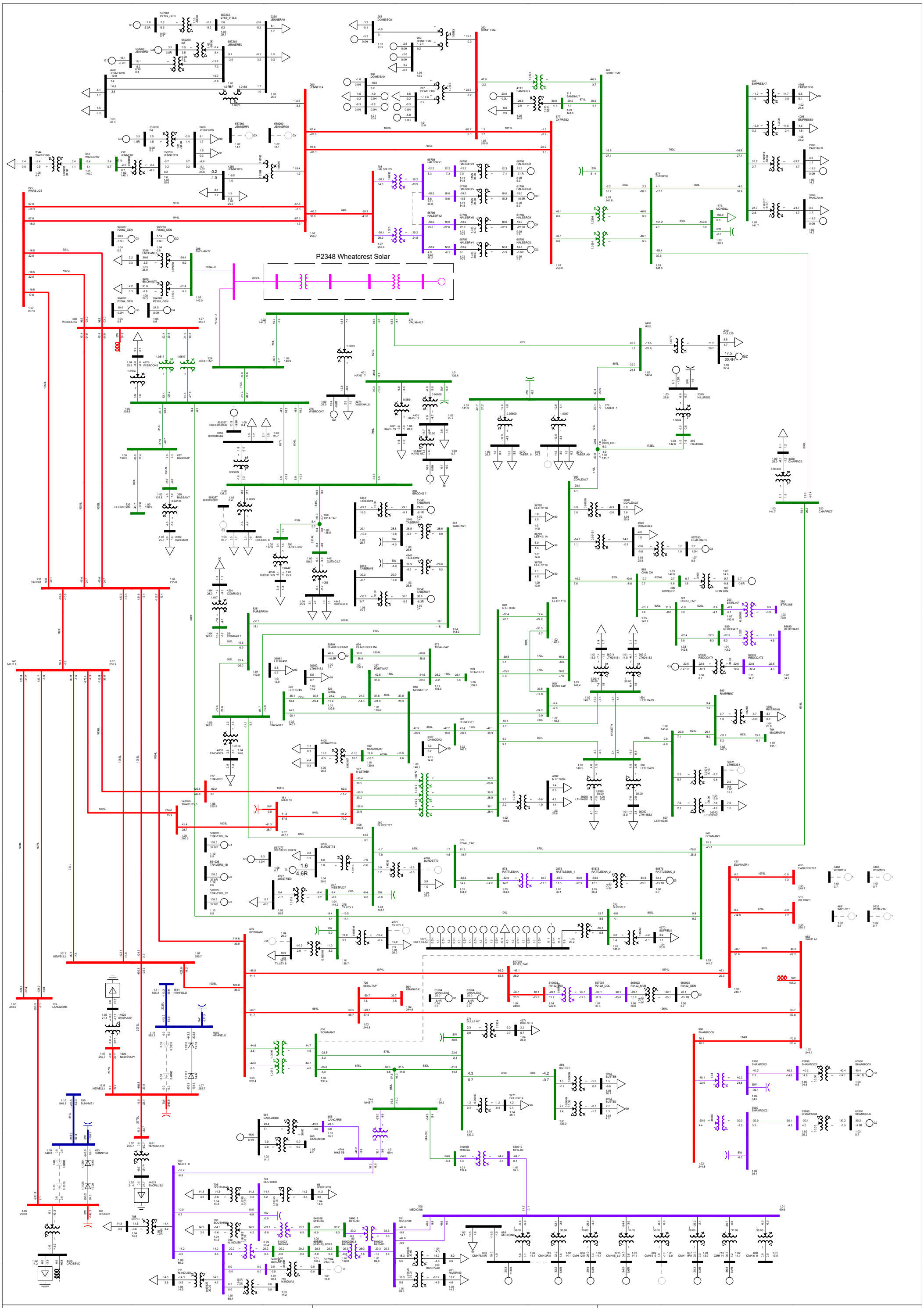


2022SL PRE SC1
N-0, SYSTEM NORMAL WITHOUT N-0 GENERATION CURTAILMENT
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Figure A2-SL-Pre-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

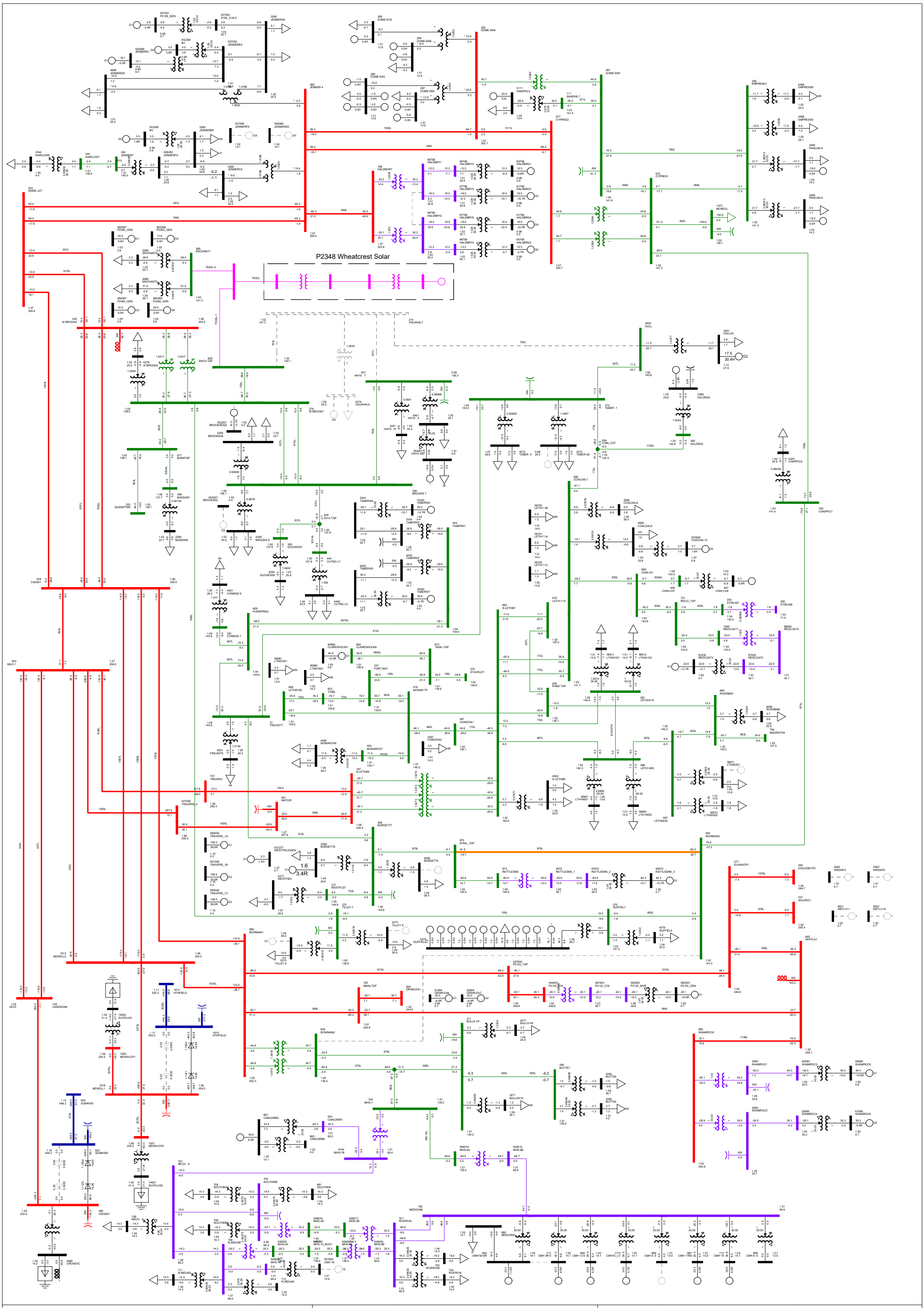


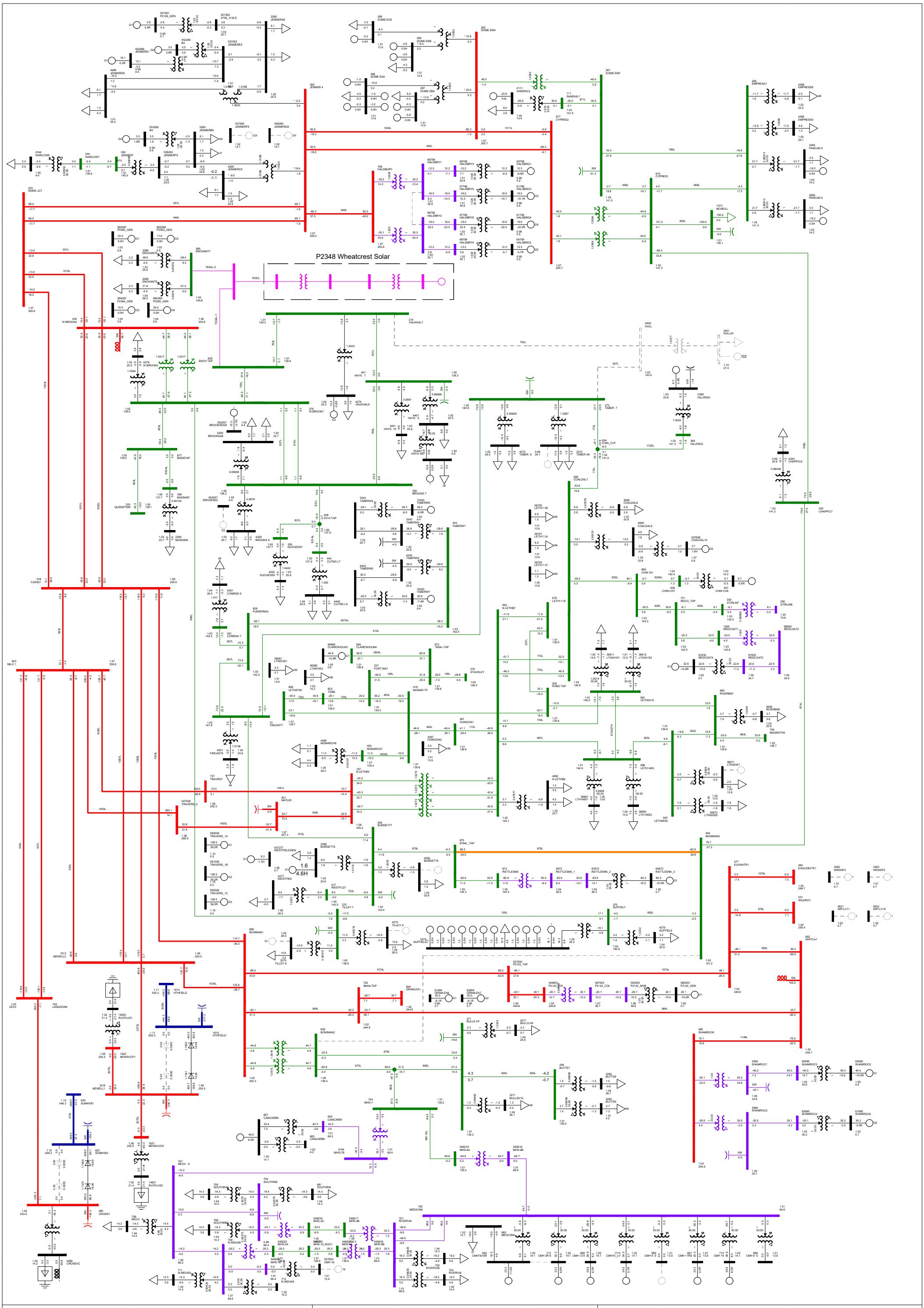
2022SL PRE SC1
N-0, SYSTEM NORMAL WITH GENERATION CURTAILMENT
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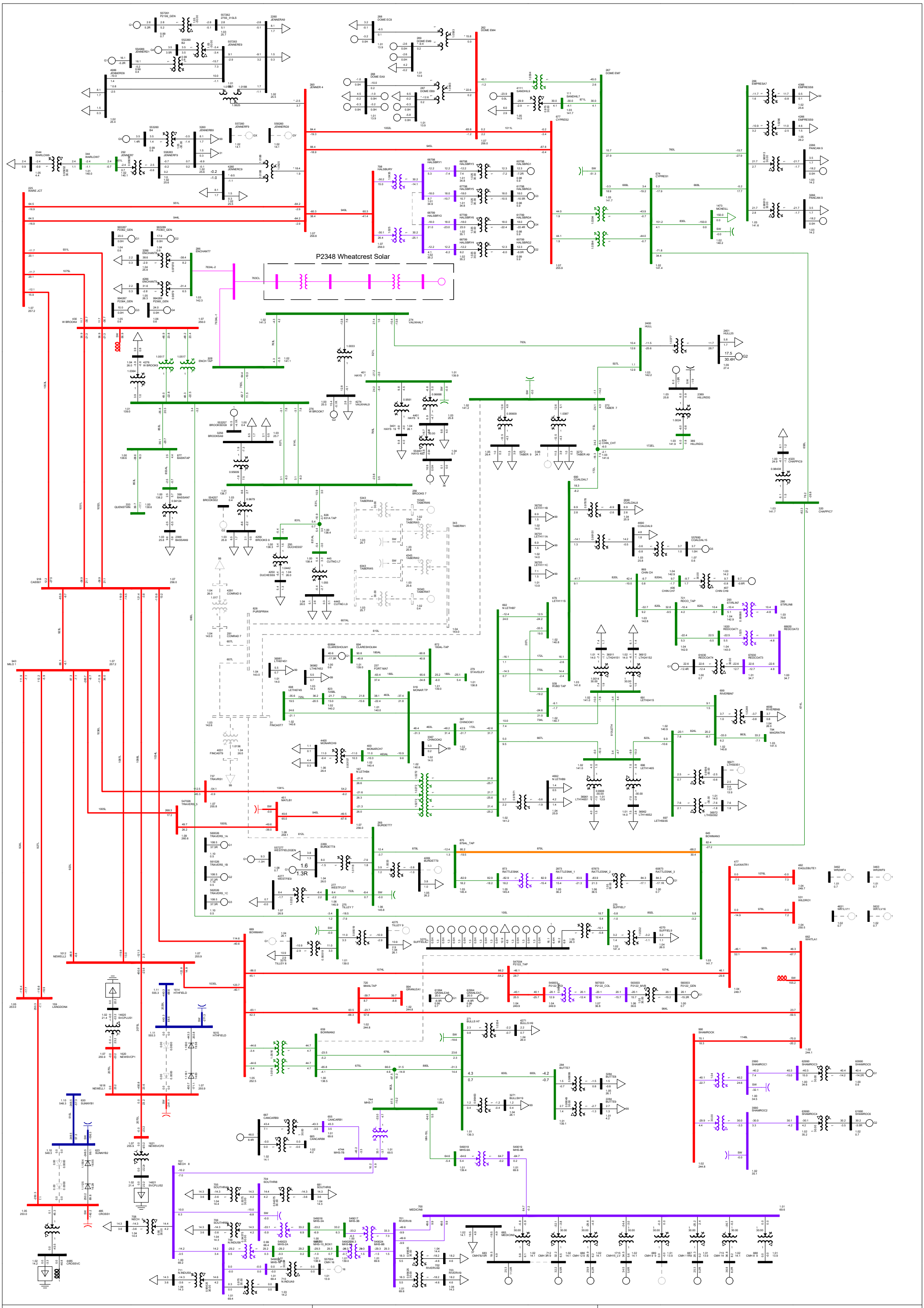
Figure A2-SL-Pre-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


P2348 Wheatcrest Solar
763CL
763AL-2
763AL-1
763L
931L
1075L
1005L
1041L
612L
940L
945L
944L
951L
949L
1002L
1011L
760L
668L
669L
830L
507L
172L
172EL
763L
1053L
1035L
1034L
1039L
1038L
1037L
1036L
924L
927L
923L
934L
935L
936L
933L
932L
931L
928L
926L
925L
696L
674L
610L
607AL
607L
831L
831AL
831A TAP
821L
879L
879AL_TAP
892L
1074L
1148L
978L
983L
964L
1041L
1074L
1035L
1074L
1148L
1074L
1076L
1074L
1074L
1074


P2348 Wheatcrest Solar
763CL
763AL-2
763AL-1
225 WARE JCT
430 W BROOK4
928 ENCH TAP
274 VAUXHAL7
401 HAYS 7
4274 VAUXHAL9
276 W BROOK7
4276 W BROOK9
2400 HULL
2401 HULL25
763L
507L
272 TABER 7
834 CHIN_CHT
2389 HILLRIDG
380 HILLRIDG
4272 TABER 9
3272 TABER A9
690 COALDAL7
2690 COALDAL8
4690 COALDAL9
557690 COALDAL 15
889 CHIN CH
456 CHIN CH7
407 CHIN CH9
679 LETH11S
692 N LETHB7
2470L
939 RVBD TAP
691 LETH241S
699 RIVERBN7
4699 RIVERBN9
794 MAGRATH9
696 LETH146S
697 LETH5935
645 BOWMAN3
877 BASNTAP
399 BASSAN7
2399 BASSAN9
333 QUENSTWN
828 PURSPRW4
4291 CONRAD 9
291 CONRAD 7
607AL
610L
698L
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31 FINCAST7
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547026 TRAVERS_5
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1005L
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951L
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1002L
1011L
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760L
669L
668L
830L
1473 MCNEILL
111 SANDHIL7
4111 SANDHIL9
267 DOME EM7
262 DOME EM4
288 DOME EC9
289 DOME EM9
268 DOME EA9
287 DOME EB9
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798 HALSBURY
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68799 HALSBRY2
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68799 HALSBRY4
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292 JENNER7
2244 WARLOW9
344 WARLOW7
3260 JENNERB9
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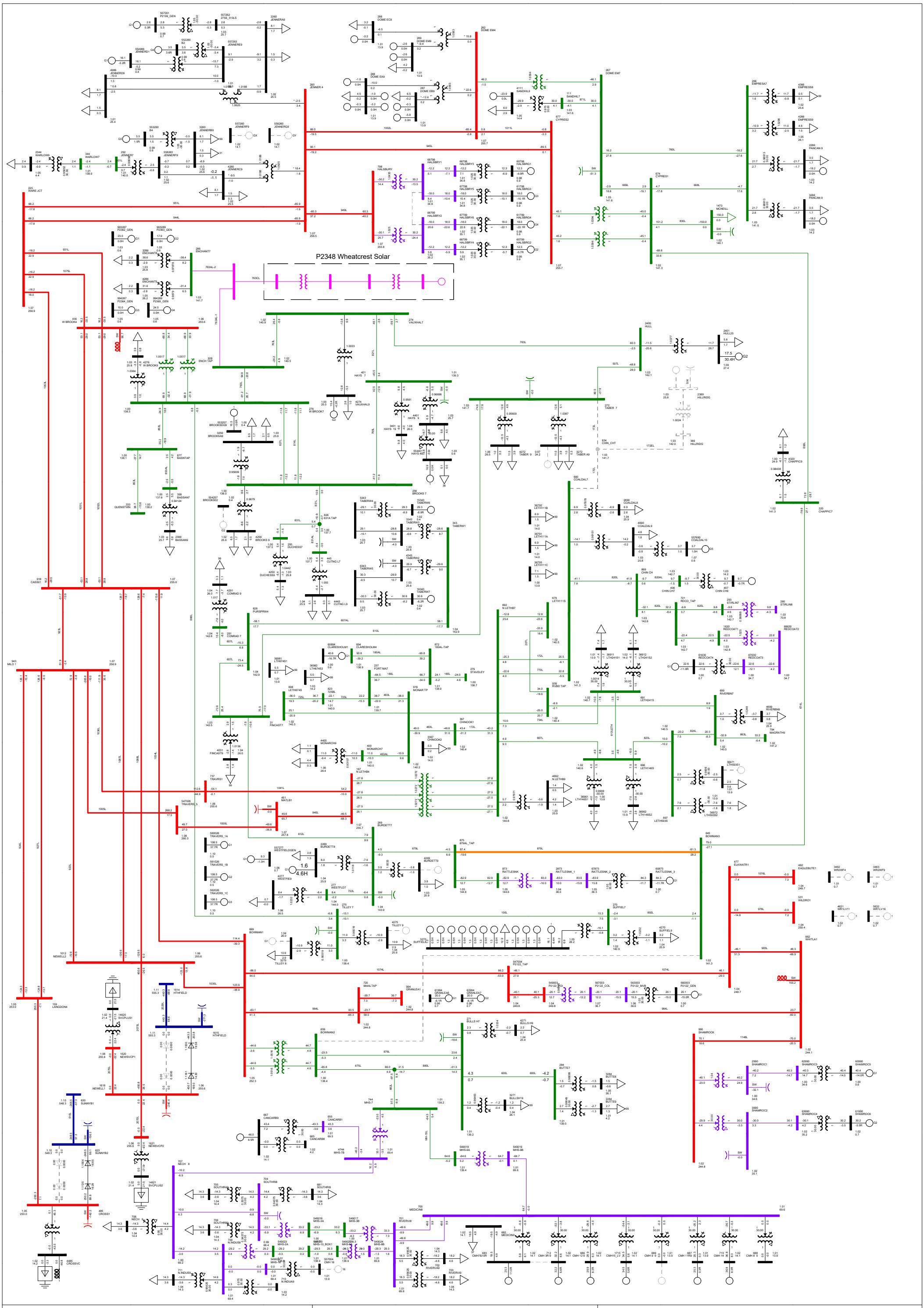


2022SL PRE SC1
336S FINCASTLE TRANSFORMER T1 (TABER 83S - FINCASTLE 336S -
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Figure A2-SL-Pre-5

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

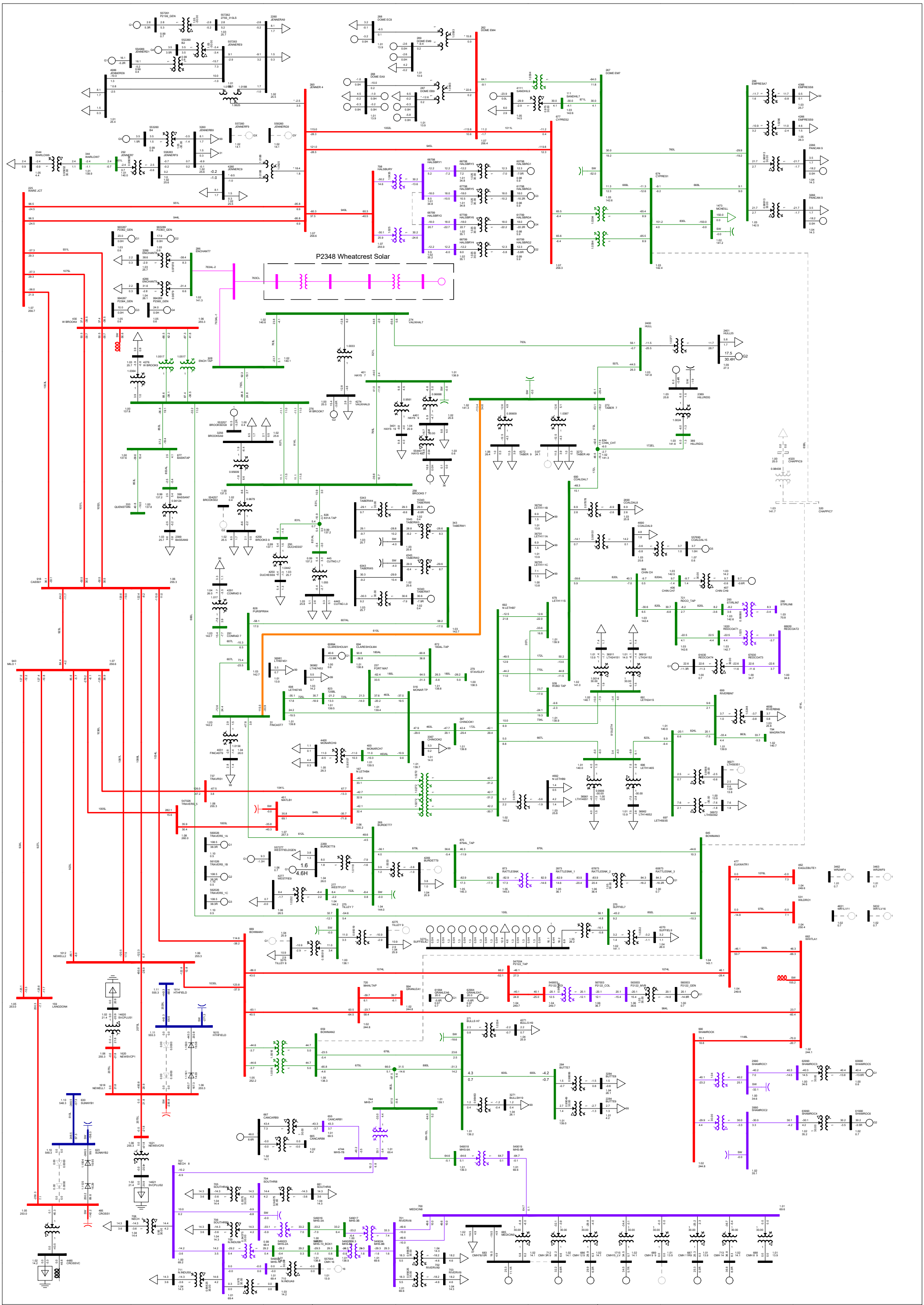


2022SL PRE SC1
172L (CHIN CHUTE 315S - TABER 83S - HILLRIDGE 139S, CHIN CHU
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Figure A2-SL-Pre-6

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

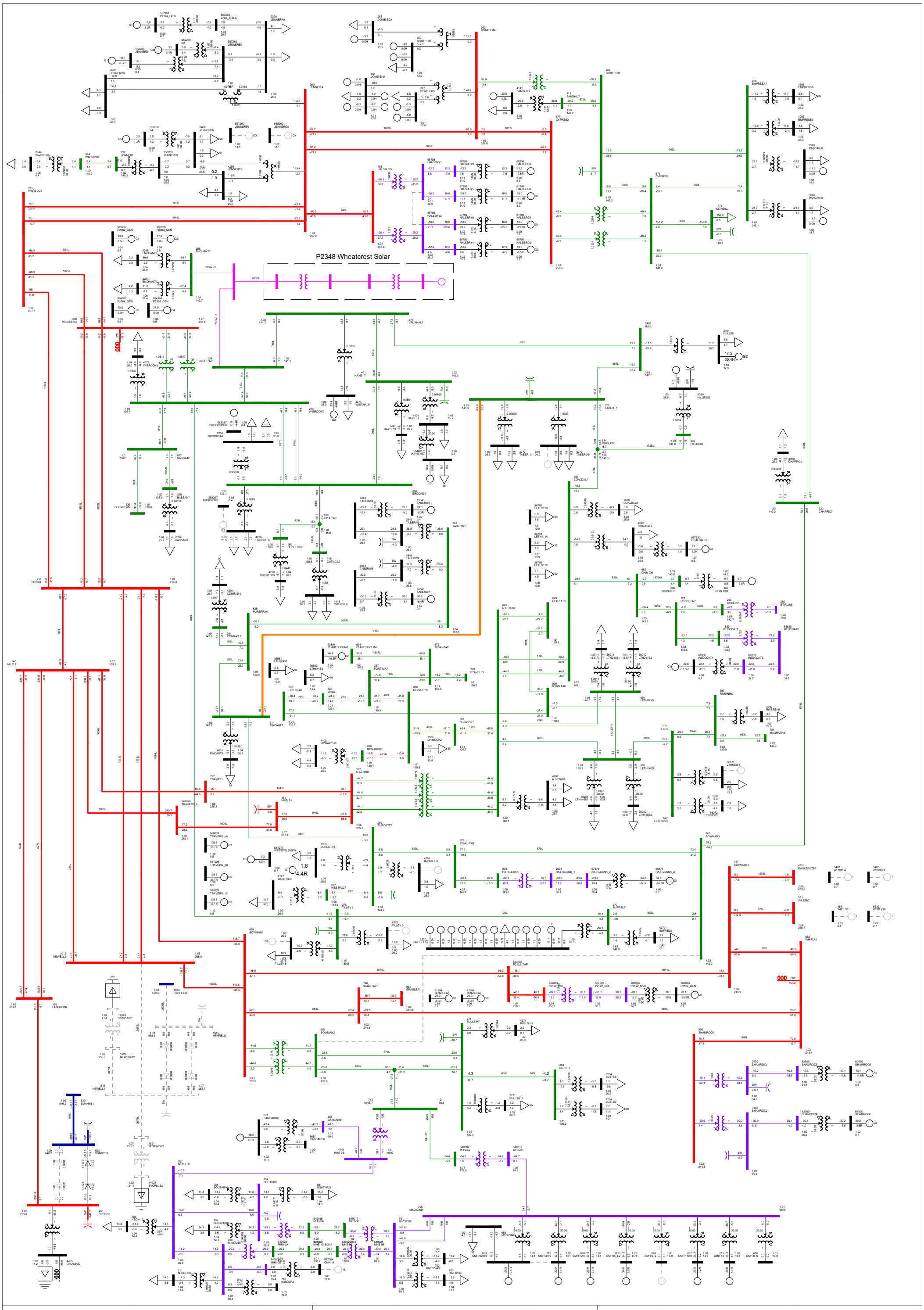


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674L AND 658L (BOWMANTON 244S - CHAPPICE LAKE 649S - CYPRESS
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Figure A2-SL-Pre-7

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

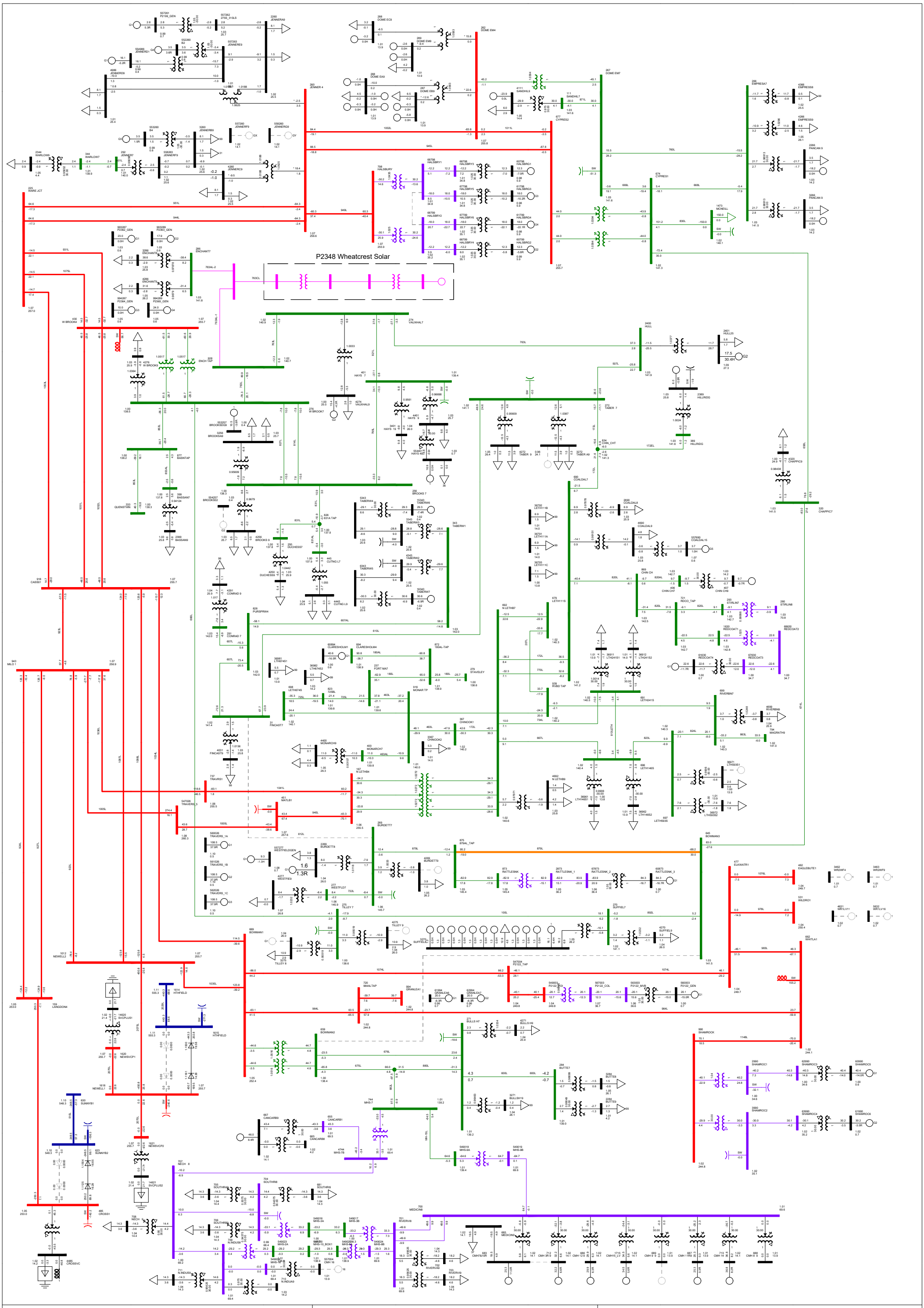


2022SL PRE SC1
EATL (HEATHFIELD 2029S - NEWELL 2075S) CONTINGENCY
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Figure A2-SL-Pre-8

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

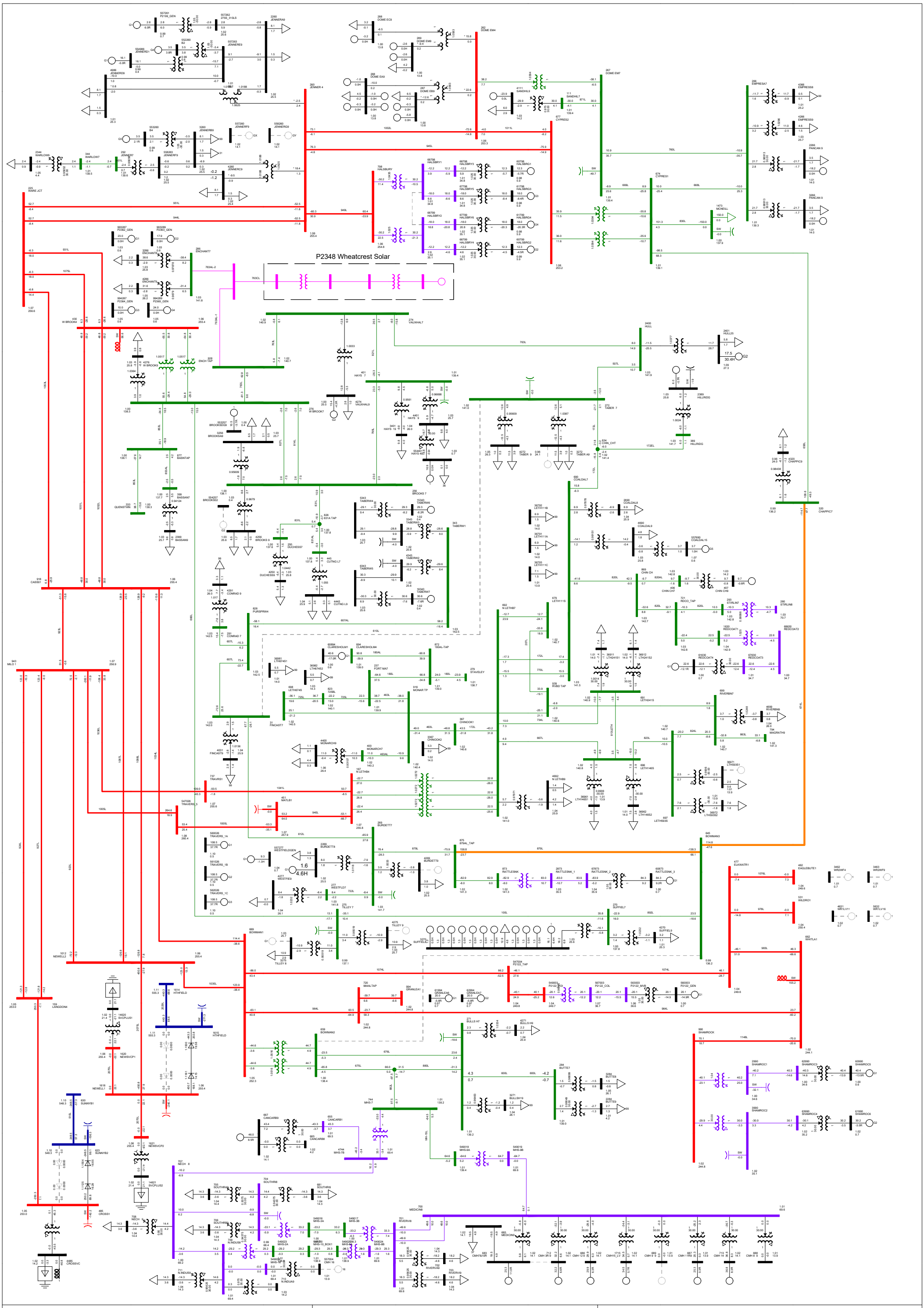


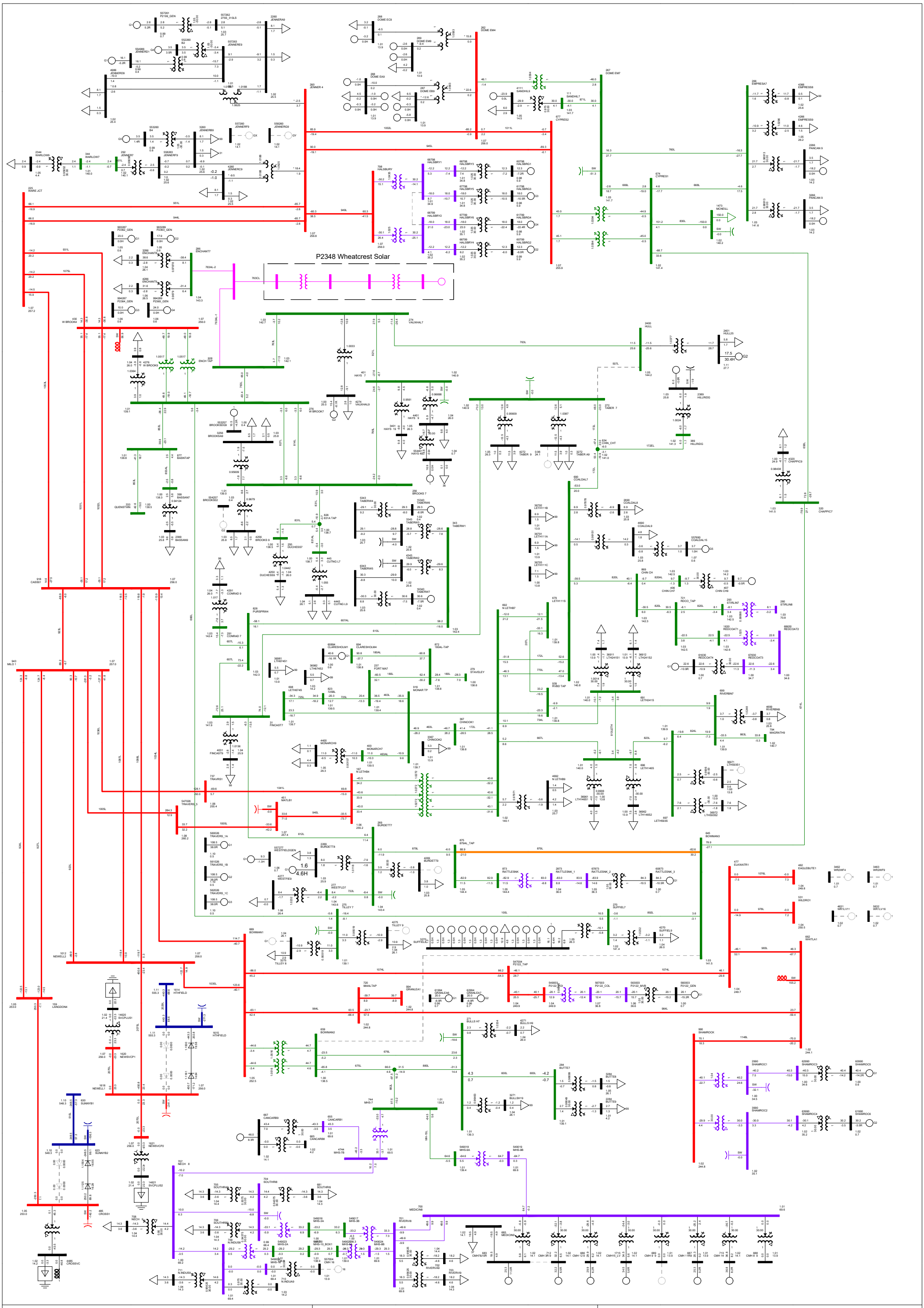
2022SL PRE SC1
612L (FINCASTLE 336S - BURDETT 368S) CONTINGENCY
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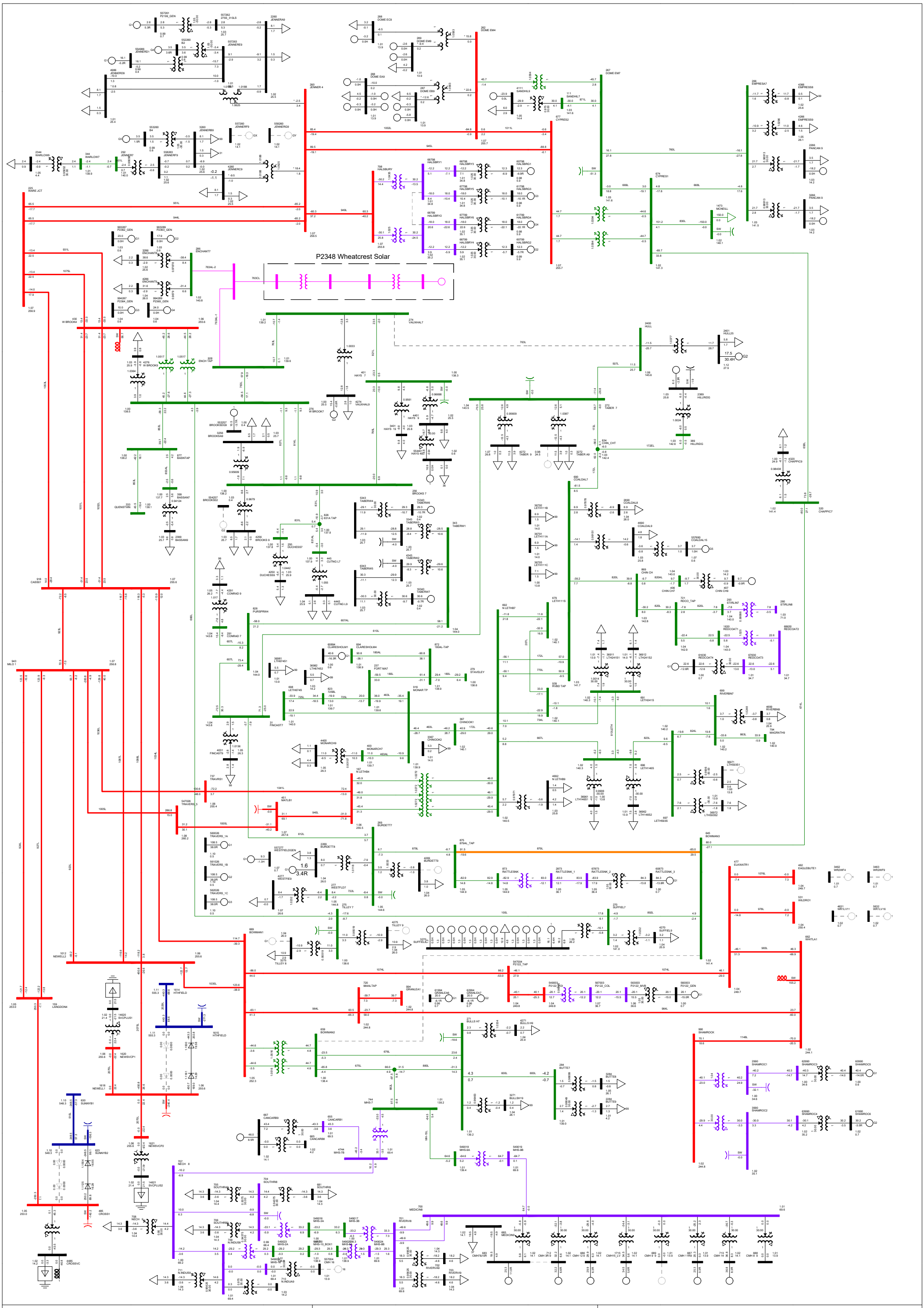
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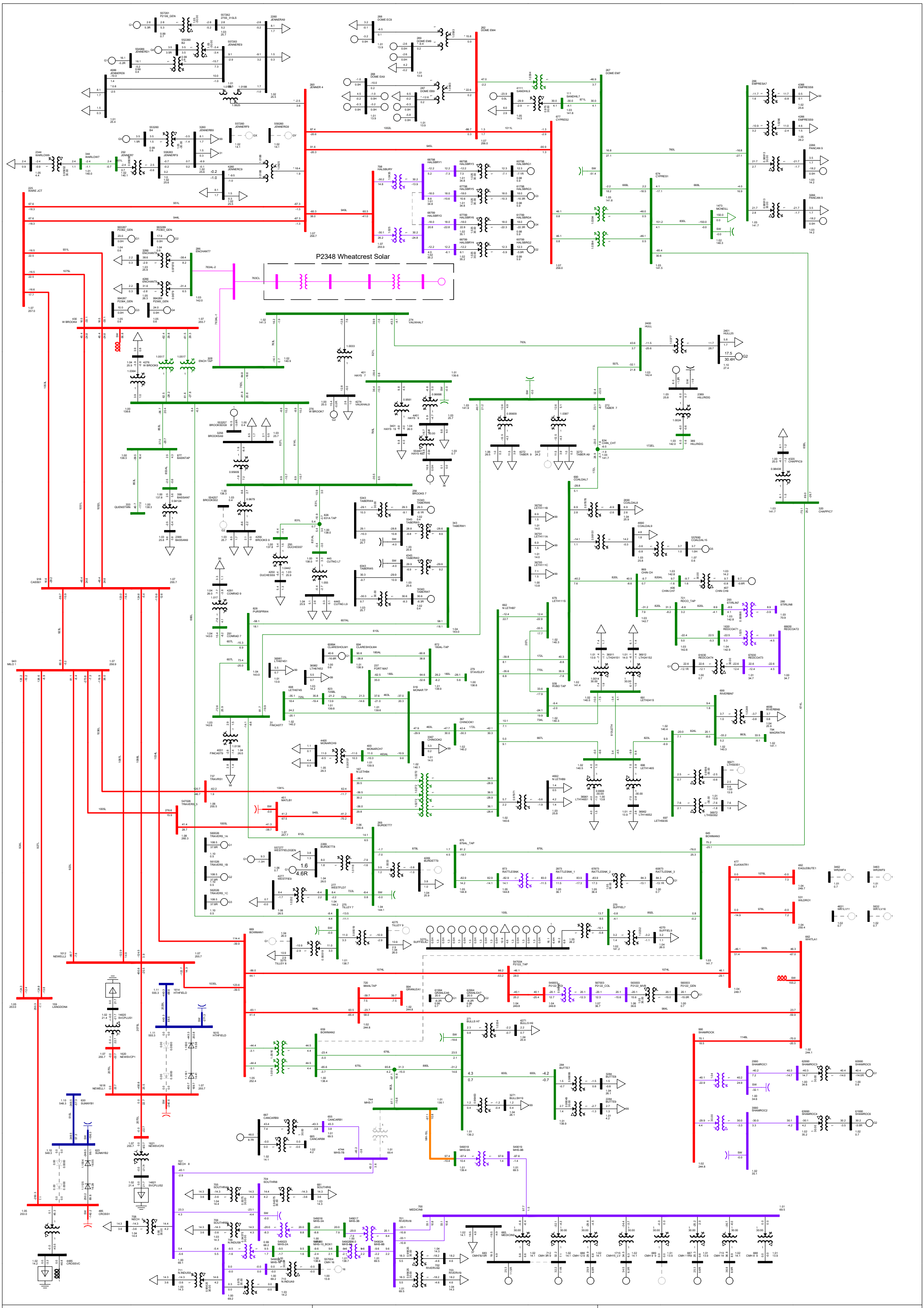
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


P2348 Wheatcrest Solar
763CL
763AL-2
763AL-1
225 WARE JCT
260 JENNER 4
262 DOME EM4
267 DOME EM7
677 CYPRES2
674 CYPRES1
1473 MCNEILL
286 ENCHANT7
928 ENCH TAP
430 W BROOK4
276 W BROOK7
274 VAUXHAL7
401 HAYS 7
4274 VAUXHAL9
2400 HULL
2401 HULL25
272 TABER 7
834 CHIN_CHT
3272 TABER A9
4272 TABER 9
2389 HILLRIDG
380 HILLRIDG
690 COALDAL7
679 LETH111S
692 N LETHB7
939 RVBD TAP
691 LETH241S
699 RIVERBN7
4609 RIVERBN9
794 MAGRATH9
696 LETH146S
697 LETH5935
645 BOWMAN3
477 ELKWATR1
462 EAGLEBUTE1
531 WILDRO1
662 WHITLA1
320 CHAPPIC7
3462 WR2WF4
3463 WR2WF9
4631 WR1LV11
5632 WR1LV16
707 NECH 8
704 SOUTHRI8
705 SOUTHRI5
706 SOUTHRI6
681 SOUTHRI9
708 NECH 6
711 N.INDUS5
710 N.INDUA9
700 MEDICINE
701 RIVERVI8
702 RIVERVA9
703 RIVERVI9
685 MEDICIN9
683 CMHT&10R
712 CMH 36 9
686 CMH 12 9
715 CMHI5_LV
689 CMH 9 9
687 CMH 1 1R9
713 CMH 14 36
688 CMH 8 9
669 BOWMAN1
650 BOWMAN2
271 BULLS H7
4271 BULLS H9
284 BUTTE7
3284 BUTTE8
3271 BULLSH19
2284 BUTTE9
990 SHAMROCK
2990 SHAMROC1
3990 SHAMROC2
62990 SHAMROC3
63990 SHAMROC4
60990 SHAMROC5
61990 SHAMROC6
943 MILO 1
1012 NEWELL2
1618 NEWELL1
1620 NEWSVCP1
1621 NEWSVCP2
14620 SVCPLUS1
14621 SVCPLUS2
1614 HTHFIELD
1615 HTHFIELD
159 LANGDON4
630 SUNNYB1
623 SUNNYB2
485 CROSSVC
4485 CROSSVC
918 CASSIO1
1012 NEWELL2
333 QUENSTWN
399 BASSAN7
2399 BASSAN9
877 BASNTAP
250 DUCHESS7
4250 DUCHESS9
445 CUTNG L7
4445 CUTNG L9
256 BROOKS 7
4256 BROOKS 9
3256 BROOKSA9
5343 TABERW4
5343 TABERW5
4343 TABERW2
343 TABERW1
15343 TABERW6
16343 TABERW7
828 PURSPRW4
291 CONRAD 7
4291 CONRAD 9
4031 FINCAST9
31 FINCAST7
737 TRAVRS1
547026 TRAVERS_5
560026 TRAVERS_1A
561026 TRAVERS_1B
560026 TRAVERS_1C
269 BURDETT7
2269 BURDETT8
4269 BURDETT9
277 WESTFLD7
4277 WESTFIE9
657277 WESTFIELDGEN
1.6
4.6H
275 TILLEY 7
4275 TILLEY 9
3275 TILLEY 8
167 N LETHB4
4692 N LETHB9
36961 LTH146S1
36962 LTH146S2
36971 LTHS935S1
36972 LTHS935S2
451 MATLB1
547004 P2122_TAP
549004 P2122_PUR
567004 P2122_COL
563004 P2122_MVB
560004 P2122_GEN
549003 P2122_SUR
720 994ALTAP
994 GRANLEA1
61994 GRANLEA6
62994 GRANLEA7
875 879AL_TAP
873 RATTLESNK
2873 RATTLESNK_1
67873 RATTLESNK_2
60873 RATTLESNK_3
549016 MHS-3A
549017 MHS-3B
549018 MHS-9A
549019 MHS-9B
549023 MHS-2A
549024 MHS-8B
549020 MHS-10_BOX1
557004 CMH 16
744 MHS-7
4744 MHS-7B
667 CANCARB9
655 CANCARB1
665 CANCARB8
4665 CANCARB7
798 HALBSRY
68798 HALBSRY1
66798 HALBSRY3
60798 HALBSRG1
67798 HALBSRY5
61798 HALBSRG3
68799 HALBSRY2
67799 HALBSRY6
61799 HALBSRG4
66799 HALBSRY4
60799 HALBSRG2
61630 REDCOAT4
67630 REDCOAT3
1630 REDCOAT1
68630 REDCOAT2
721 RDCO_TAP
293 STIRLIN7
280 STIRLIN8
4266 EMPRESS9
4366 EMPRESS8
266 EMPRESA7
2266 PANCAN 9
3266 PANCAN 9
36911 LTH241S1
36912 LTH241S2
36981 LTH674S1
36982 LTH674S2
60894 CLARESHOLM1
894 CLARESHOLM4
180AL-TAP
279 STAVELEY
237 FORT MA7
698 LETH674S
823 729BL
916 MONAR TP
367 CHINOOK1
3367 CHINOOK2
4400 MONARCH9
400 MONARCH7
4031 FINCAST9
36792 LETH111B
36791 LETH111A
36793 LETH111C
4690 COALDAL9
2690 COALDAL8
557690 COALDAL15
4111 SANDHIL9
111 SANDHIL7
871L
1002L
1011L
760L
669L
668L
830L
951L
944L
931L
1075L
1005L
1041L
940L
612L
879L
507L
172EL
172L
100L
892L
1074L
964L
676L
675L
880L
600L
820L
889 CHIN CH
406 CHIN CH7
407 CHIN CH9
1148L
978L
983L
1076L
693L
610L
607AL
607L
945L
949L
1.06 255.4
1.07 256.6
1.06 253.2
1.01 139.4
1.02 140.7
1.03 141.8
1.08 260.4
1.07 257.9
1.07 255.6
1.06 254.8
1.02 244.8
1.05 252.3
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1.02 244.1
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1.01 139.0
1.01 138.7
1.01 139.1
1.01 139.2
1.01 139.4
1.02 140.9
1.02 141.0
1.02 141.3
1.02 141.4
1.02 141.7
1.03 141.9
1.03 142.5
1.03 142.8
1.03 142.9
1.03 143.2
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1.04 250.4
1.04 252.5
1.04 252.7
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1.04 253.3
1.04 253.4
1.04 253.5
1.04 253.6
1.04 253.7
1.04 253.8
1.04 253.9
1.04 254.0
1.04 254.1
1.04 254.2
1.04 254.3
1.04 254.4
1.04 254.5
1.04 254.6
1.04 254.7
1.04 254.8
1.04 254.9
1.04 255.0
1.04 255.1
1.04


P2348 Wheatcrest Solar
763CL
763AL-2
763AL-1
763L
945L
944L
951L
931L
1075L
1005L
1041L
940L
612L
1002L
1011L
760L
668L
669L
830L
824L
823L
507L
172EL
1074L
1148L
983L
978L
1076L
1035L
1041S
1042S
1043S
1044S
1045S
1046S
1047S
1048S
1049S
1050S
1051S
1052S
1053S
1054S
1055S
1056S
1057S
1058S
1059S
1060S
1061S
1062S
1063S
1064S
1065S
1066S
1067S
1068S
1069S
1070S
1071S
1072S
1073S
1074S
1075S
1076S
1077S
1078S
1079S
1080S


P2348 Wheatcrest Solar
763CL
763AL-2
763AL-1
763L
763L
763L



2022SL PRE SC1
MH138-T71 (BRIER PARK MHS-7 - BRIER PARK MHS-7) CONTINGENCY
THU, JUN 30 2022 11:34

Figure A2-SL-Pre-13

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SL PRE SC1
2075L (NEWELL 2075S - NEWELL 2075S) CONTINGENCY
THU, JUN 30 2022 11:34

Figure A2-SL-Pre-14

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A2: List of 2022 Summer Peak Pre-Project Scenario 2 Load Flow Diagrams

Figure	Category	Contingency
A2-SP-Pre-1	A (N-0)	System Normal
A2-SP-Pre-2	B (N-1)	172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
A2-SP-Pre-3	B (N-1)	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)
A2-SP-Pre-4	B (N-1)	100L (Suffield 895S – Tilley 498S)
A2-SP-Pre-5	B (N-1)	EATL (Heathfield 2029S- Newell 207S)
A2-SP-Pre-6	B (N-1)	610L (Fincastle 336S – Taber 83S)
A2-SP-Pre-7	B (N-1)	879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)
A2-SP-Pre-8	B (N-1)	498S TILLEY TRANSFORMER T1 or T2 (West Brooks 28S – Tilley 498S - Suffield 895S)
A2-SP-Pre-9	B (N-1)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
A2-SP-Pre-10	B (N-1)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
A2-SP-Pre-11	B (N-1)	MH138-T63 (Riverview MH69S-6 - MH69S-3B)
A2-SP-Pre-12	B (N-1)	MH138-T34 (South Ridge MH69S-3 - MH69S-3A)
A2-SP-Pre-13	B (N-1)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)
A2-SP-Pre-14	B (N-1)	2075L (Newell 2075S - Newell 2075S)
A2-SP-Pre-15	B (N-1)	MH-20L (MH69S-3A - MH69S-3B)
A2-SP-Pre-16	B (N-1)	1036L (Milo 356S – Travers 554S)

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2022SP PRE SC2
N-0, SYSTEM NORMAL
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Figure A2-SP-Pre-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

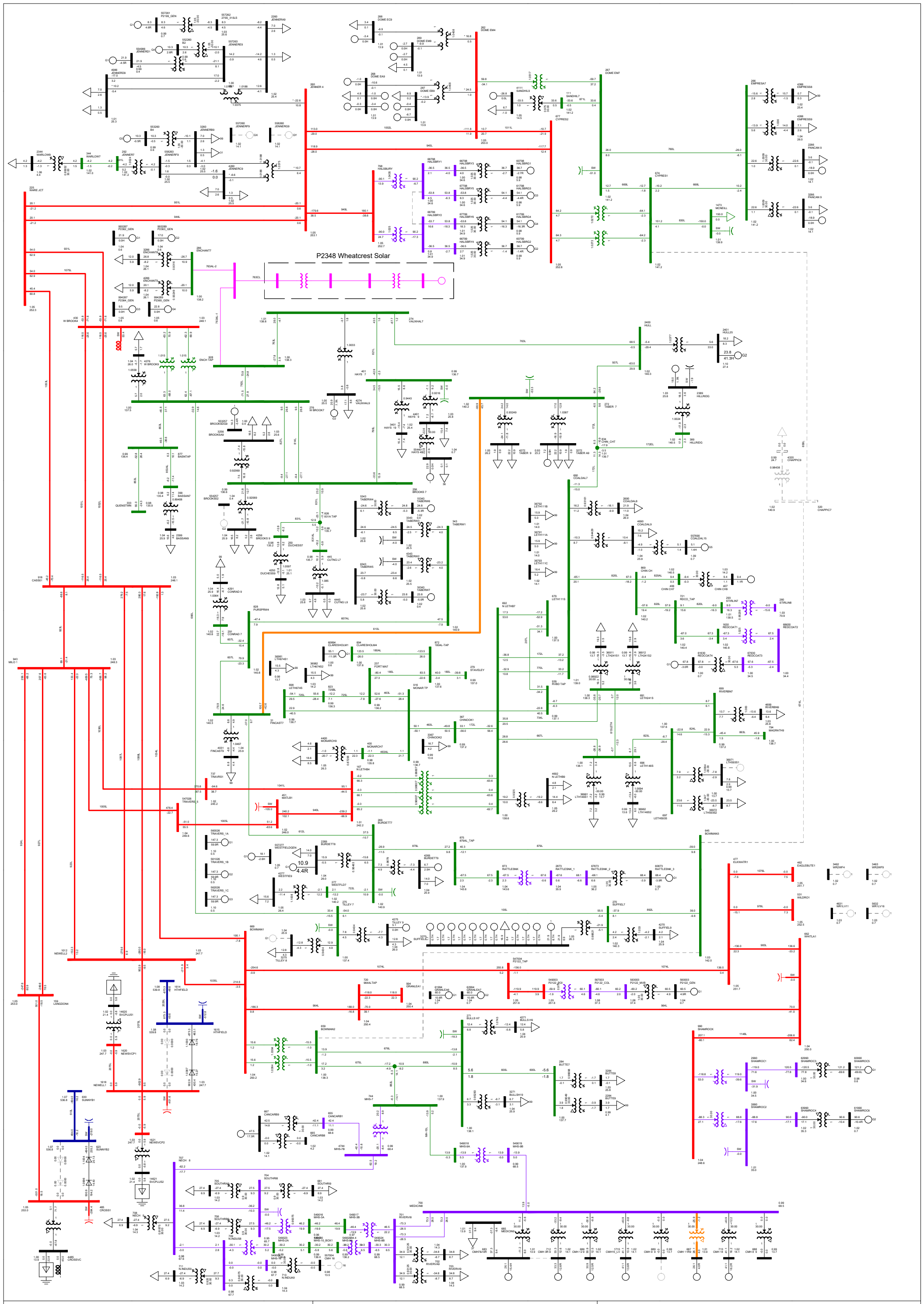
P2348 Wheatcrest Solar

2022SP PRE SC2
172L CHIN CHUTE 315S - TABER 83S - HILLRIDGE 139S, CHIN CHUT
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP PRE SC2
674L AND 658L (BOWMANTON 244S - CHAPPICE LAKE 649S - CYPRESS
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-3

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

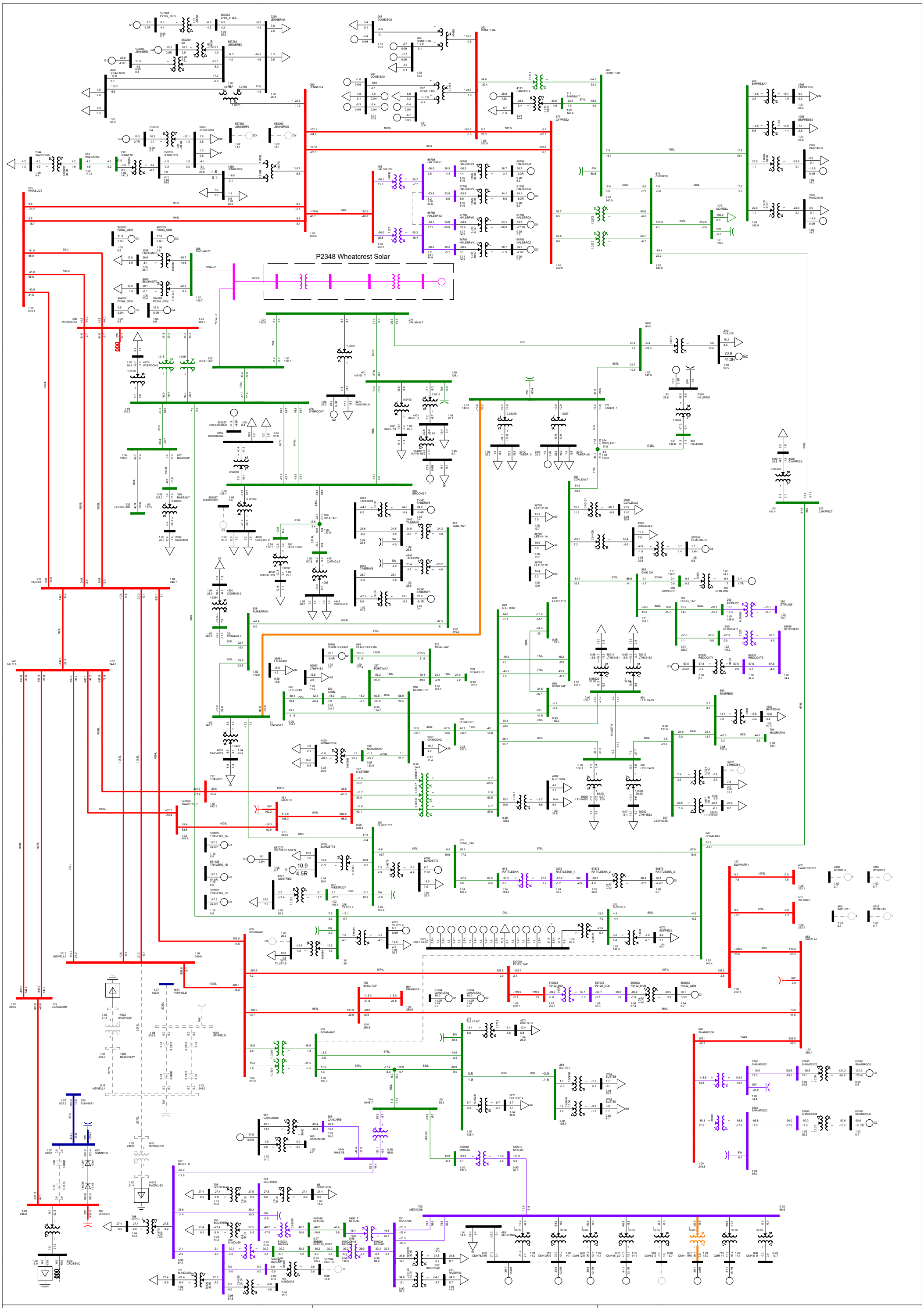
P2348 Wheatcrest Solar

2022SP PRE SC2
100L (SUFFIELD 895S - TILLEY 498S) CONTINGENCY
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-4

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

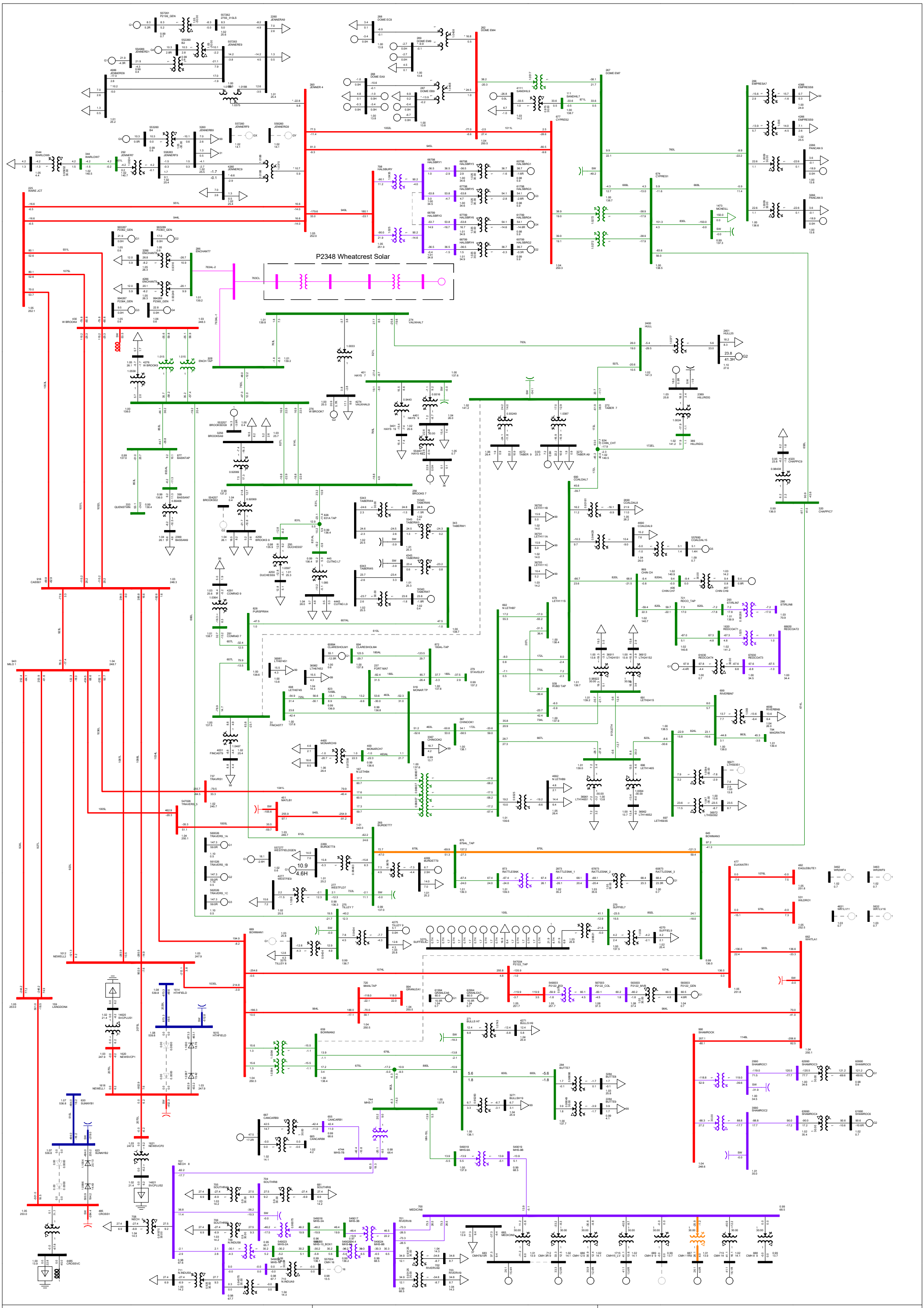


2022SP PRE SC2
EATL (HEATHFIELD 2029S - NEWELL 2075S) CONTINGENCY
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-5

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

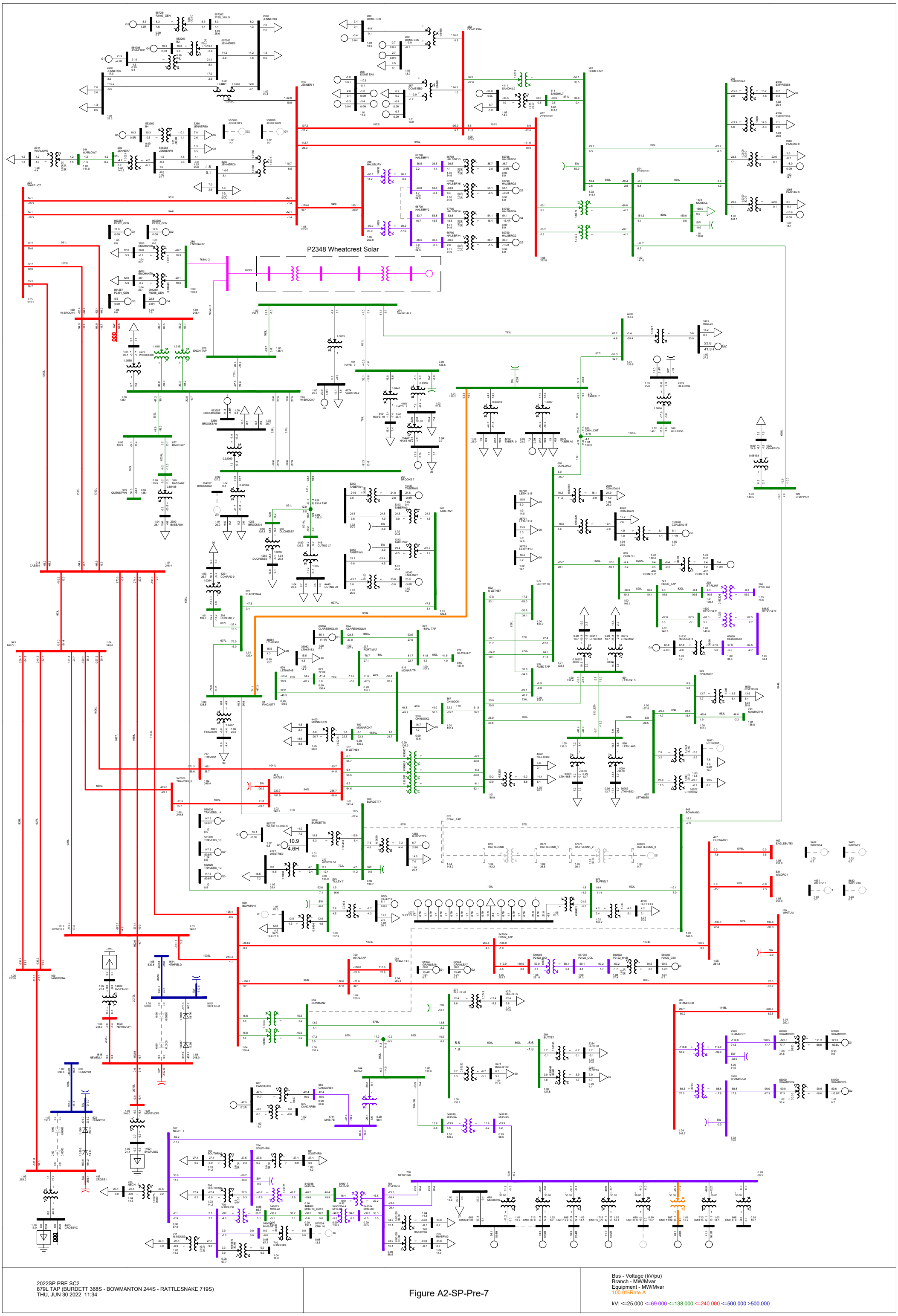


2022SP PRE SC2
610L (FINCASTLE 336S - TABER 83S) CONTINGENCY
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-6

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP PRE SC2
879L TAP (BURDETT 368S - BOWMANTON 244S - RATTLESNAKE 719S)
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-7

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP PRE SC2
498S TILLEY TRANSFORMER T1 OR T2 (WEST BROOKS 28S - TILLEY 4
THU, JUN 30 2022 11:34

Figure A2-SP-Pre-8

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

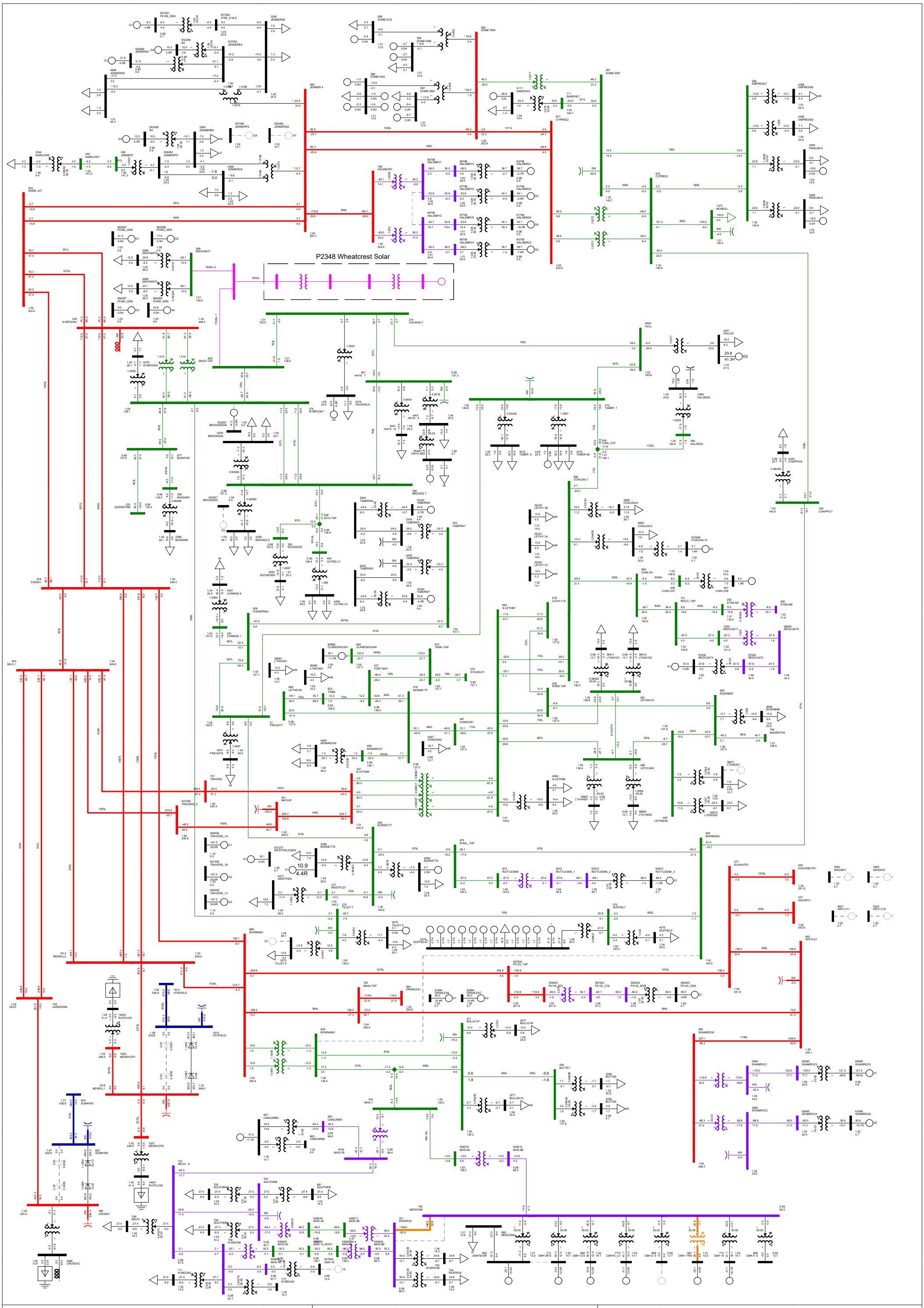
P2348 Wheatcrest Solar

2022SP PRE SC2
MH-4L (POWER PLANT SWITCHYARD MH69S-1 - RIVERVIEW MH69S-6) C
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-9

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

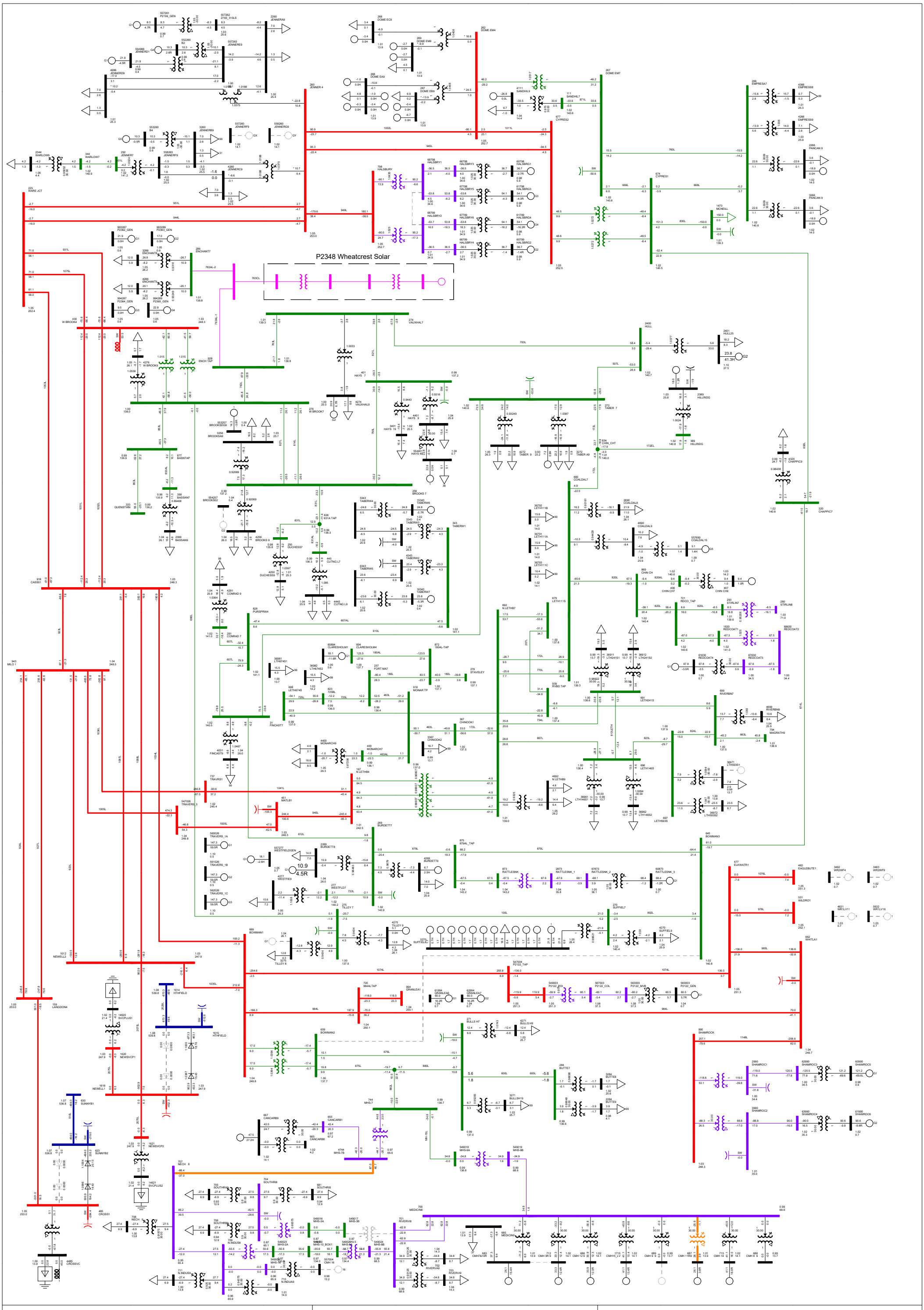


2022SP PRE SC2
MH-8L (POWER PLANT SWITCHYARD MH69S-1 - RIVERVIEW MH69S-6) C
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-10

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP PRE SC2
MH138-T63 (RIVERVIEW MH69S-6 - MH69S-3B) CONTINGENCY
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-11

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

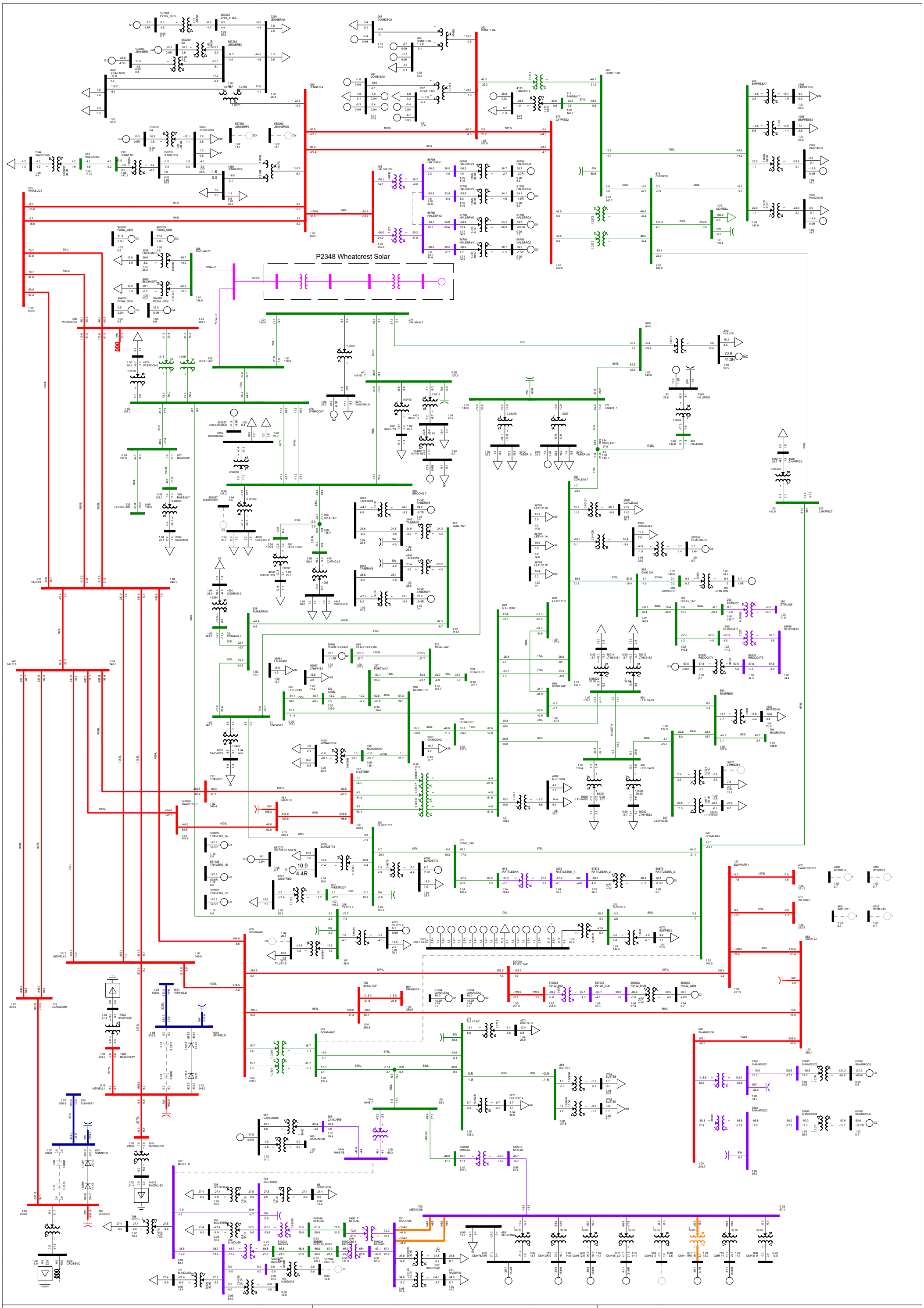
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2022SP PRE SC2
MH138-T34 (SOUTH RIDGE MH69S-3 - MH69S-3A) CONTINGENCY
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

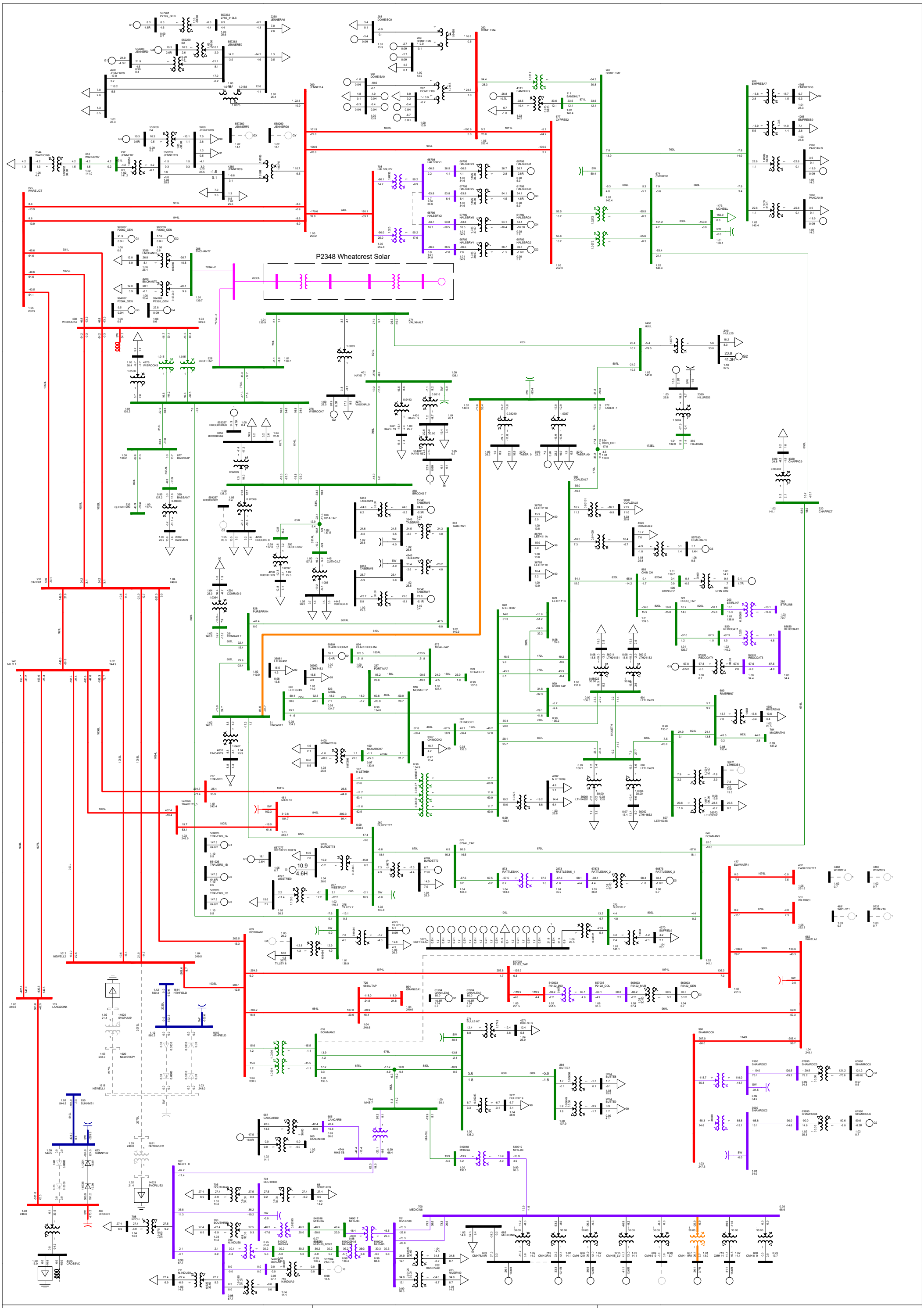


2022SP PRE SC2
MH-60L (NORTH EAST CRESCENT HEIGHTS MH69S - BRIER PARK MHS-7
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-13

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP PRE SC2
2075L (NEWELL 2075S - NEWELL 2075S) CONTINGENCY
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-14

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP PRE SC2
MH-20L (MH69S-3A - MH69S-3B) CONTINGENCY
THU, JUN 30 2022 11:35

Figure A2-SP-Pre-15

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP PRE SC2
1036L (MILO 356S - TRAVERS 554S) CONTINGENCY
THU, JUN 30 2022 11:35

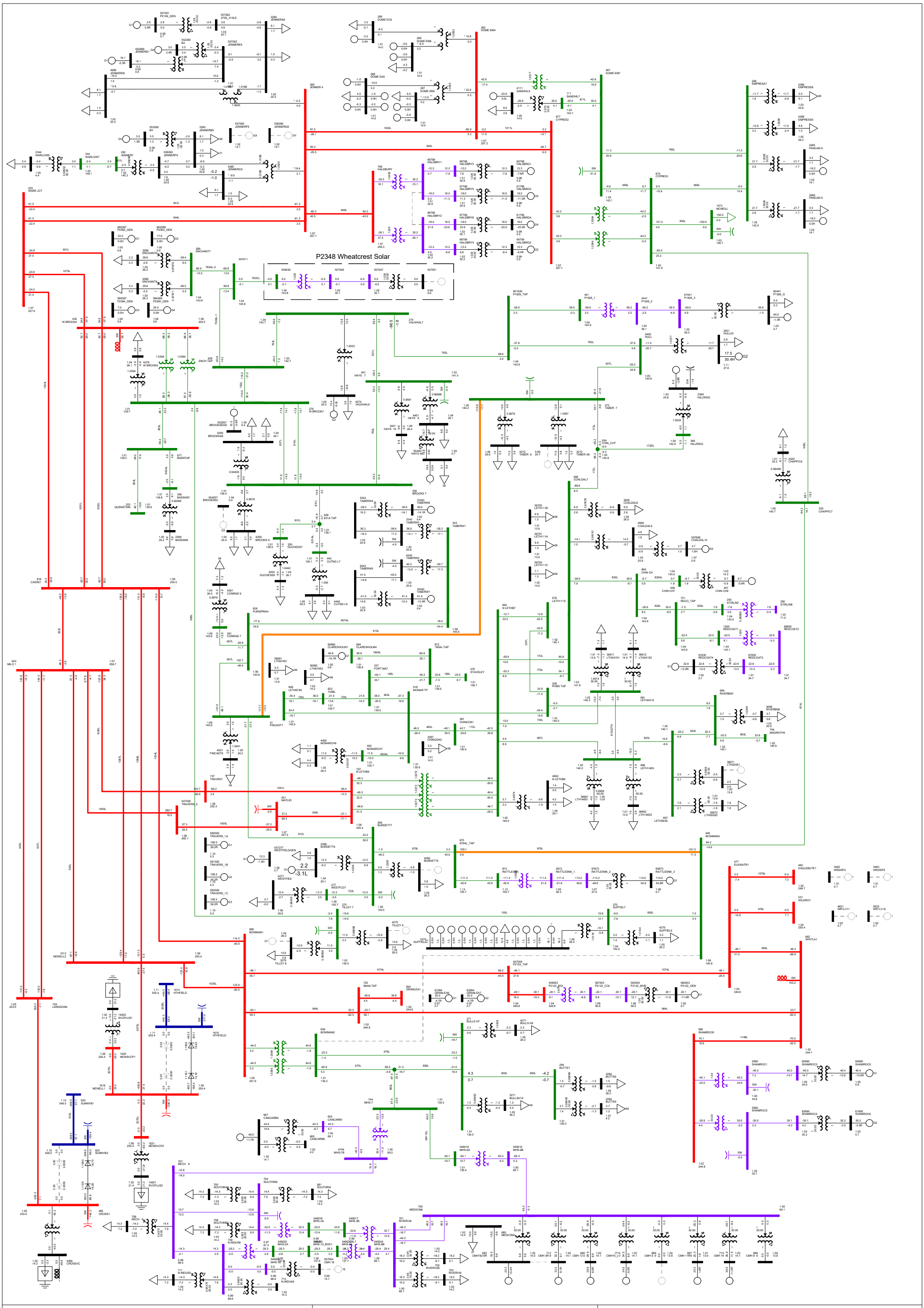
Figure A2-SP-Pre-16

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A3: List of 2022 Summer Light Pre-Sensitivity Project Scenario 6 Load Flow Diagrams

Figure	Category	Contingency
A3-SL-Pre-Sensitivity-1	A (N-0)	System Normal with Project at 50 MW



2022SL PRE SENSITIVITY SC6
N-0, SYSTEM NORMAL
FRI, JUN 10 2022 12:33

Figure A3-SL-Pre-Sensitivity-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A3: List of 2022 Summer Peak Pre-Sensitivity Project Scenario 7 Load Flow Diagrams

Figure	Category	Contingency
A3-SP-Pre-Sensitivity-1	A (N-0)	System Normal with Project at 50 MW

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2022SP PRE SENSITIVITY SC7
N-0, SYSTEM NORMAL
FRI, JUN 10 2022 12:33

Figure A3-SP-Pre-Sensitivity-1

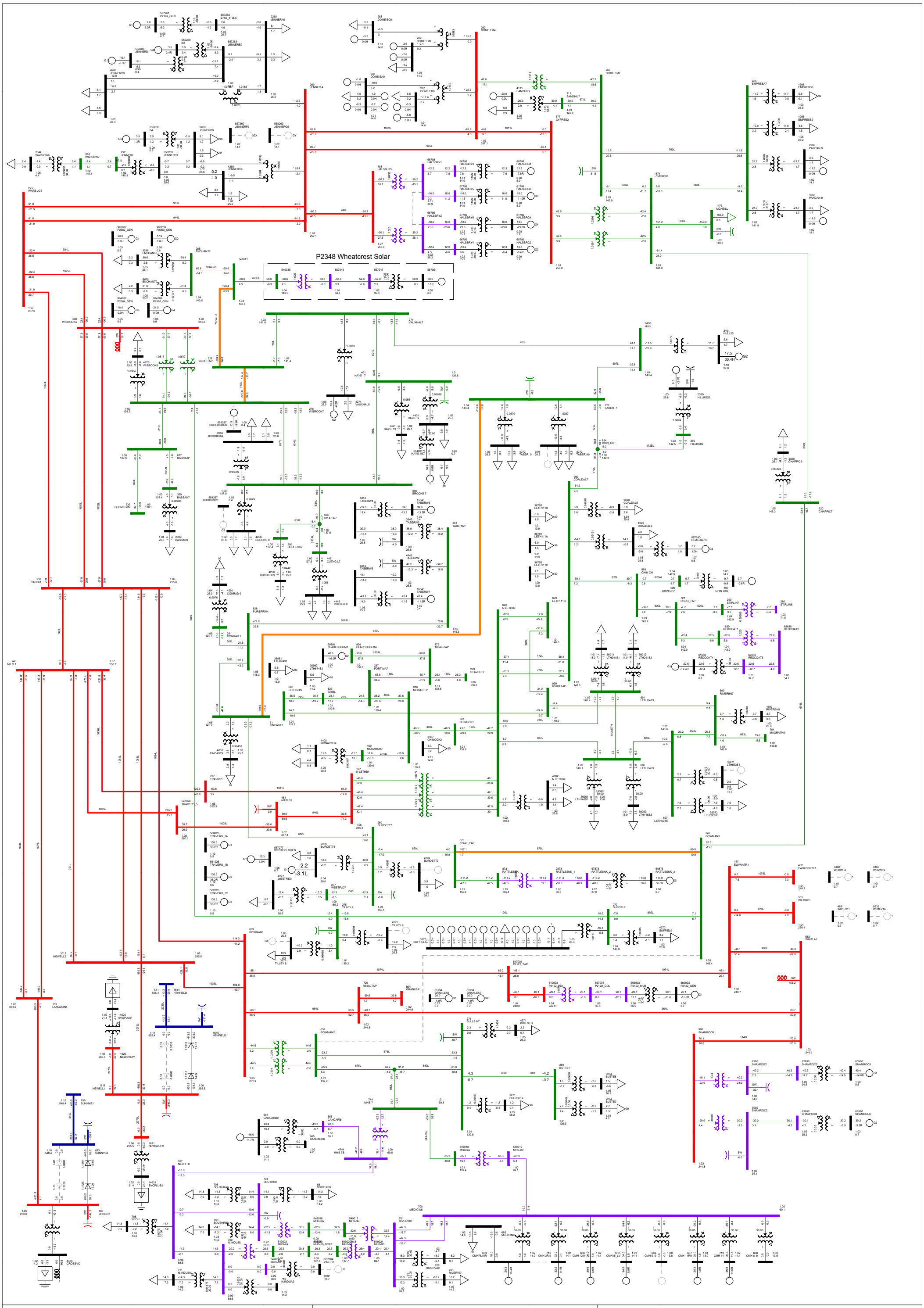
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A3
Post-Project Power Flow Diagrams

Table A3: List of 2022 Summer Light Post-Project Scenario 3 Load Flow Diagrams

Figure	Category	Contingency
A3-SL-Post-1	A (N-0)	System Normal with Project at 60 MW without N-0 generation curtailment
A3-SL-Post-2	A (N-0)	System Normal with Project at 60 MW with N-0 generation curtailment
A3-SL-Post-3	A (N-0)	System Normal with Project at 50 MW without N-0 generation curtailment
A3-SL-Post-4	B (N-1)	158S VAUXHALL TRANSFORMER T1 (Hull 257S - Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)
A3-SL-Post-5	B (N-1)	257S HULL TRANSFORMER T1 (Taber 83S - Hull 257S – Vauxhall 158S)
A3-SL-Post-6	B (N-1)	421S HAYS TRANSFORMER T2 (Hays 421S - Vauxhall 158S – West Brooks 28S)
A3-SL-Post-7	B (N-1)	336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)
A3-SL-Post-8	B (N-1)	172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
A3-SL-Post-9	B (N-1)	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)
A3-SL-Post-10	B (N-1)	121S BROOKS TRANSFORMER T2 (Brooks 121S - West Brooks 28S - Hays 421S)
A3-SL-Post-11	B (N-1)	795L (Brooks 121S - Hays 421S)
A3-SL-Post-12	B (N-1)	612L (Fincastle 336S – Burdett 368S)
A3-SL-Post-13	B (N-1)	610L (Fincastle 336S – Taber 83S)
A3-SL-Post-14	B (N-1)	507L (Taber 83S – Hull 257S)
A3-SL-Post-15	B (N-1)	821L (Vauxhall 158S – Hays 421S)
A3-SL-Post-16	B (N-1)	763L (Vauxhall 158S – Hull 257S)
A3-SL-Post-17	B (N-1)	MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)
A3-SL-Post-18	B (N-1)	1005L (Travers 554S - Travers 554S)
A3-SL-Post-19	B (N-1)	895S SUFFIELD TRANSFORMER T2 (Suffield 895S- Tilley 498S - Bowmanton 244S)
A3-SL-Post-20	B (N-1)	100L (Suffield 895S - Tilley 498S)
A3-SL-Post-21	B (N-1)	1034L (Bowmanton 244S - Cassils 324S)
A3-SL-Post-22	B (N-1)	935L (Cassils 324S - Milo 356S)
A3-SL-Post-23	B (N-1)	923L (Milo 356S - Newell 2075S)
A3-SL-Post-24	B (N-1)	1035L (Bowmanton 244S - Newell 2075S)
A3-SL-Post-25	B (N-1)	163S AMOCO EMPRESS TRANSFORMER T1 OR T5 (Amoco Empress 163S - Empress 394S, Cypress 562S - Amoco Empress 163S - Empress Liquid Tap 164S, Sandy point 204S - Amoco Empress 163S – Sandhills 341S)
A3-SL-Post-26	B (N-1)	28S WEST BROOKS TRANSFORMER 28ST1A (West Brooks 28S - West Brooks 28S)
A3-SL-Post-27	B (N-1)	28S WEST BROOKS TRANSFORMER 28ST2A (West Brooks 28S - West Brooks 28S)
A3-SL-Post-28	B (N-1)	1036L (Milo 356S – Travers 554S)



2022SL POST SC3
N-0, SYSTEM NORMAL AT 60 MW WITHOUT N-0 GENERATION CURTAILM
THU, JUN 30 2022 10:53

Figure A3-SL-Post-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SL POST SC3
N-0, SYSTEM NORMAL AT 60 MW WITH N-0 GENERATION CURTAILMENT
THU, JUN 30 2022 11:05

Figure A3-SL-Post-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

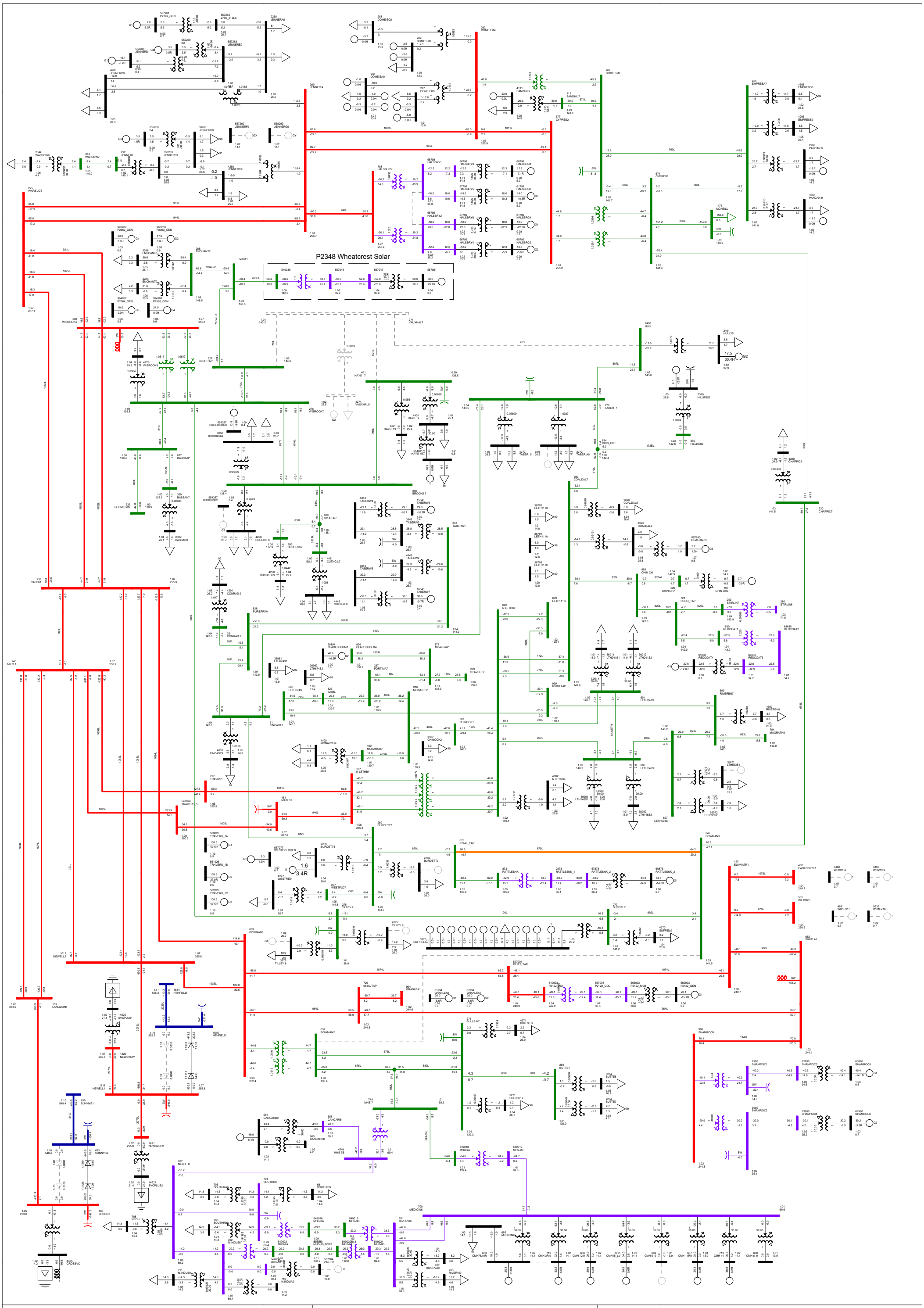
P2348 Wheatcrest Solar

2022SL POST SC3
N-0, SYSTEM NORMAL AT 50 MW NO CURTAILMENT & 763AL RESTORED
THU, JUN 30 2022 11:12

Figure A3-SL-Post-3

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

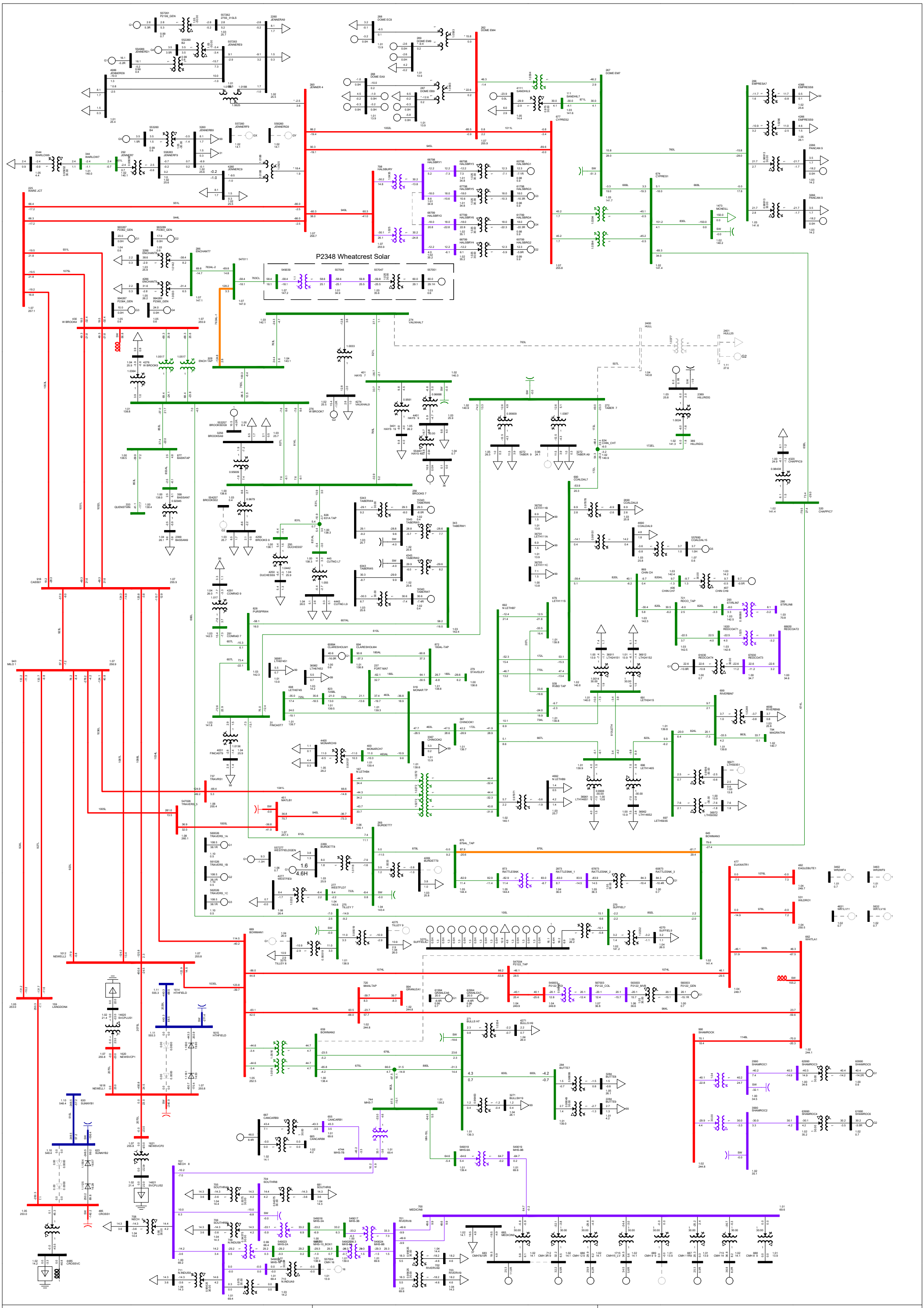


2022SL POST SC3
158S VAUXHALL TRANSFORMER T1 HULL 257S - VAUXHALL 158S - HAY
THU, JUN 30 2022 11:35

Figure A3-SL-Post-4

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
257S HULL TRANSFORMER T1 (TABER 83S - HULL 257S - VAUXHALL 1
THU, JUN 30 2022 11:36

Figure A3-SL-Post-5

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

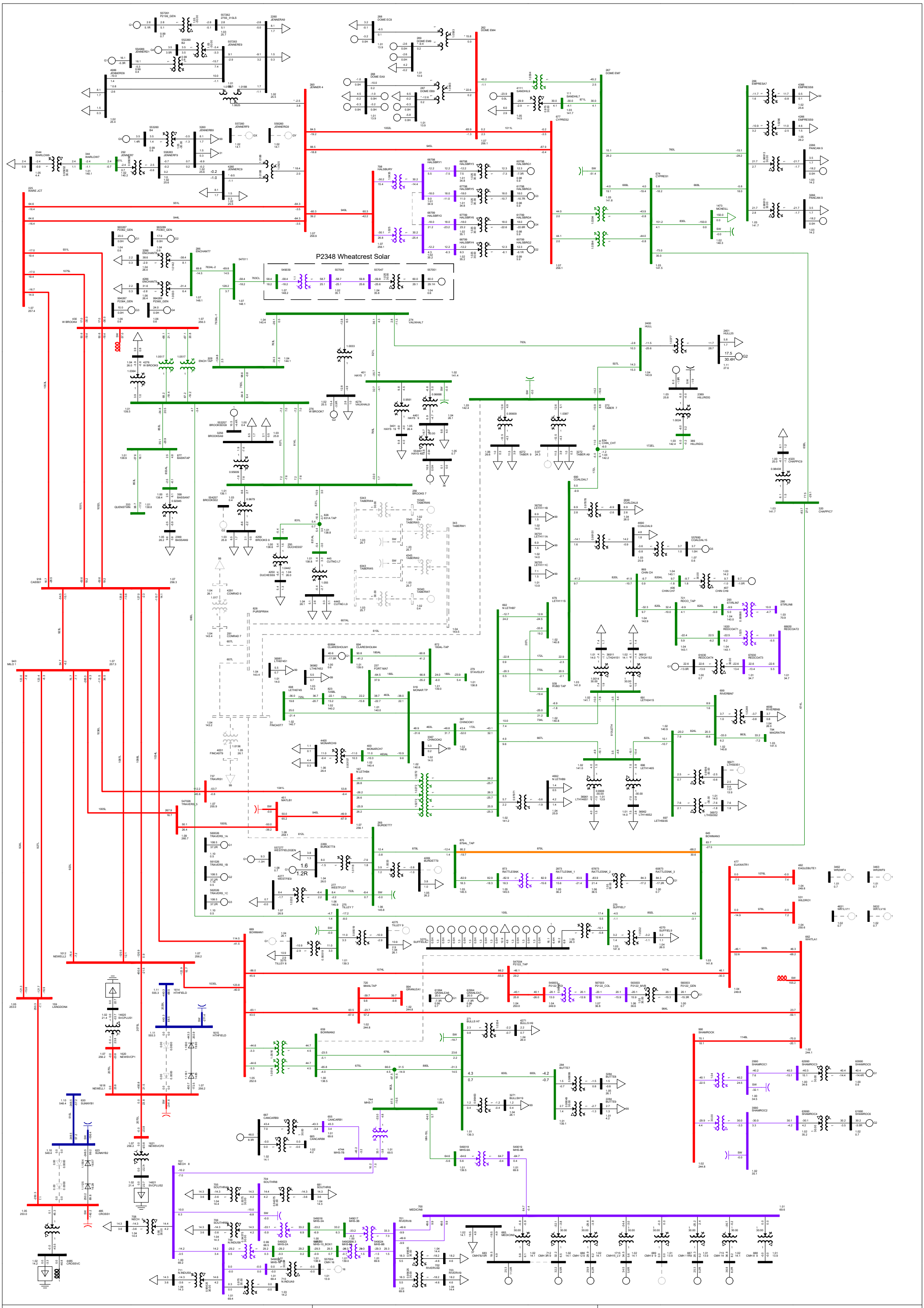
P2348 Wheatcrest Solar

2022SL POST SC3
421S HAYS TRANSFORMER T2 (HAYS 421S - VAUXHALL 158S - WEST B
THU, JUN 30 2022 11:36

Figure A3-SL-Post-6

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

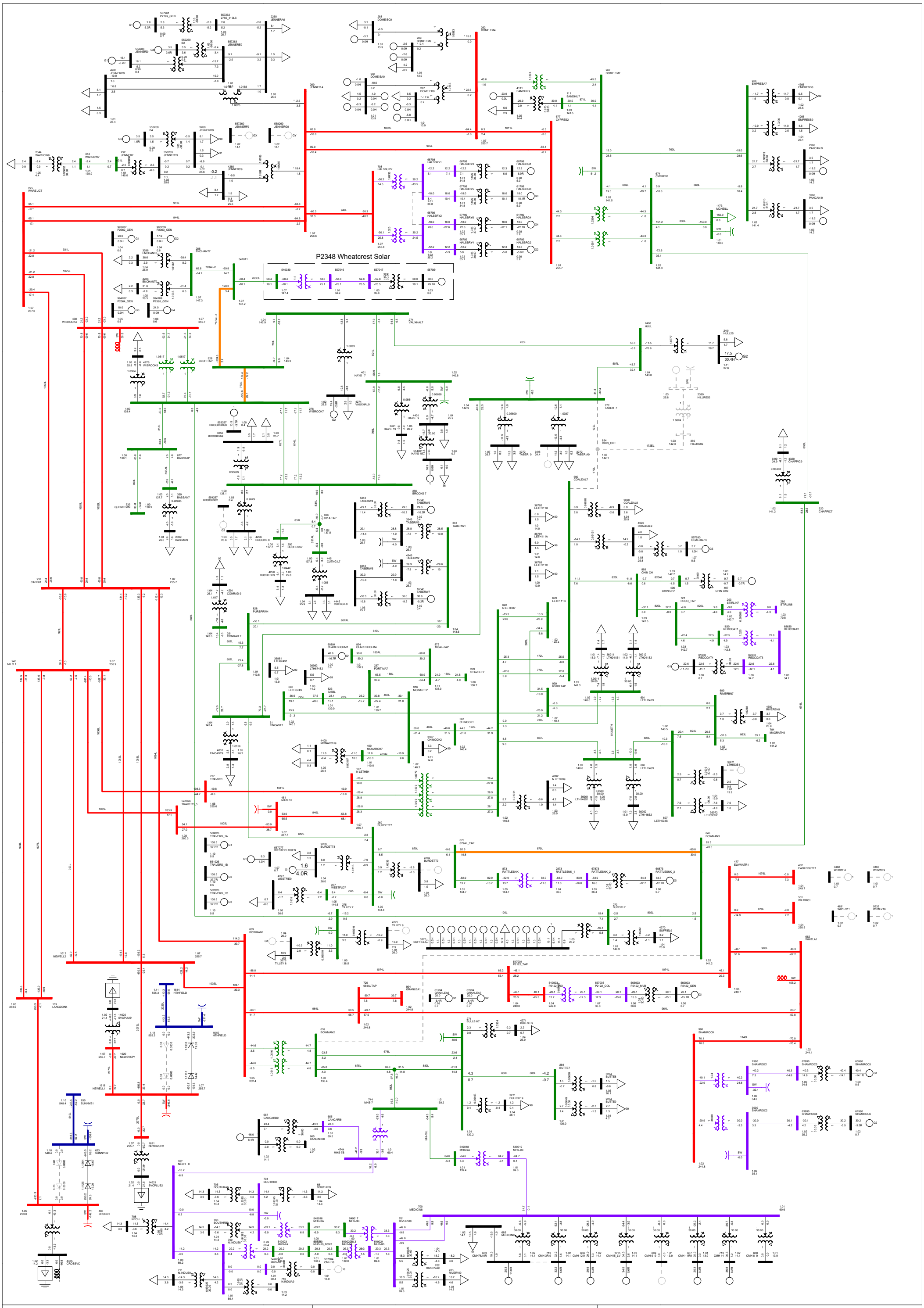


2022SL POST SC3
336S FINCASTLE TRANSFORMER T1 (TABER 83S - FINCASTLE 336S -
THU, JUN 30 2022 11:36

Figure A3-SL-Post-7

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

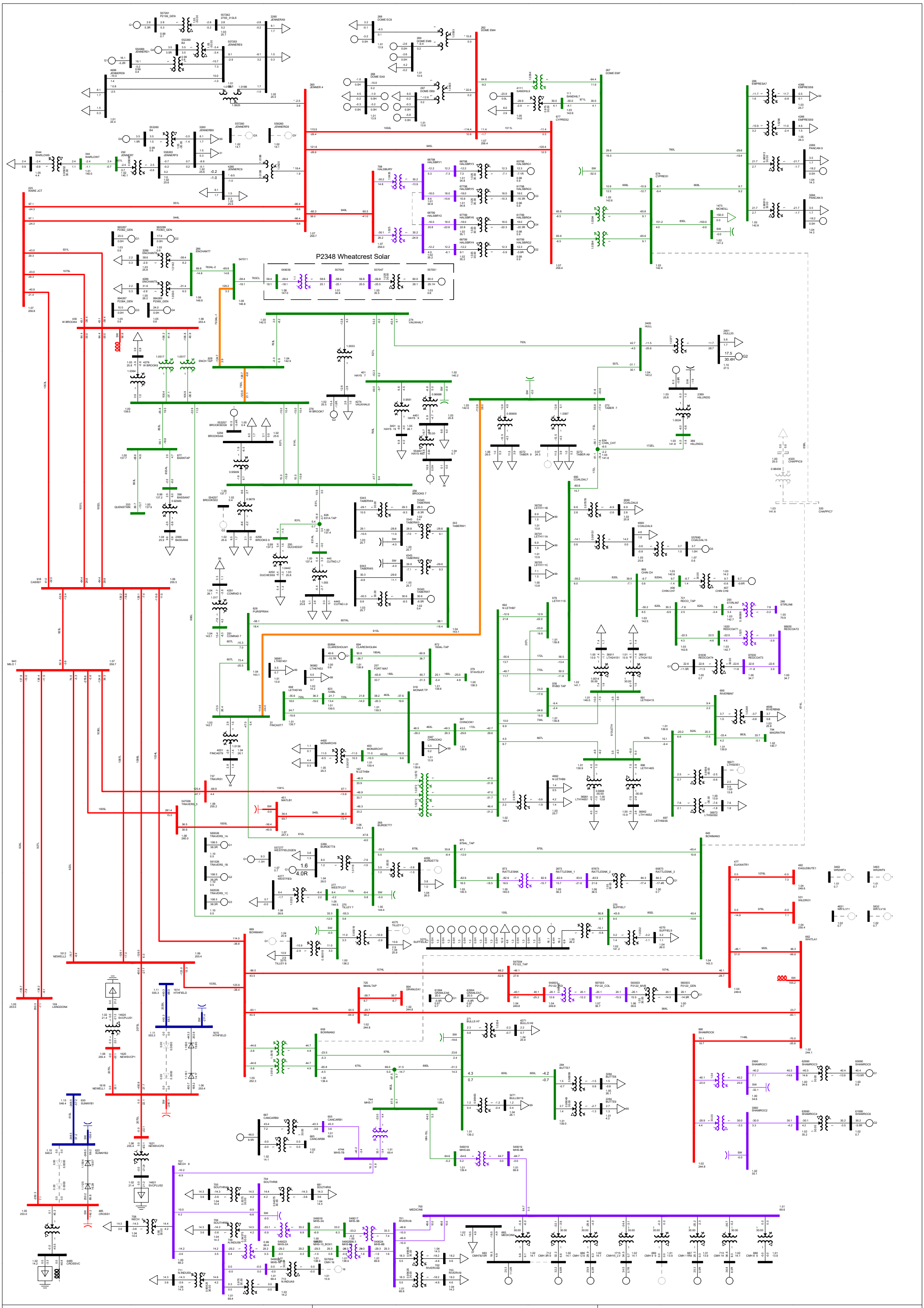


2022SL POST SC3
172L (CHIN CHUTE 315S - TABER 83S - HILLRIDGE 139S, CHIN CHU
THU, JUN 30 2022 11:36

Figure A3-SL-Post-8

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

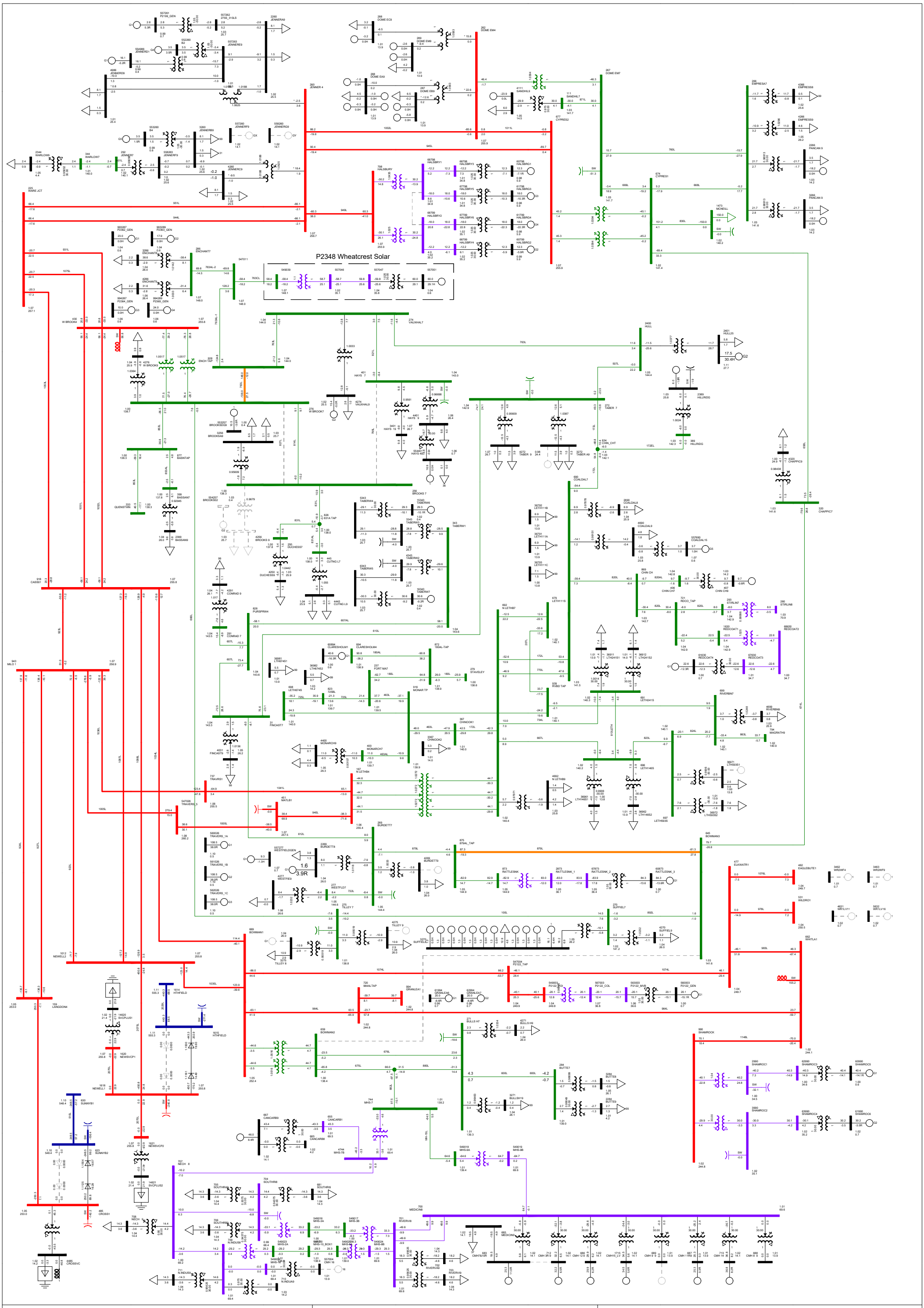


2022SL POST SC3
674L AND 658L (BOWMANTON 244S - CHAPPICE LAKE 649S - CYPRESS
THU, JUN 30 2022 11:36

Figure A3-SL-Post-9

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

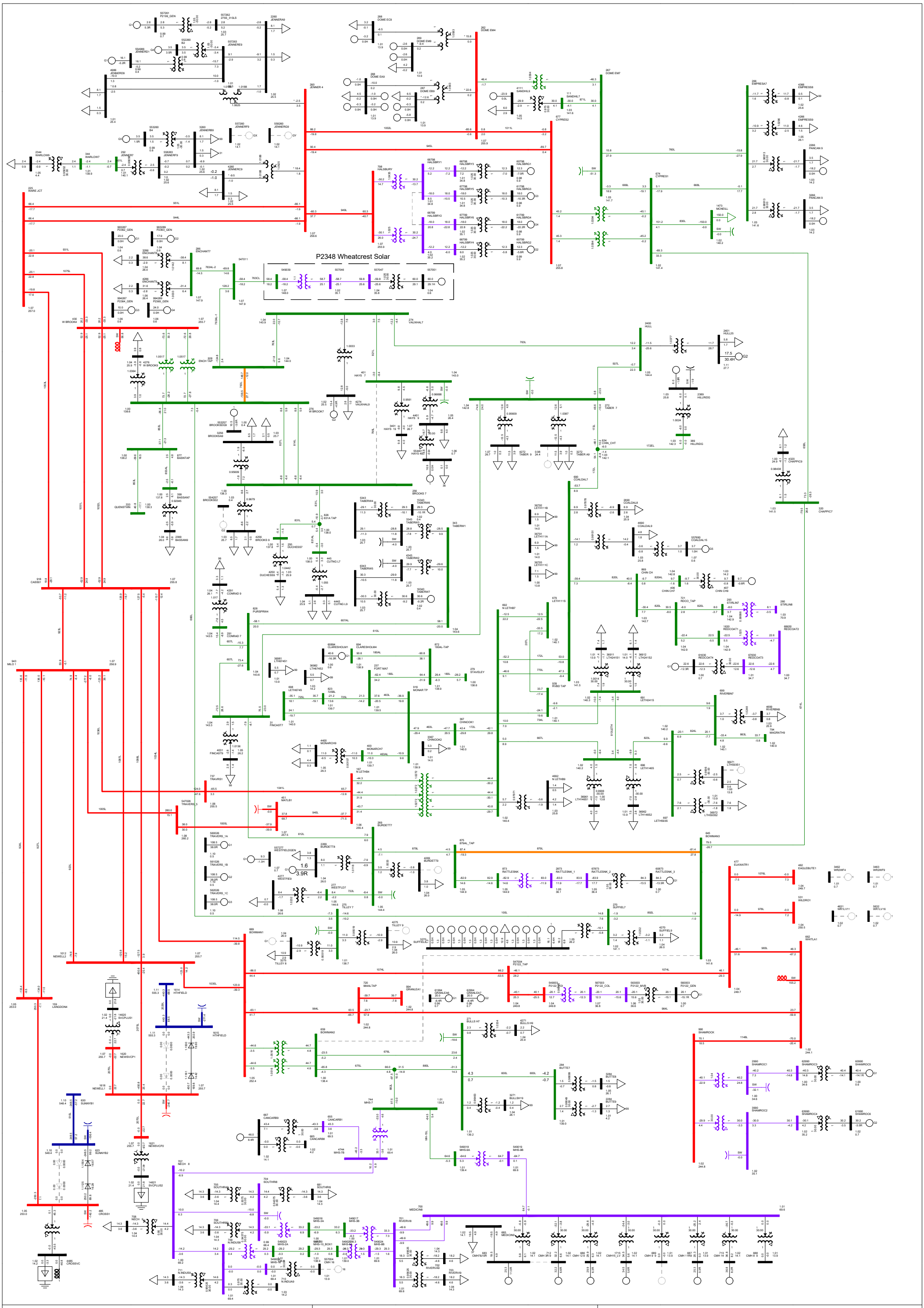


2022SL POST SC3
121S BROOKS TRANSFORMER T2 (BROOKS 121S - WEST BROOKS 28S -
THU, JUN 30 2022 11:36

Figure A3-SL-Post-10

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

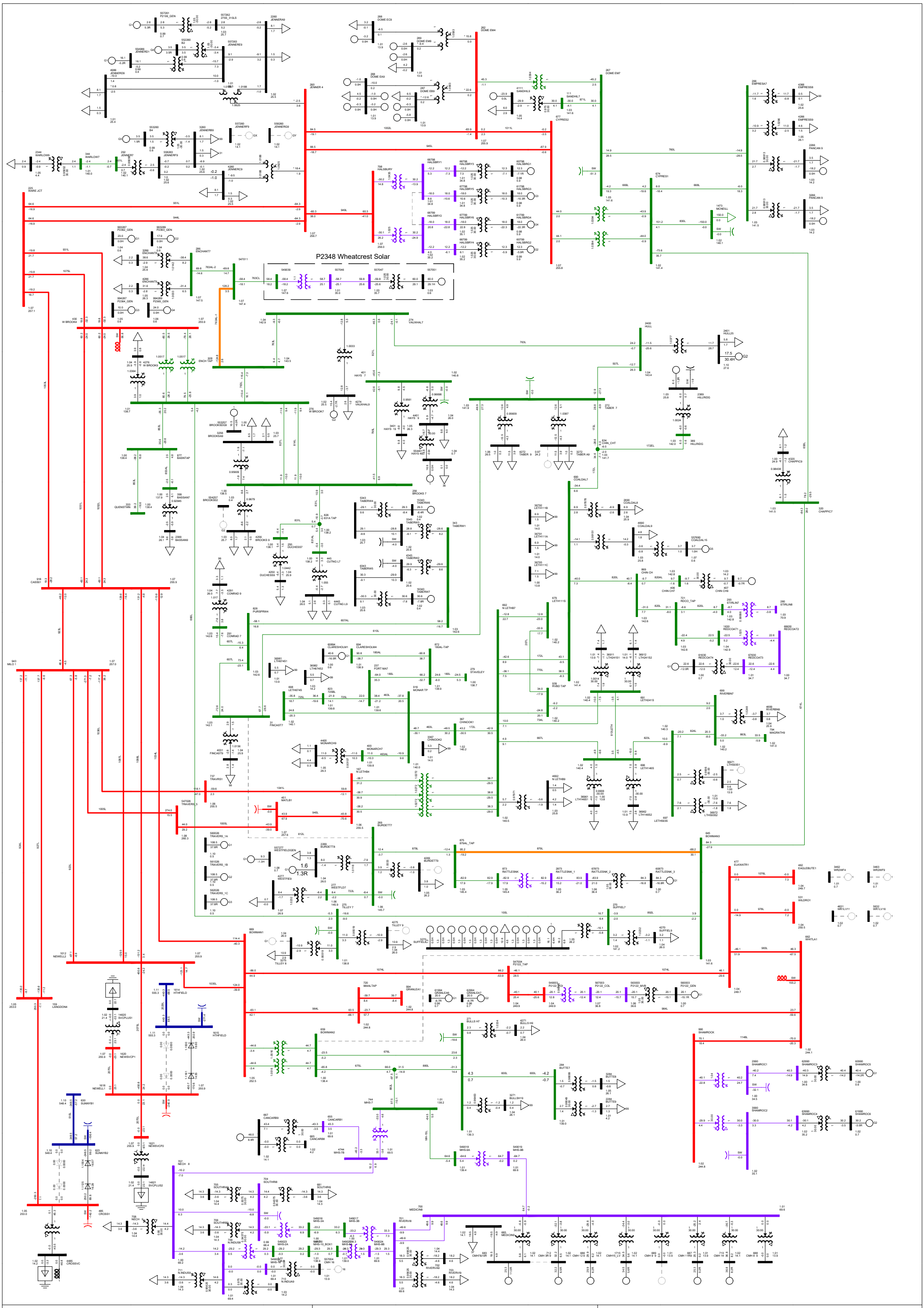


2022SL POST SC3
795L (BROOKS 121S - HAYS 421S) CONTINGENCY
THU, JUN 30 2022 11:36

Figure A3-SL-Post-11

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

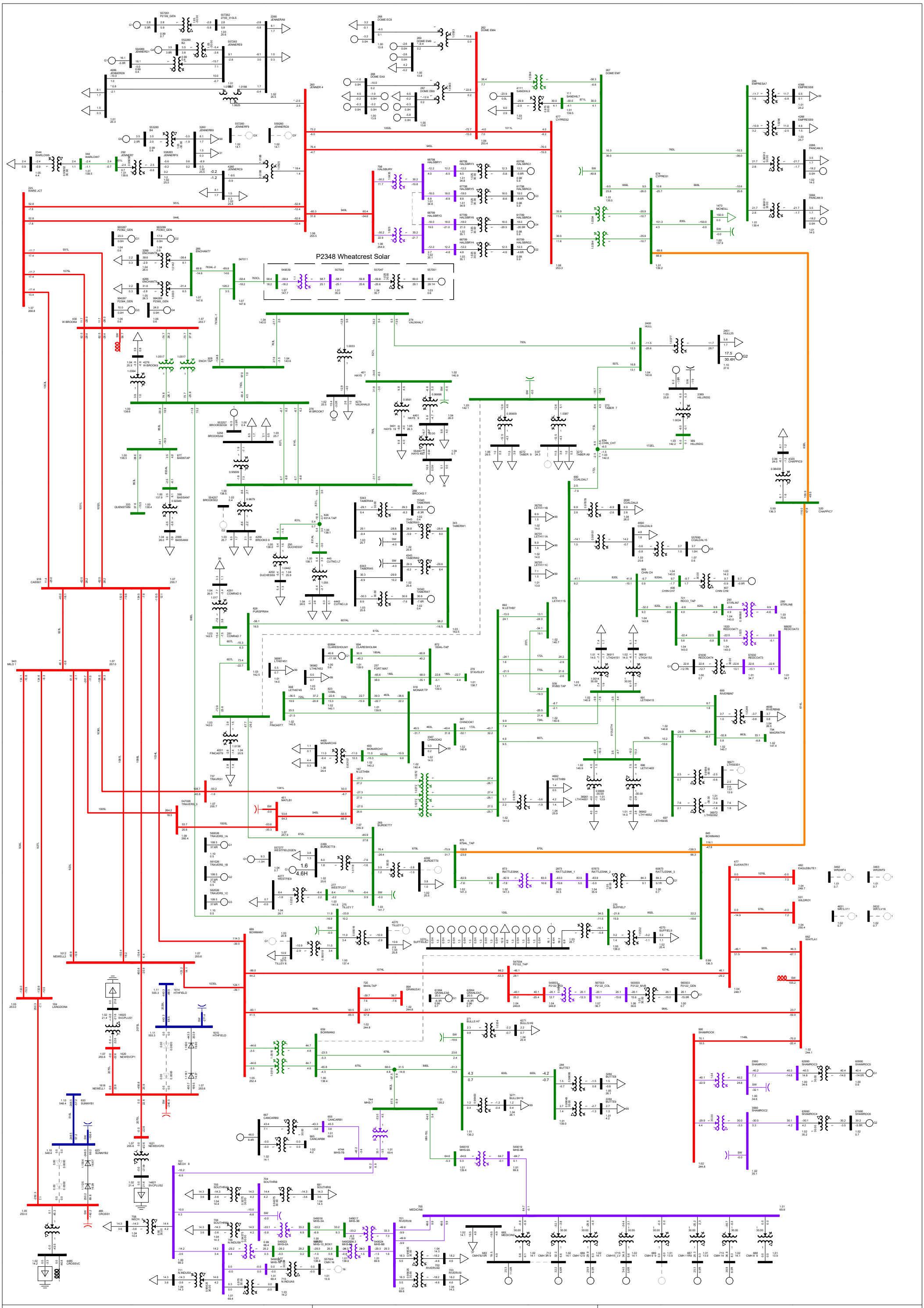


2022SL POST SC3
612L (FINCASTLE 336S - BURDETT 368S) CONTINGENCY
THU, JUN 30 2022 11:36

Figure A3-SL-Post-12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

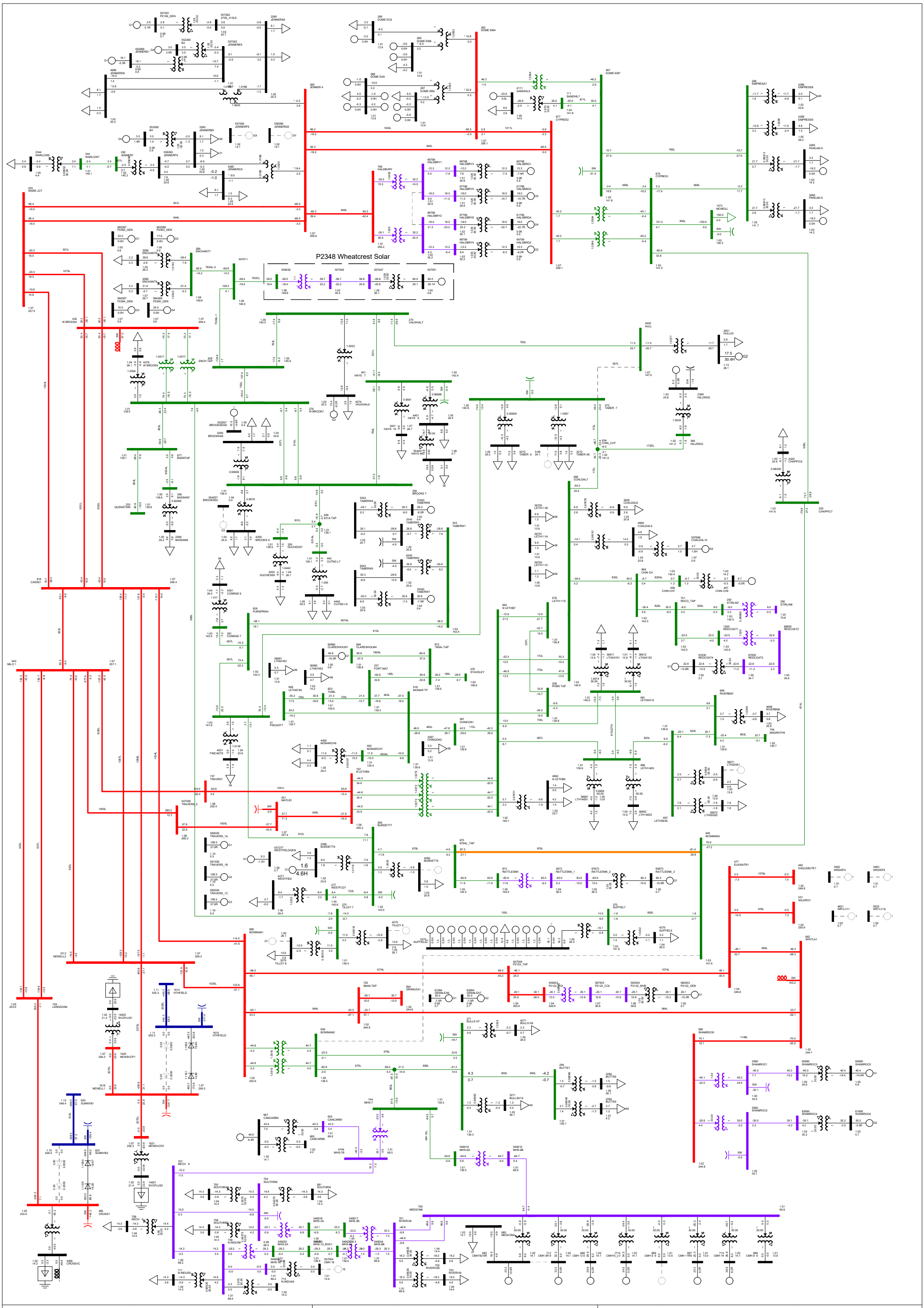


2022SL POST SC3
610L (FINCASTLE 336S - TABER 83S) CONTINGENCY
THU, JUN 30 2022 11:36

Figure A3-SL-Post-13

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
507L (TABER 83S - HULL 257S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-14

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

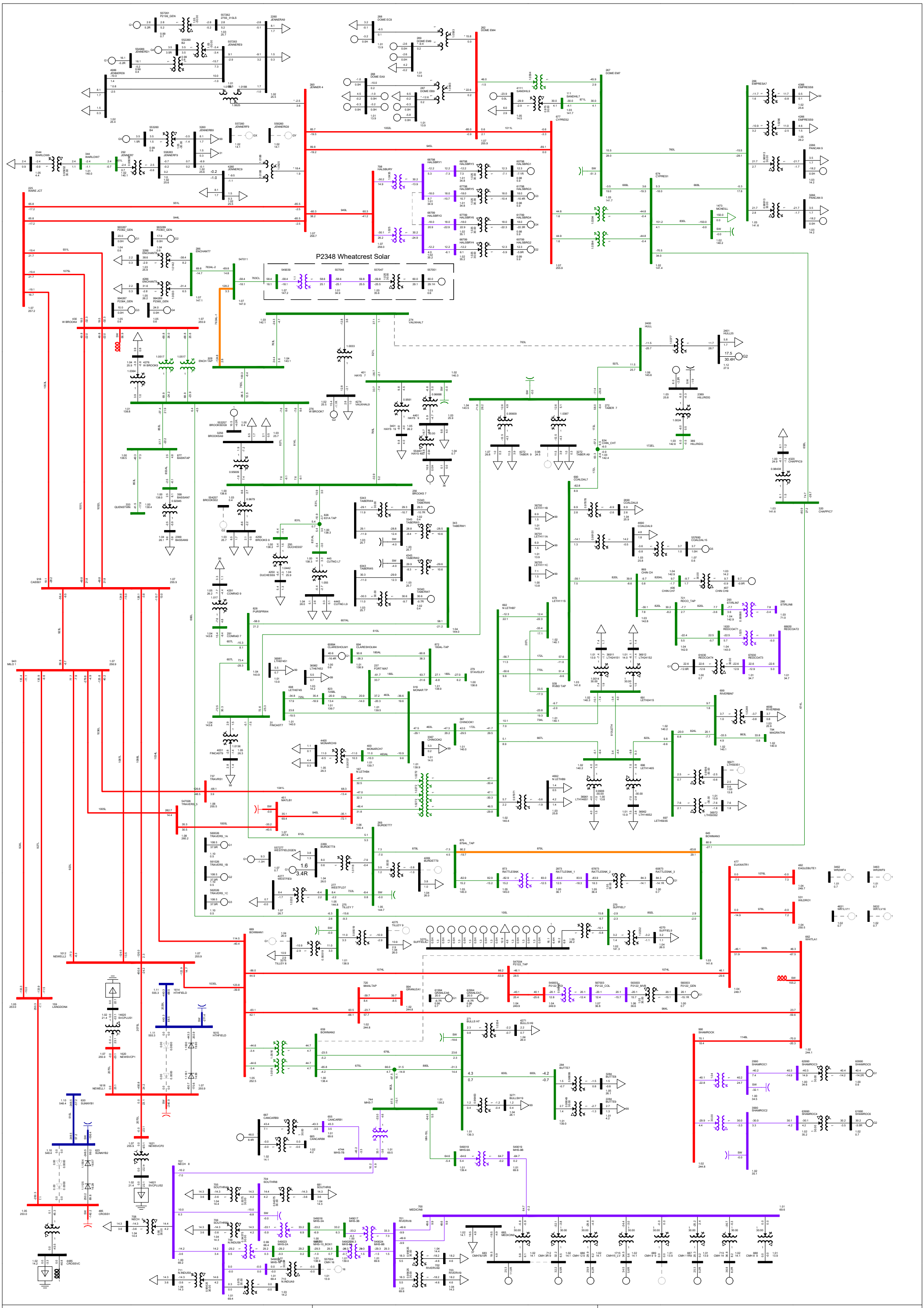
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2022SL POST SC3
821L (VAUXHALL 158S - HAYS 421S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-15

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
763L (VAUXHALL 158S - HULL 257S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-16

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

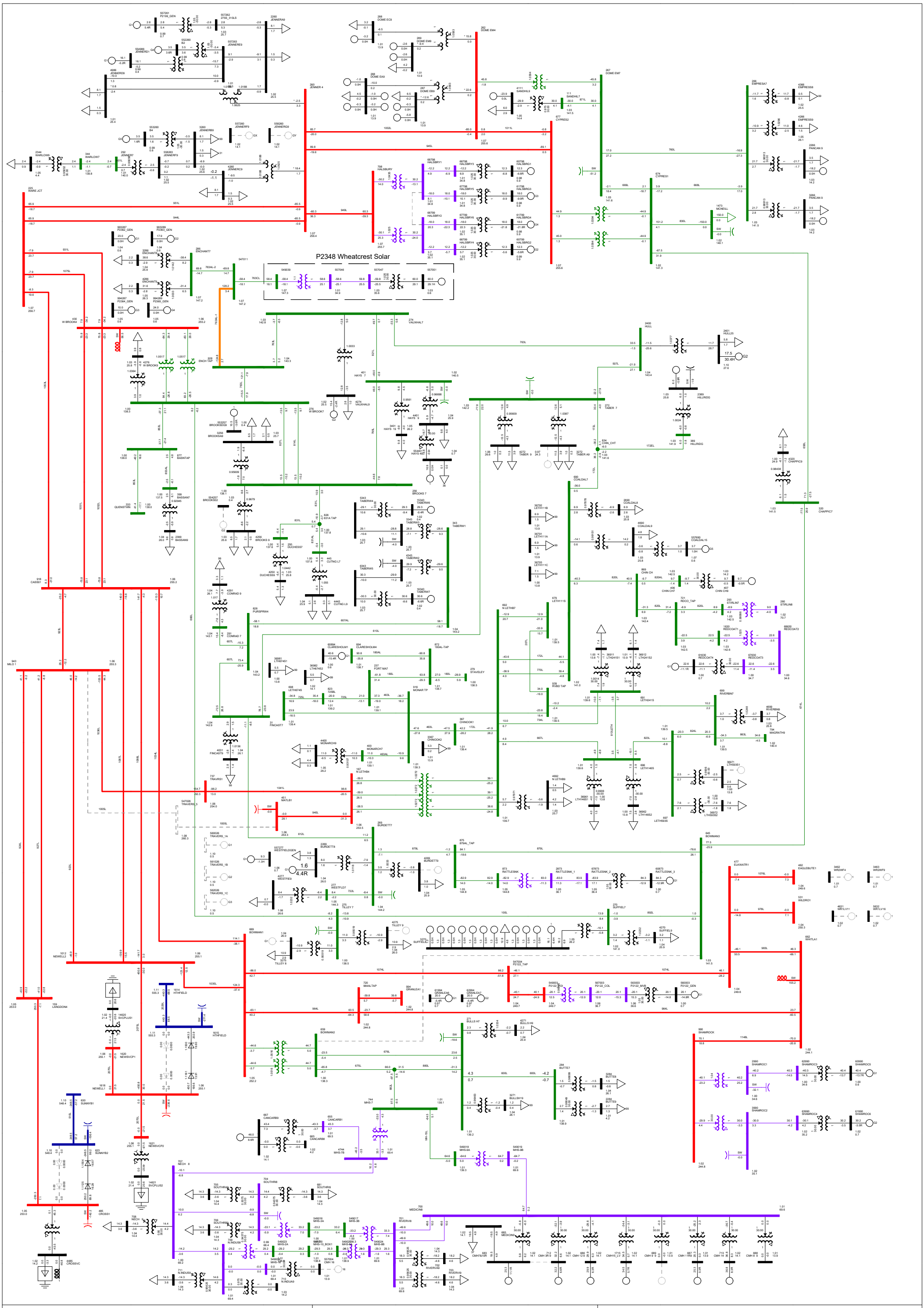
P2348 Wheatcrest Solar

2022SL POST SC3
MH138-T71 (BRIER PARK MHS-7 - BRIER PARK MHS-7) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
1005L (TRAVERS 554S - TRAVERS 554S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SL POST SC3
895S SUFFIELD TRANSFORMER T2 (SUFFIELD 895S- TILLEY 498S - B
THU, JUN 30 2022 11:37

Figure A3-SL-Post-19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

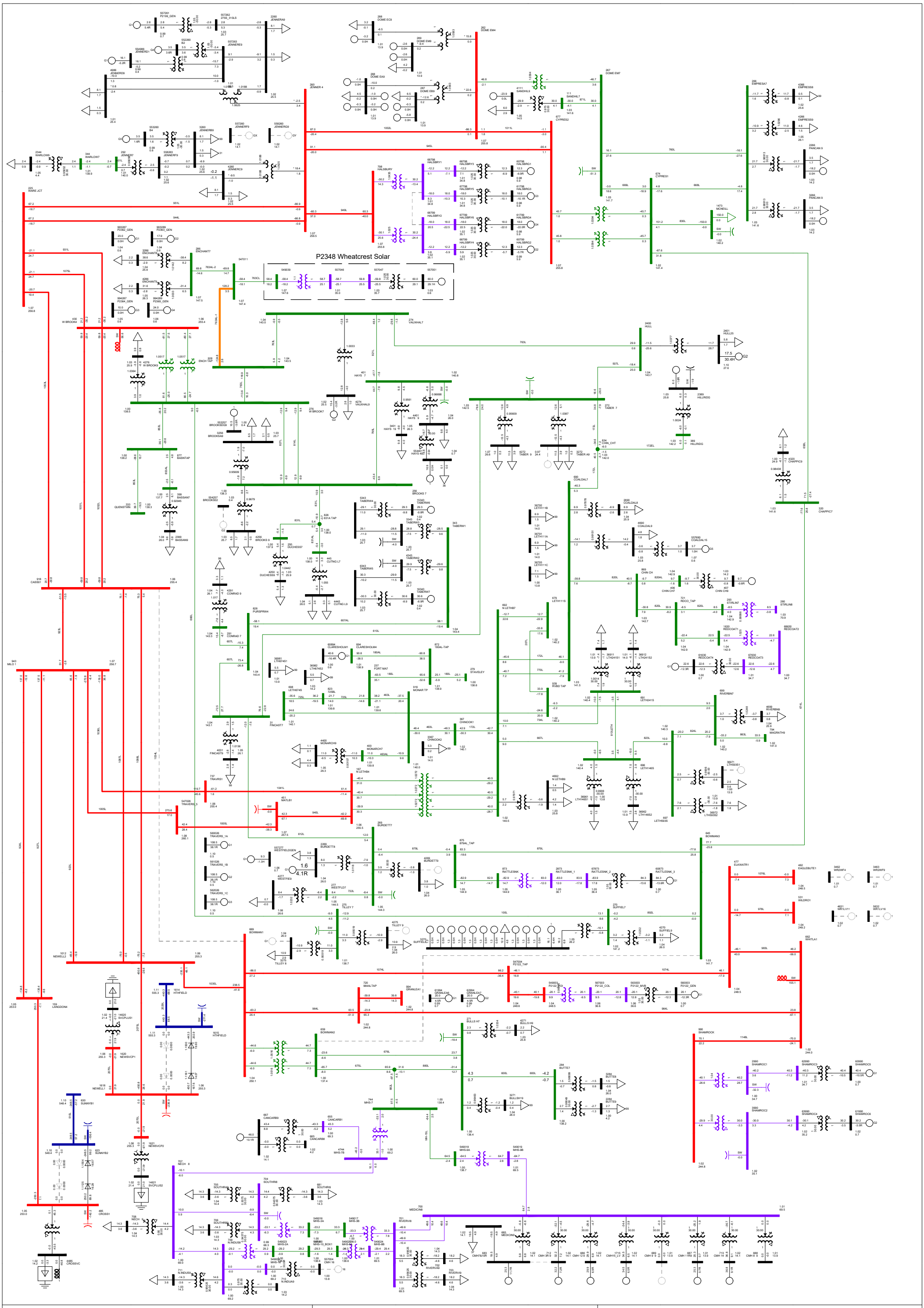
P2348 Wheatcrest Solar

2022SL POST SC3
100L (SUFFIELD 895S - TILLEY 498S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-20

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
1034L (BOWMANTON 244S - CASSILS 324S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-21

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

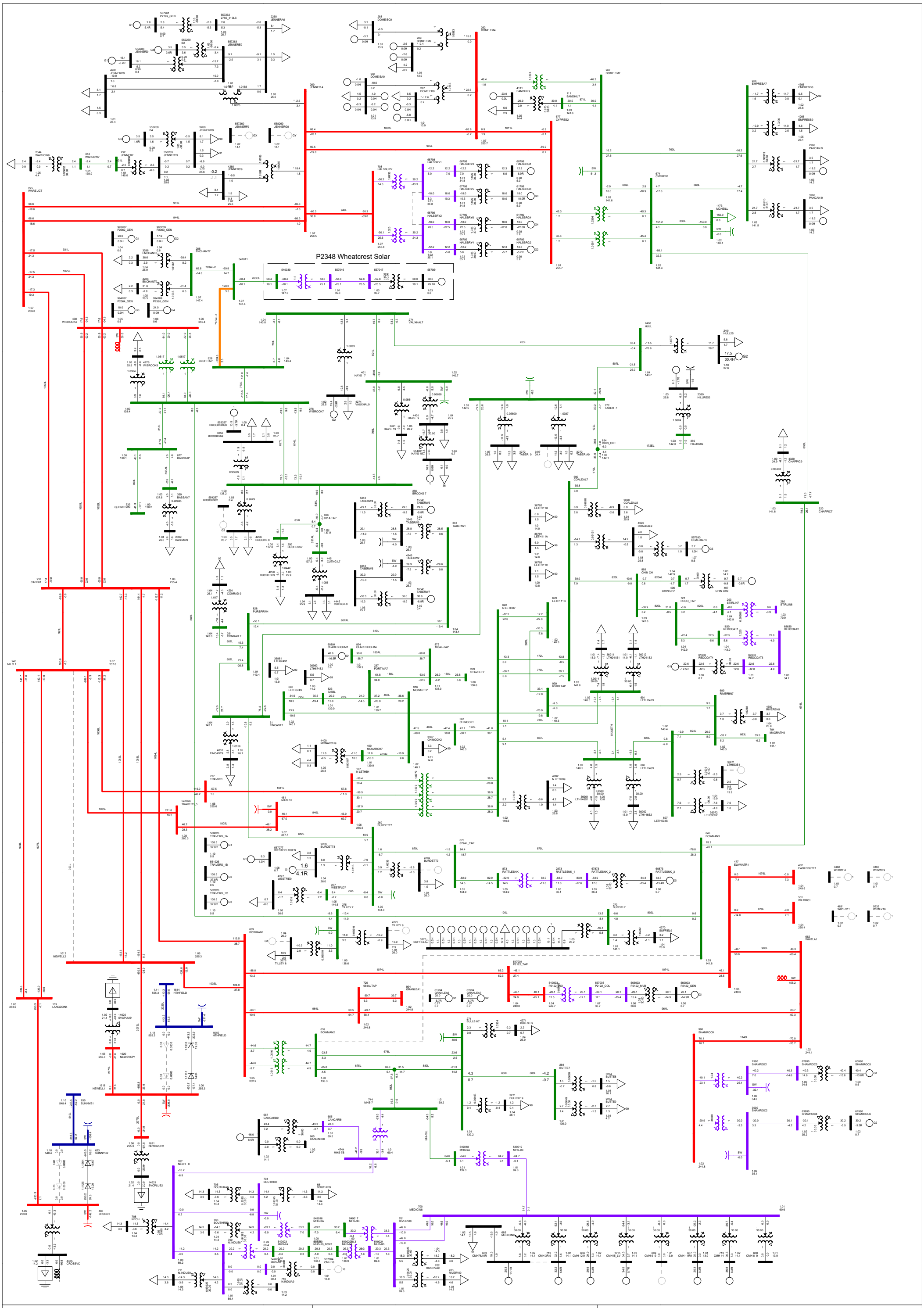
P2348 Wheatcrest Solar

2022SL POST SC3
935L (CASSILS 324S - MILO 356S) CONTINGENCY
THU, JUN 30 2022 11:37

Figure A3-SL-Post-22

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
923L (MILO 356S - NEWELL 2075S) CONTINGENCY
THU, JUN 30 2022 11:38

Figure A3-SL-Post-23

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

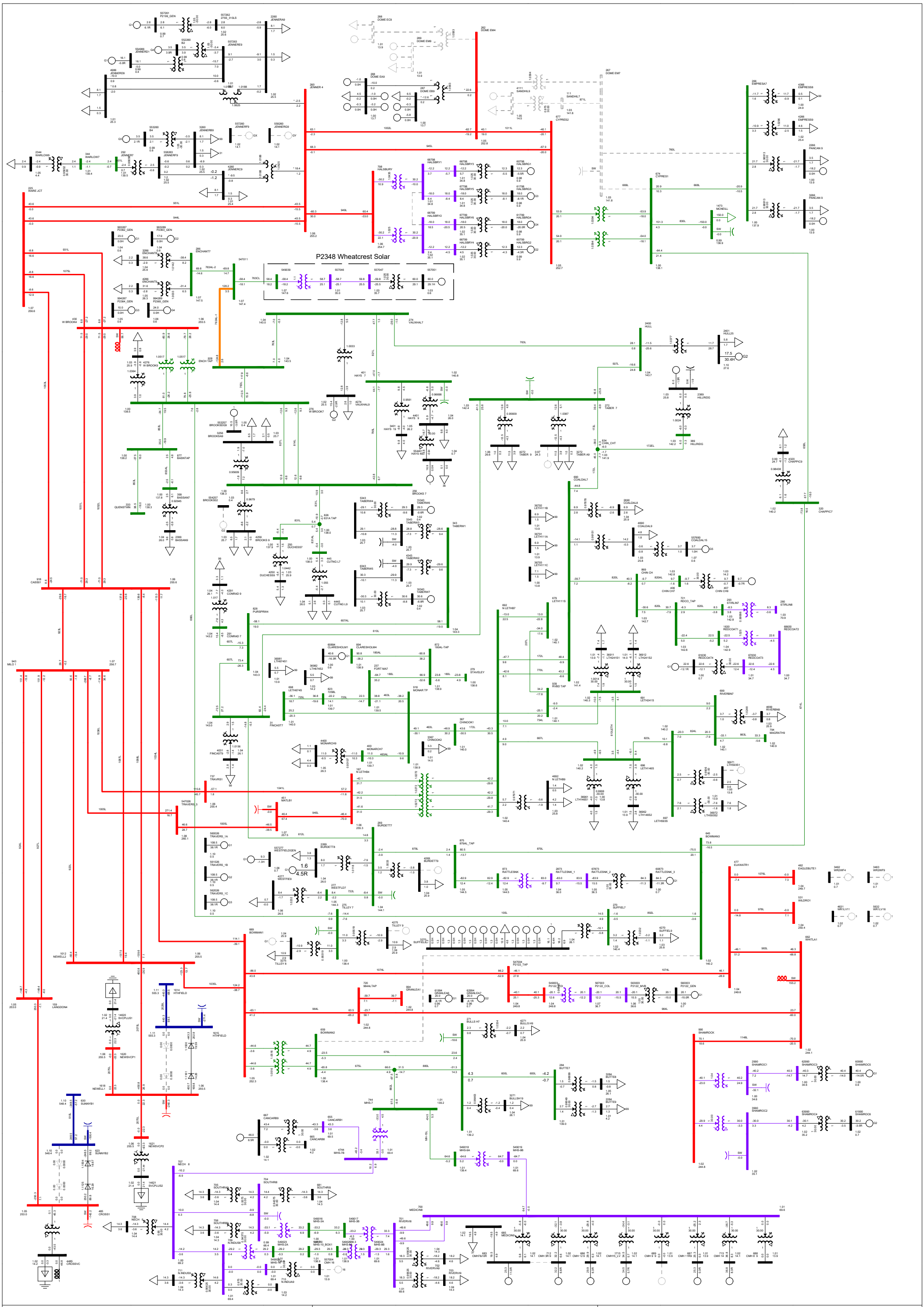
P2348 Wheatcrest Solar

2022SL POST SC3
1035L (BOWMANTON 244S - NEWELL 2075S) CONTINGENCY
THU, JUN 30 2022 11:38

Figure A3-SL-Post-24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

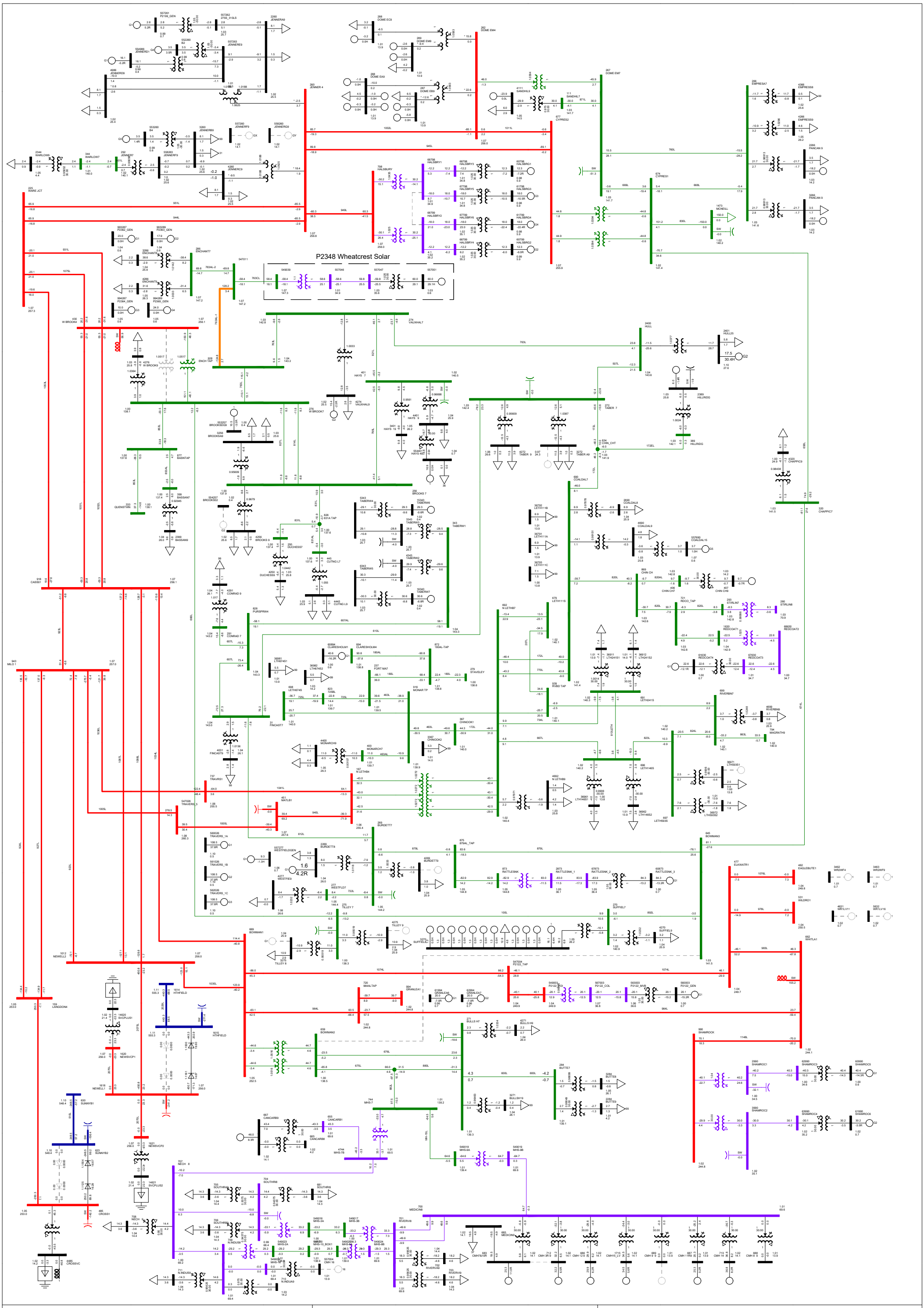


2022SL POST SC3
163S AMOCO EMPRESS TRANSFORMER T1 OR T5 (AMOCO EMPRESS 163S
THU, JUN 30 2022 11:38

Figure A3-SL-Post-25

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

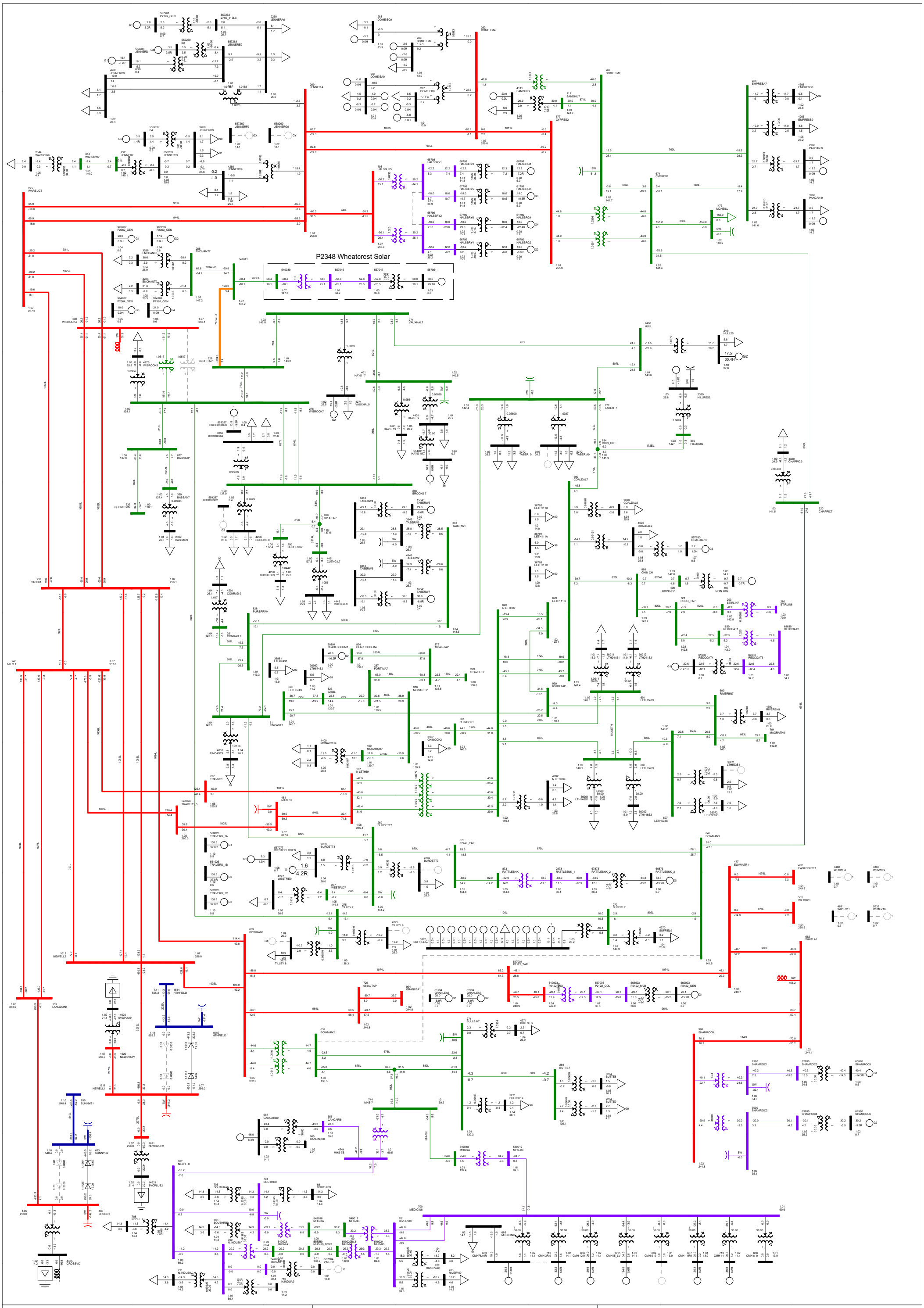


2022SL POST SC3
28S WEST BROOKS TRANSFORMER 28ST1A (WEST BROOKS 28S - WEST B
THU, JUN 30 2022 11:38

Figure A3-SL-Post-26

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

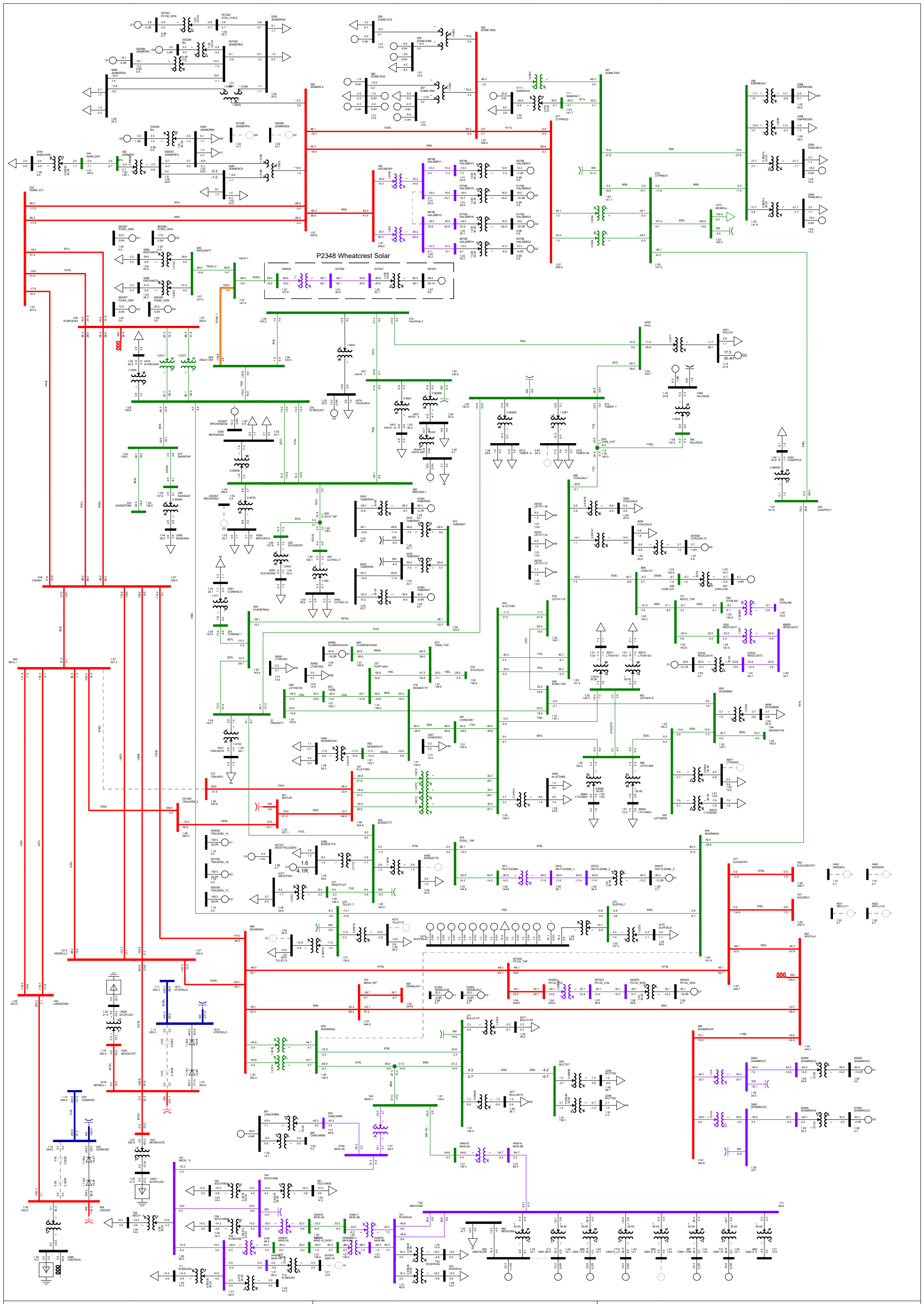


2022SL POST SC3
28S WEST BROOKS TRANSFORMER 28ST2A (WEST BROOKS 28S - WEST B
THU, JUN 30 2022 11:38

Figure A3-SL-Post-27

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SC3
1036L (MILO 356S - TRAVERS 554S) CONTINGENCY
THU, JUN 30 2022 11:38

Figure A3-SL-Post-28

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A3: List of 2022 Summer Peak Post-Project Scenario 4 Load Flow Diagrams

Figure	Category	Contingency
A3-SP-Post-1	A (N-0)	System Normal with Project at 50 MW and before 763AL line restoration
A3-SP-Post-2	A (N-0)	System Normal with Project at 50 MW and after 763AL line restoration
A3-SP-Post-3	B (N-1)	172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)
A3-SP-Post-4	B (N-1)	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)
A3-SP-Post-5	B (N-1)	879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)
A3-SP-Post-6	B (N-1)	610L (Fincastle 336S – Taber 83S)
A3-SP-Post-7	B (N-1)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
A3-SP-Post-8	B (N-1)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)
A3-SP-Post-9	B (N-1)	MH138-T63 (Riverview MH69S-6 - MH69S-3B)
A3-SP-Post-10	B (N-1)	MH138-T34 (South Ridge MH69S-3 - MH69S-3A)
A3-SP-Post-11	B (N-1)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)
A3-SP-Post-12	B (N-1)	2075L (Newell 2075S - Newell 2075S)
A3-SP-Post-13	B (N-1)	MH-20L (MH69S-3A - MH69S-3B)
A3-SP-Post-14	B (N-1)	1036L (Milo 356S – Travers 554S)

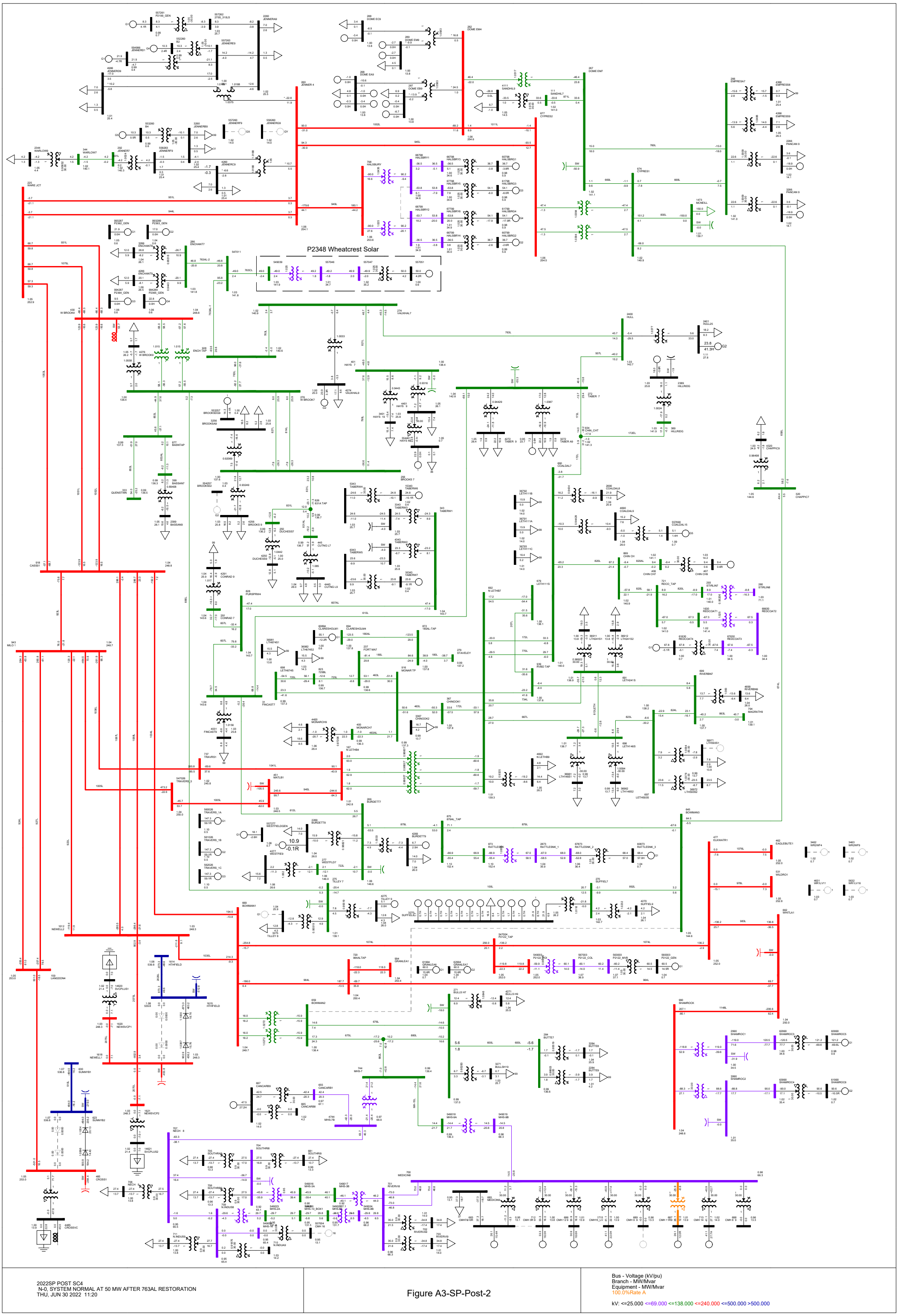
P2348 Wheatcrest Solar

2022SP POST SC4
N-0, SYSTEM NORMAL AT 50 MW BEFORE 763AL RESTORATION
THU, JUN 30 2022 11:19

Figure A3-SP-Post-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP POST SC4
N-0, SYSTEM NORMAL AT 50 MW AFTER 763AL RESTORATION
THU, JUN 30 2022 11:20

Figure A3-SP-Post-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP POST SC4
172L CHIN CHUTE 315S - TABER 83S - HILLRIDGE 139S, CHIN CHUT
THU, JUN 30 2022 11:38

Figure A3-SP-Post-3

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP POST SC4
674L AND 658L (BOWMANTON 244S - CHAPPICE LAKE 649S - CYPRESS
THU, JUN 30 2022 11:38

Figure A3-SP-Post-4

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

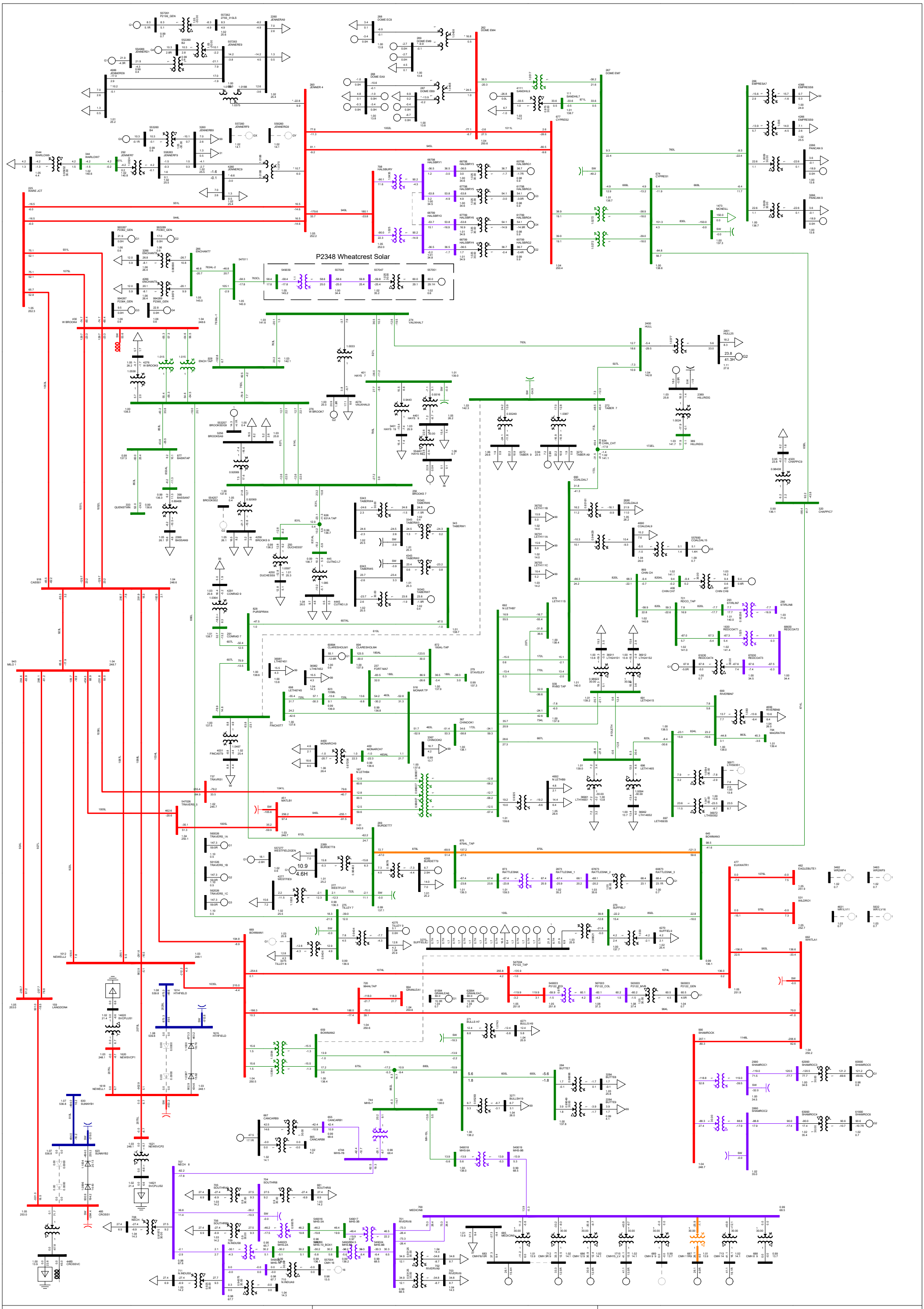
P2348 Wheatcrest Solar

2022SP POST SC4
879L TAP (BURDETT 368S - BOWMANTON 244S - RATTLESNAKE 719S)
THU, JUN 30 2022 11:39

Figure A3-SP-Post-5

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

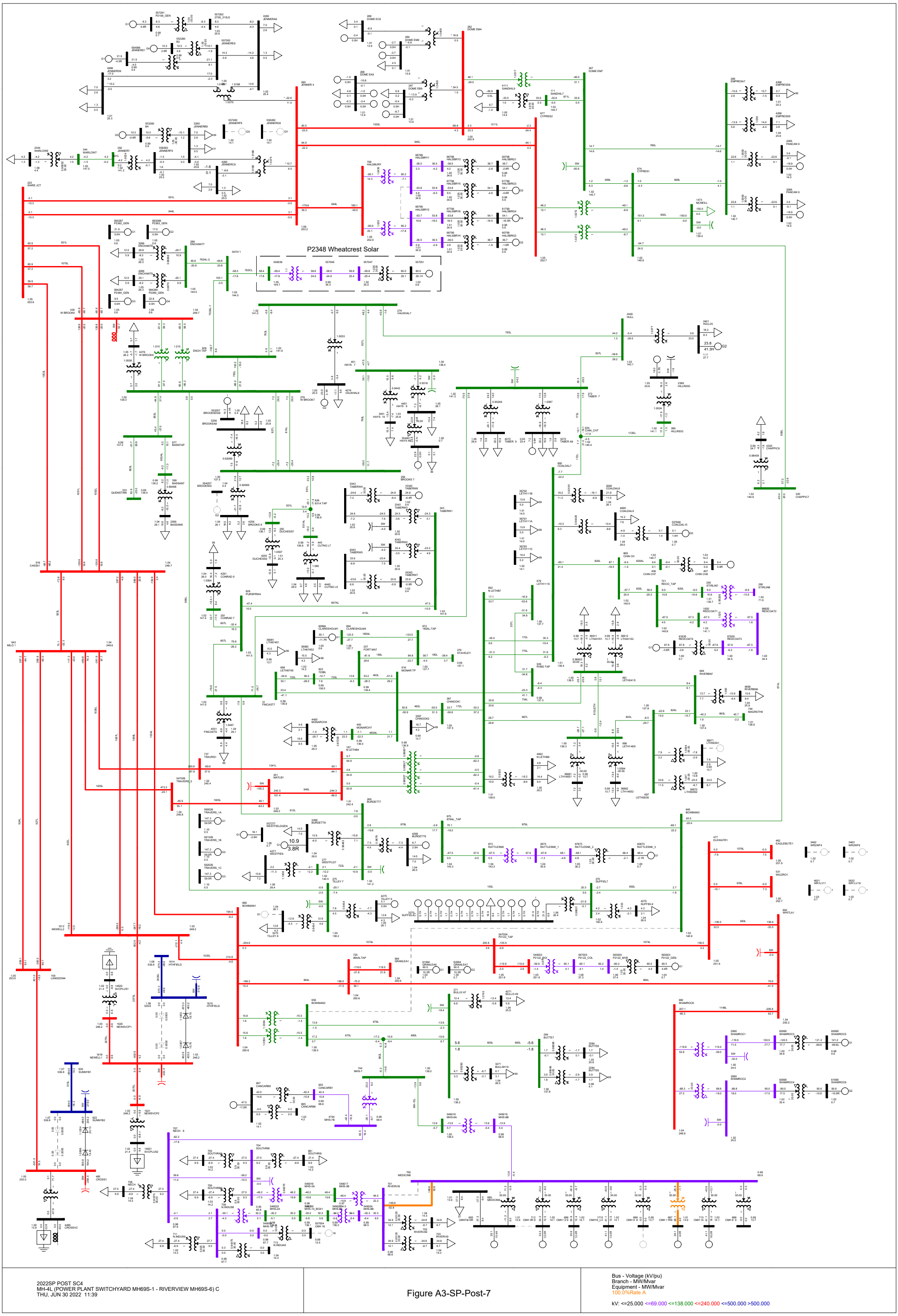


2022SP POST SC4
610L (FINCASTLE 336S - TABER 83S) CONTINGENCY
THU, JUN 30 2022 11:39

Figure A3-SP-Post-6

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP POST SC4
MH-4L (POWER PLANT SWITCHYARD MH69S-1 - RIVERVIEW MH69S-6) C
THU, JUN 30 2022 11:39

Figure A3-SP-Post-7

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

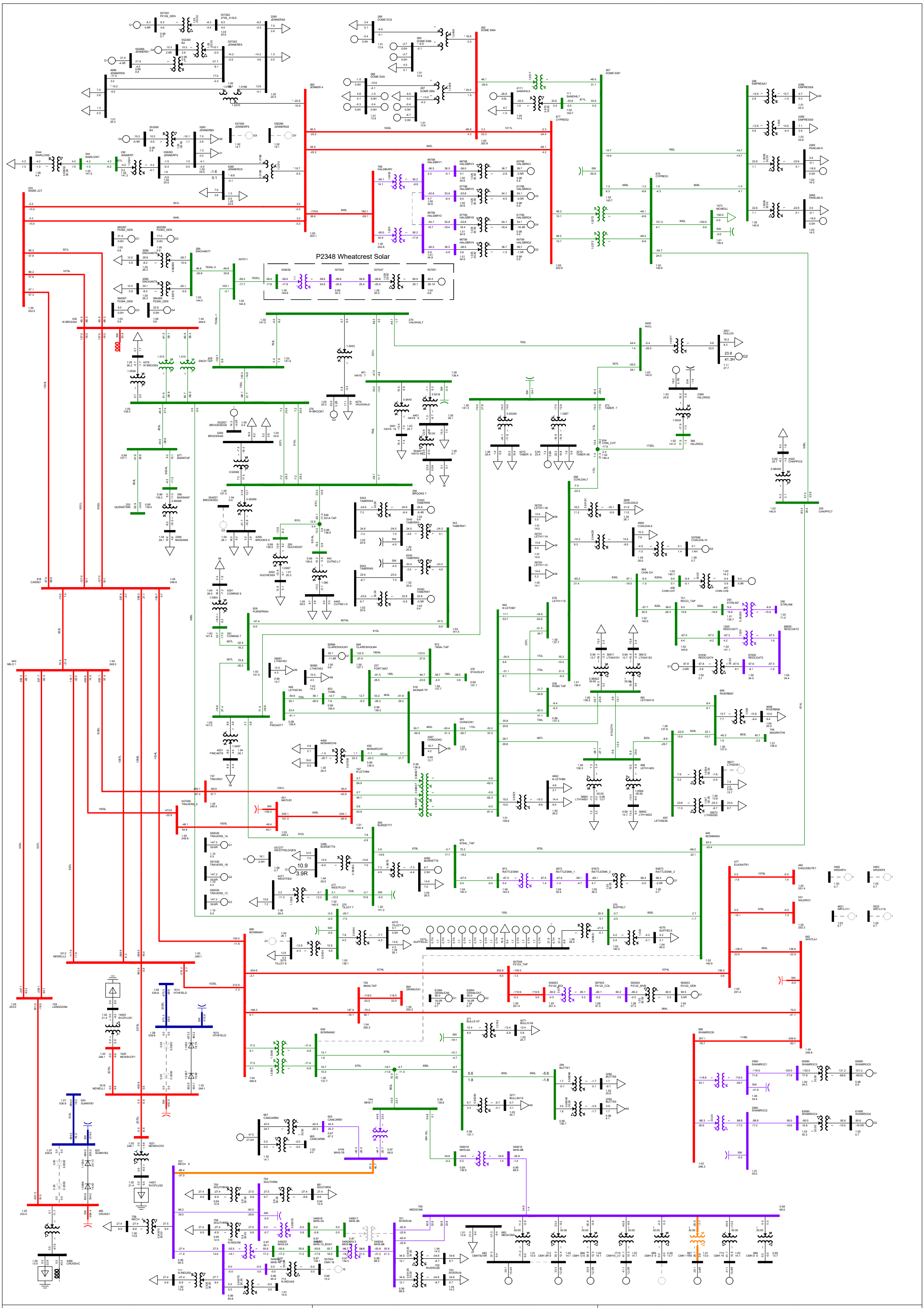
P2348 Wheatcrest Solar

2022SP POST SC4
MH-8L (POWER PLANT SWITCHYARD MH69S-1 - RIVERVIEW MH69S-6) C
THU, JUN 30 2022 11:39

Figure A3-SP-Post-8

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

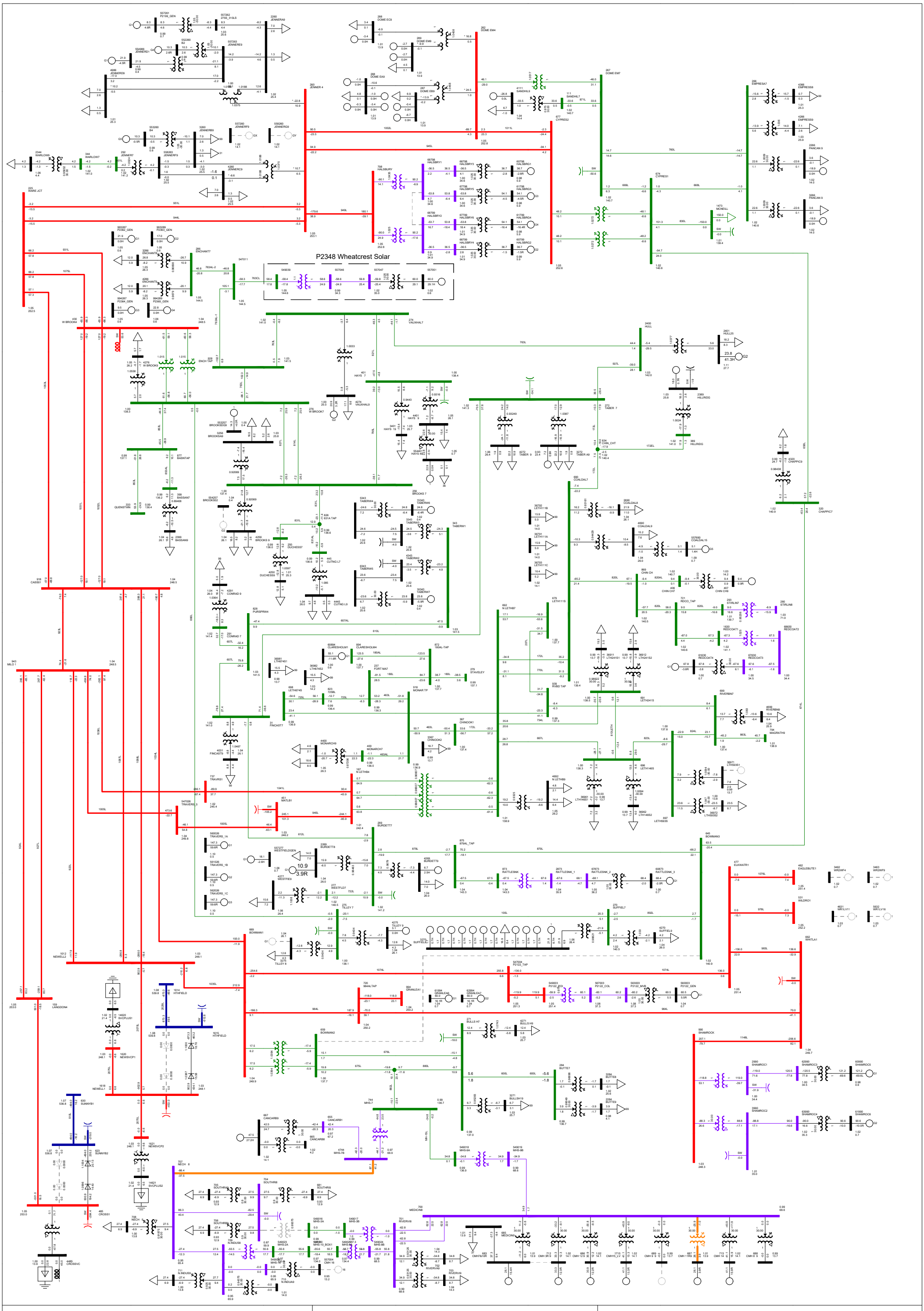


2022SP POST SC4
MH138-T63 (RIVERVIEW MH69S-6 - MH69S-3B) CONTINGENCY
THU, JUN 30 2022 11:39

Figure A3-SP-Post-9

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

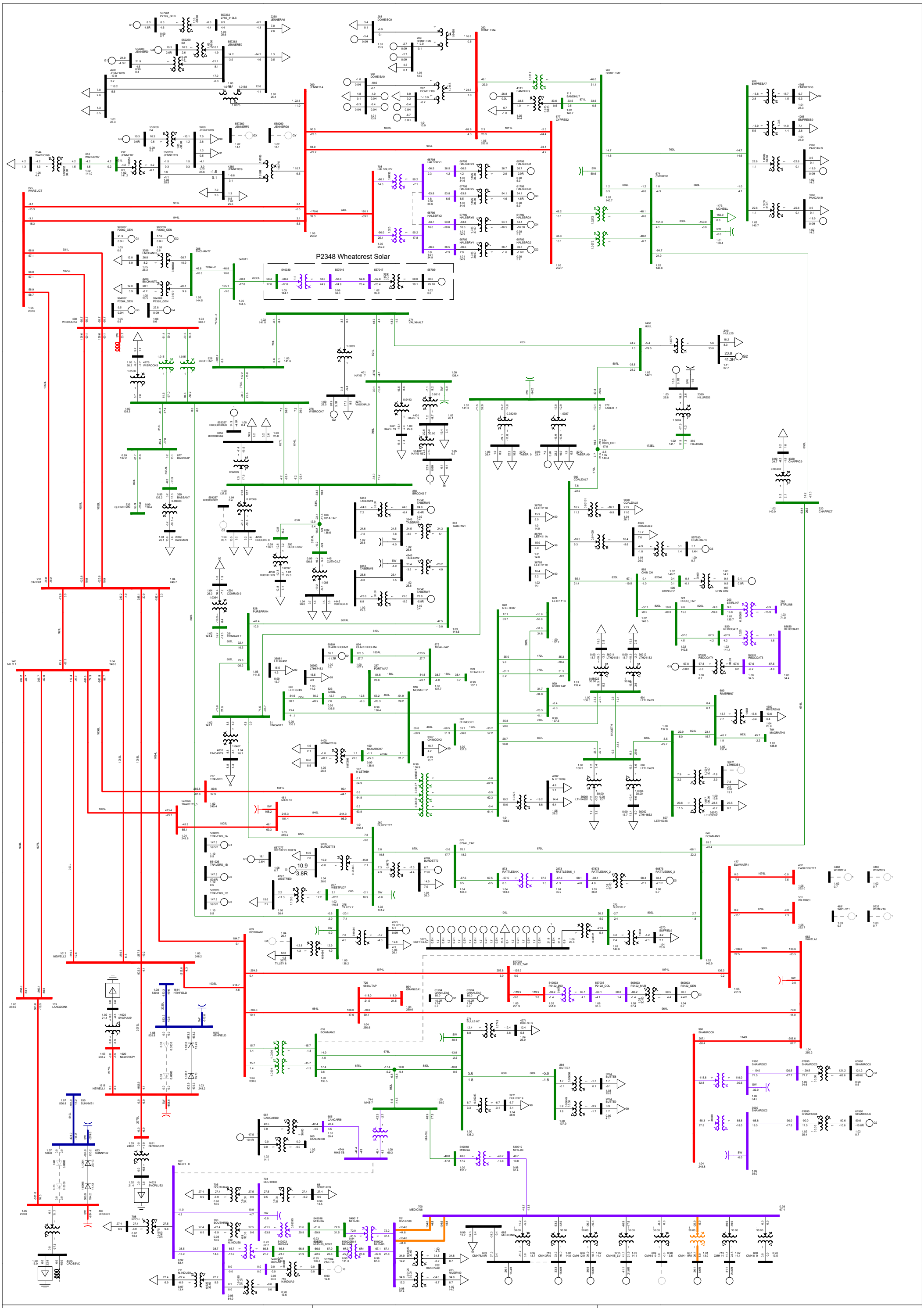


2022SP POST SC4
MH138-T34 (SOUTH RIDGE MH69S-3 - MH69S-3A) CONTINGENCY
THU, JUN 30 2022 11:39

Figure A3-SP-Post-10

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

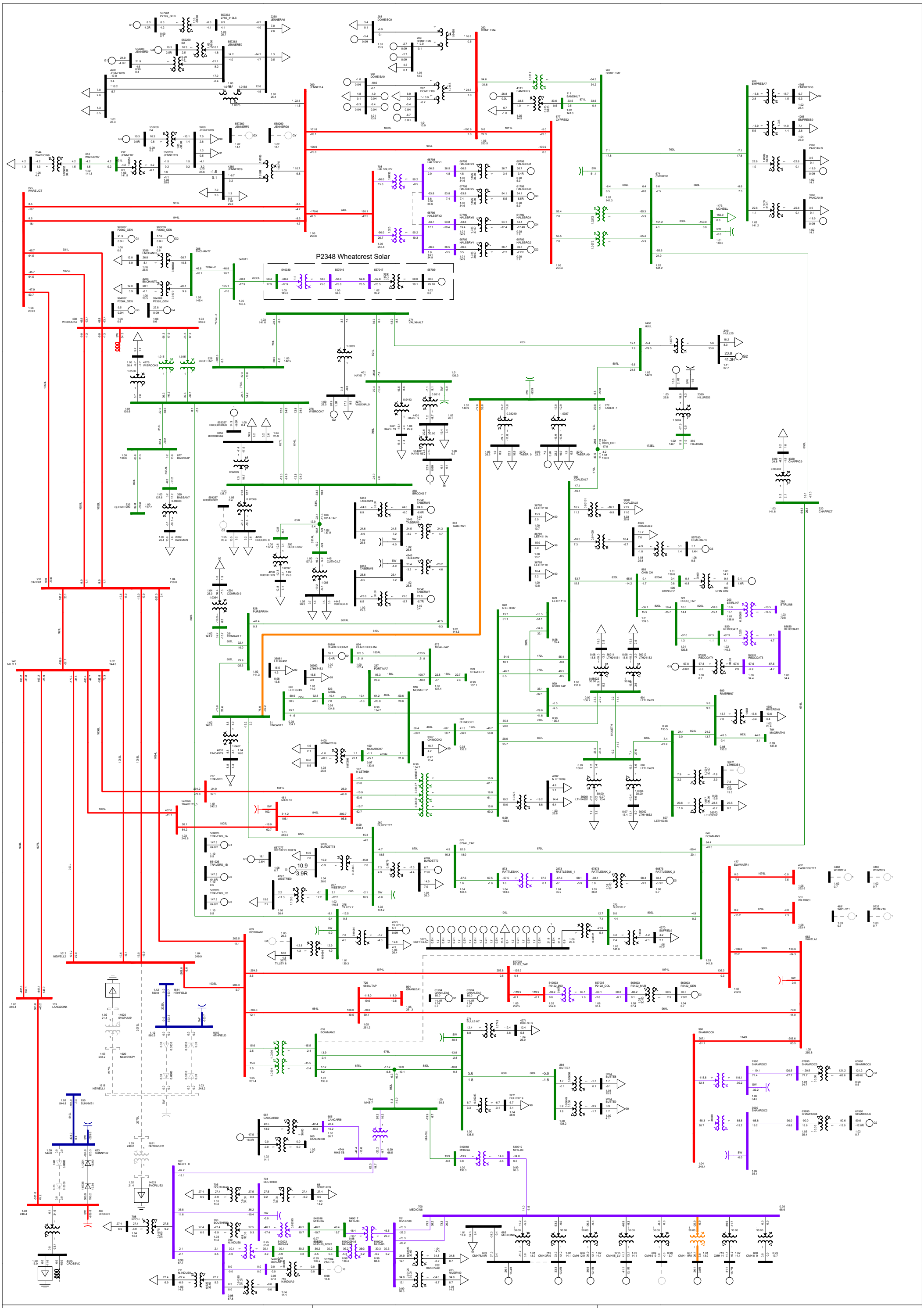


2022SP POST SC4
MH-60L (NORTH EAST CRESCENT HEIGHTS MH69S - BRIER PARK MHS-7
THU, JUN 30 2022 11:39

Figure A3-SP-Post-11

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

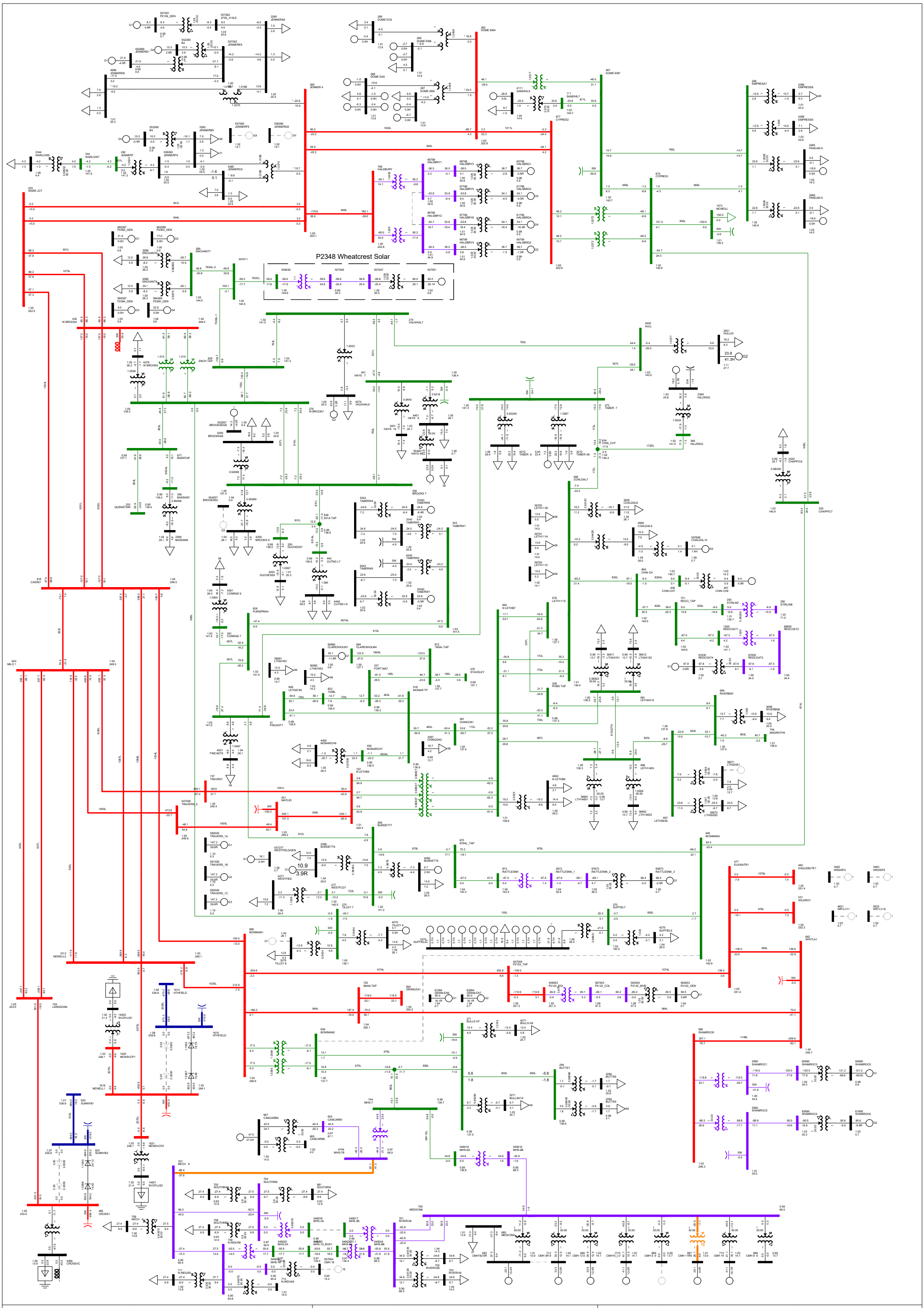


2022SP POST SC4
2075L (NEWELL 2075S - NEWELL 2075S) CONTINGENCY
THU, JUN 30 2022 11:39

Figure A3-SP-Post-12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP POST SC4
MH-20L (MH69S-3A - MH69S-3B) CONTINGENCY
THU, JUN 30 2022 11:39

Figure A3-SP-Post-13

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP POST SC4
1036L (MILO 356S - TRAVERS 554S) CONTINGENCY
THU, JUN 30 2022 11:40

Figure A3-SP-Post-14

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A3: List of 2022 Summer Light Post-Sensitivity Project Scenario 8 Load Flow Diagrams

Figure	Category	Contingency
A3-SL-Post-Sensitivity-1	A (N-0)	System Normal with Project at 50 MW and before 763AL line restoration
A3-SL-Post-Sensitivity-2	A (N-0)	System Normal with Project at 50 MW and after 763AL line restoration

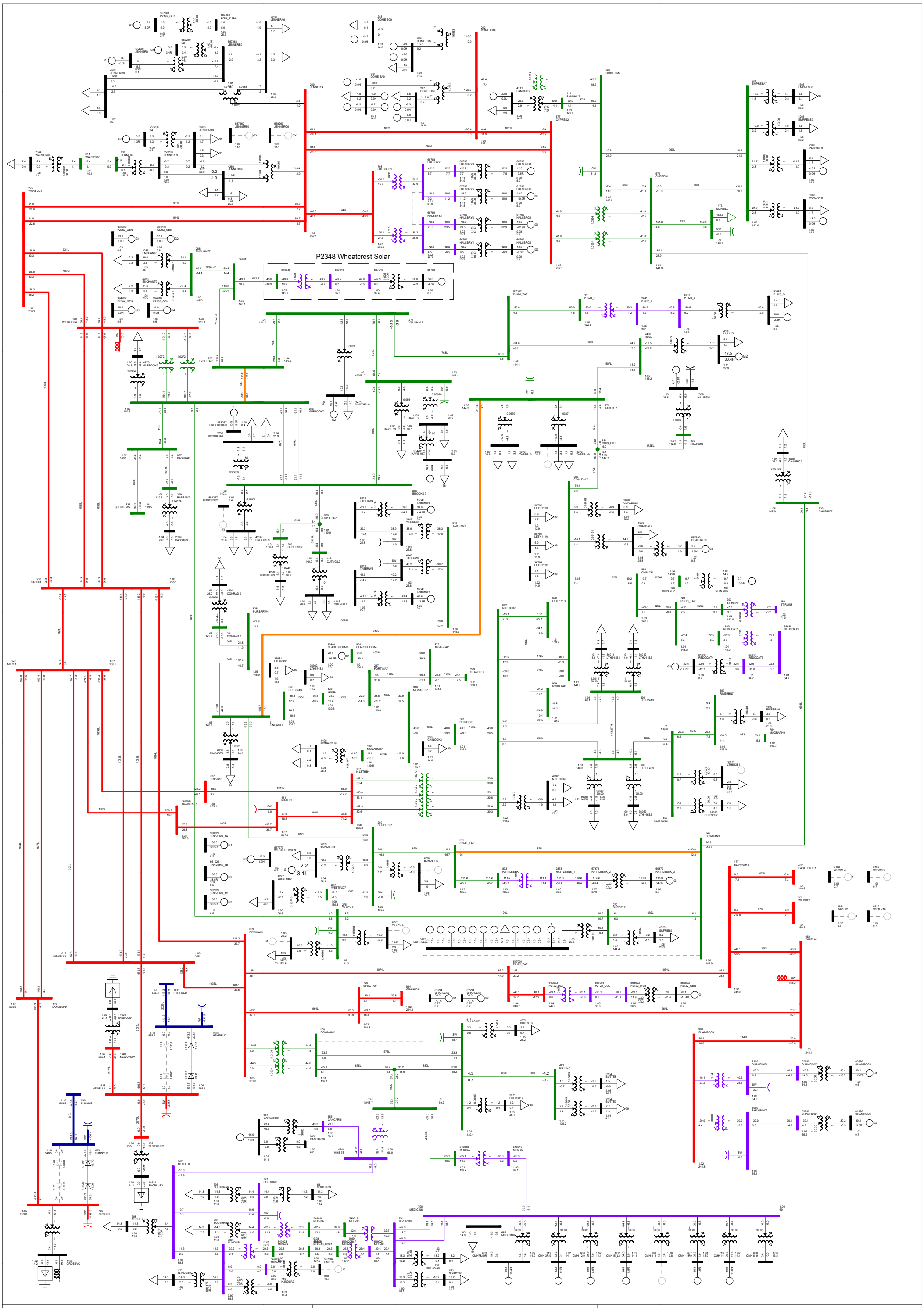
P2348 Wheatcrest Solar

2022SL POST SENSITIVITY SC8
N-0, SYSTEM NORMAL PRIOR TO 763AL RESTORATION
MON, JUN 20 2022 17:59

Figure A3-SL-Post-Sensitivity-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SENSITIVITY SC8
N-0, SYSTEM NORMAL
FRI, JUN 10 2022 15:41

Figure A3-SL-Post-Sensitivity-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A3: List of 2022 Summer Peak Post-Sensitivity Project Scenario 9 Load Flow Diagrams

Figure	Category	Contingency
A3-SP-Post-Sensitivity-1	A (N-0)	System Normal with Project at 50 MW and before 763AL line restoration
A3-SP-Post-Sensitivity-2	A (N-0)	System Normal with Project at 50 MW and after 763AL line restoration

P2348 Wheatcrest Solar

2022SP POST SENSITIVITY SC9
N-0, SYSTEM NORMAL PRIOR TO 763AL RESTORATION
MON, JUN 20 2022 18:01

Figure A3-SP-Post-Sensitivity-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SP POST SENSITIVITY SC9
N-0, SYSTEM NORMAL
FRI, JUN 10 2022 15:42

Figure A3-SP-Post-Sensitivity-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A4
Post-Project Transient Stability Diagrams

Scenario 3

Summer Light Post Project

Transient Response Plot Key

Table Summer Light Post Project Figure Reference:

Scenario	Plots	Figure #
Summer Light Post Project	Angles Plots	A-SC3-1 to A-SC3-15
	Power Plots	B-SC3-1 to B-SC3-15
	Var Plots	C-SC3-1 to C-SC3-15
	Bus Voltage Plots	D-SC3-1 to D-SC3-15
	Branchflow MW Plots	E-SC3-1 to E-SC3-15
	Branchflow MVar Plots	F-SC3-1 to F-SC3-15

Table Summer Light Post Project Figures:

Category	Line Element	Substation Terminals		Faulted End	Figure Reference
A	n/a	Flat Start		n/a	A-SC3-1 B-SC3-1 C-SC3-1 D-SC3-1 E-SC3-1 F-SC3-1
B	612L	Fincastle 336S	Burdett 368S	336S	A-SC3-2 B-SC3-2 C-SC3-2 D-SC3-2 E-SC3-2 F-SC3-2
				368S	A-SC3-3 B-SC3-3 C-SC3-3 D-SC3-3 E-SC3-3 F-SC3-3
B	610L	Fincastle 336S	Taber 83S	336S	A-SC3-4 B-SC3-4 C-SC3-4 D-SC3-4 E-SC3-4 F-SC3-4
				83S	A-SC3-5 B-SC3-5 C-SC3-5 D-SC3-5 E-SC3-5 F-SC3-5
B	507L	Taber 83S	Hull 257S	83S	A-SC3-6 B-SC3-6 C-SC3-6 D-SC3-6 E-SC3-6 F-SC3-6
				257S	A-SC3-7 B-SC3-7 C-SC3-7 D-SC3-7 E-SC3-7 F-SC3-7
B	879L	Burdett 368S	Bowmanton 244S	368S	A-SC3-8 B-SC3-8 C-SC3-8 D-SC3-8 E-SC3-8 F-SC3-8
				244S	A-SC3-9

					B-SC3-9 C-SC3-9 D-SC3-9 E-SC3-9 F-SC3-9
B	763L	Vauxhall 158S	West Brooks 28S	158S	A-SC3-10 B-SC3-10 C-SC3-10 D-SC3-10 E-SC3-10 F-SC3-10
				28S	A-SC3-11 B-SC3-11 C-SC3-11 D-SC3-11 E-SC3-11 F-SC3-11
B	795L	Brooks 121s	Hays 421S	121S	A-SC3-12 B-SC3-12 C-SC3-12 D-SC3-12 E-SC3-12 F-SC3-12
				421S	A-SC3-13 B-SC3-13 C-SC3-13 D-SC3-13 E-SC3-13 F-SC3-13
B	821L	Vauxhall 158S	Hays 421S	158S	A-SC3-14 B-SC3-14 C-SC3-14 D-SC3-14 E-SC3-14 F-SC3-14
				421S	A-SC3-15 B-SC3-15 C-SC3-15 D-SC3-15 E-SC3-15 F-SC3-15

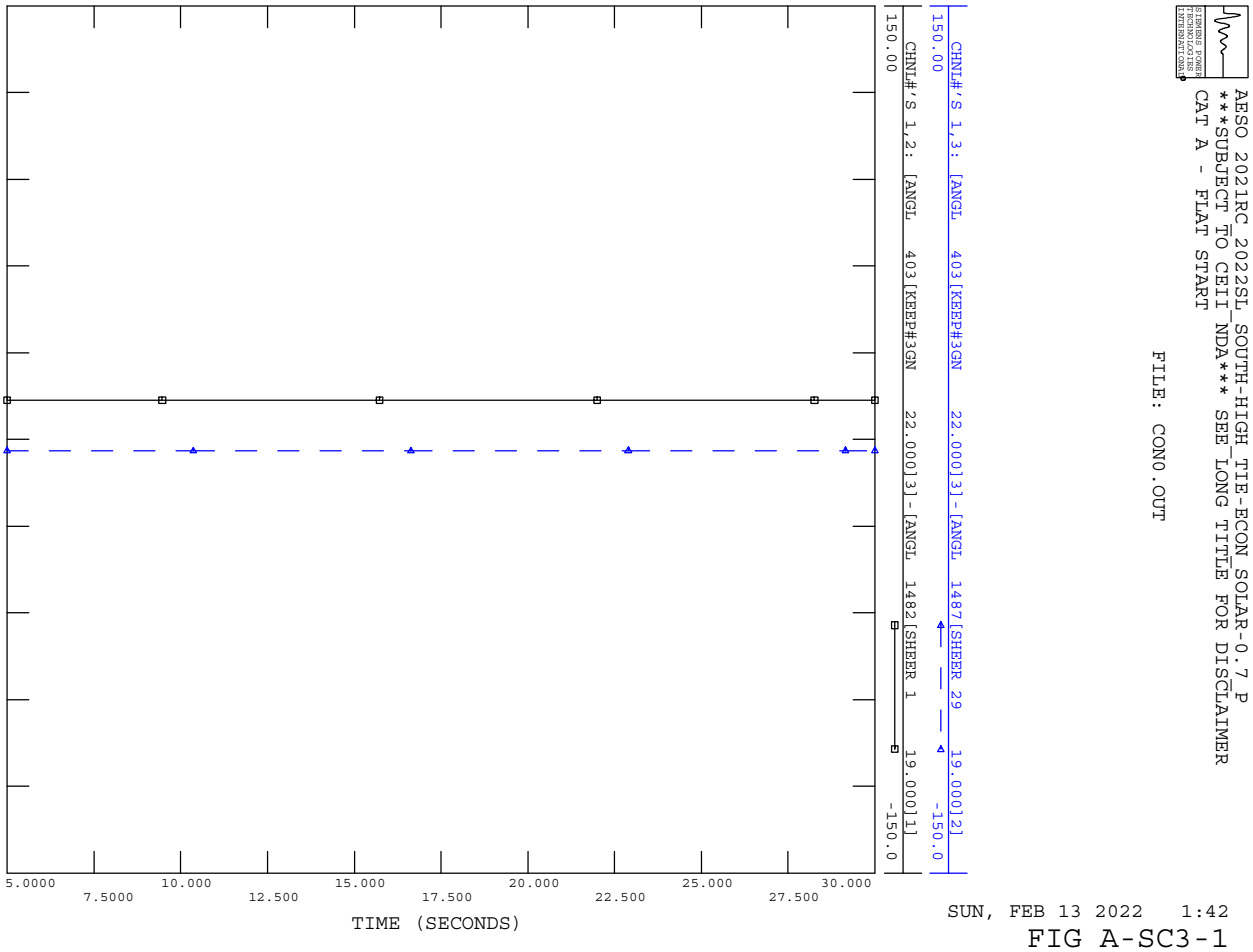


FIG A-SC3-1

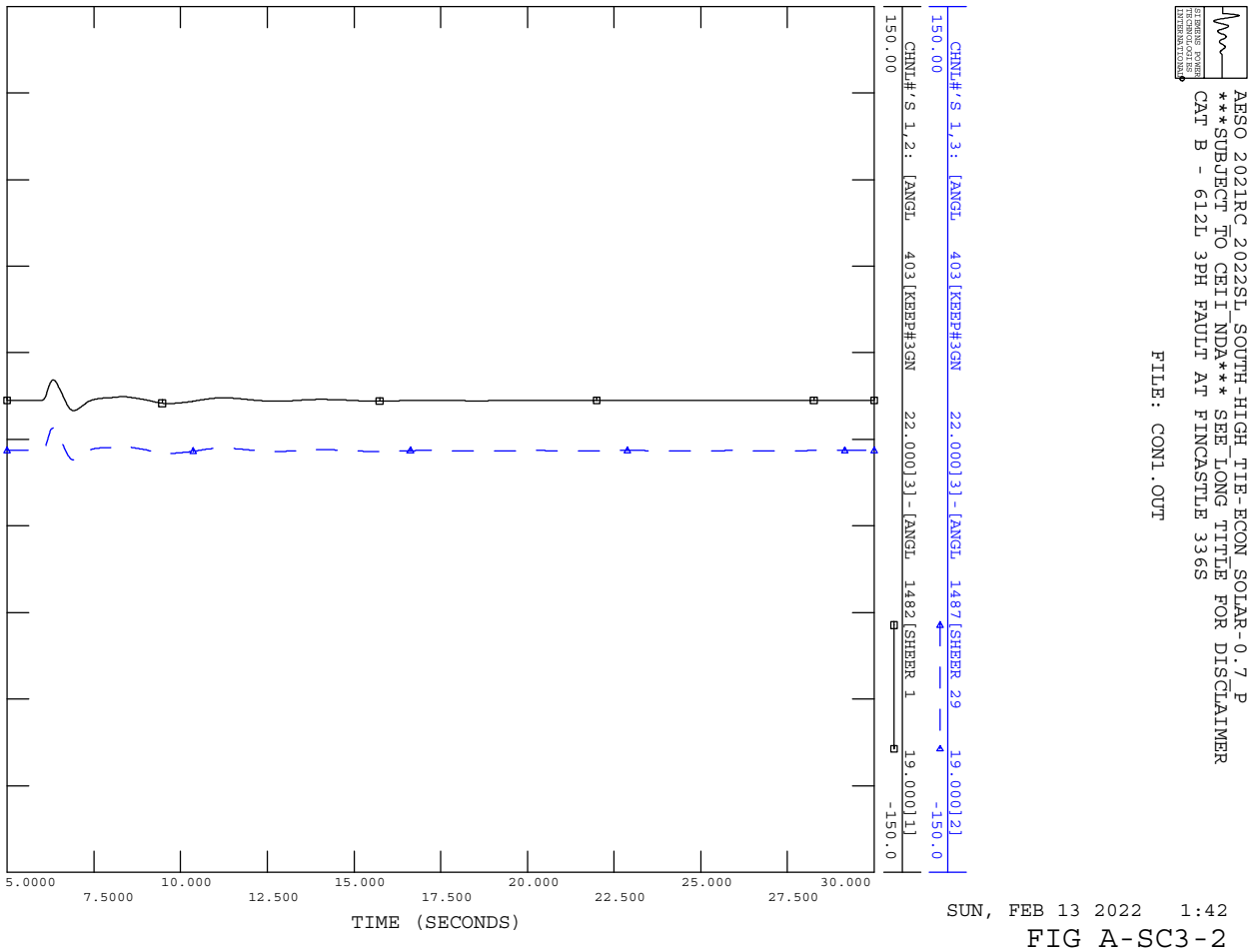


FIG A-SC3-2

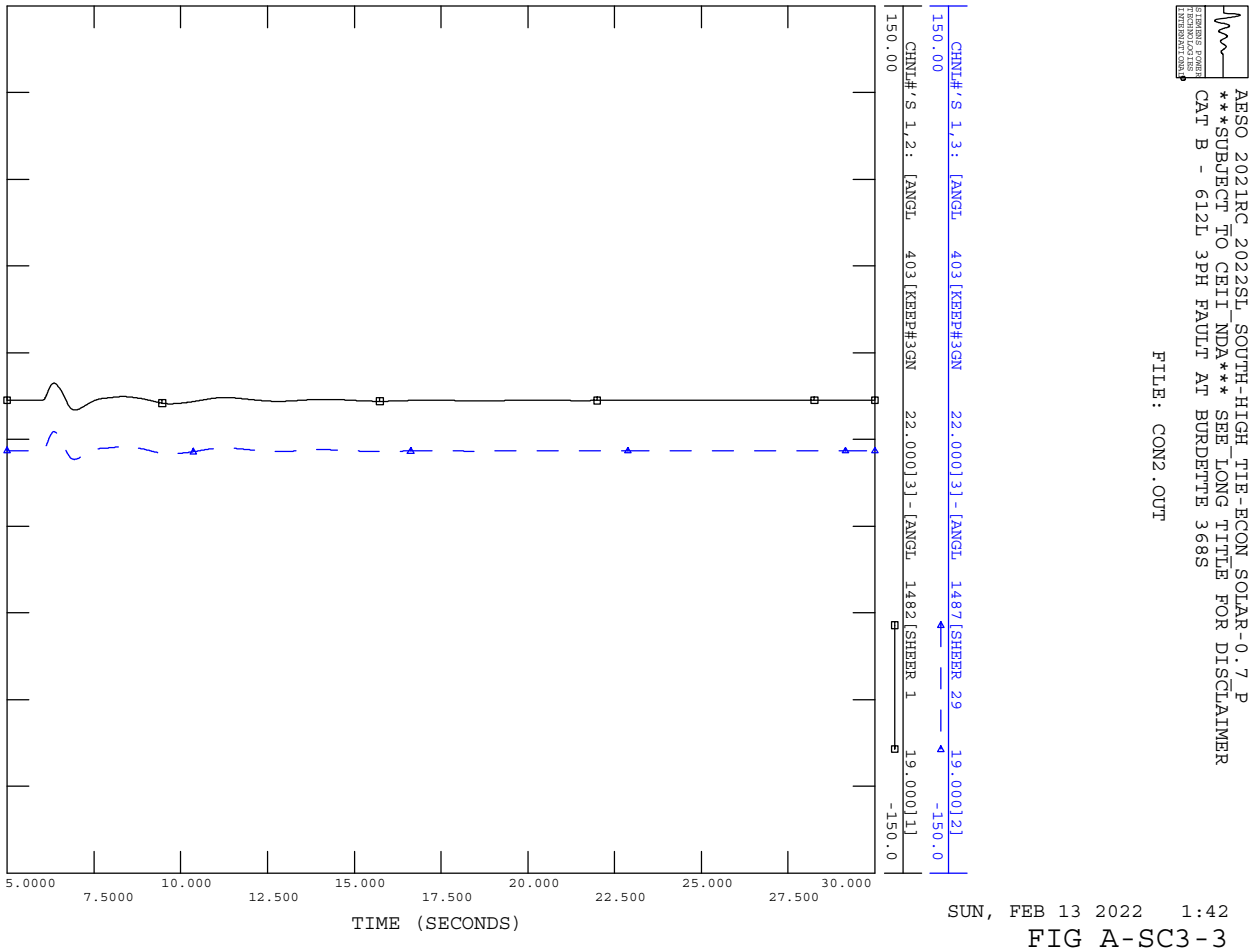


FIG A-SC3-3

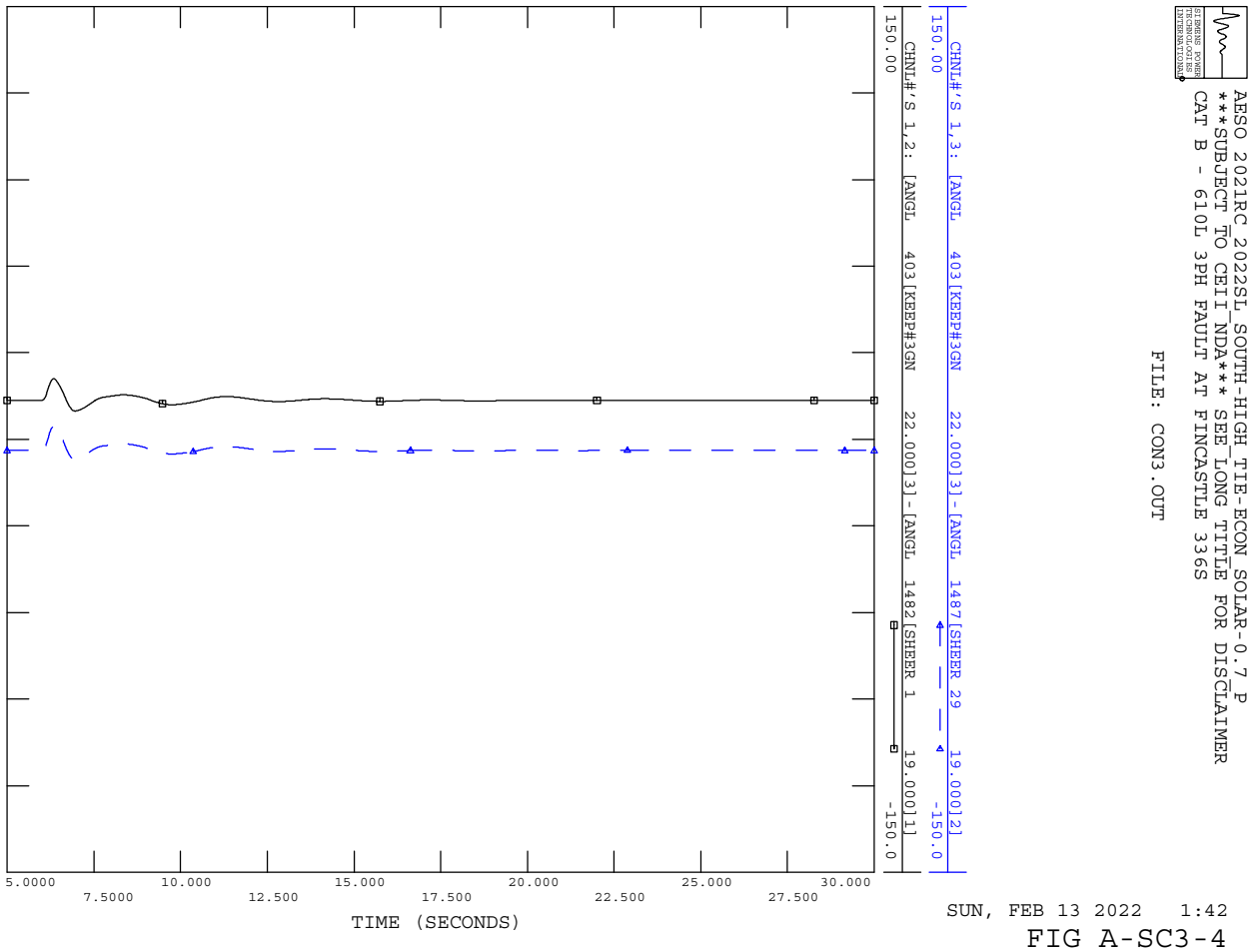


FIG A-SC3-4

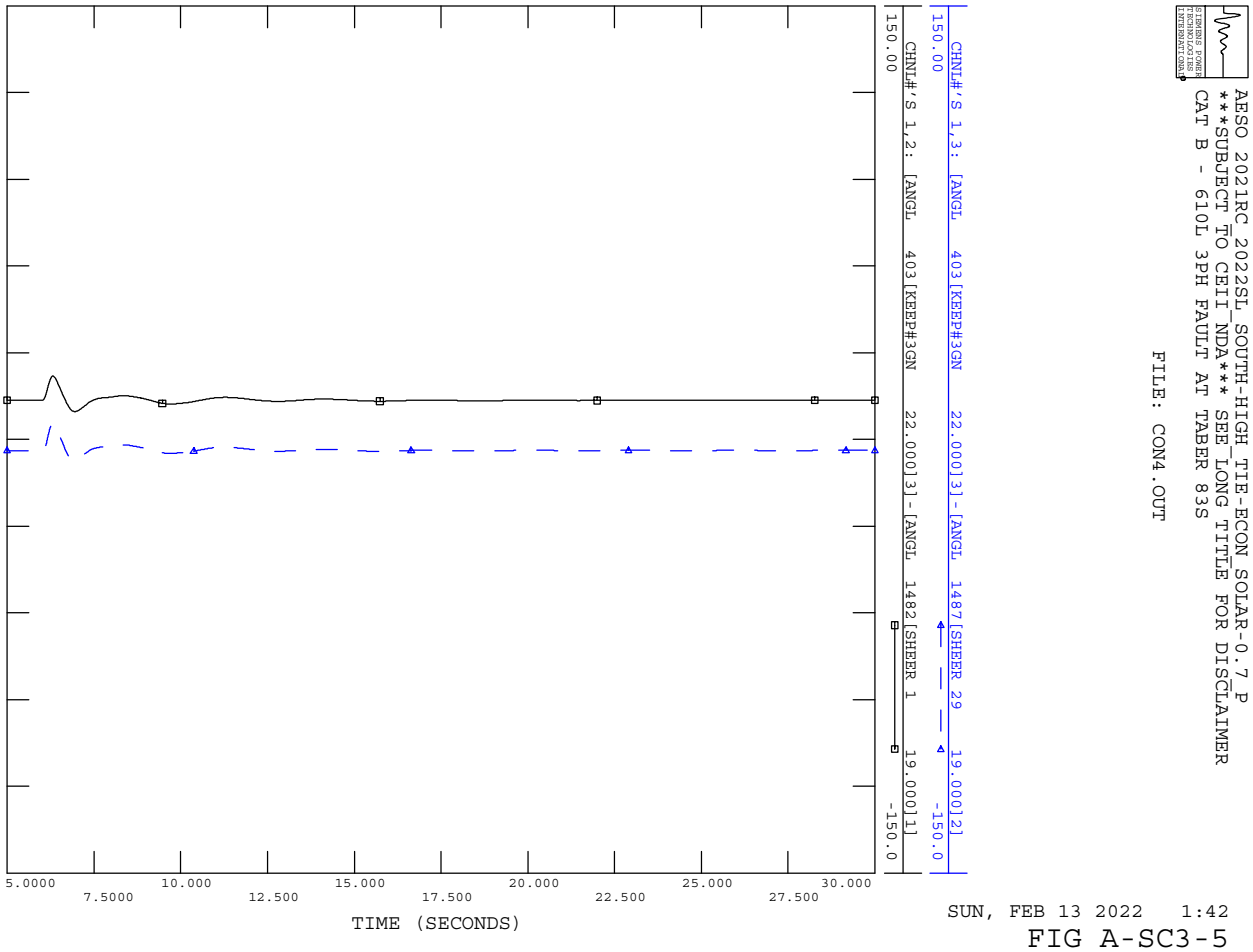


FIG A-SC3-5

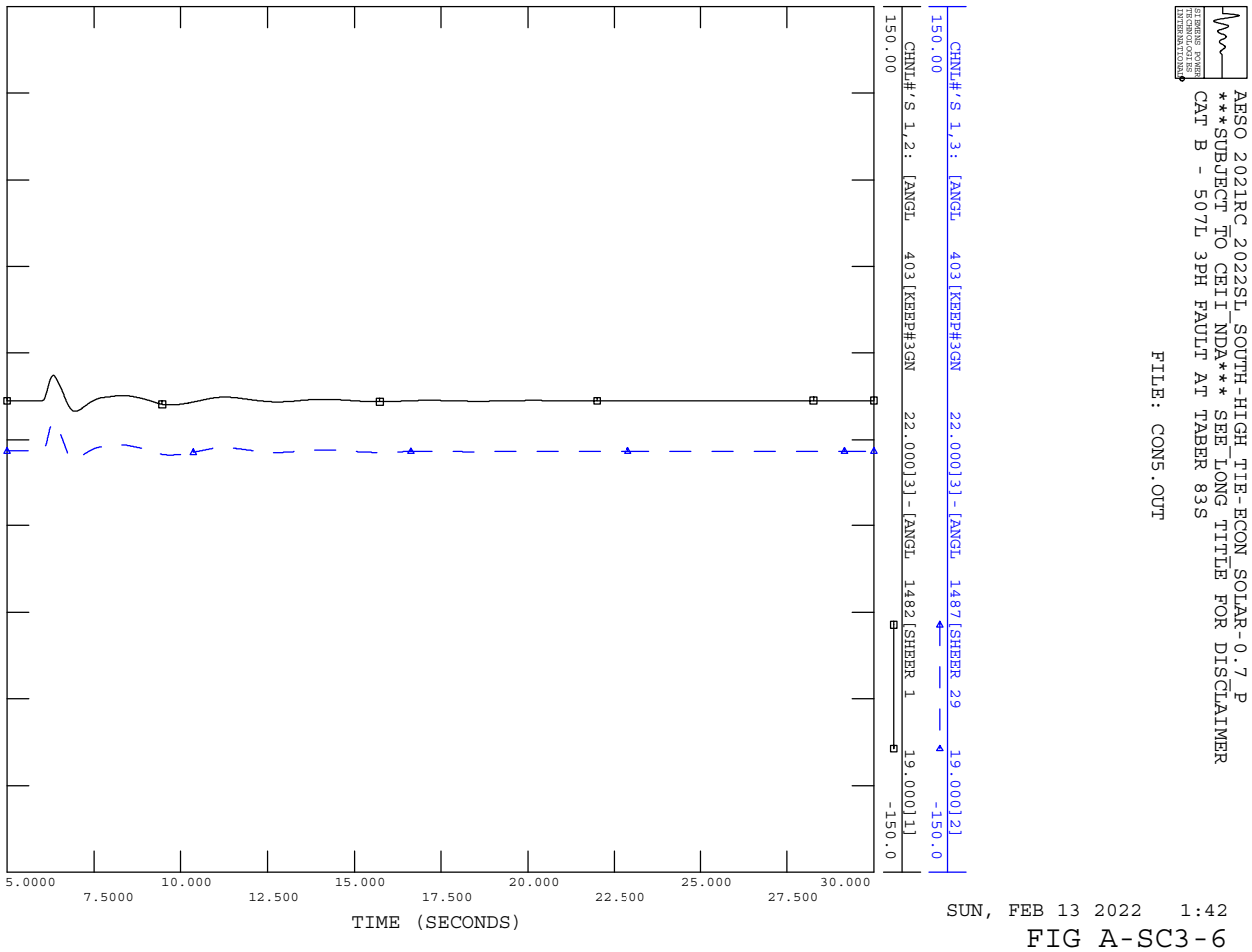


FIG A-SC3-6

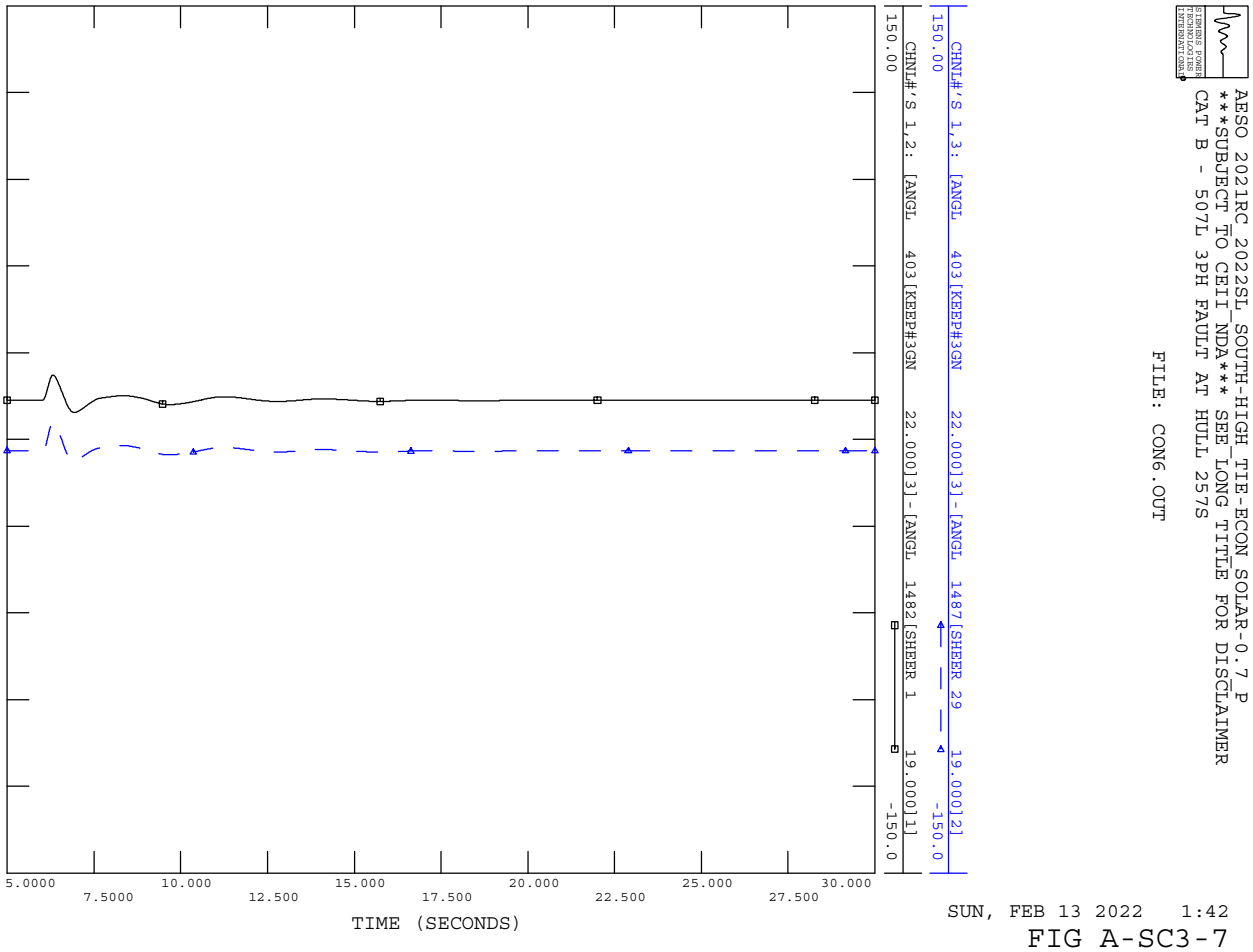


FIG A-SC3-7

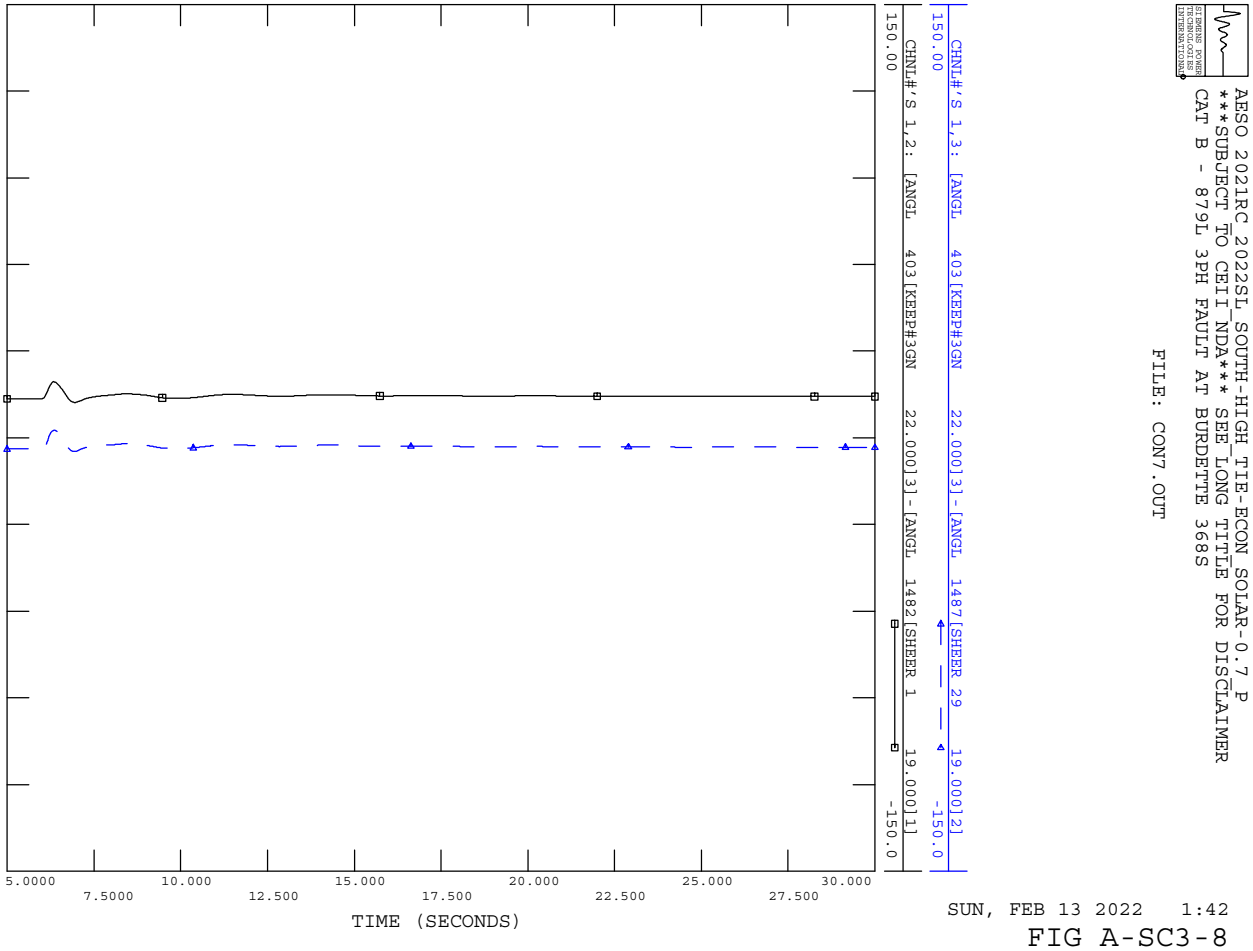


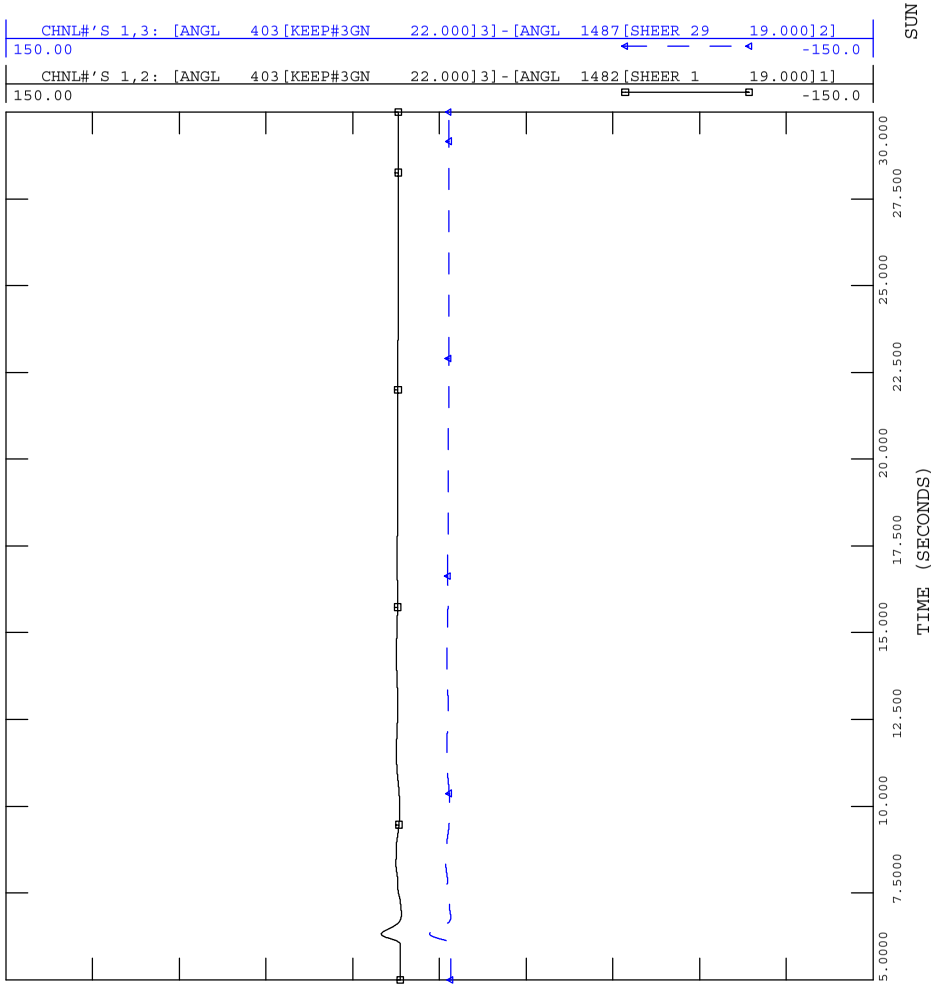
FIG A-SC3-8

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 879L 3PH FAULT AT BOWMANTON 244S

FILE: CON8.OUT

SUN, FEB 13 2022 1:42

FIG A-SC3-9

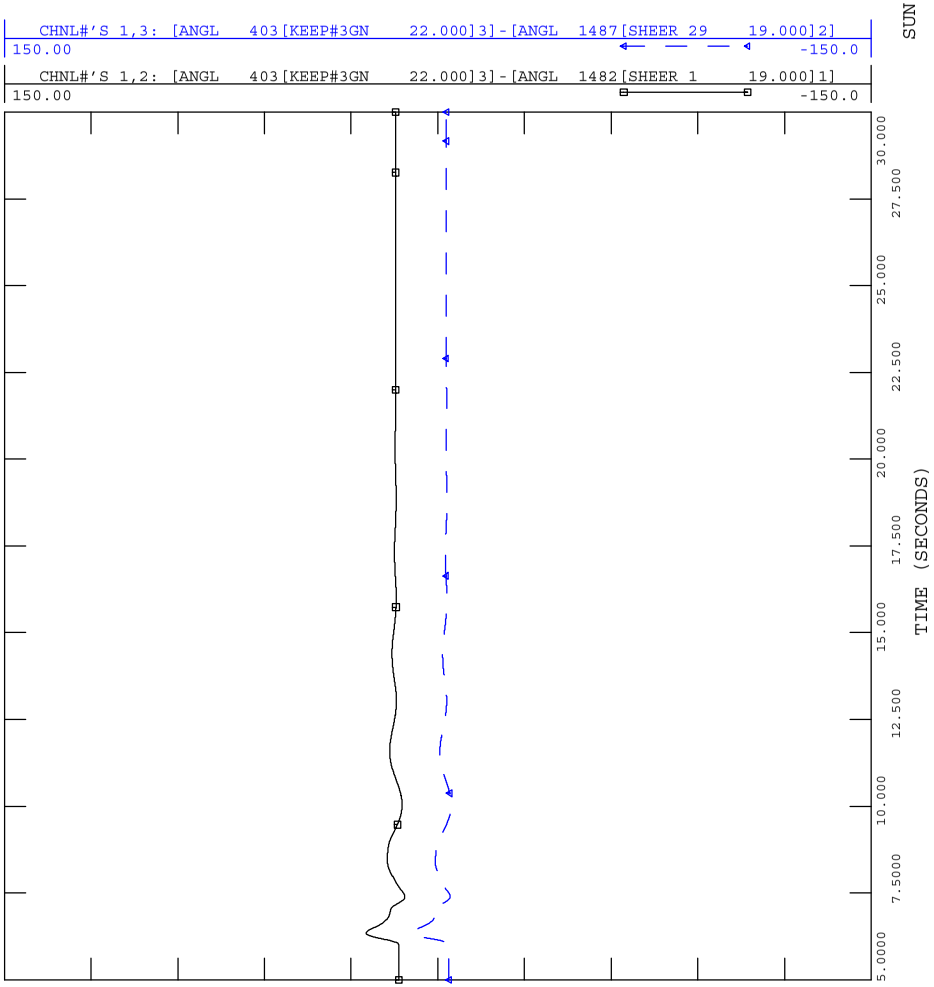


AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 763L 3PH FAULT AT VAUXHALL 158S

FILE: CON9.OUT

SUN, FEB 13 2022 1:42

FIG A-SC3-10

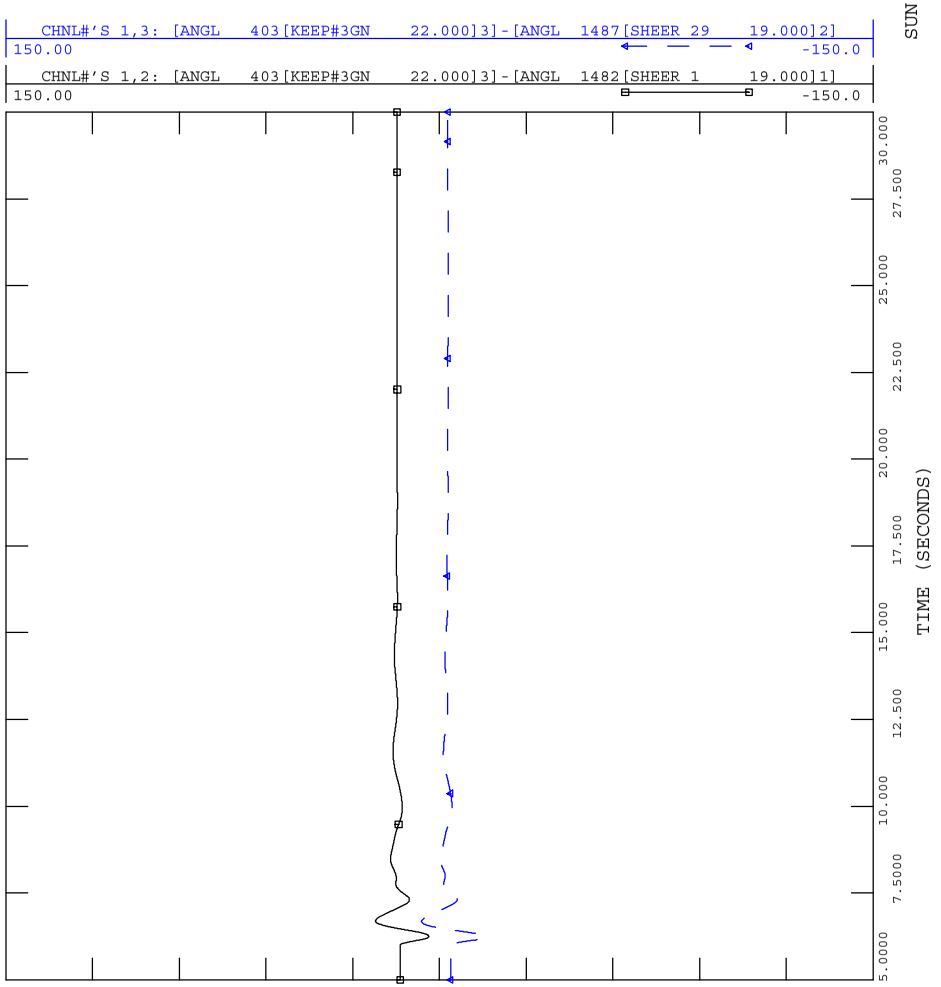


AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 763L 3PH FAULT AT W. BROOKS 28S

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SUN, FEB 13 2022 1:42

FIG A-SC3-11

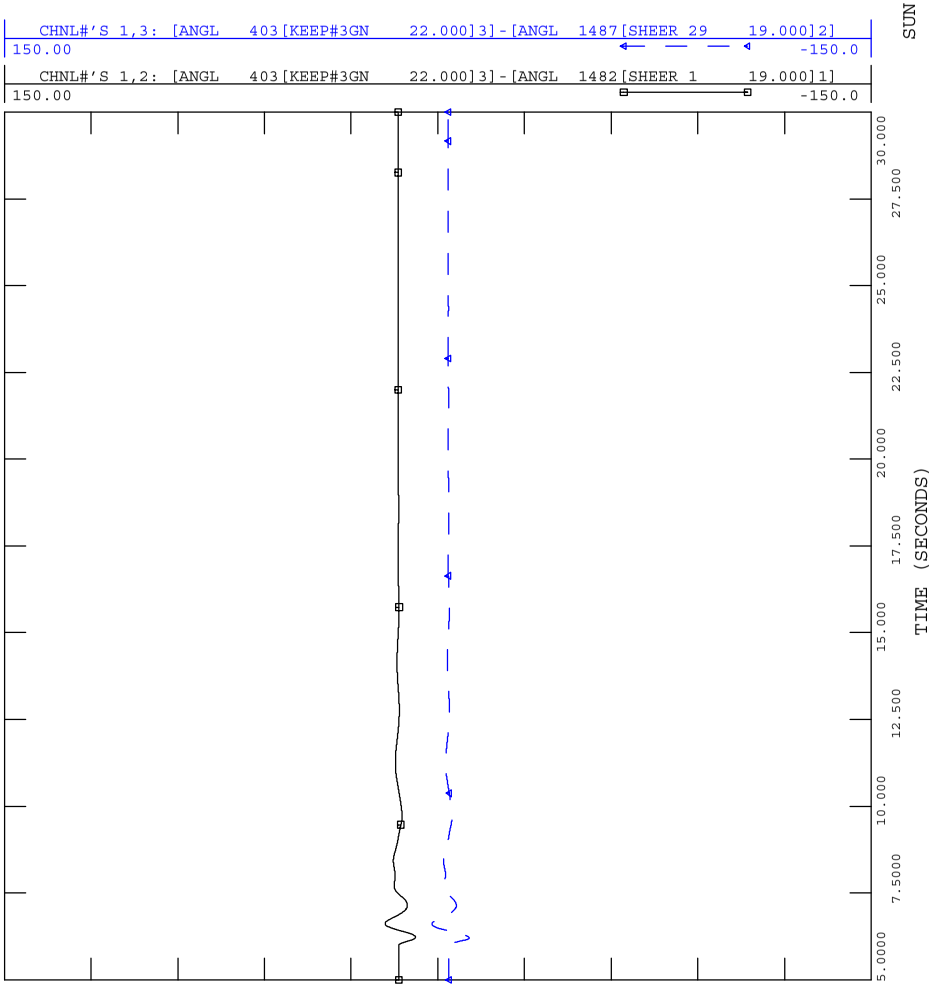


AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 795L 3PH FAULT AT BROOKS 121S

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FIG A-SC3-12

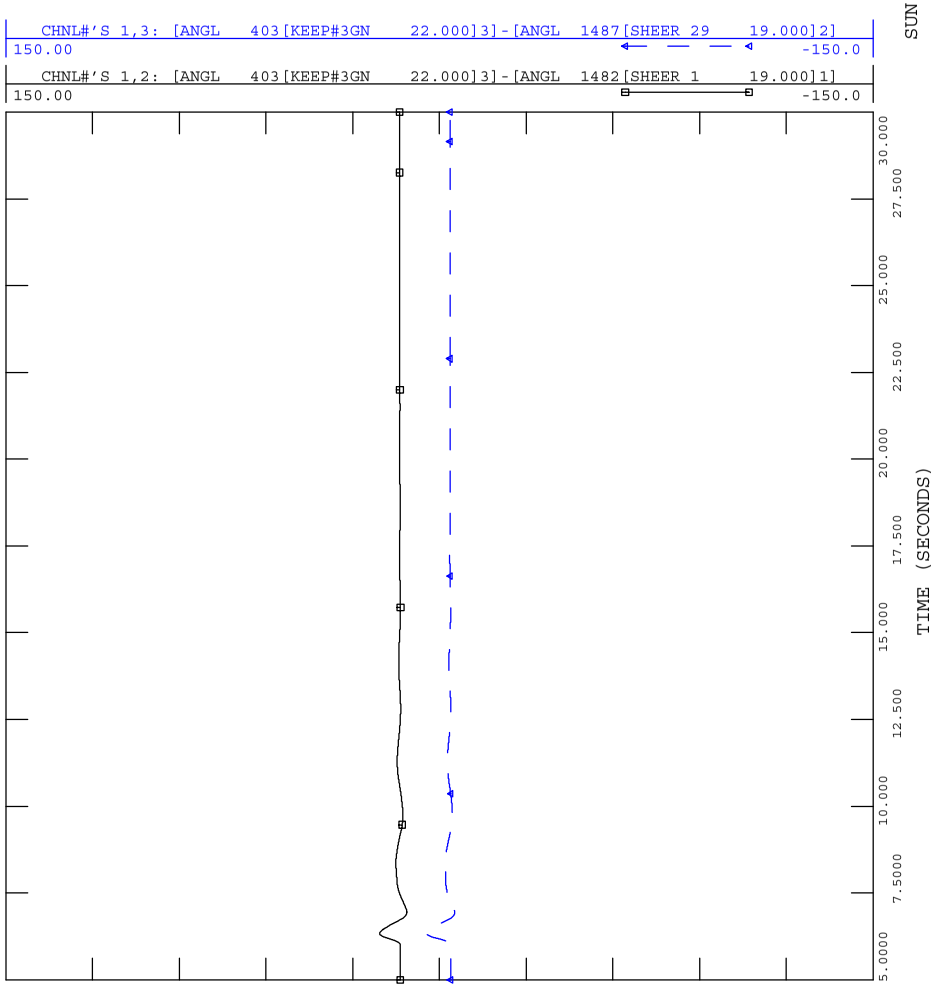


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CAT B - 795L 3PH FAULT AT HAYS 421S

FILE: CON12.OUT

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FIG A-SC3-13

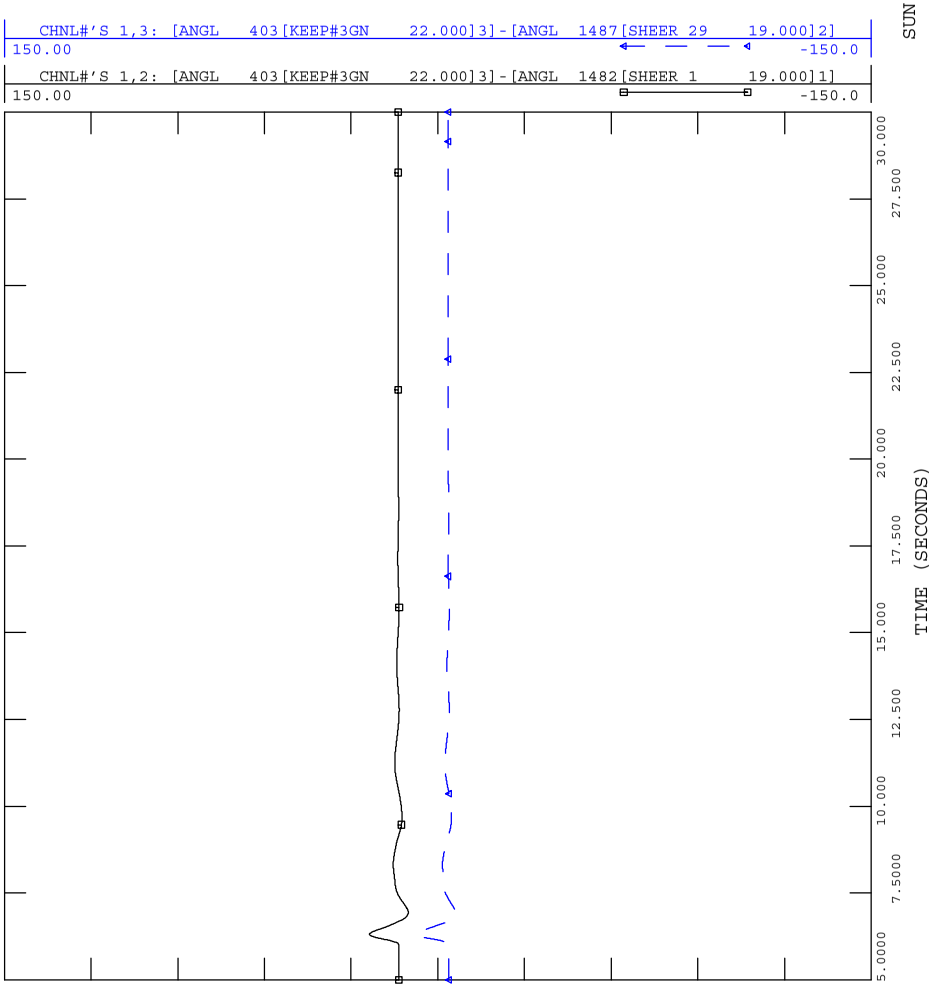


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SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT VAUXHALL 158S

FILE: CON13.OUT

SUN, FEB 13 2022 1:42

FIG A-SC3-14

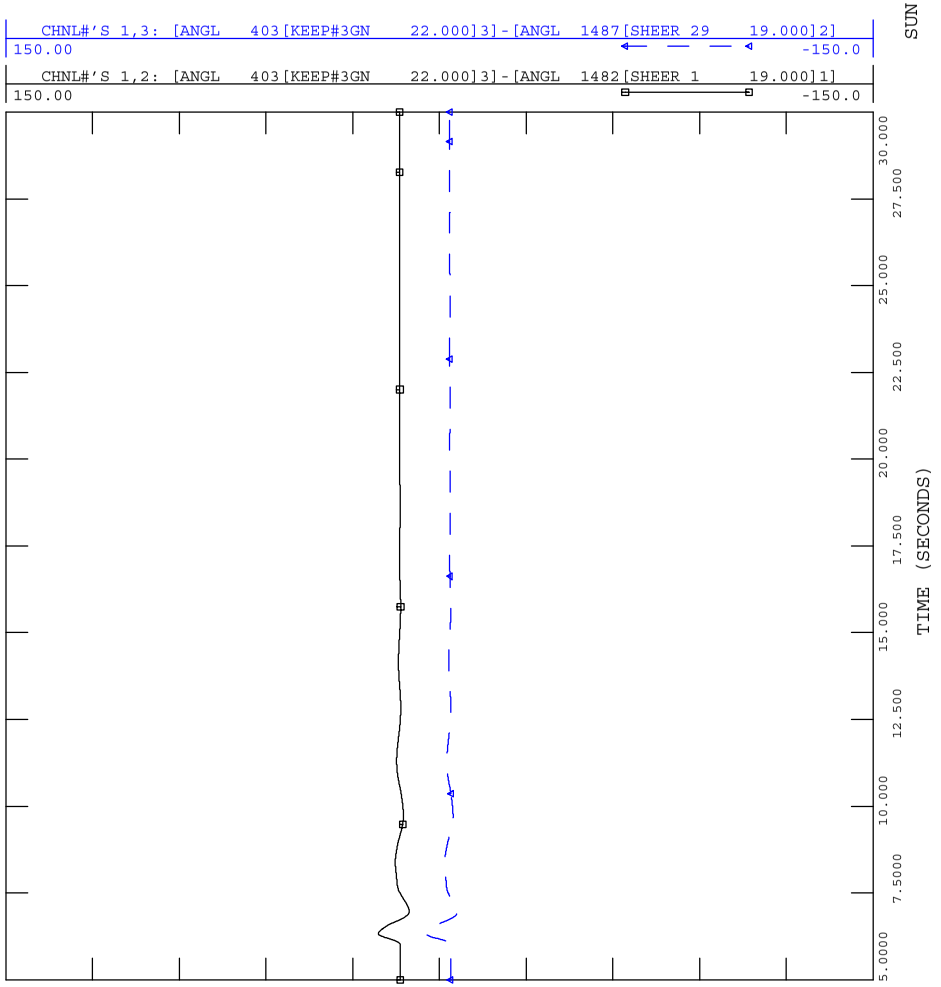


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CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT

SUN, FEB 13 2022 1:42

FIG A-SC3-15



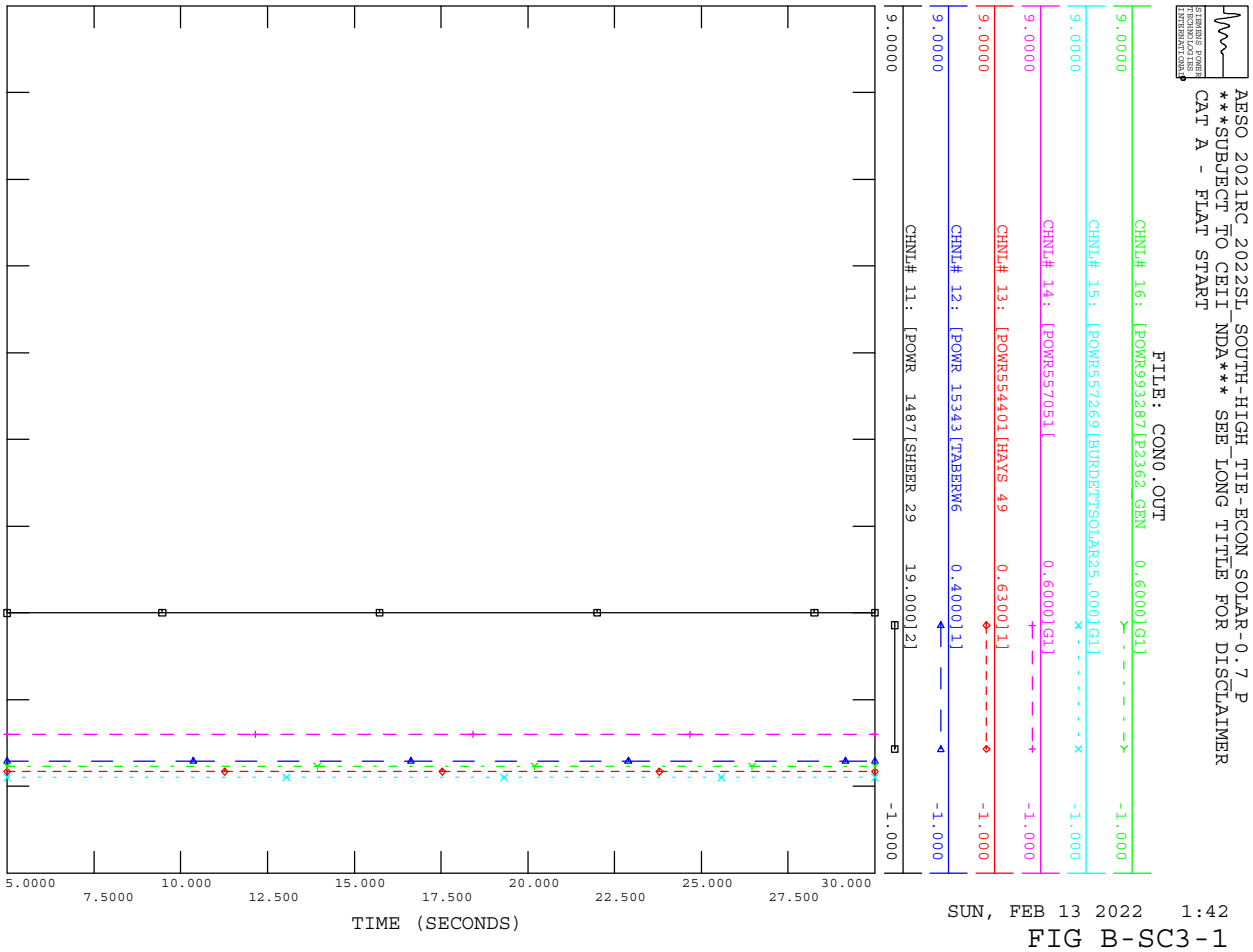


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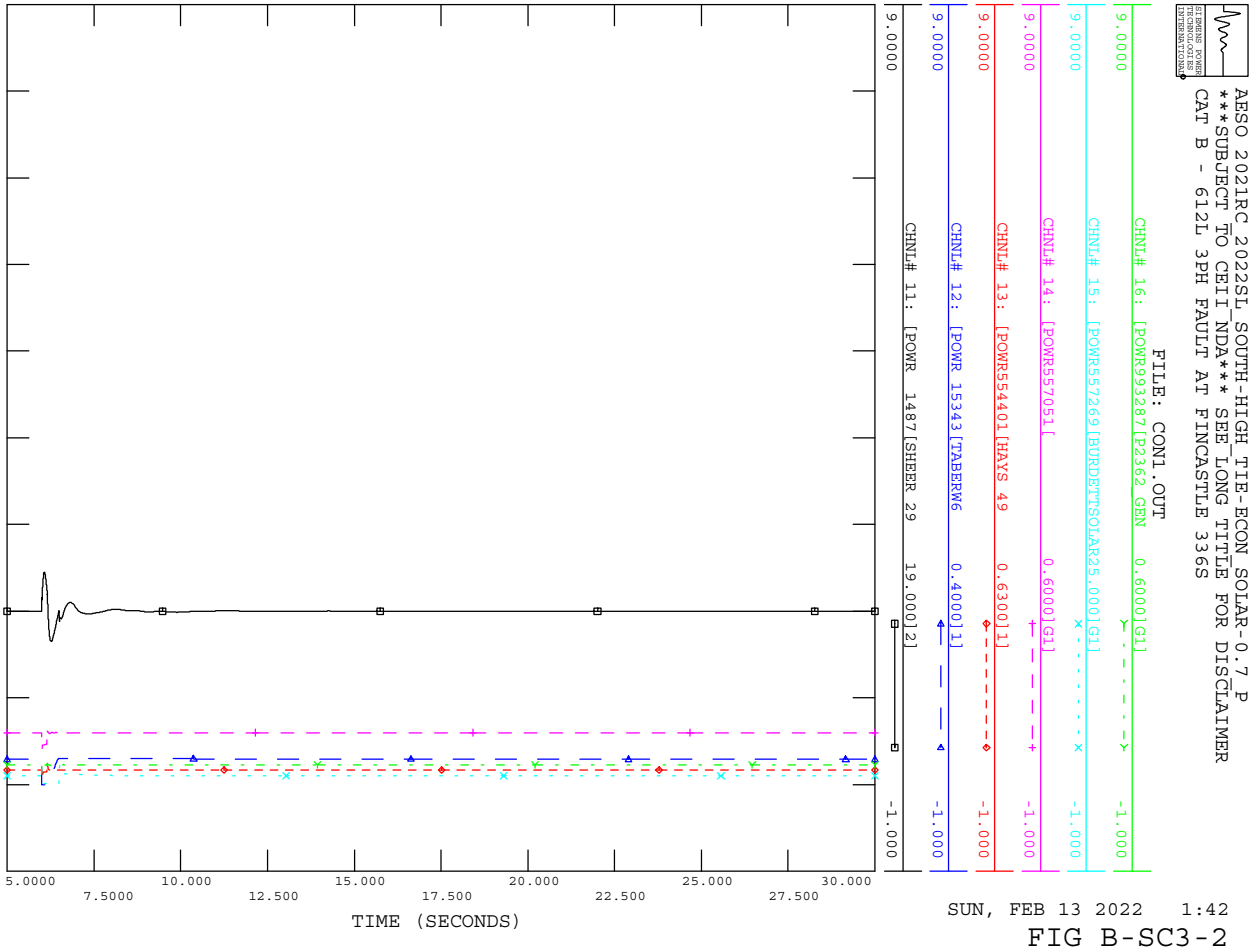


FIG B-SC3-2

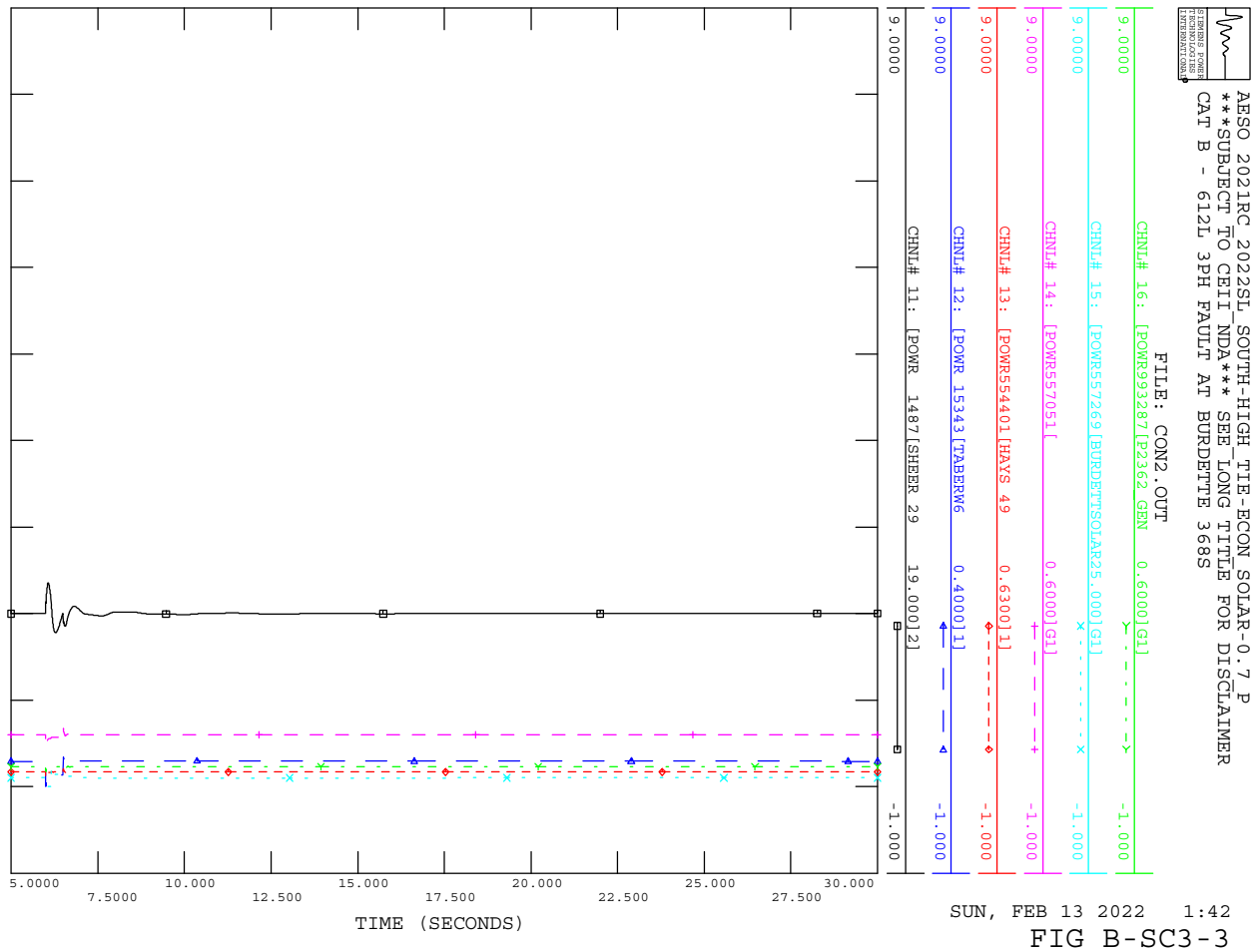


FIG B-SC3-3

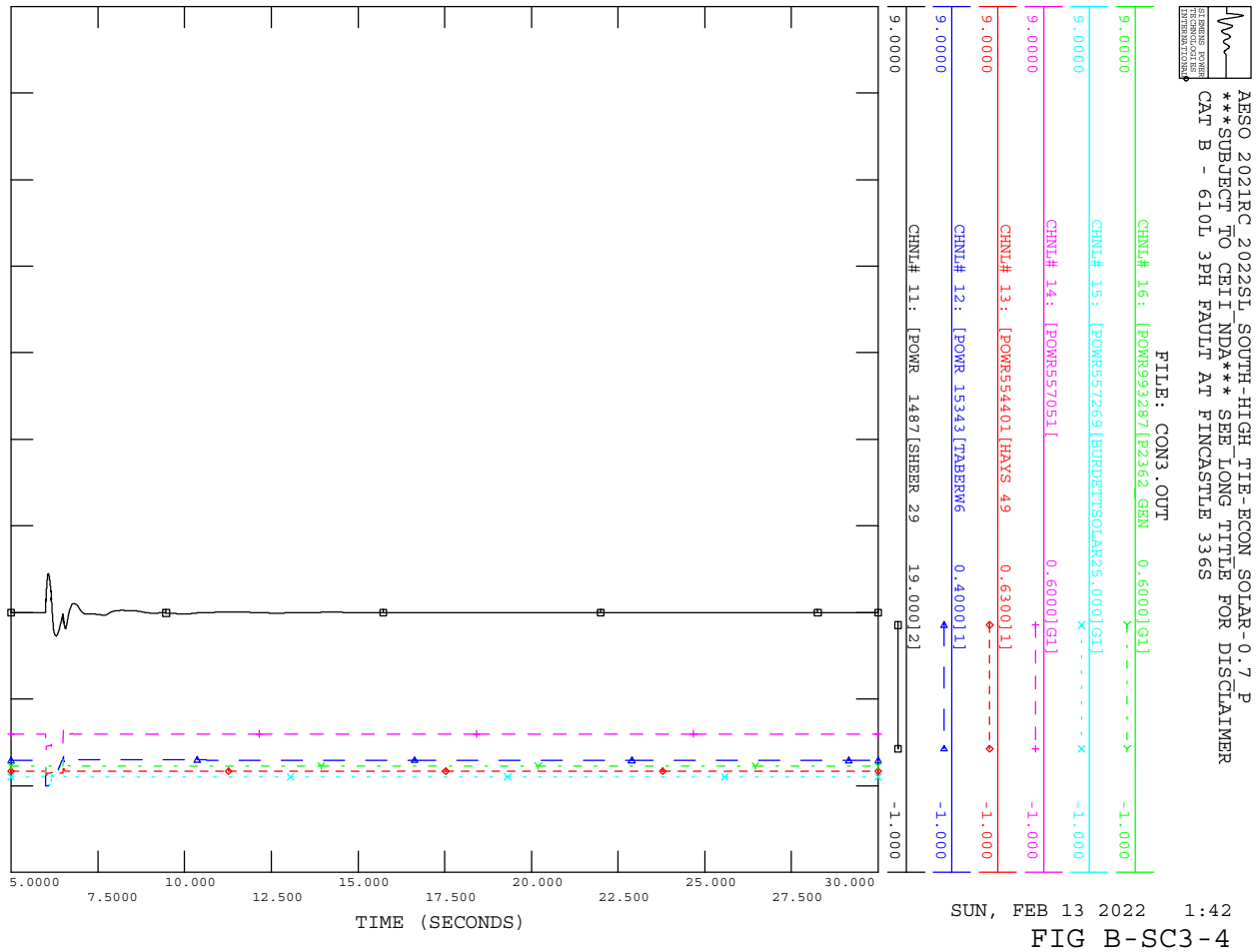


FIG B-SC3-4

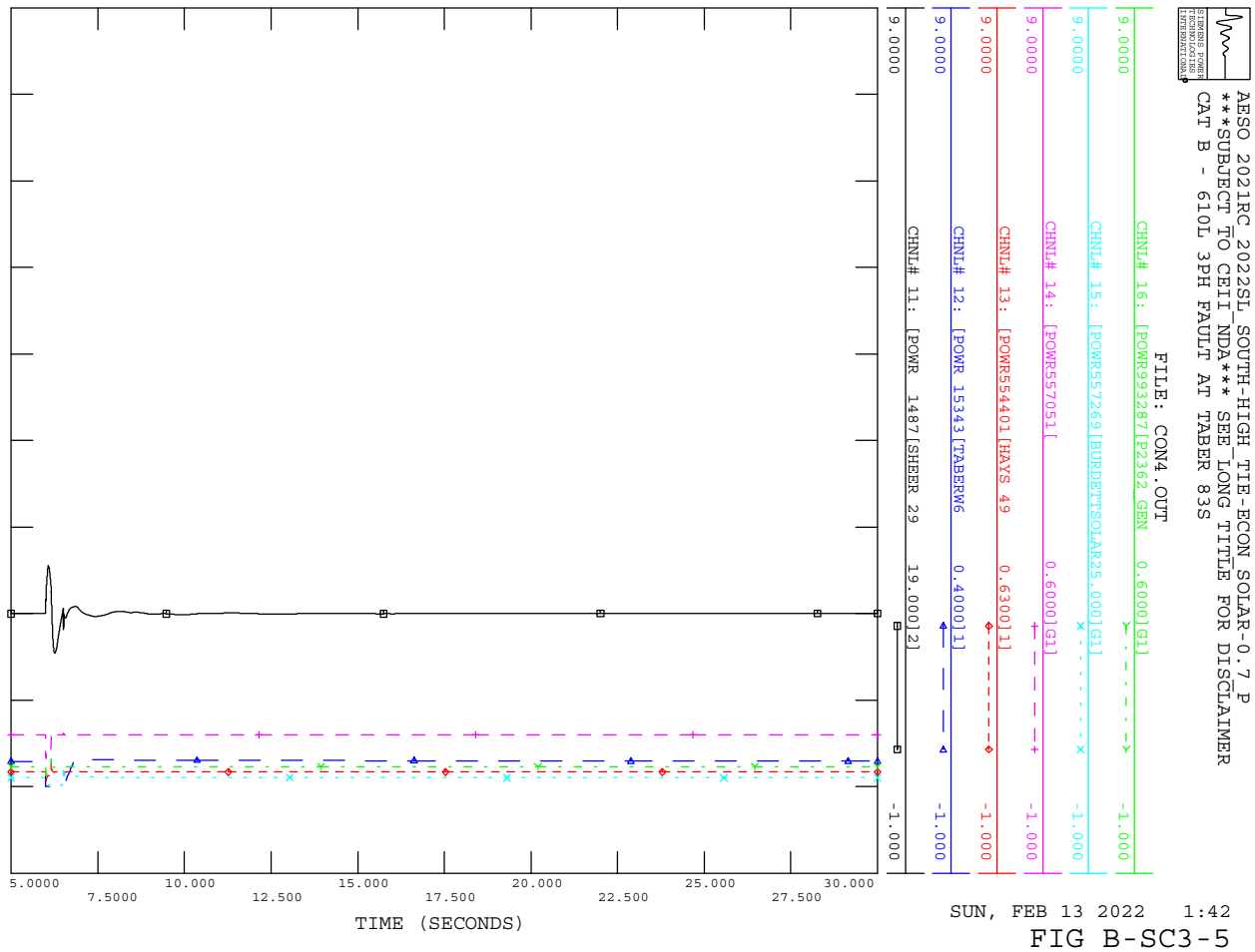


FIG B-SC3-5

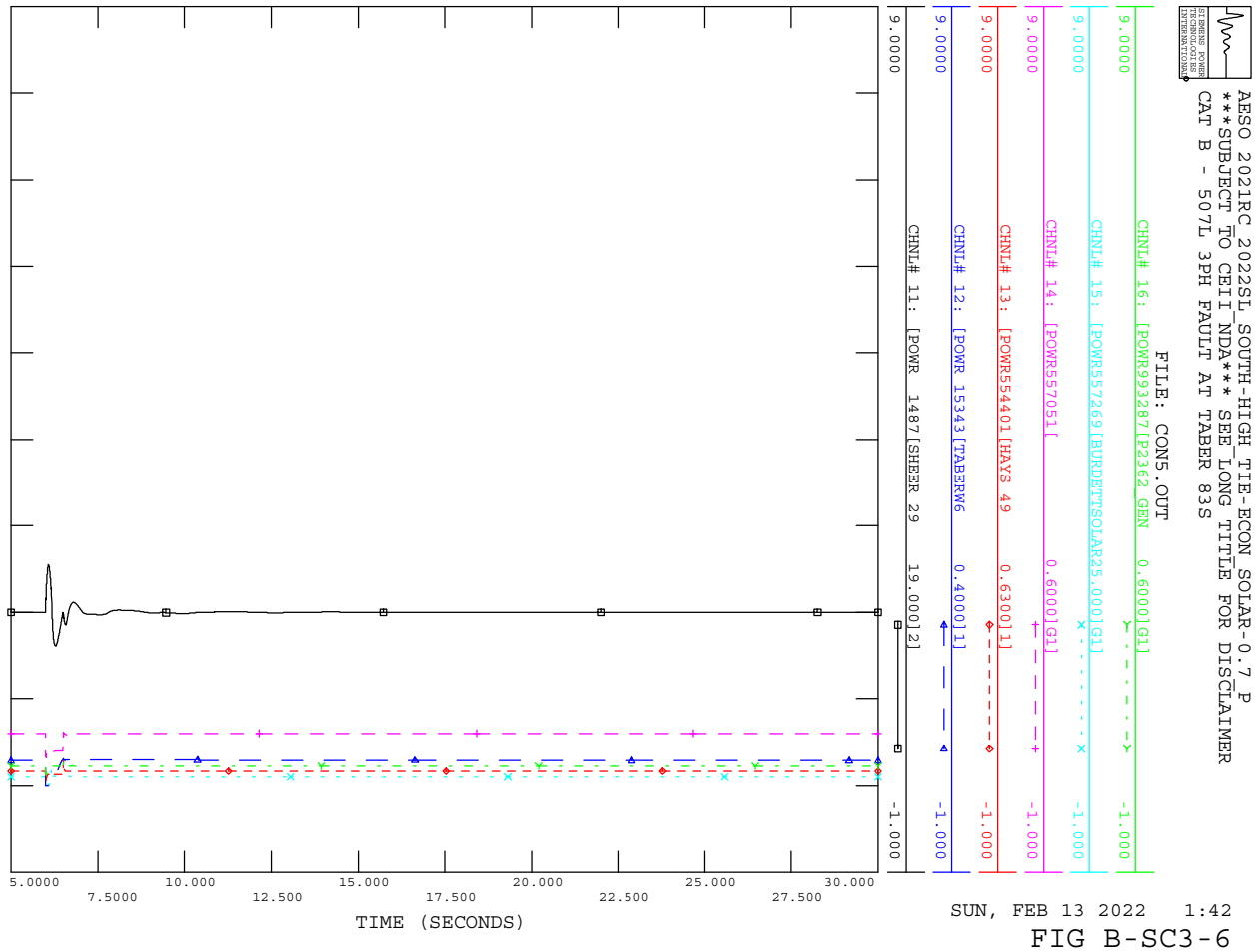


FIG B-SC3-6

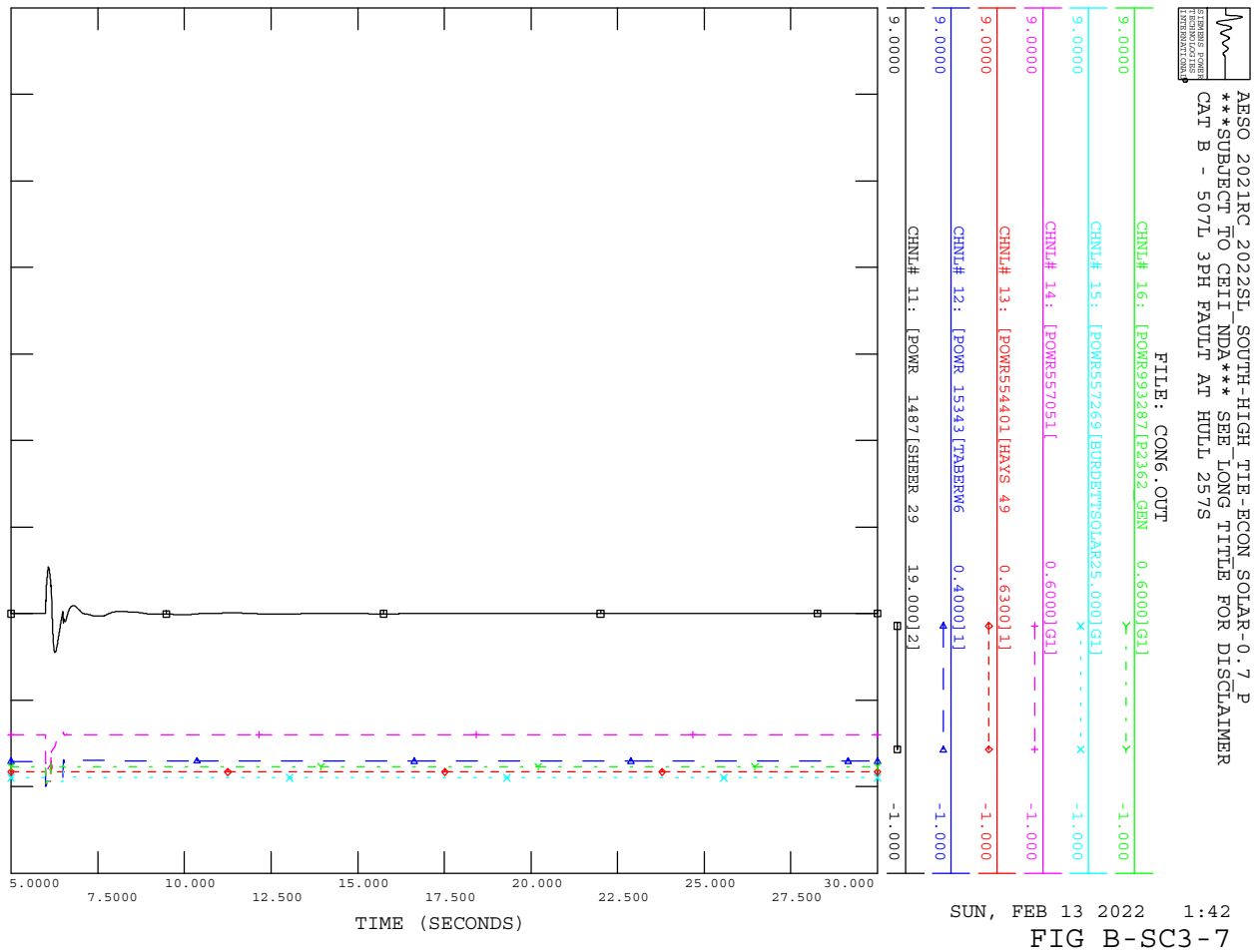


FIG B-SC3-7

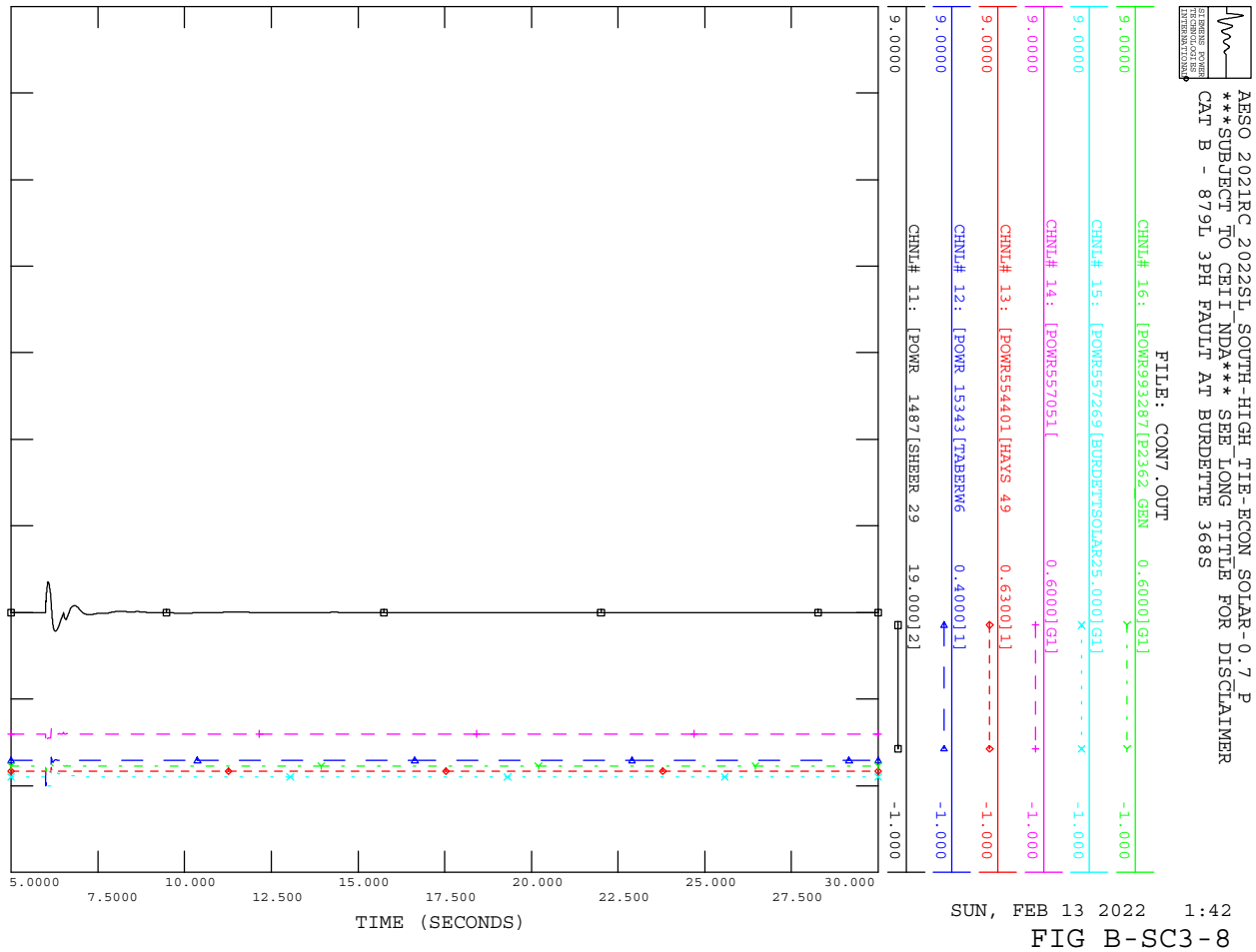


FIG B-SC3-8

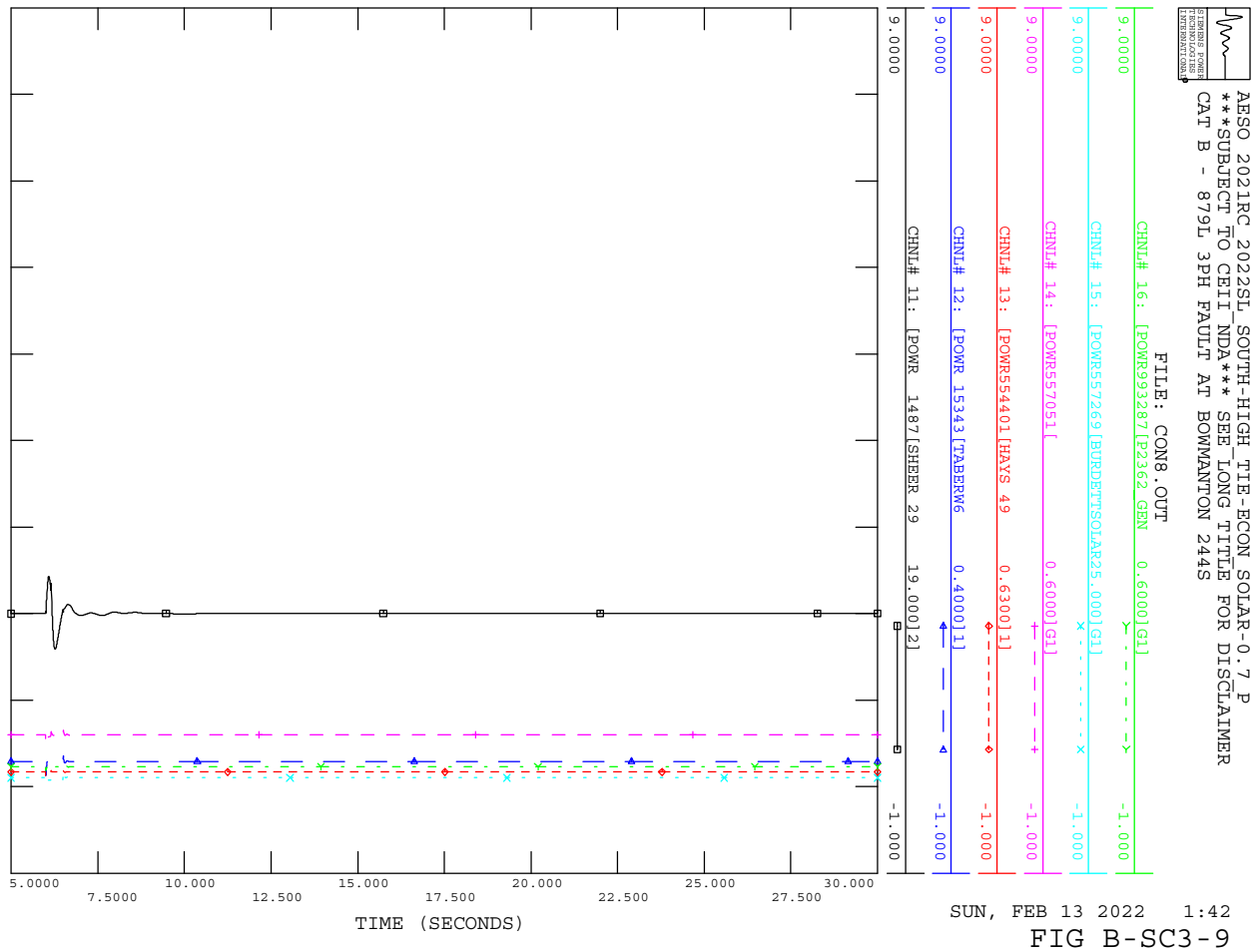


FIG B-SC3-9

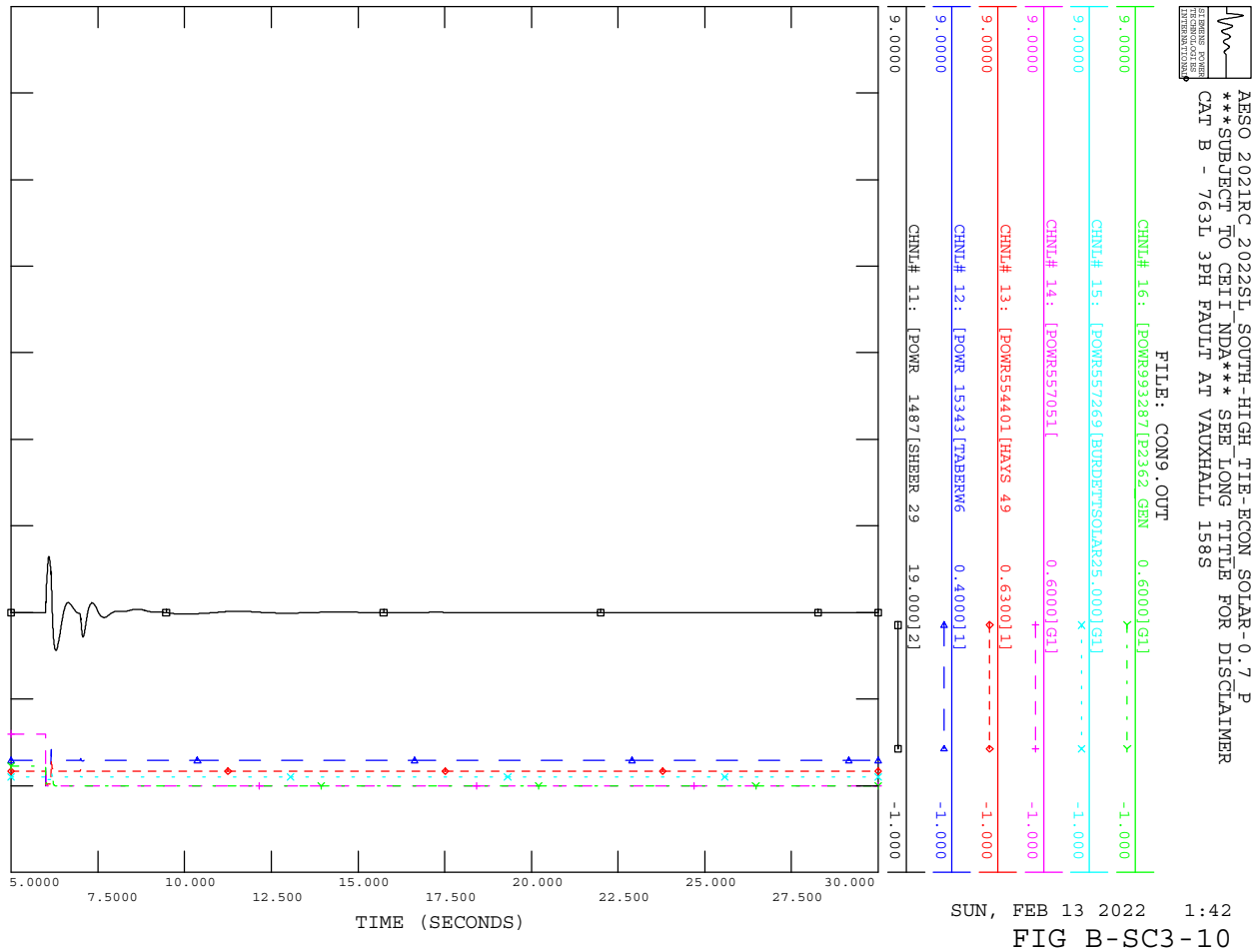


FIG B-SC3-10

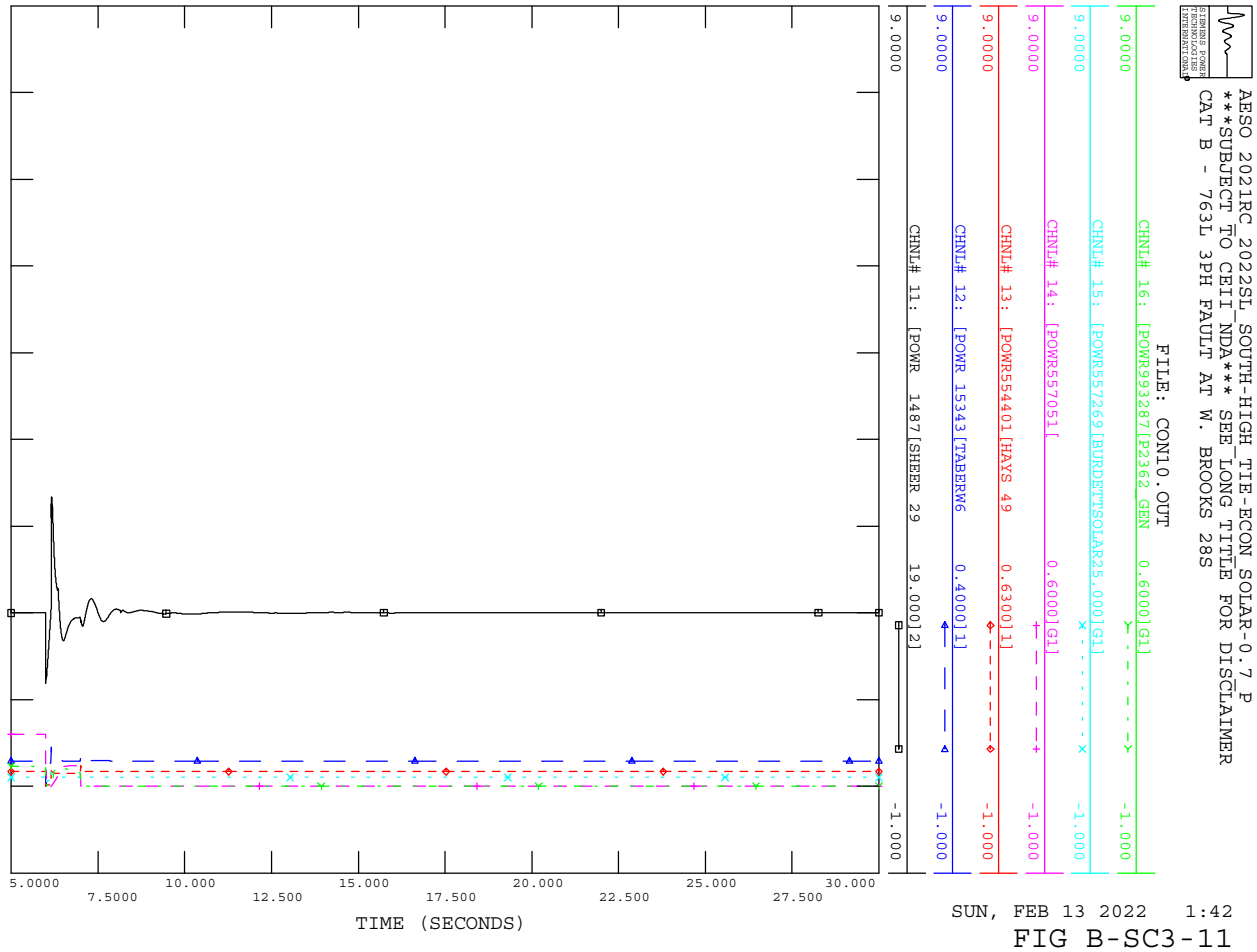


FIG B-SC3-11

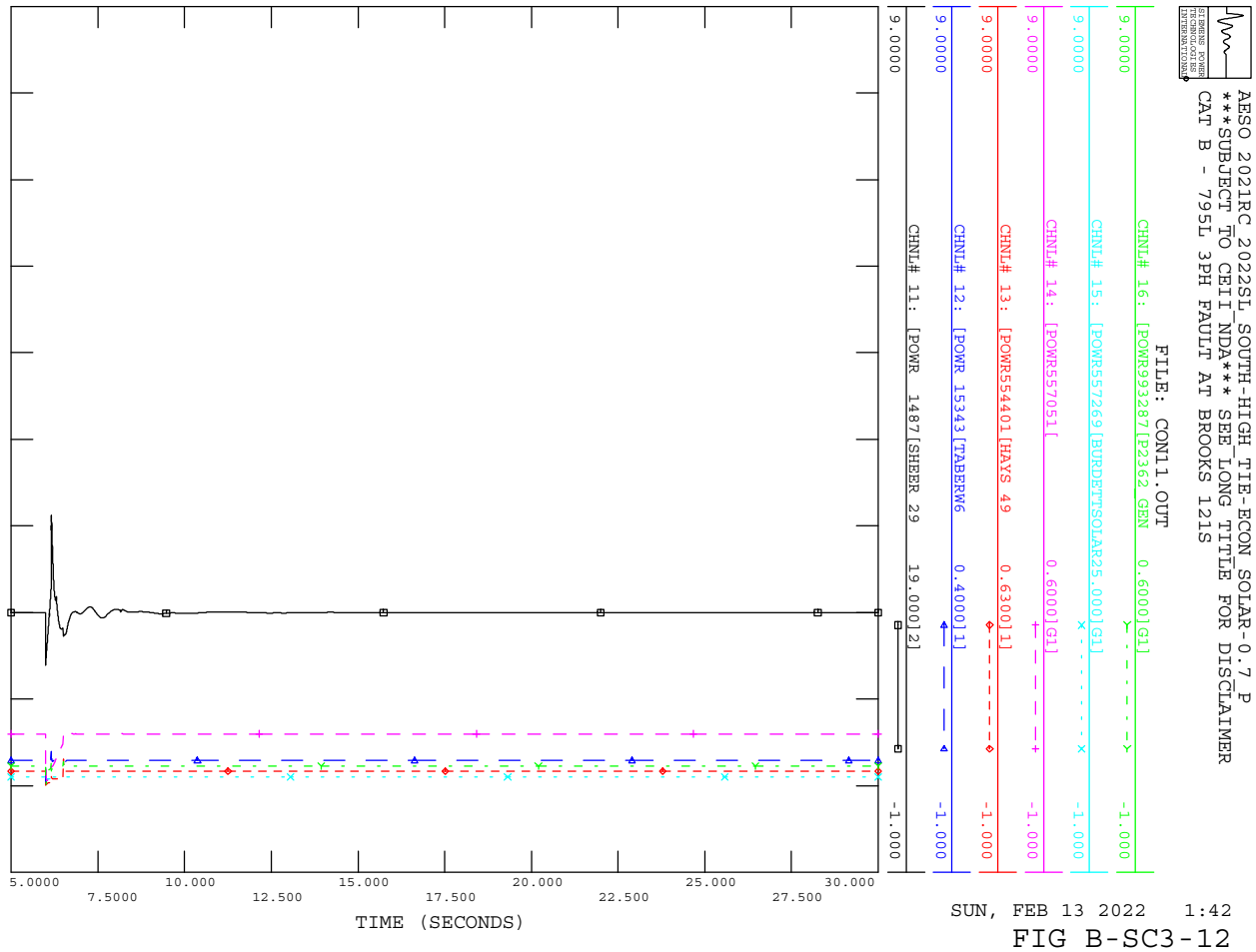


FIG B-SC3-12

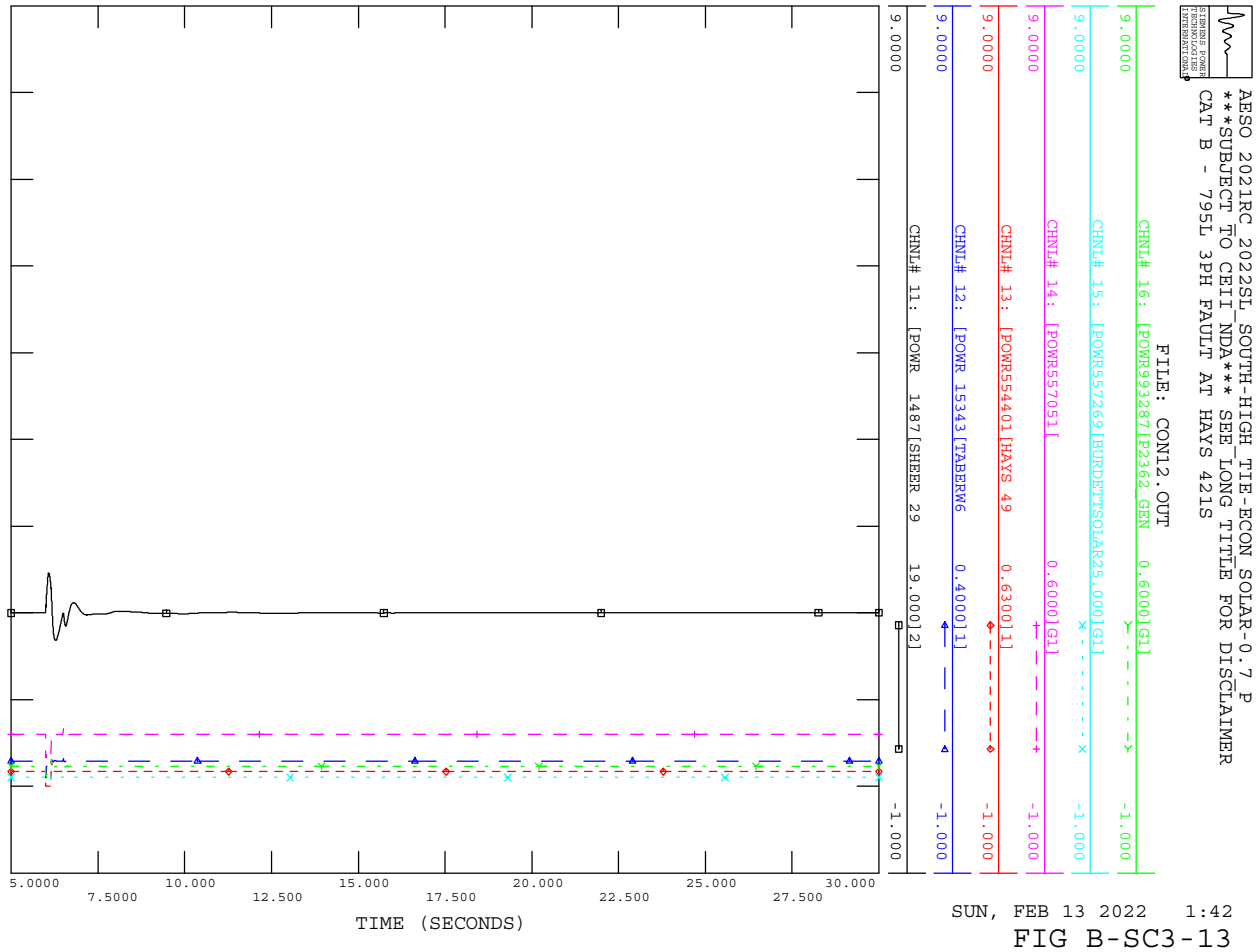


FIG B-SC3-13

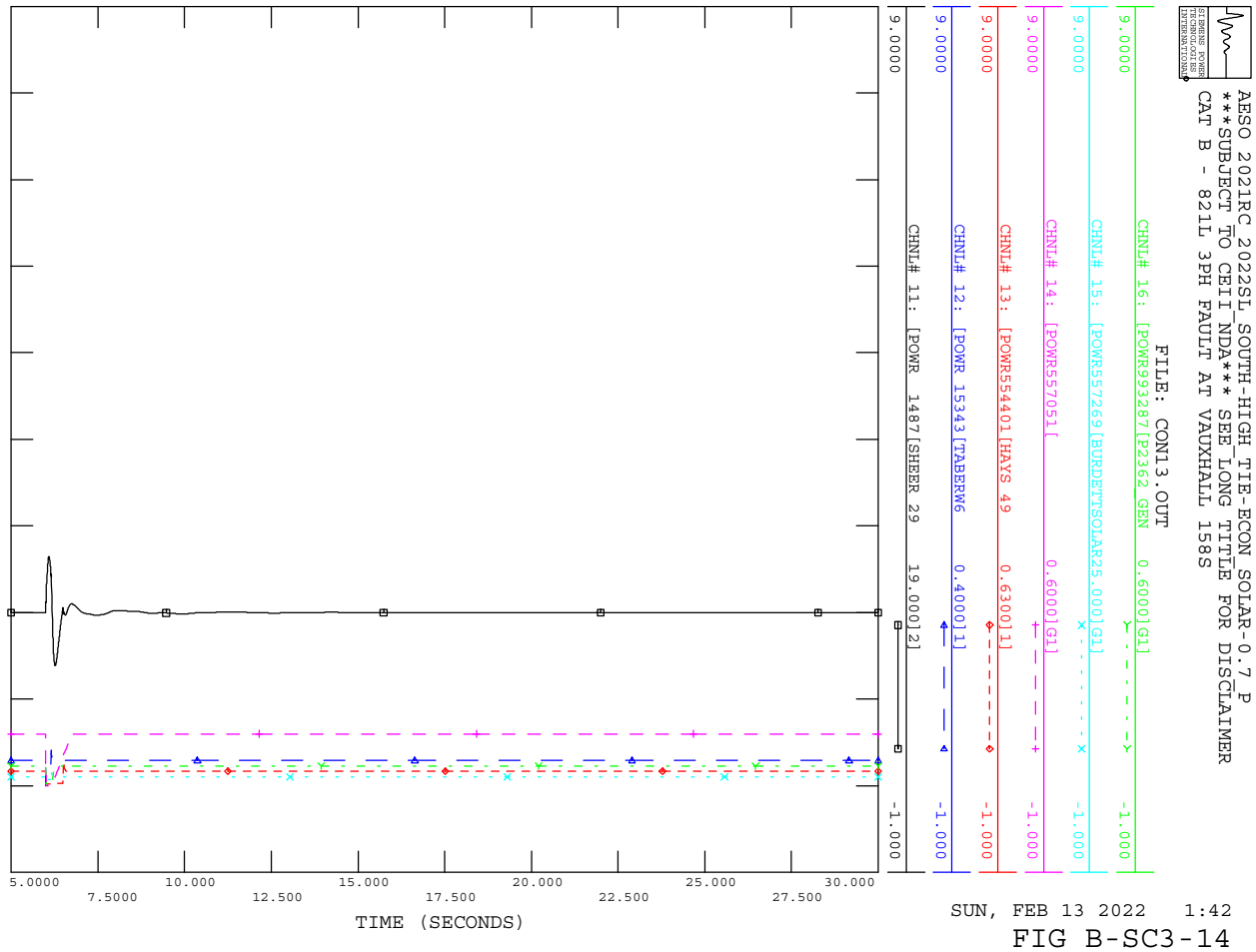
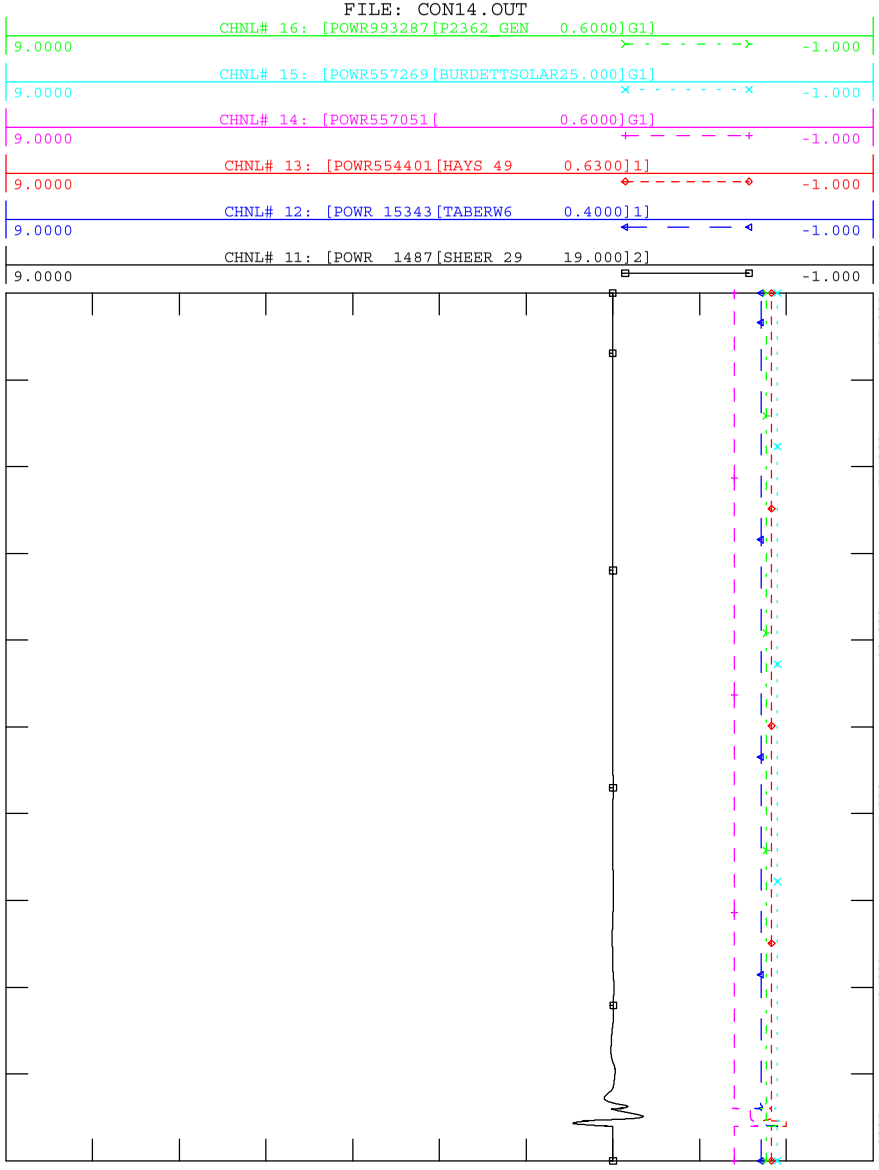


FIG B-SC3-14

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT

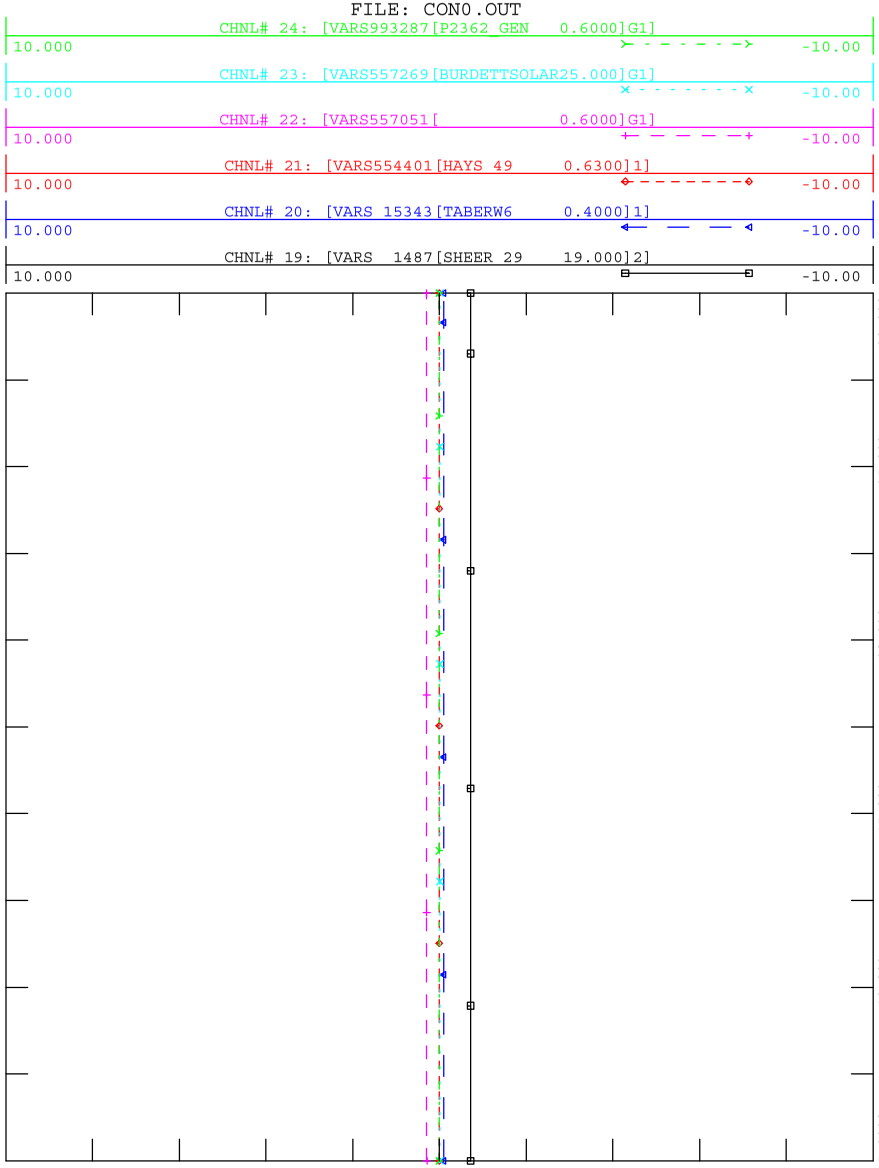


SUN, FEB 13 2022 1:42

FIG B-SC3-15

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT A - FLAT START

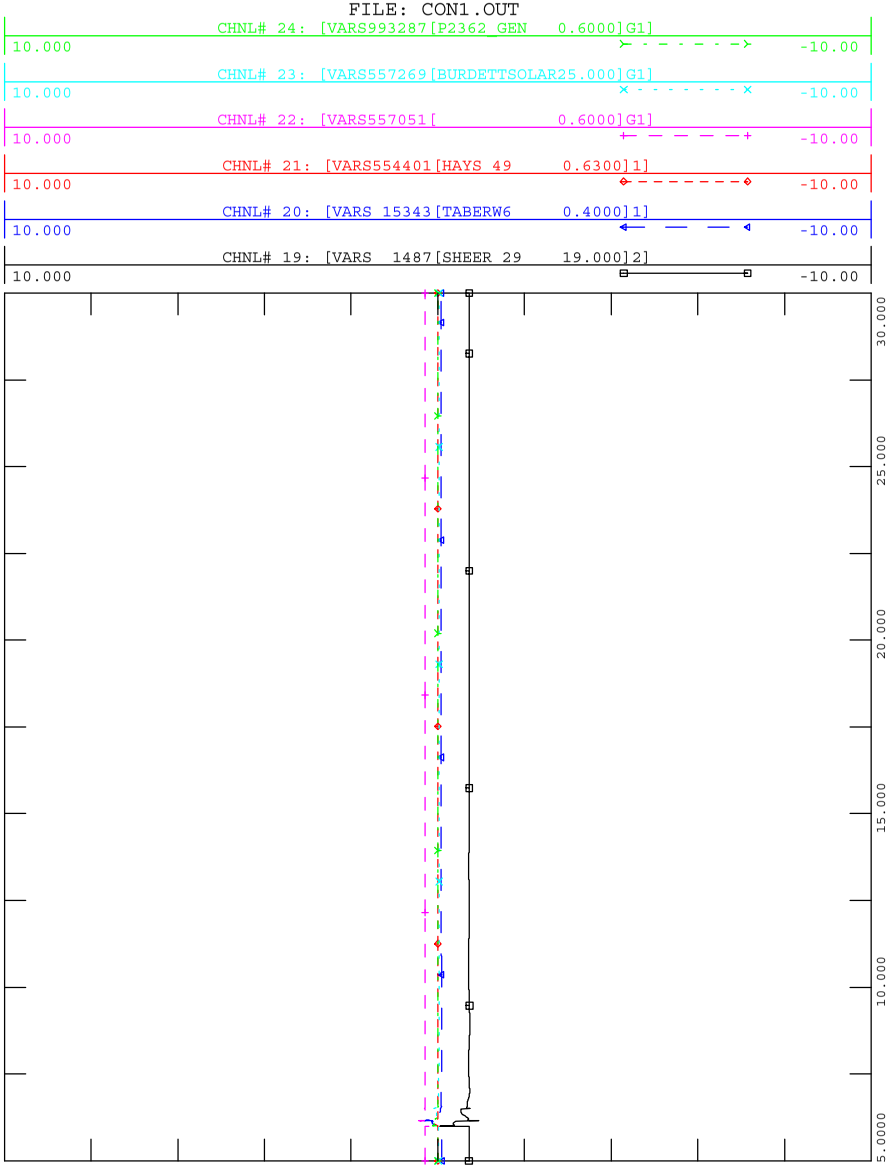
FILE: CON0.OUT



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FIG C-SC3-1

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 612L 3PH FAULT AT FINCASTLE 336S

FILE: CON1.OUT



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FIG C-SC3-2

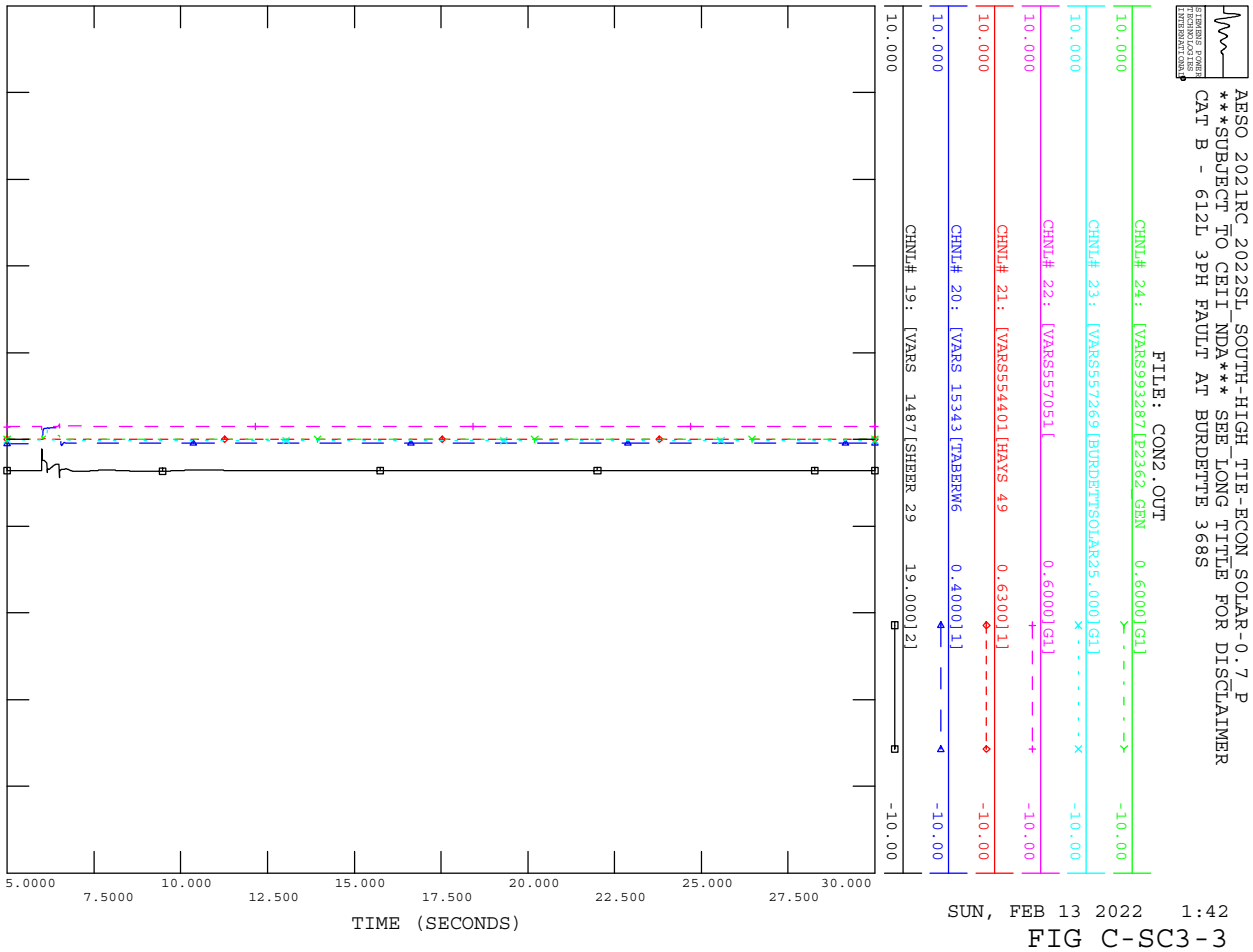


FIG C-SC3-3

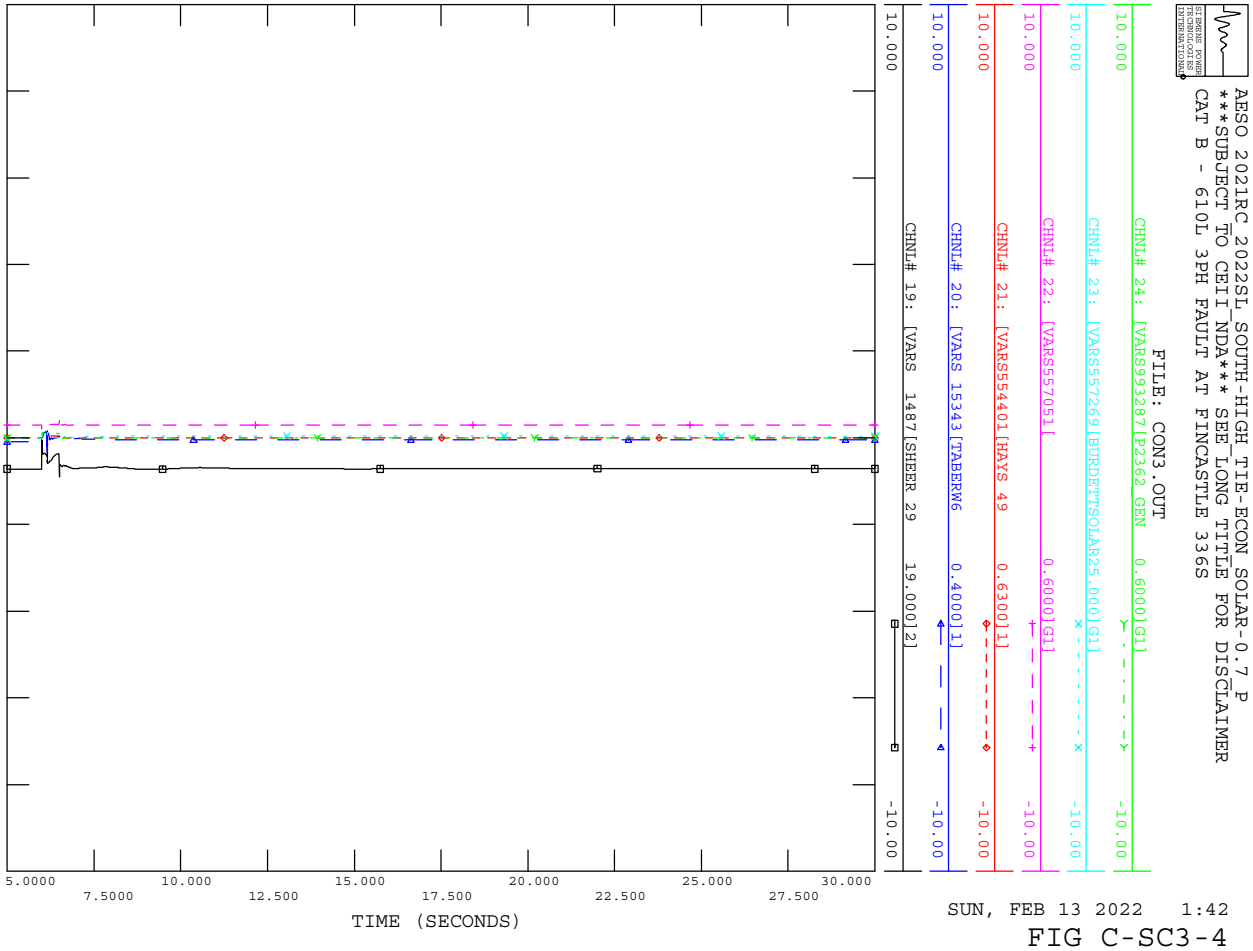


FIG C-SC3-4

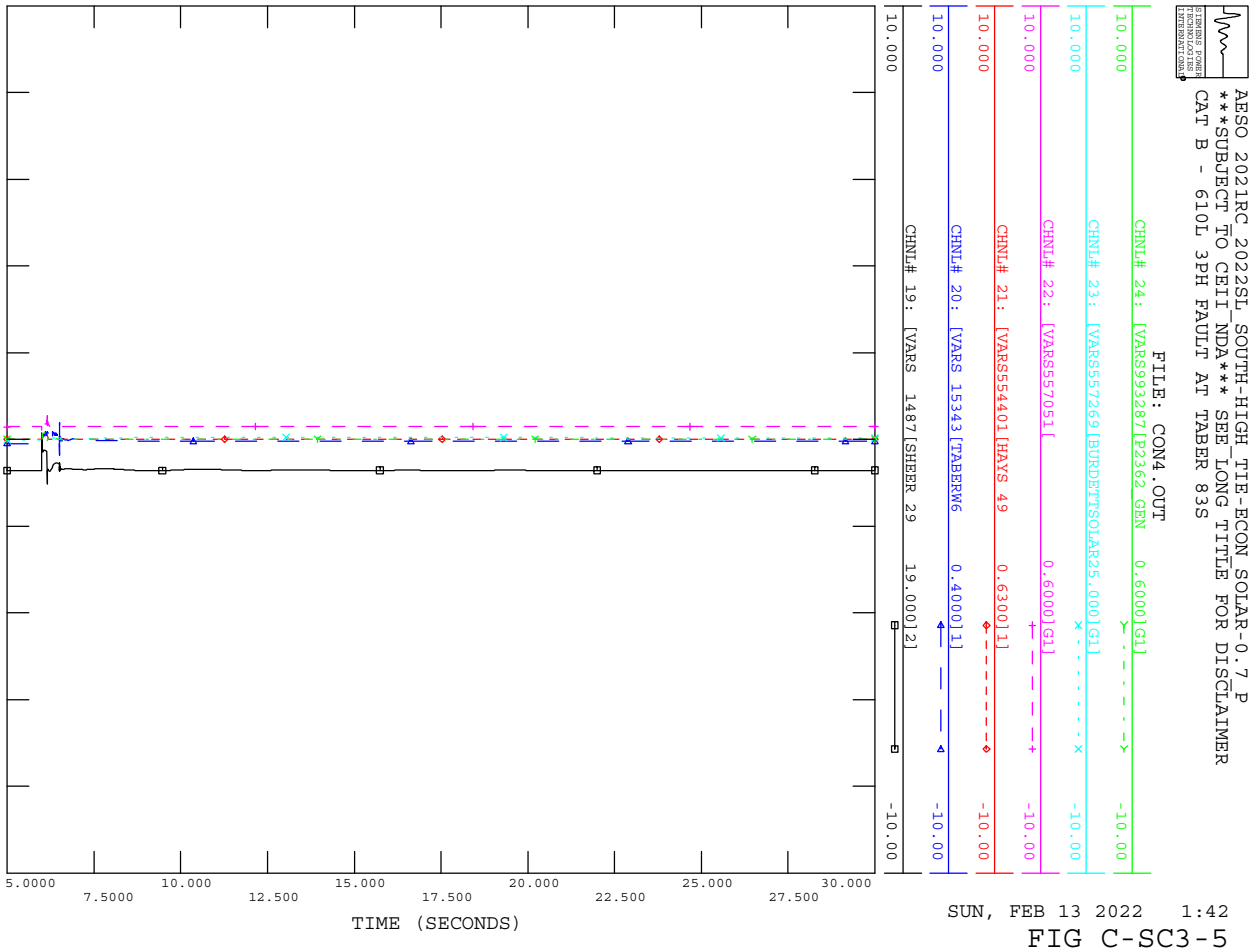


FIG C-SC3-5

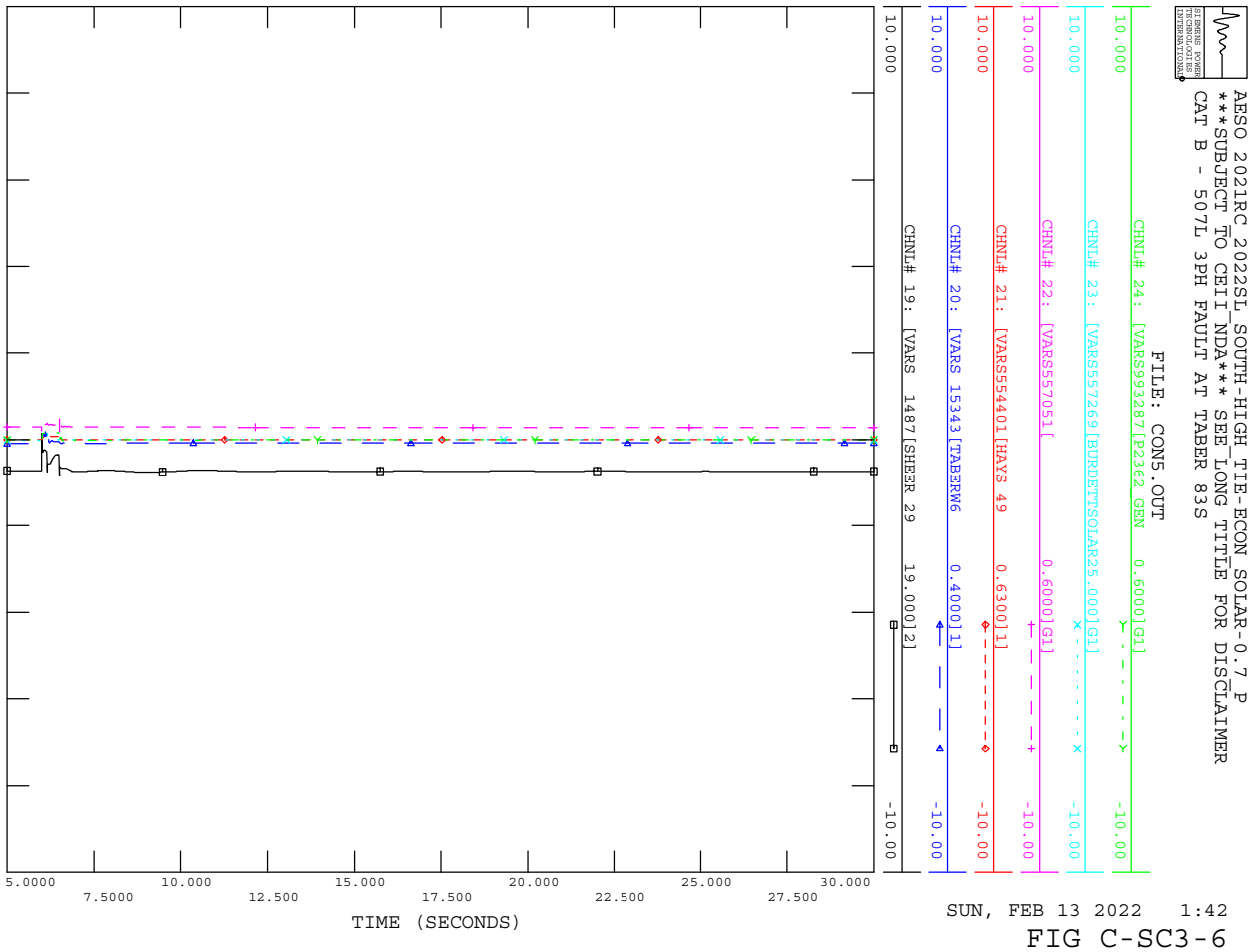


FIG C-SC3-6

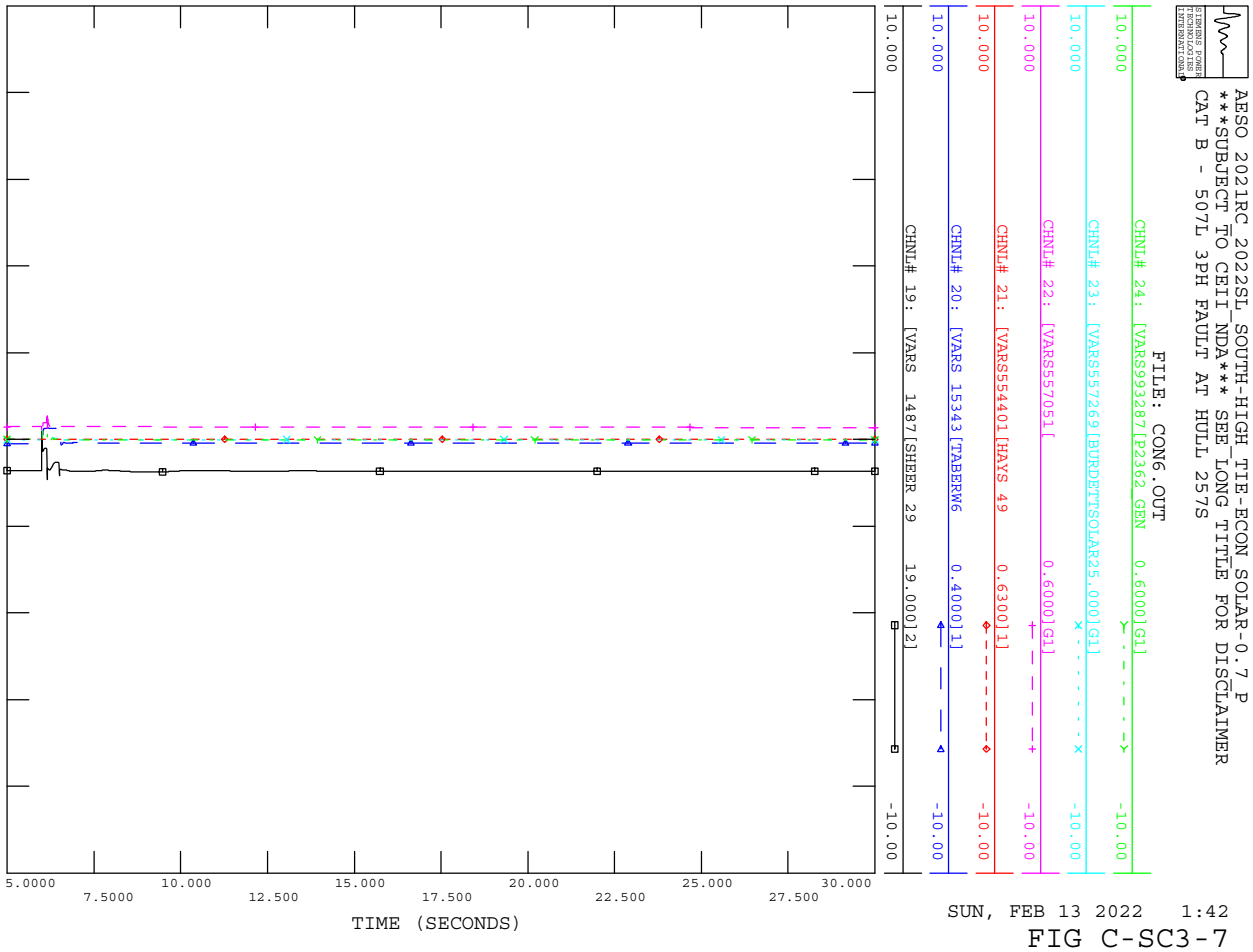


FIG C-SC3-7

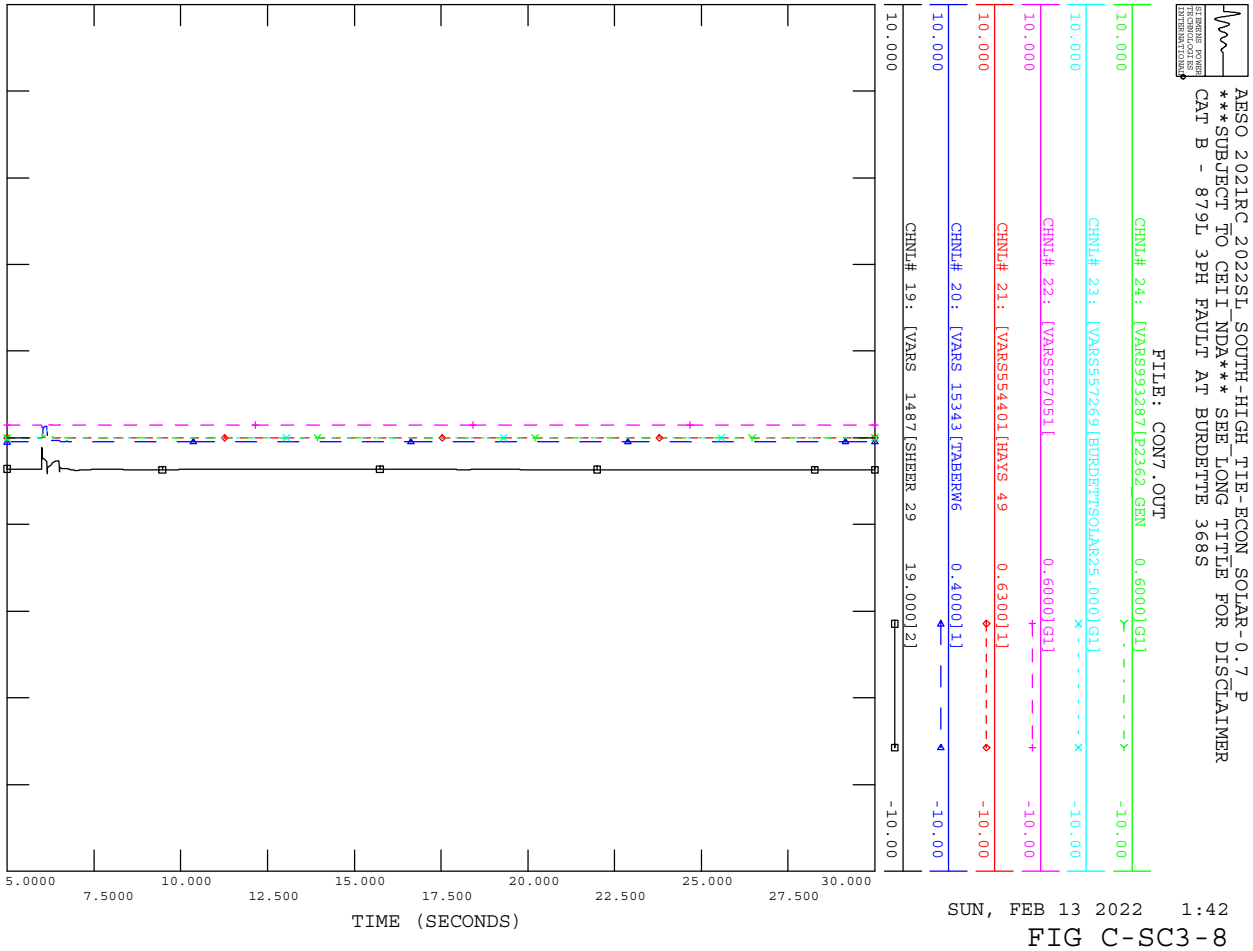


FIG C-SC3-8

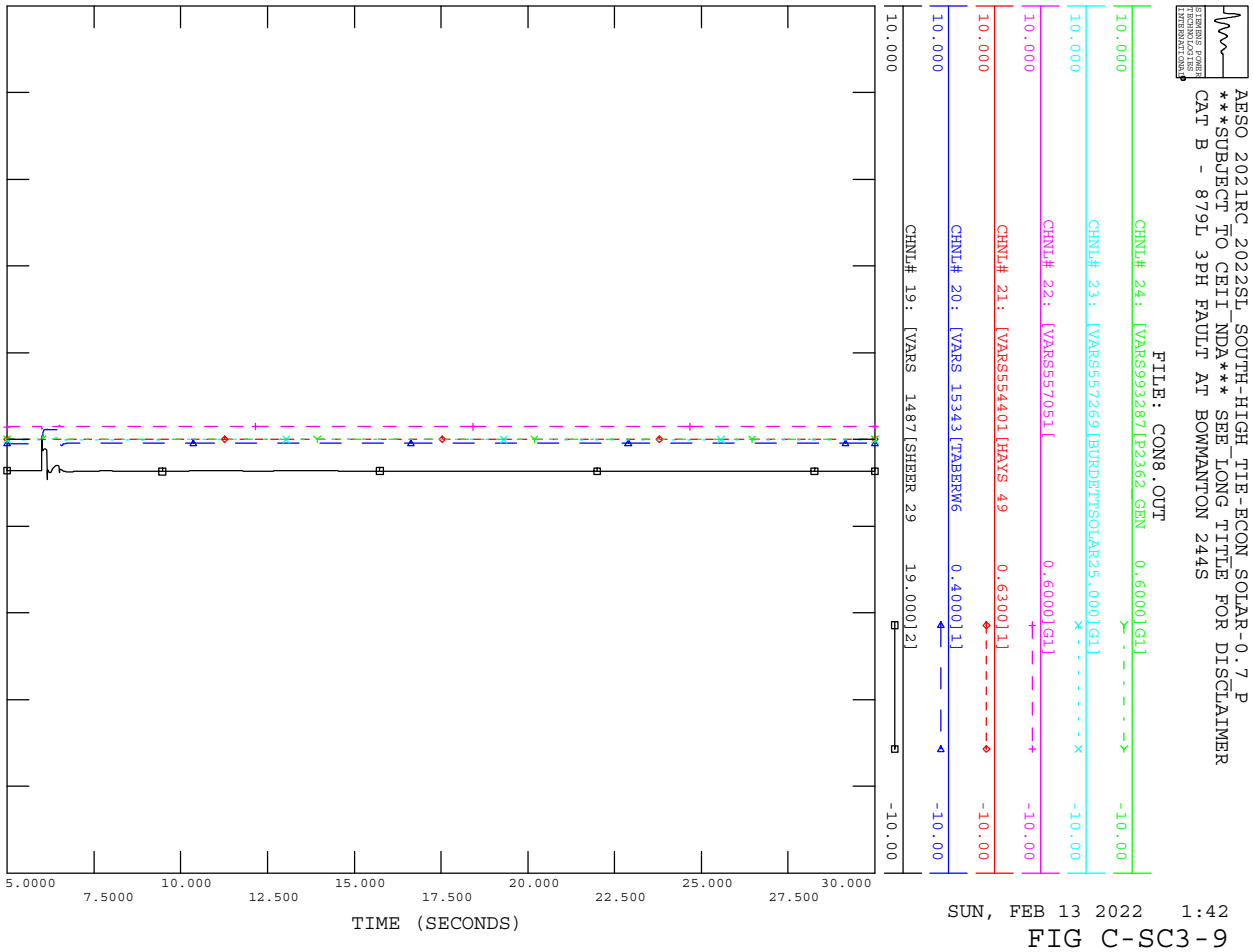


FIG C-SC3-9

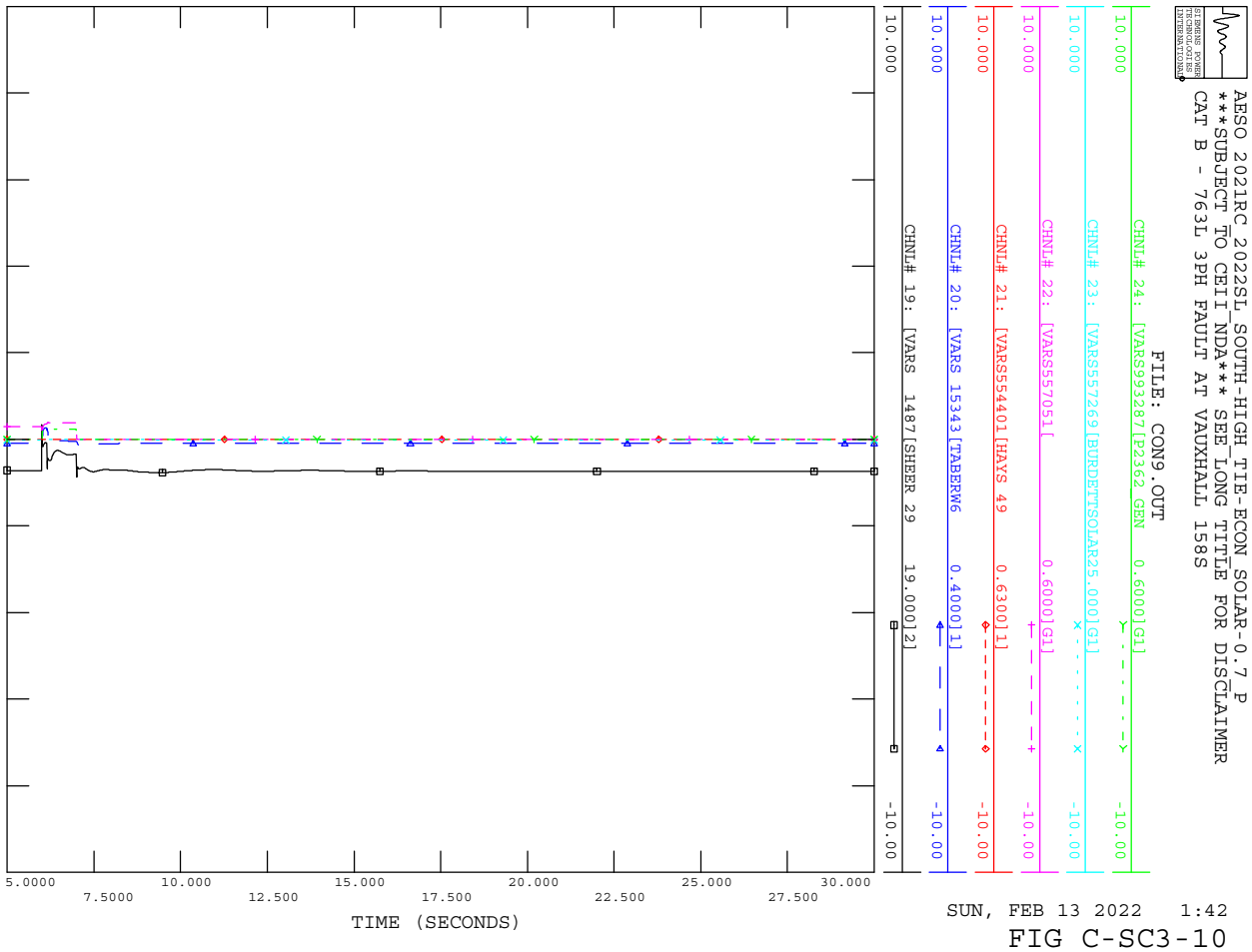


FIG C-SC3-10

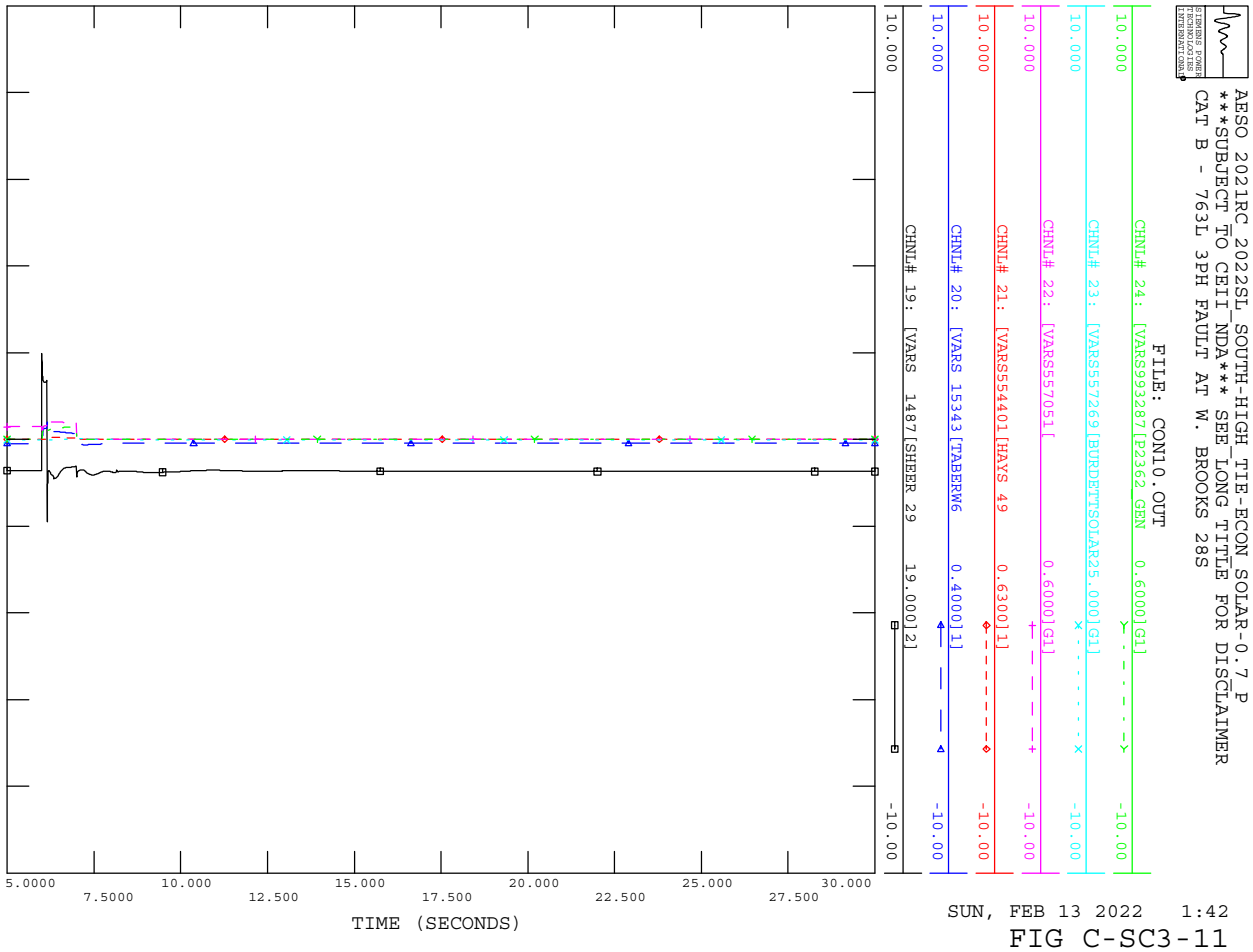


FIG C-SC3-11

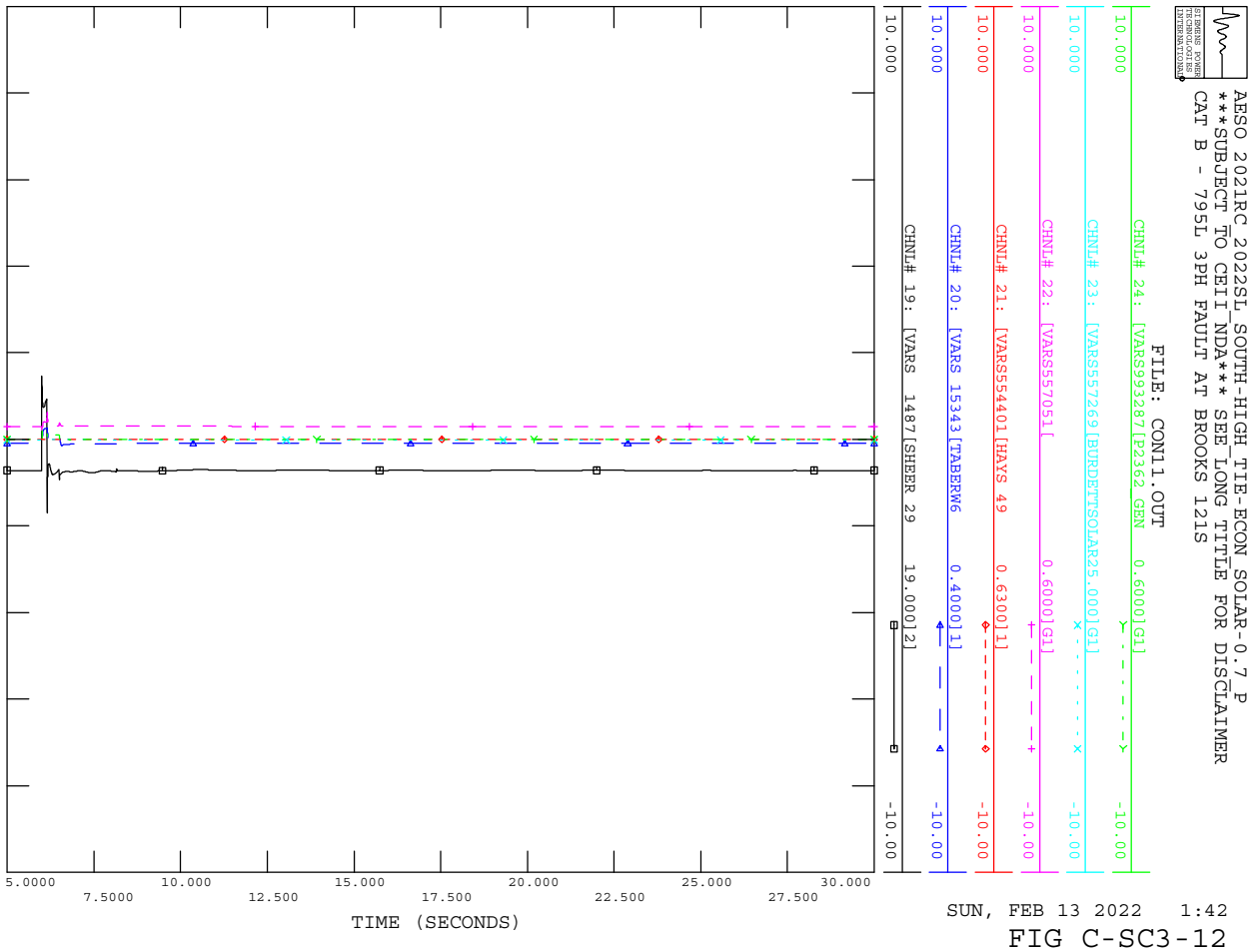


FIG C-SC3-12

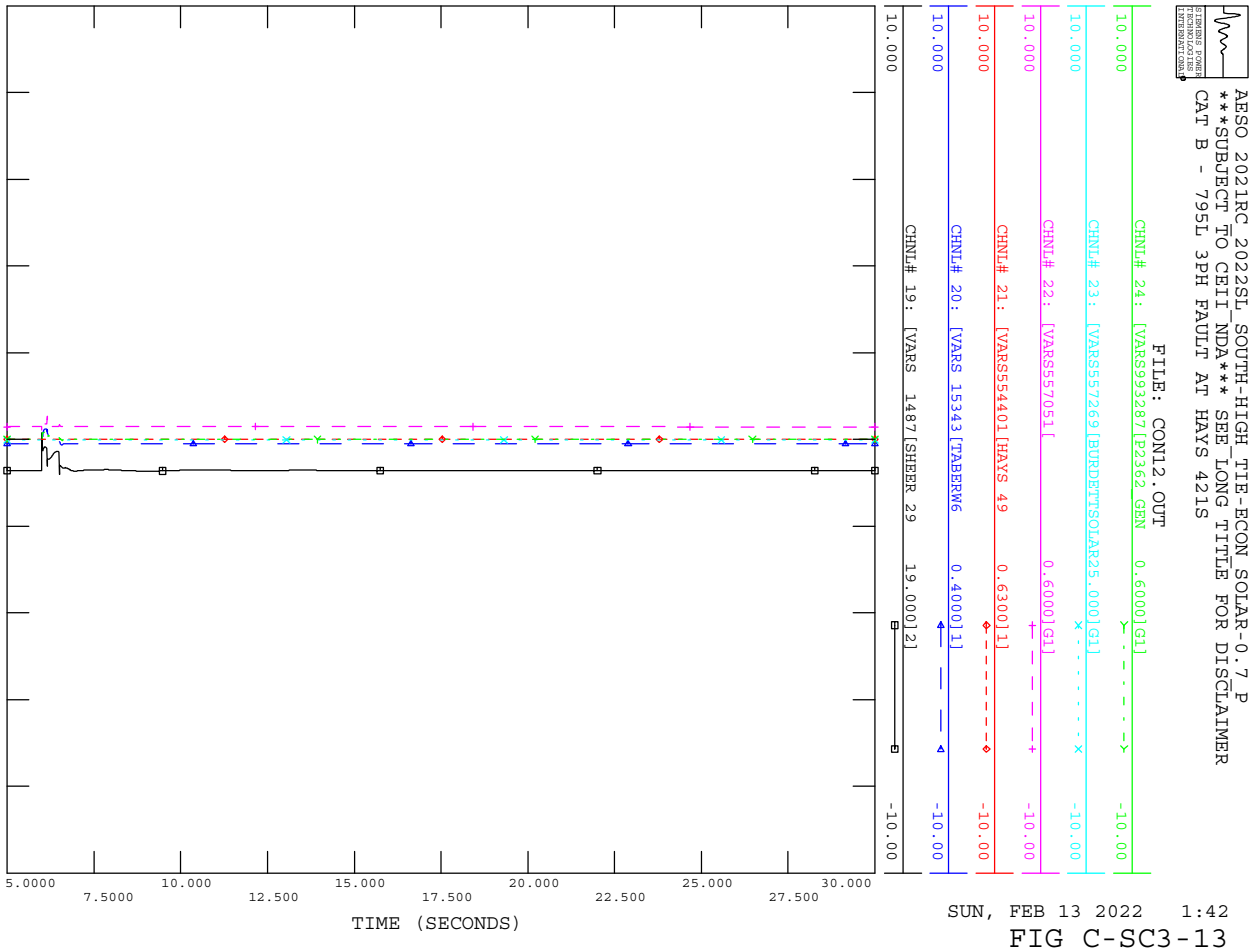


FIG C-SC3-13

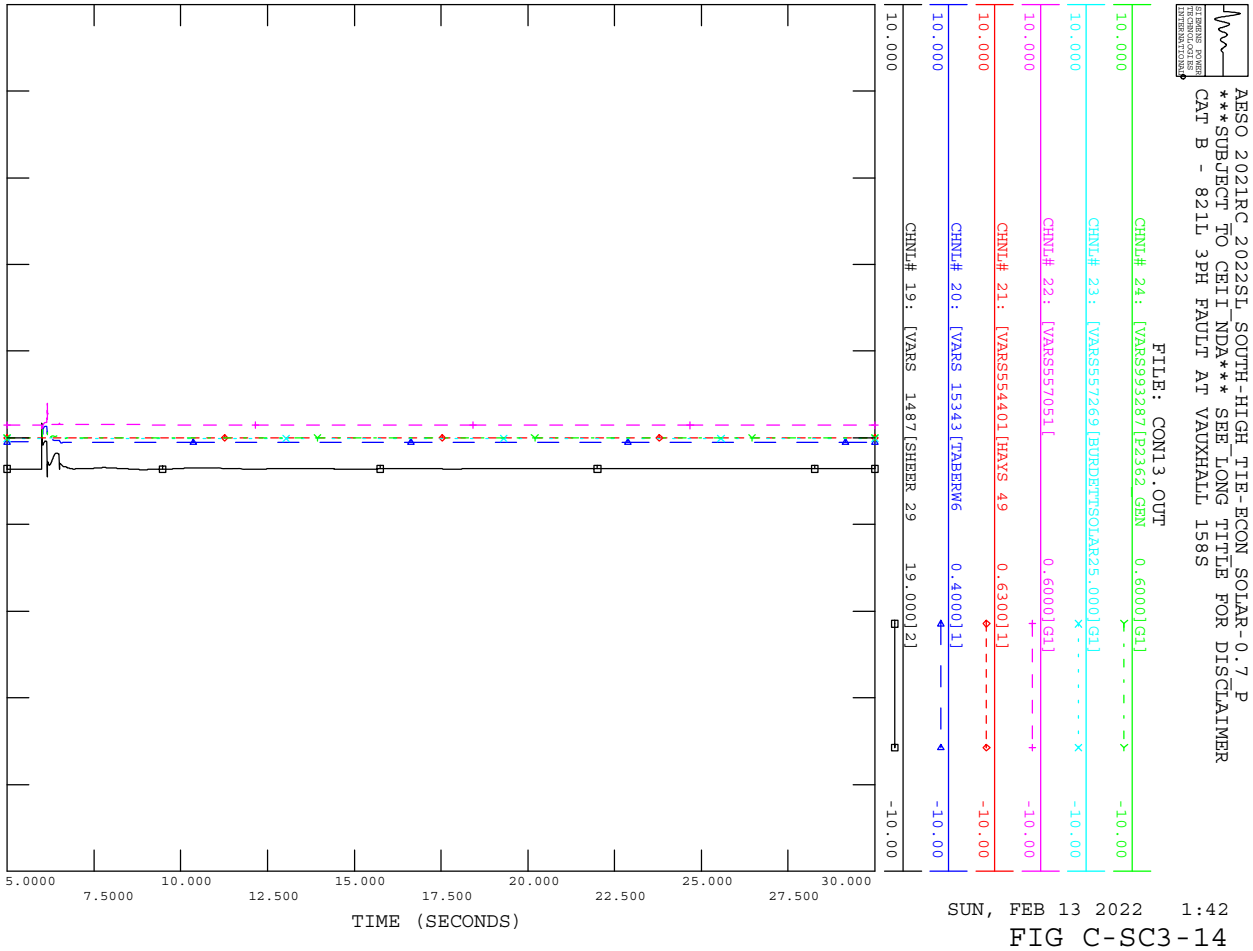
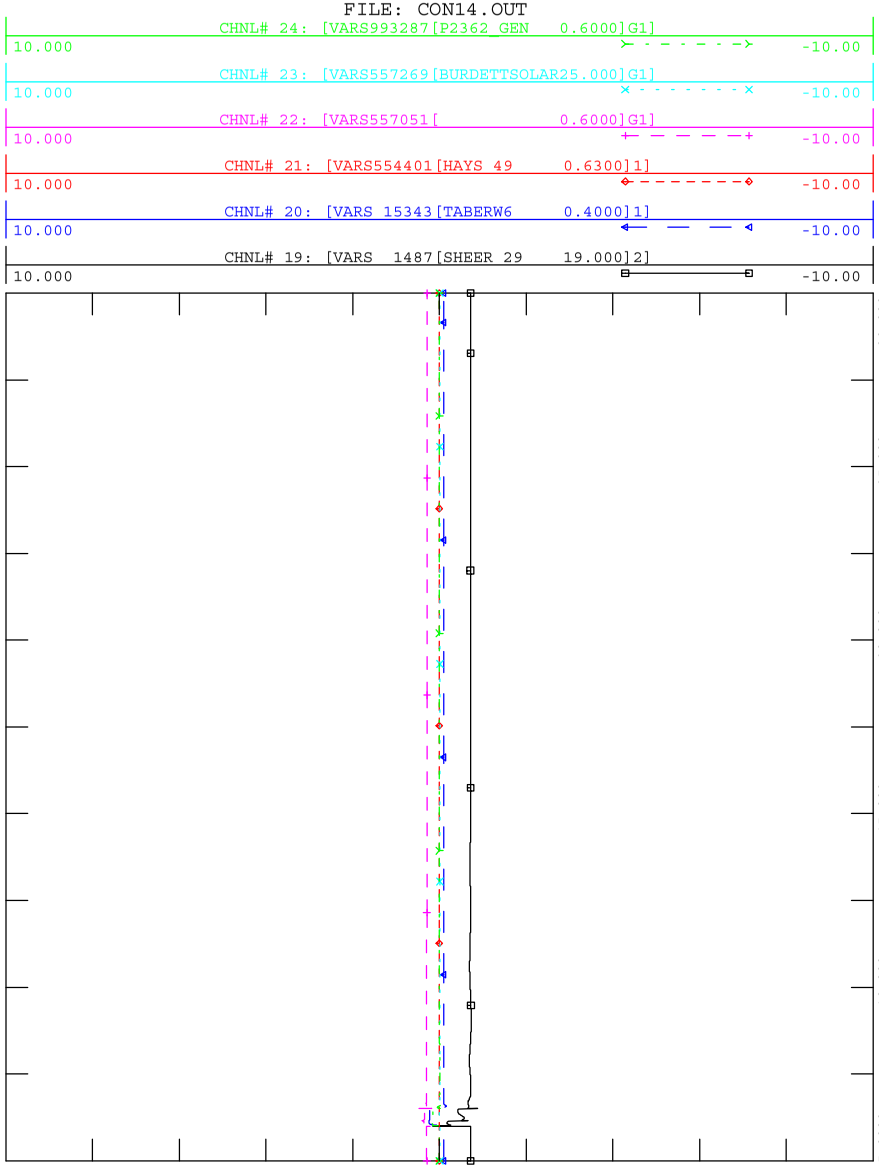


FIG C-SC3-14

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT



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FIG C-SC3-15

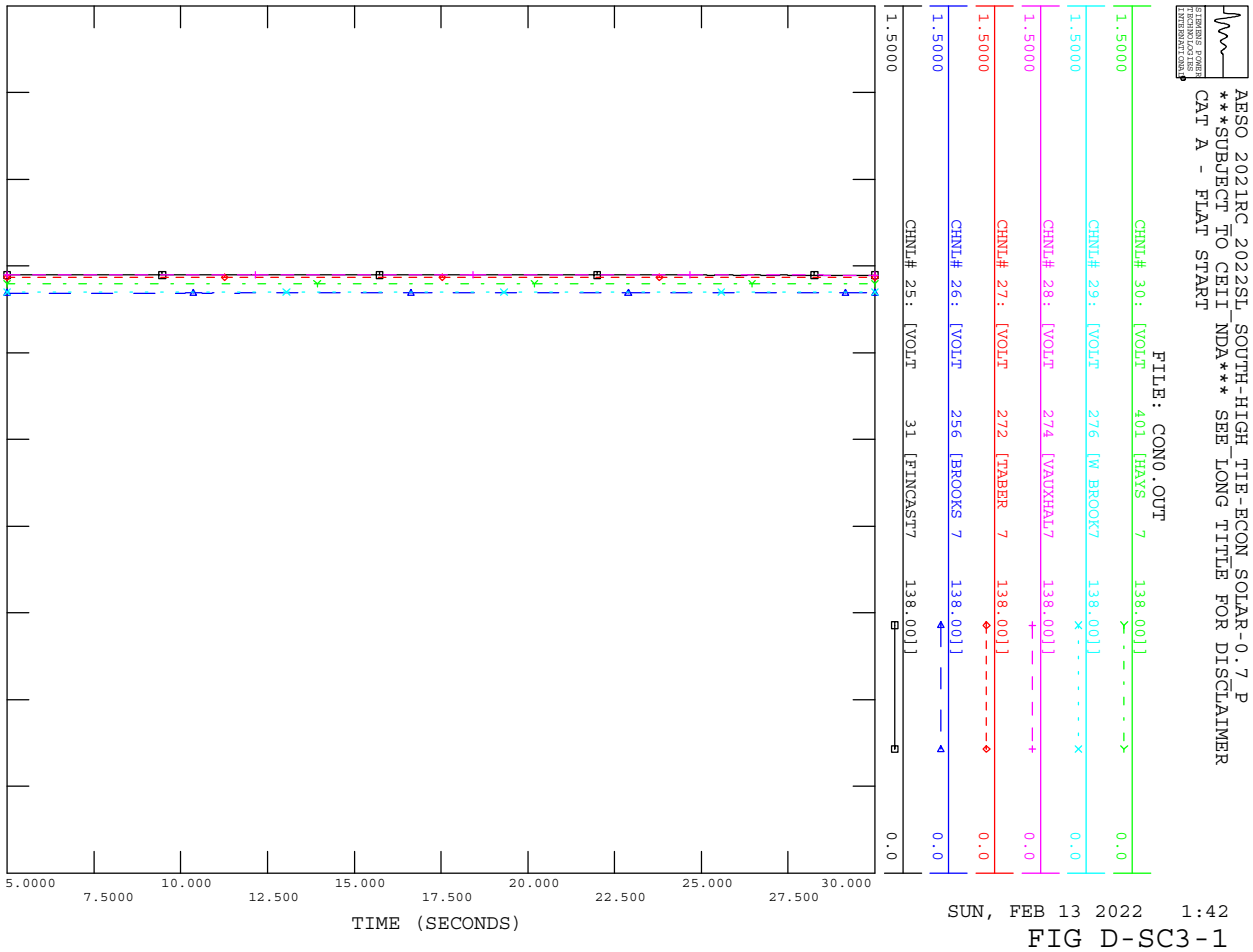


FIG D-SC3-1

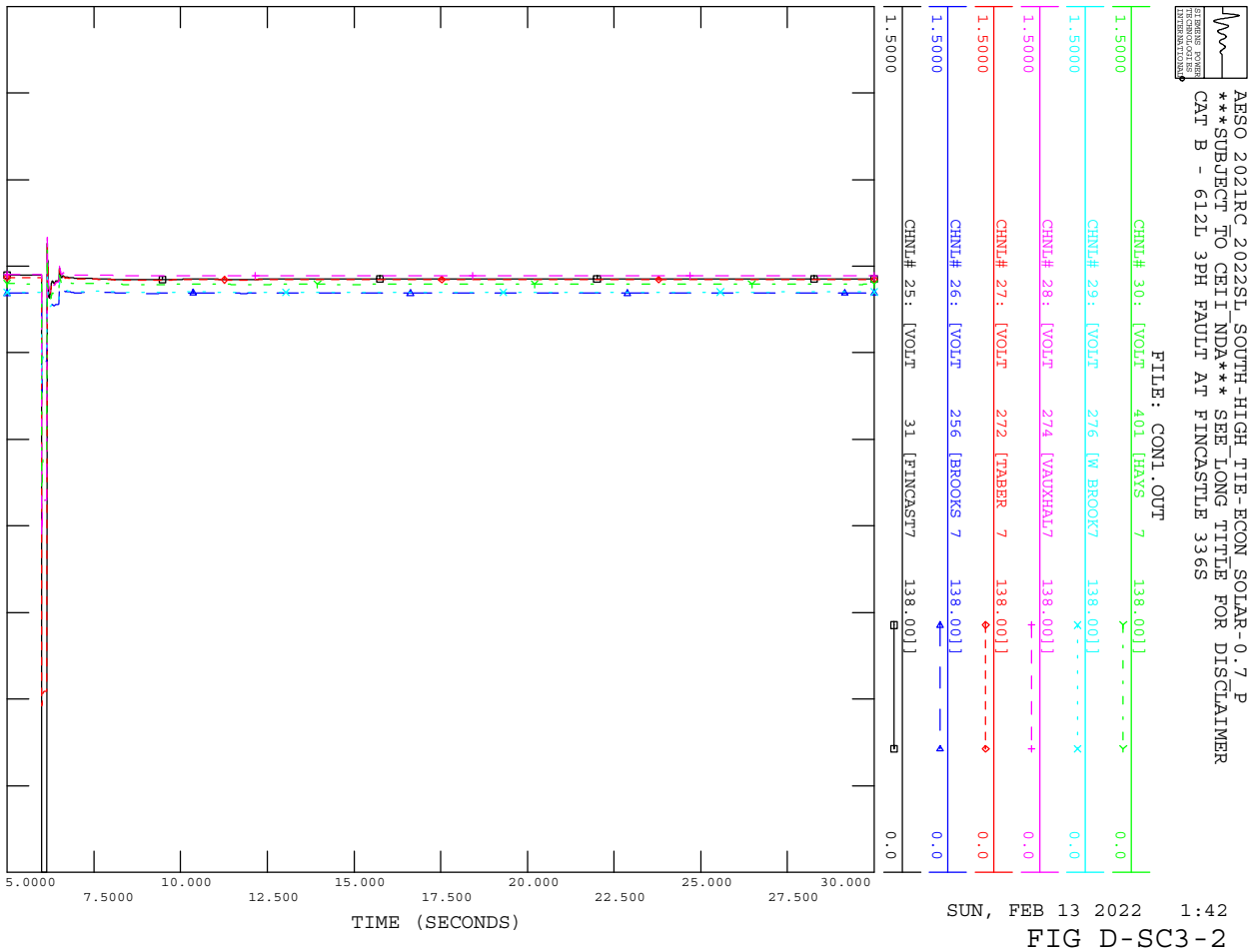


FIG D-SC3-2

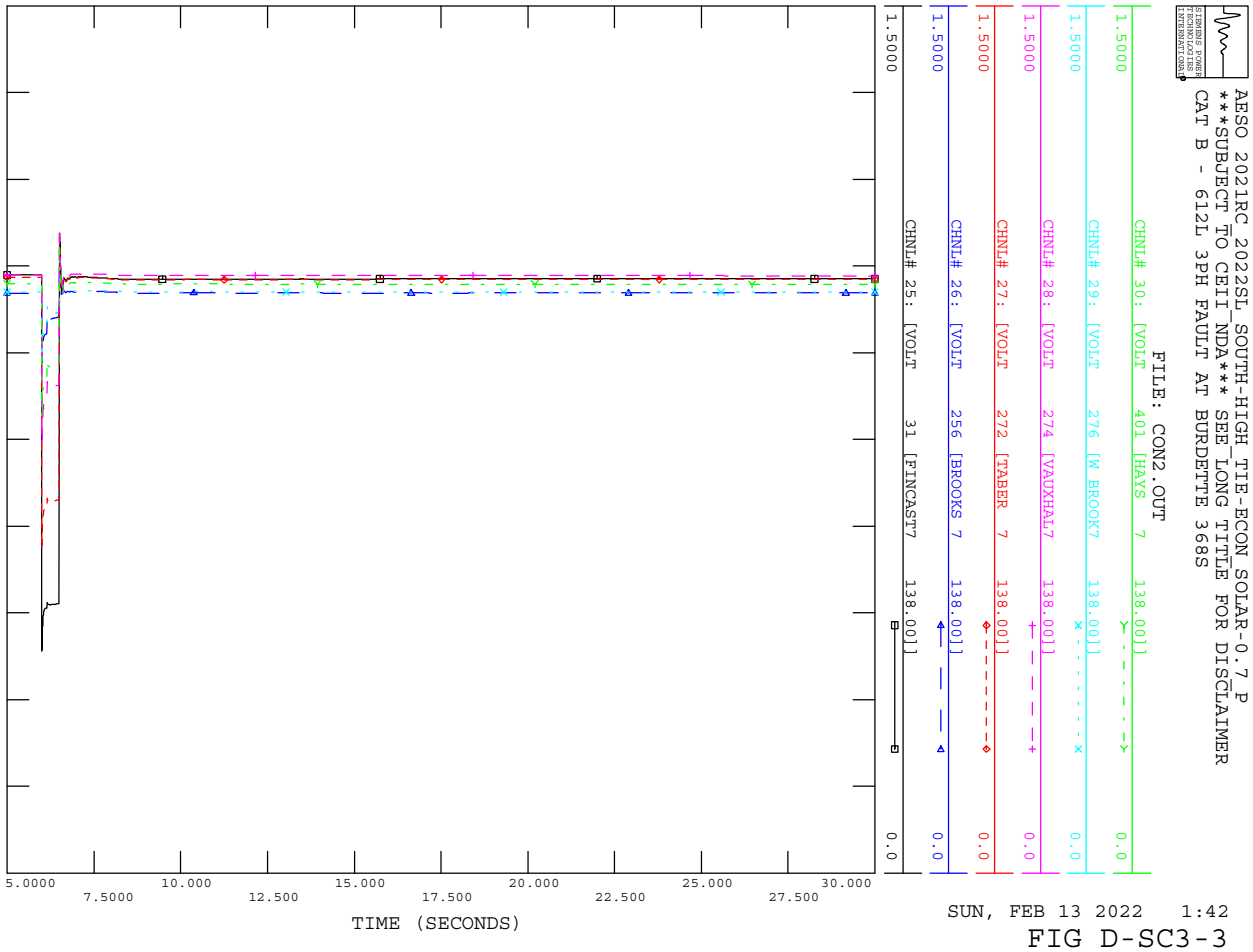


FIG D-SC3-3

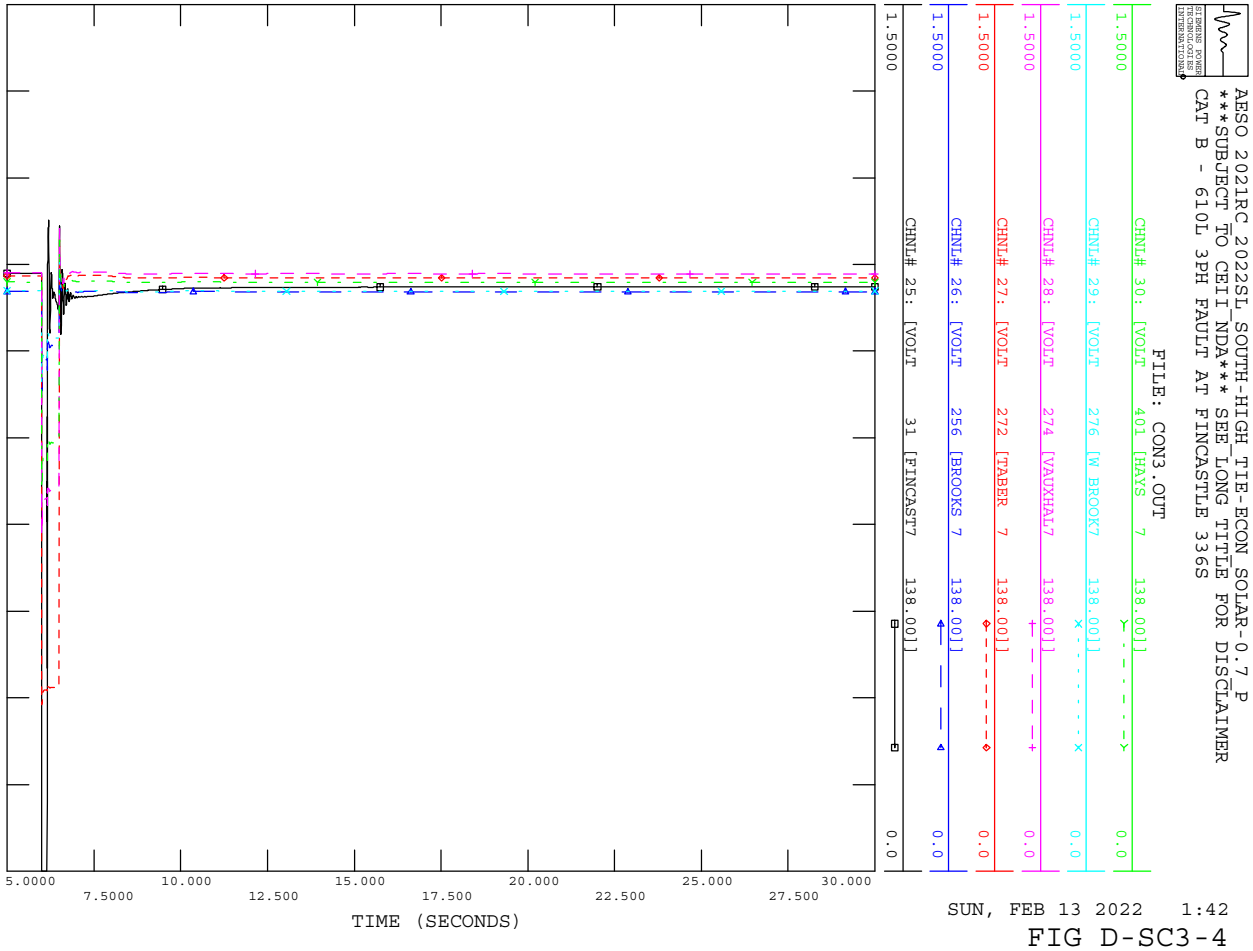


FIG D-SC3-4

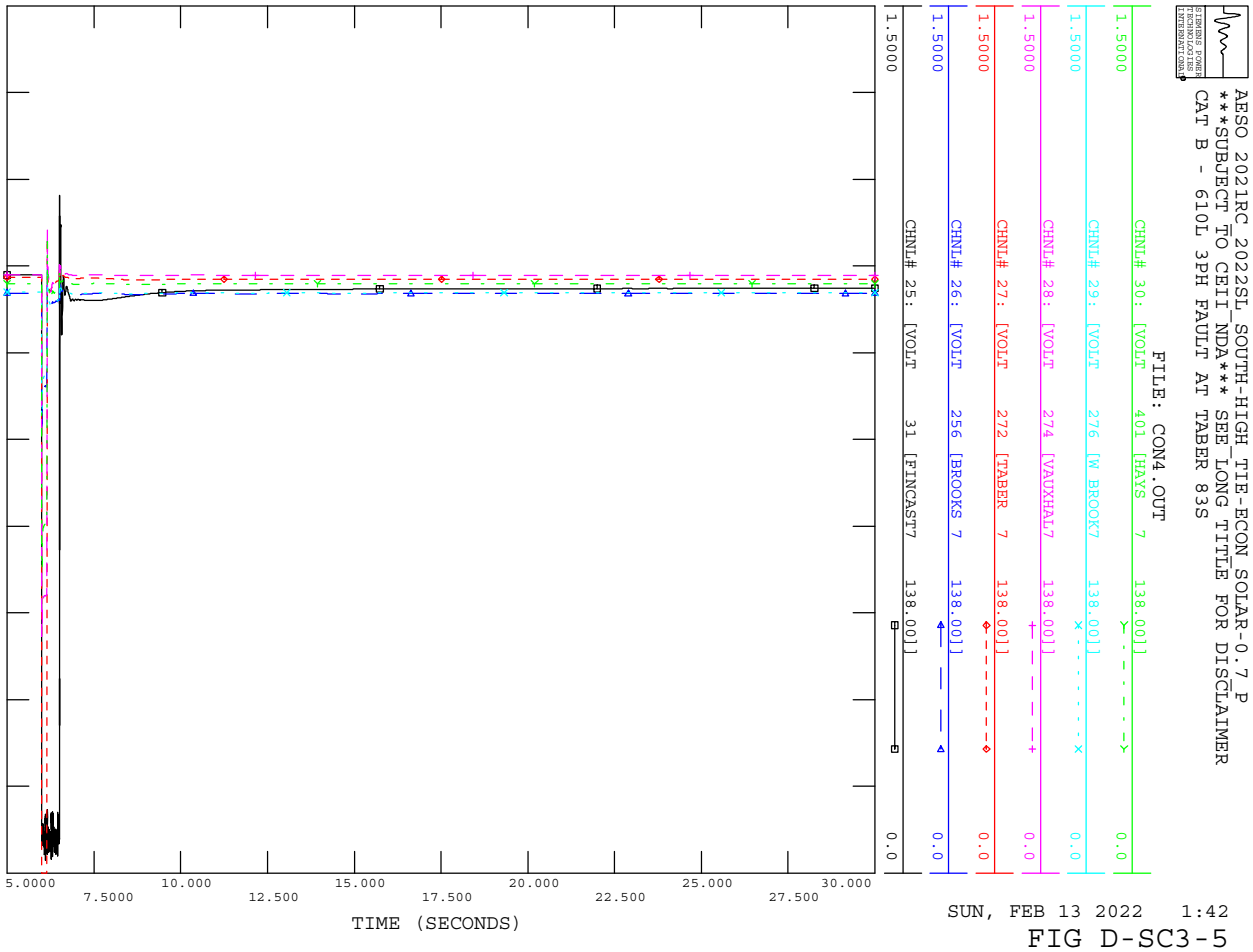


FIG D-SC3-5

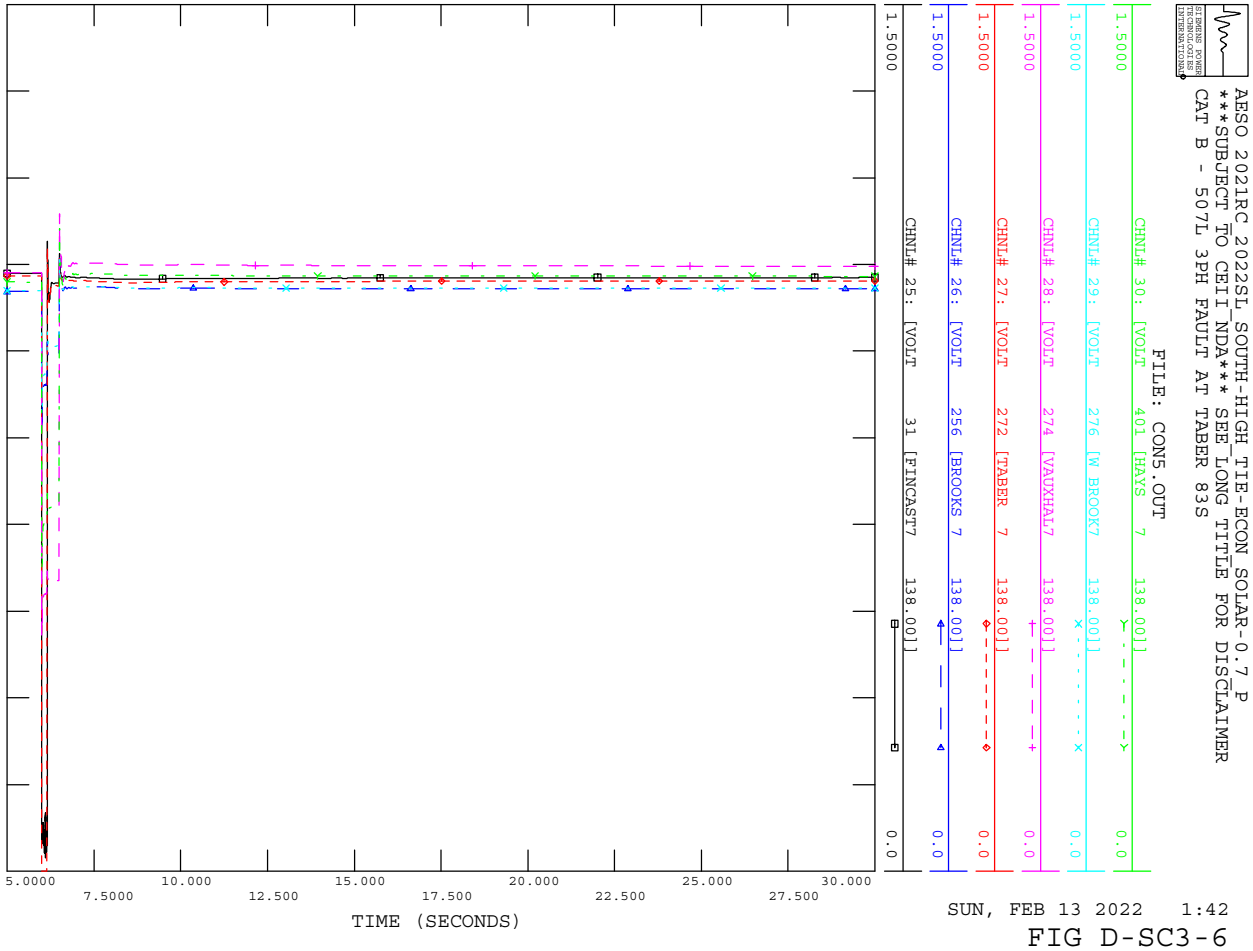


FIG D-SC3-6

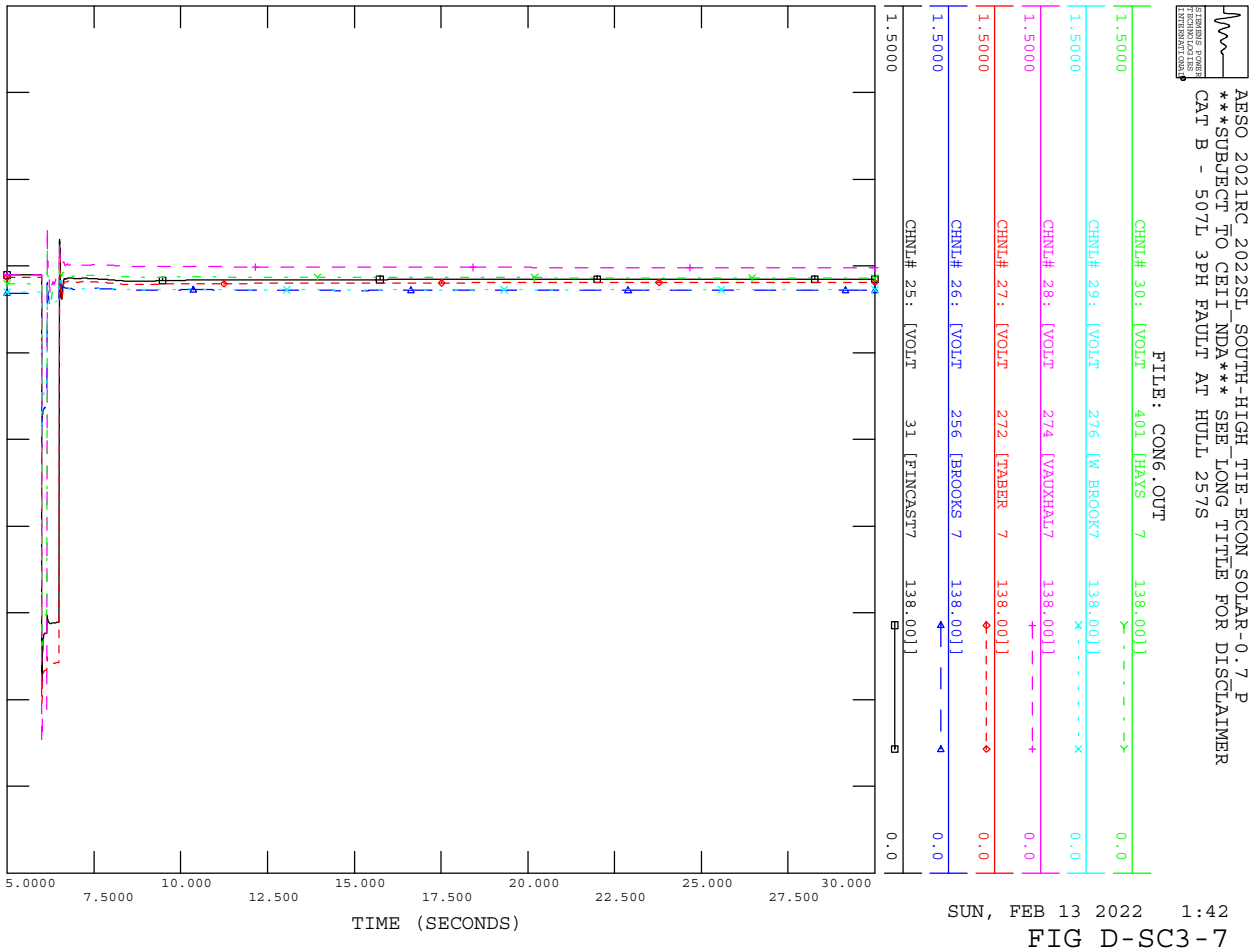


FIG D-SC3-7

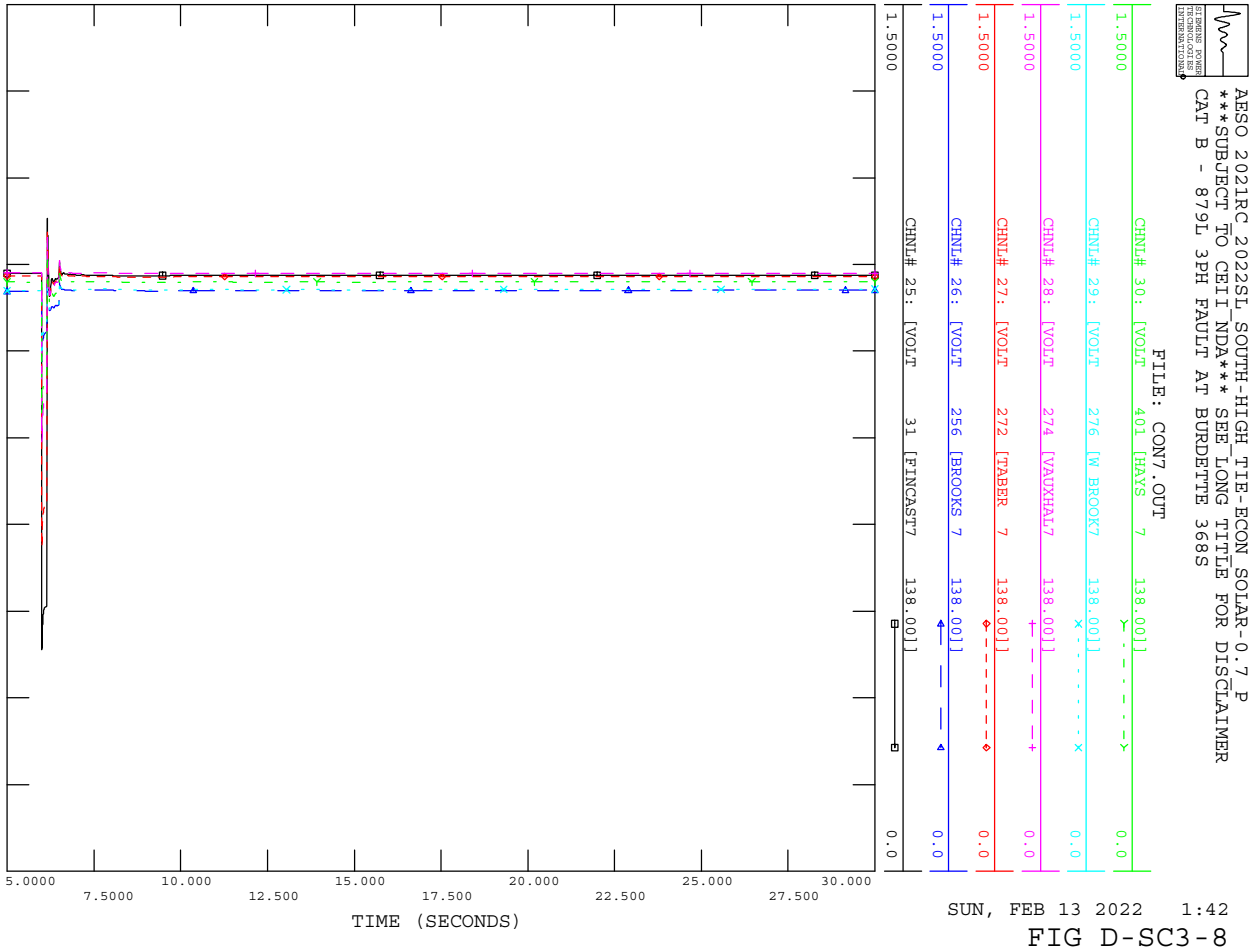


FIG D-SC3-8

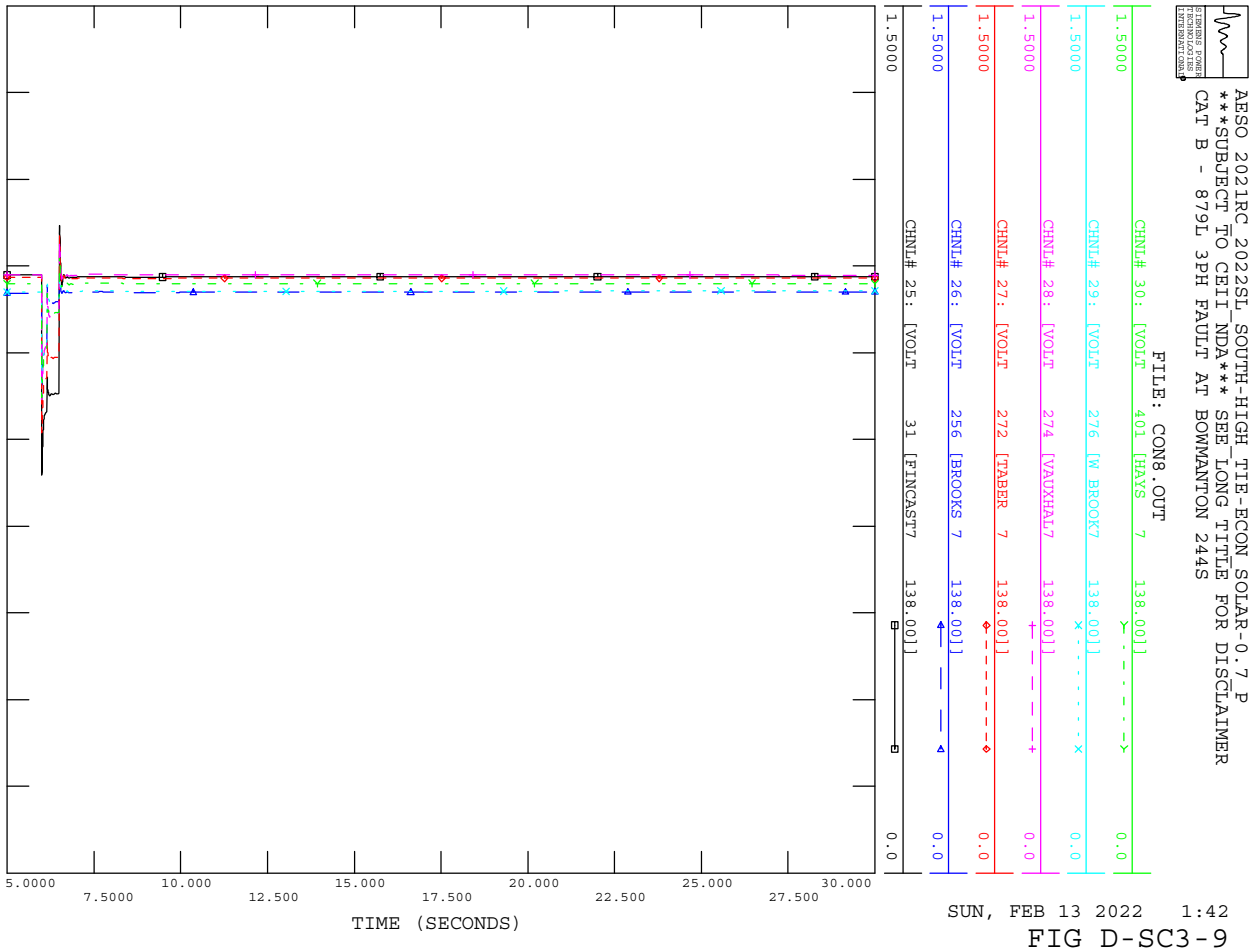


FIG D-SC3-9

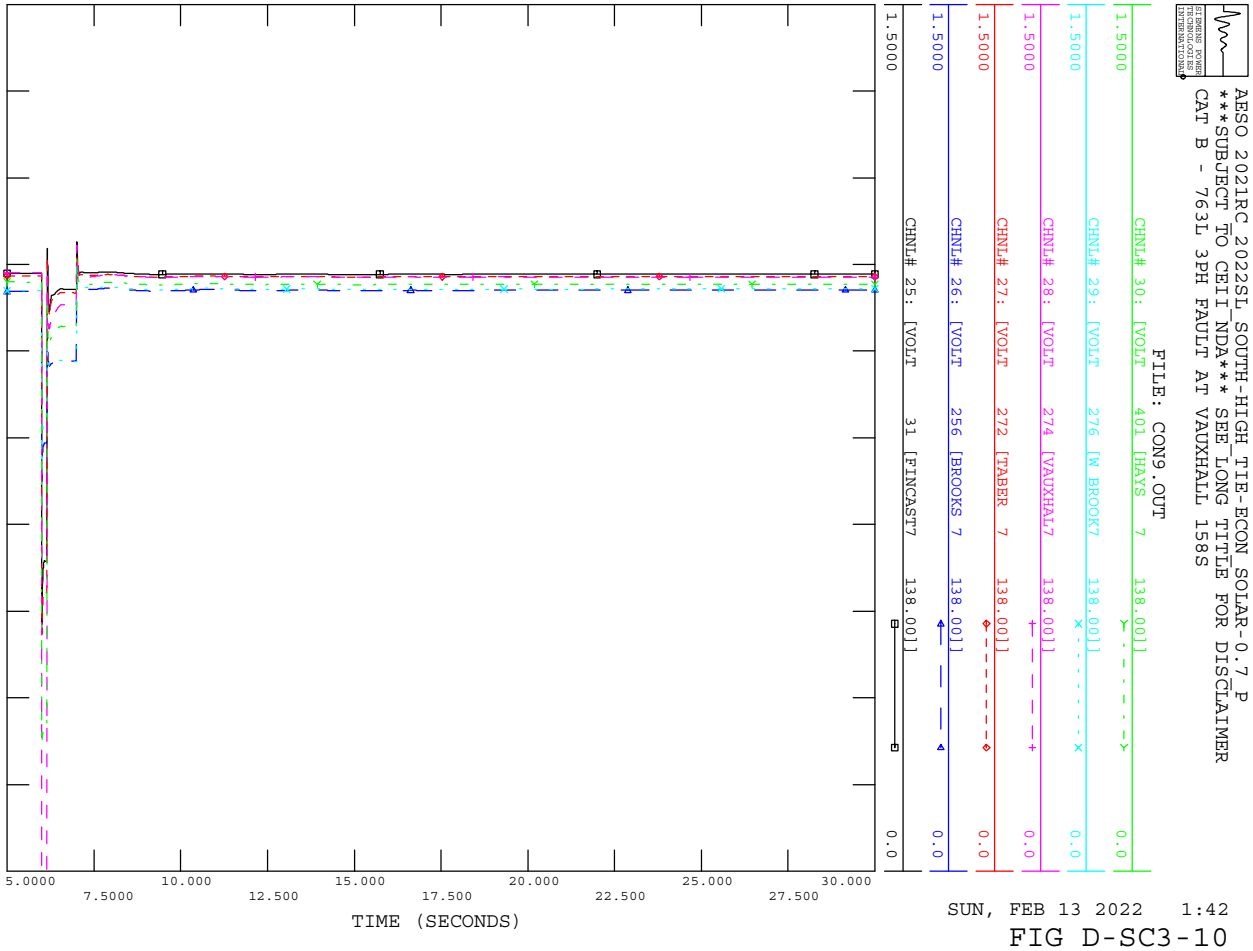


FIG D-SC3-10

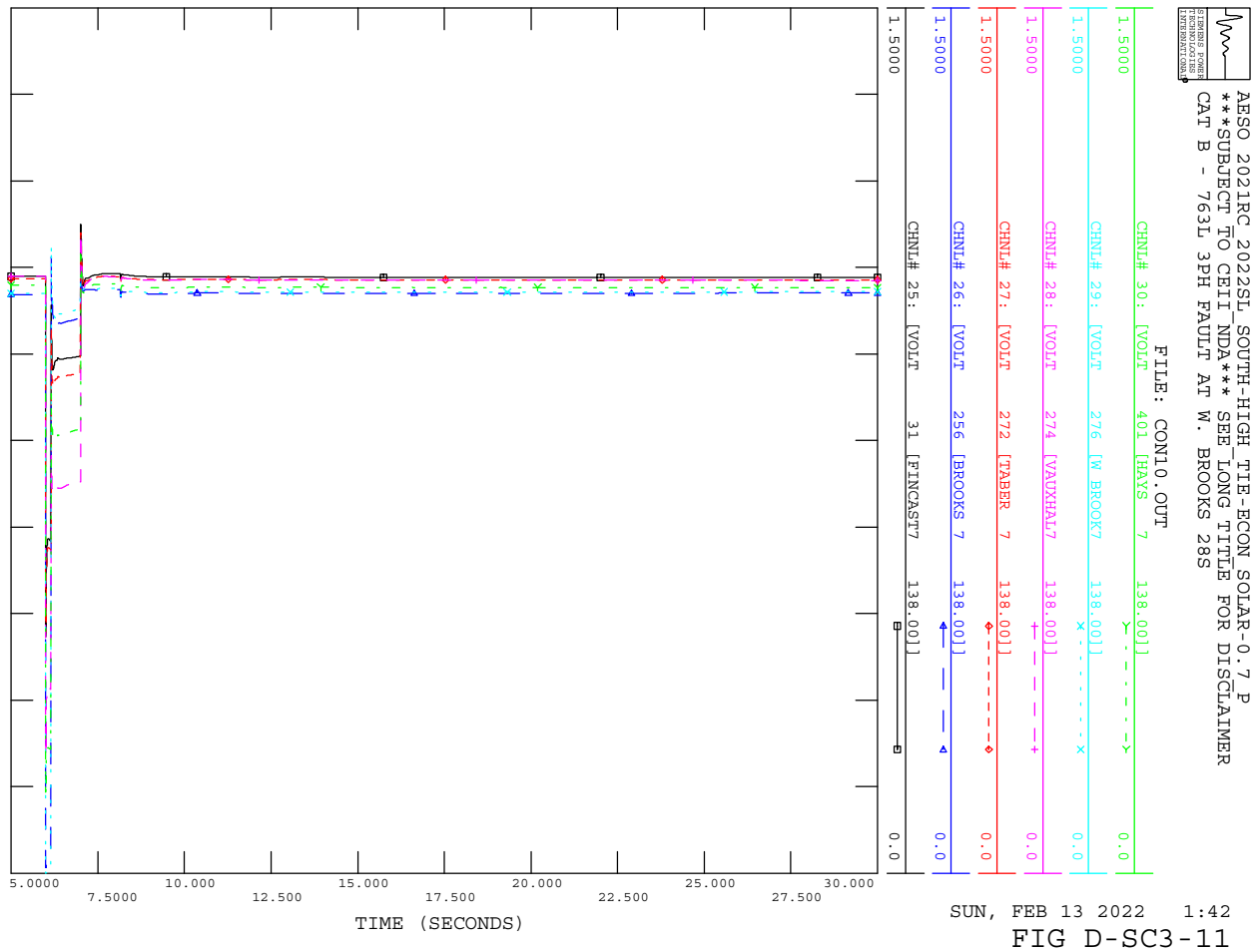


FIG D-SC3-11

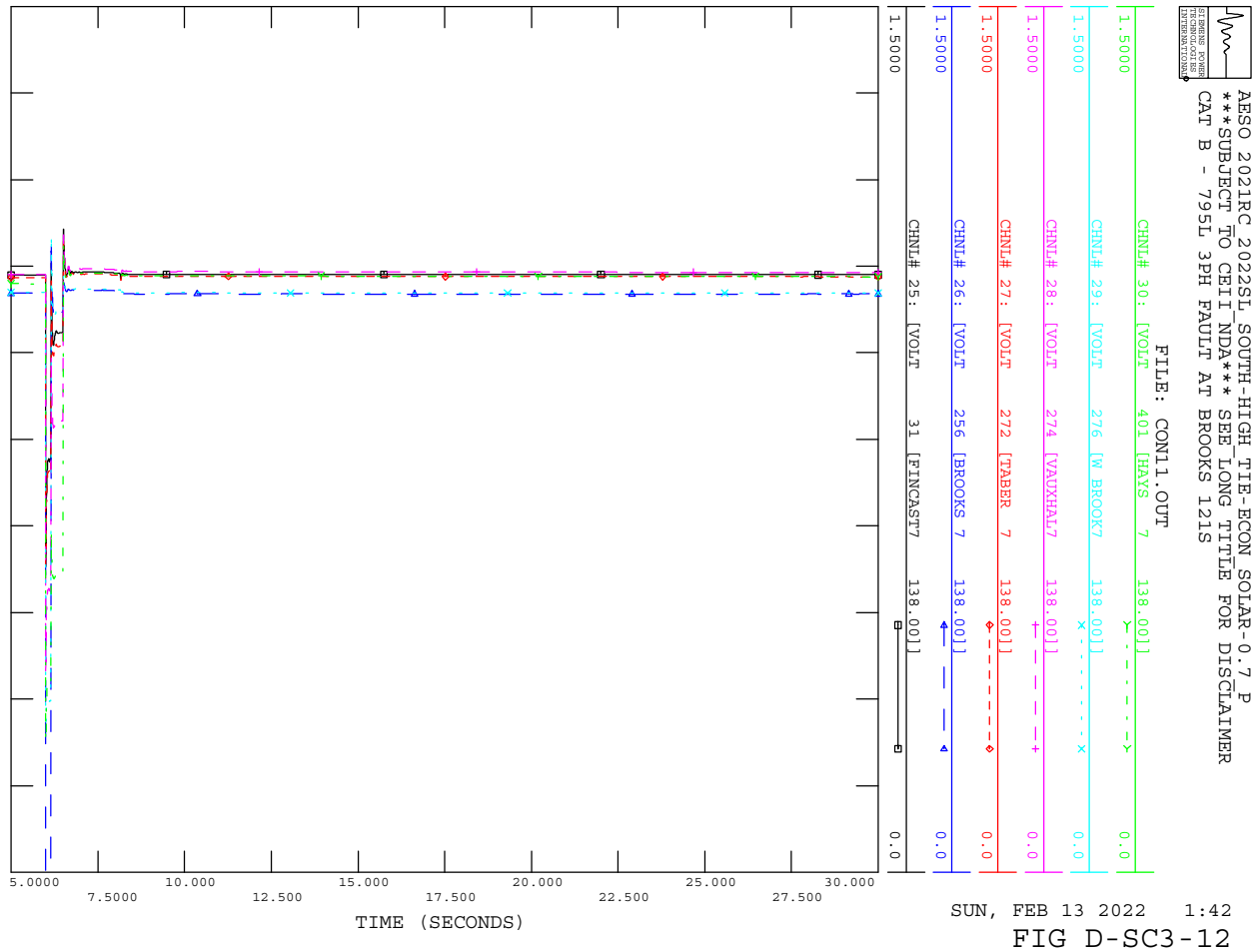


FIG D-SC3-12

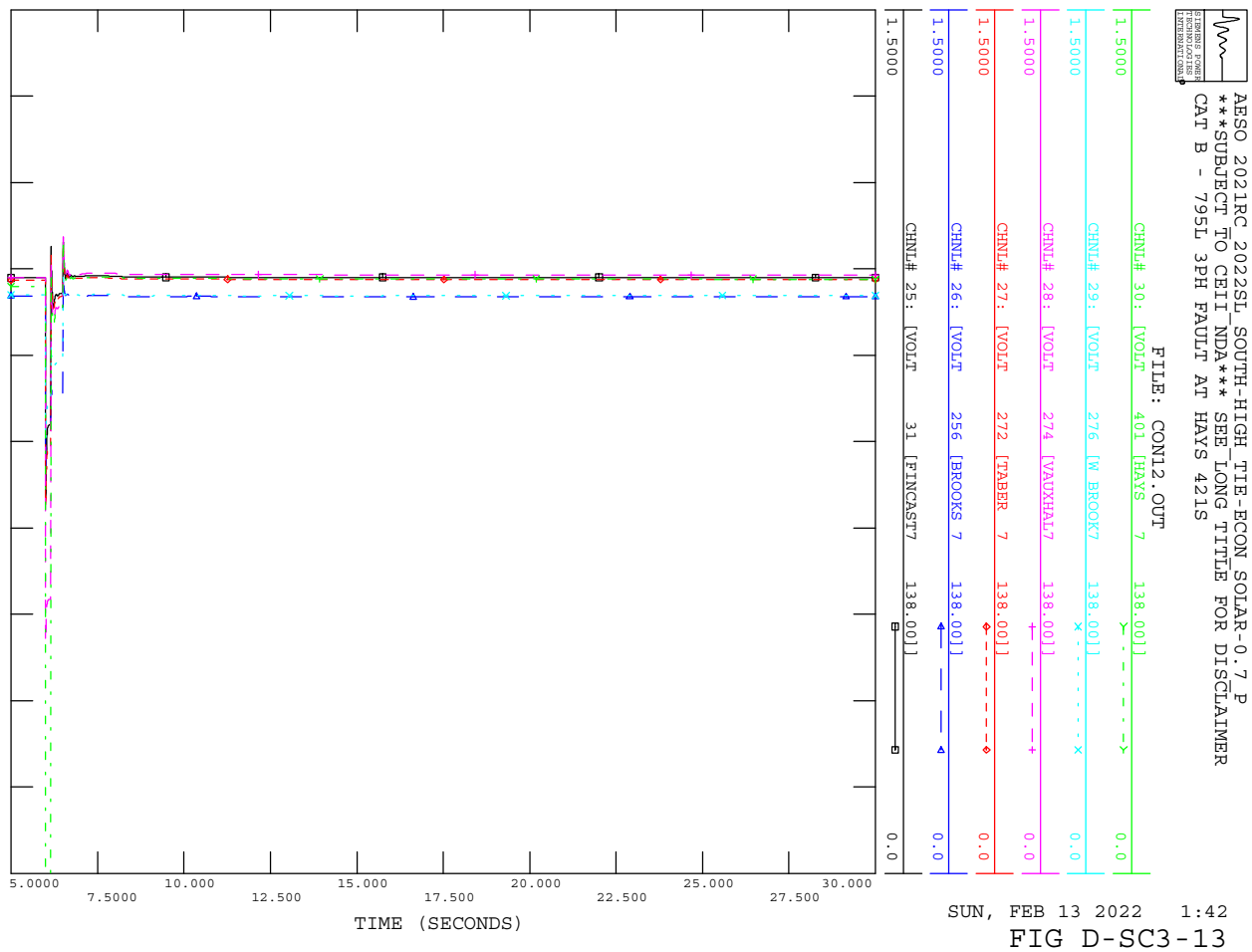


FIG D-SC3-13

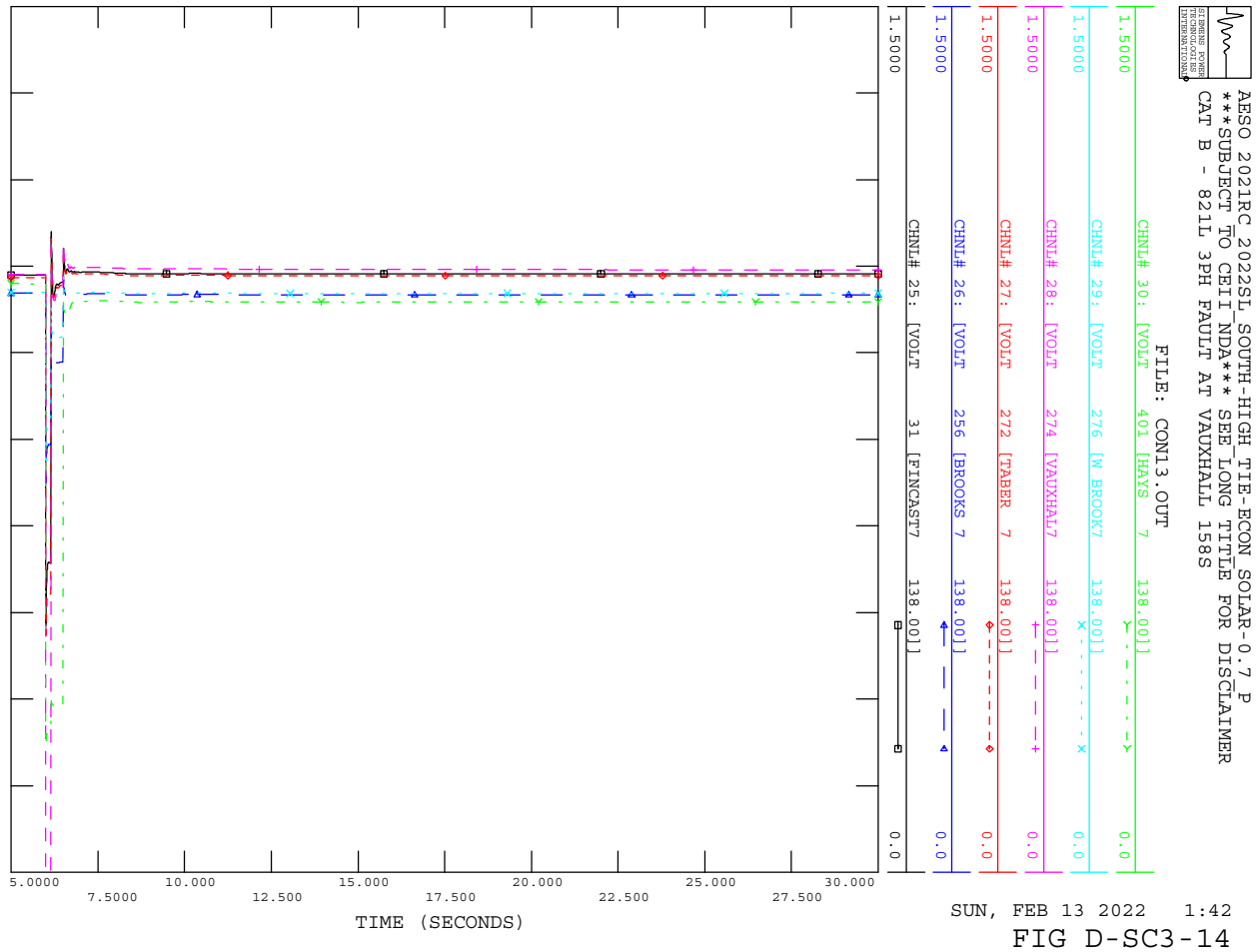


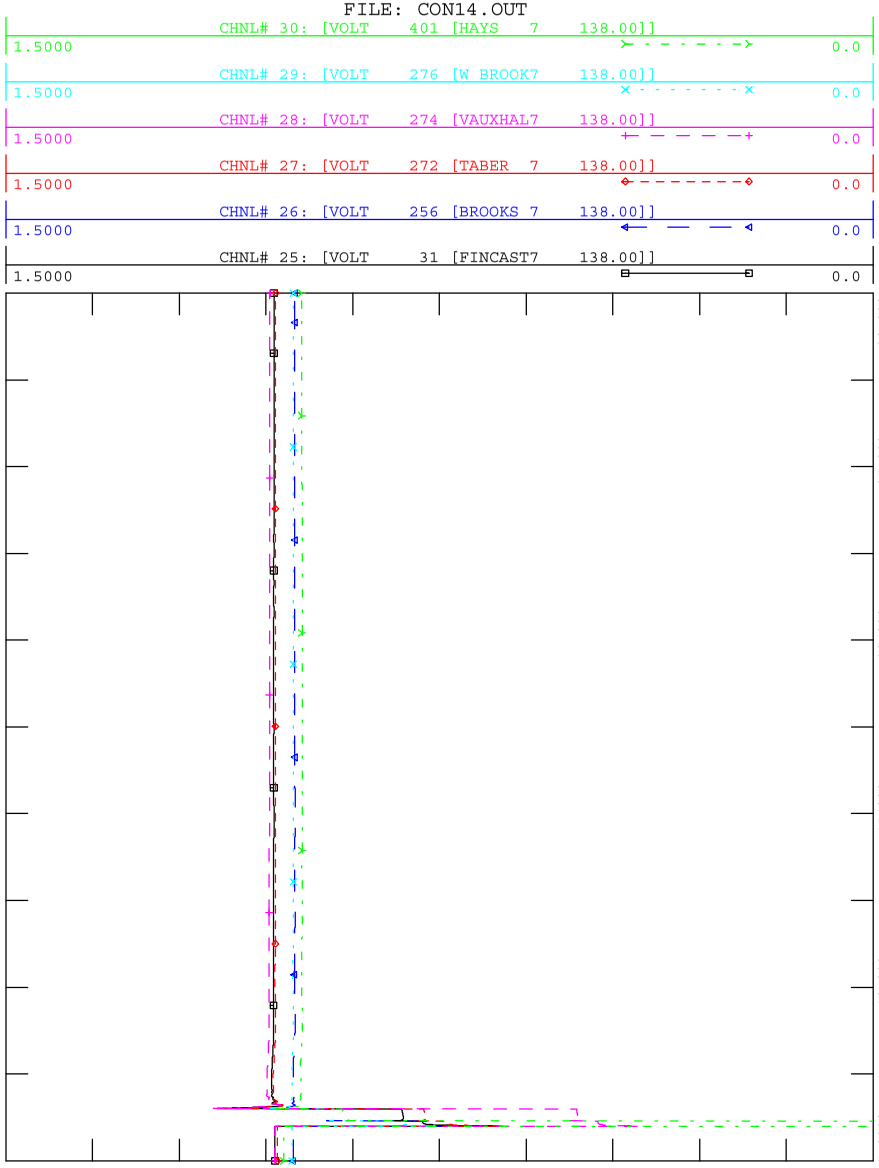
FIG D-SC3-14

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT

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FIG D-SC3-15



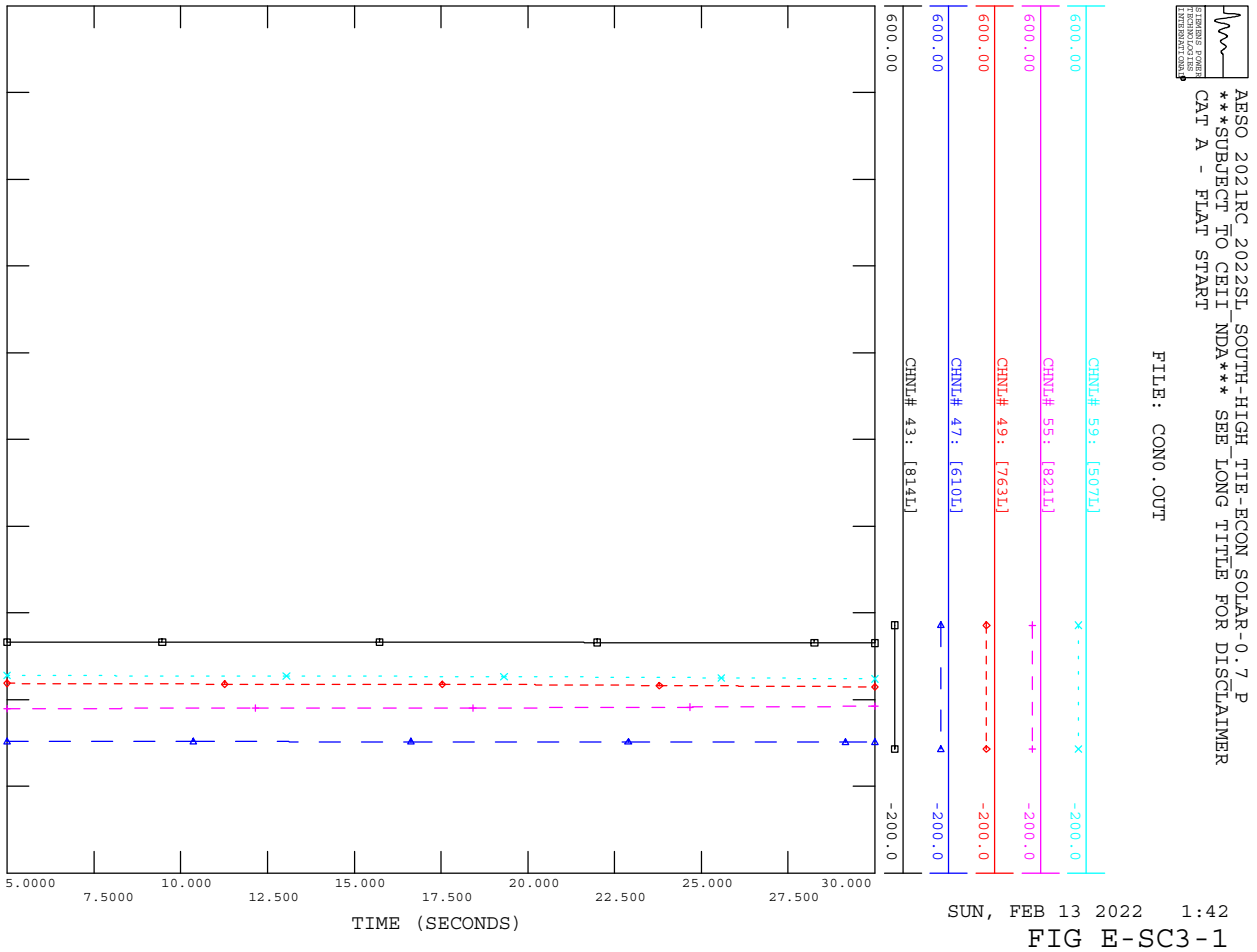


FIG E-SC3-1

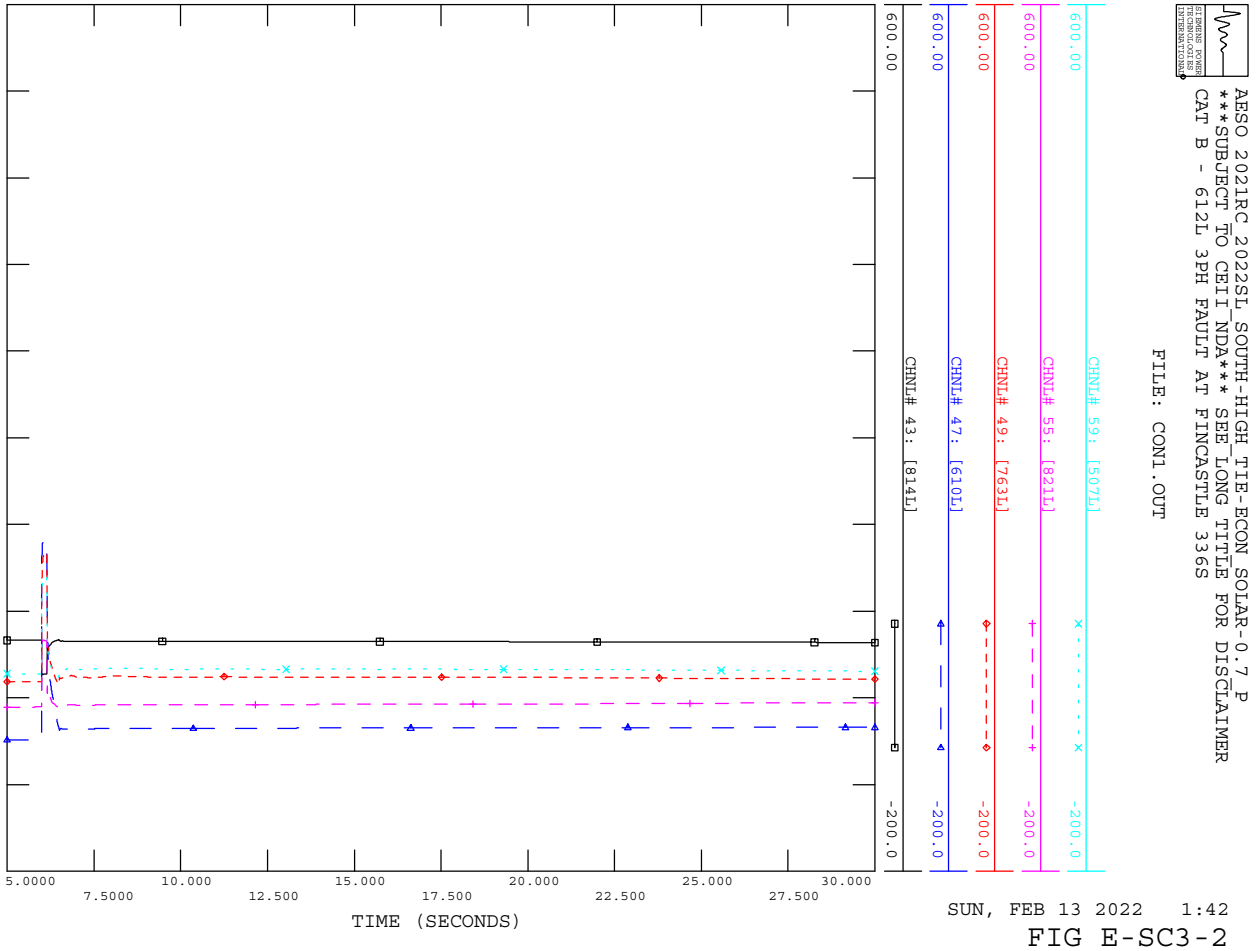


FIG E-SC3-2

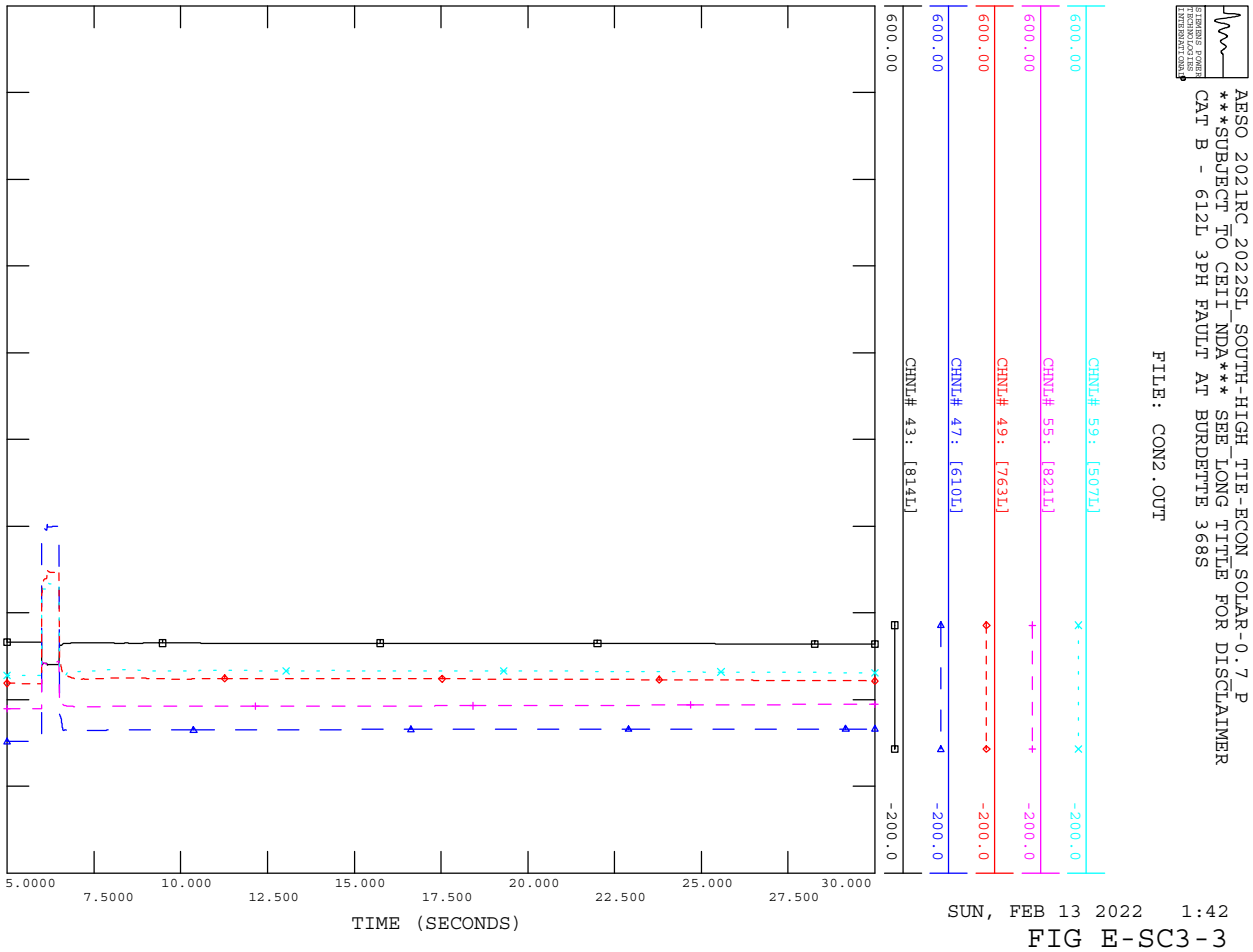


FIG E-SC3-3

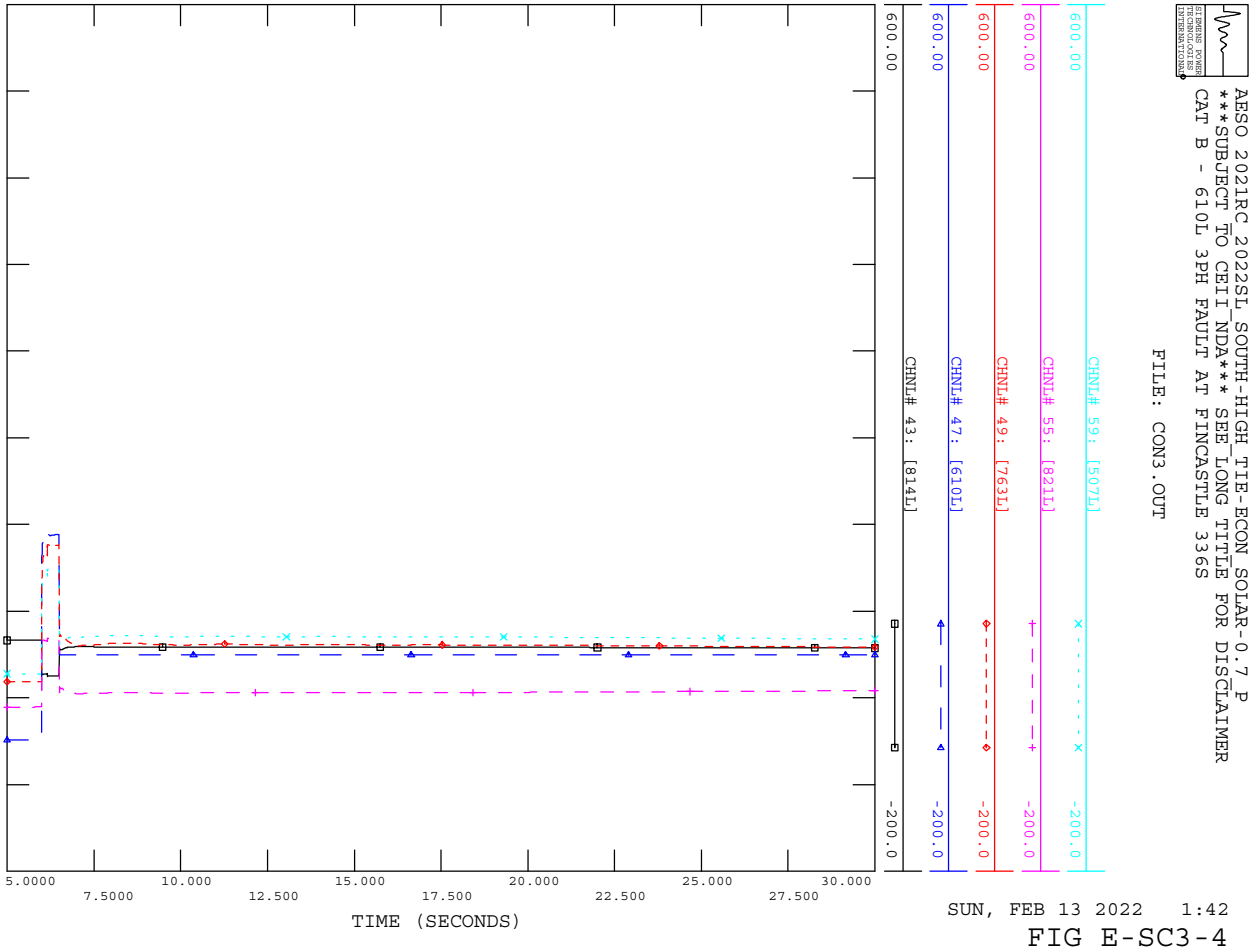


FIG E-SC3-4

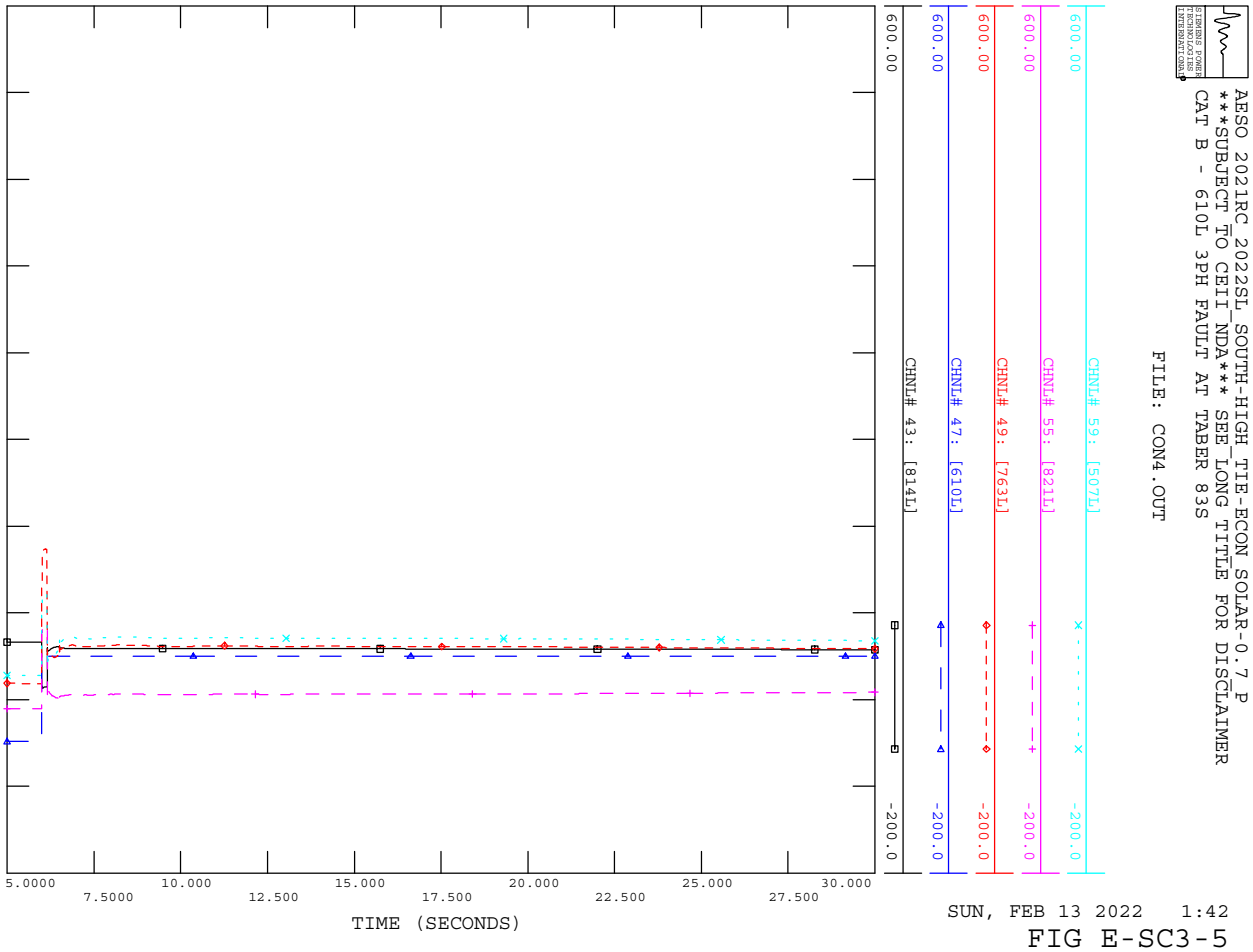


FIG E-SC3-5

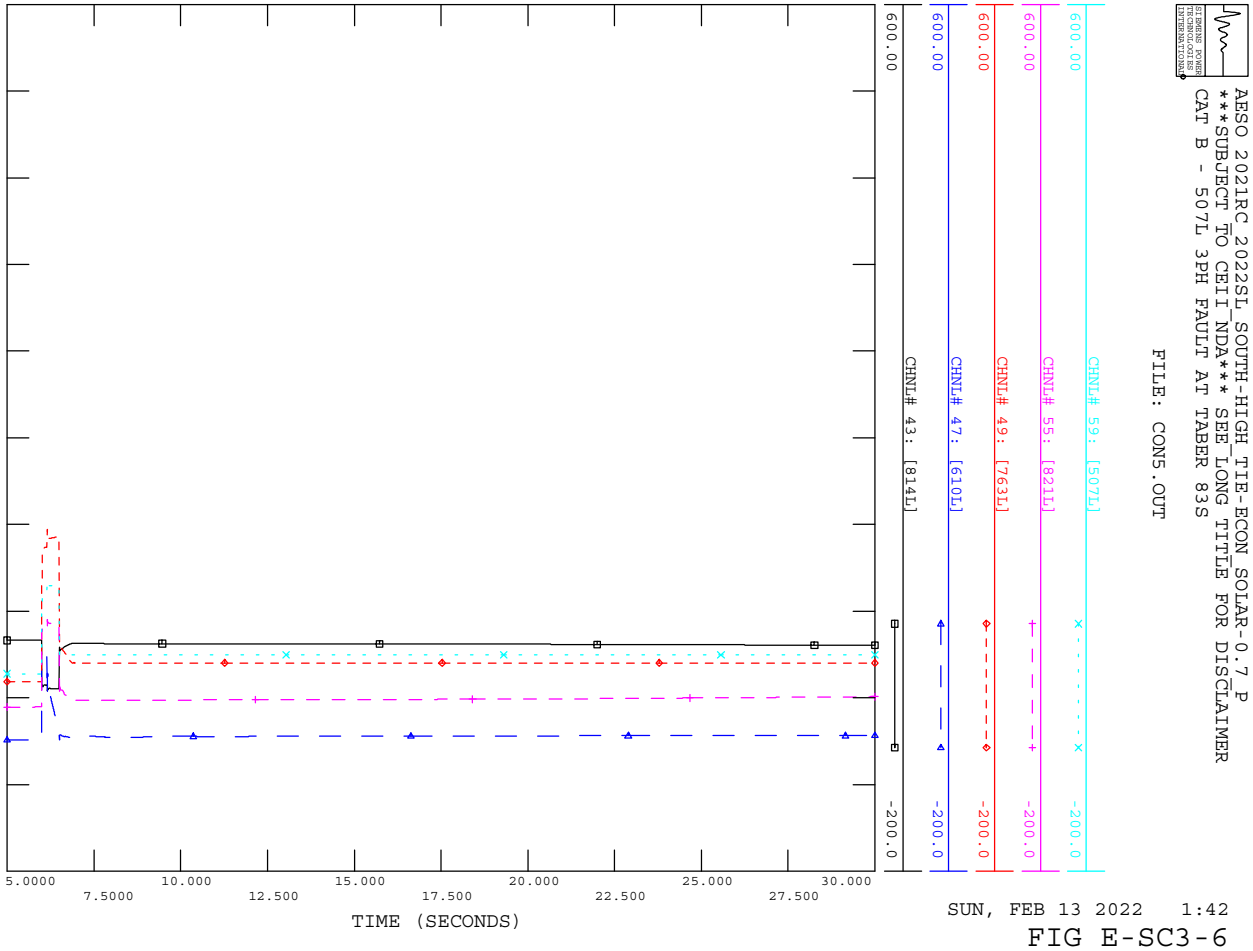


FIG E-SC3-6

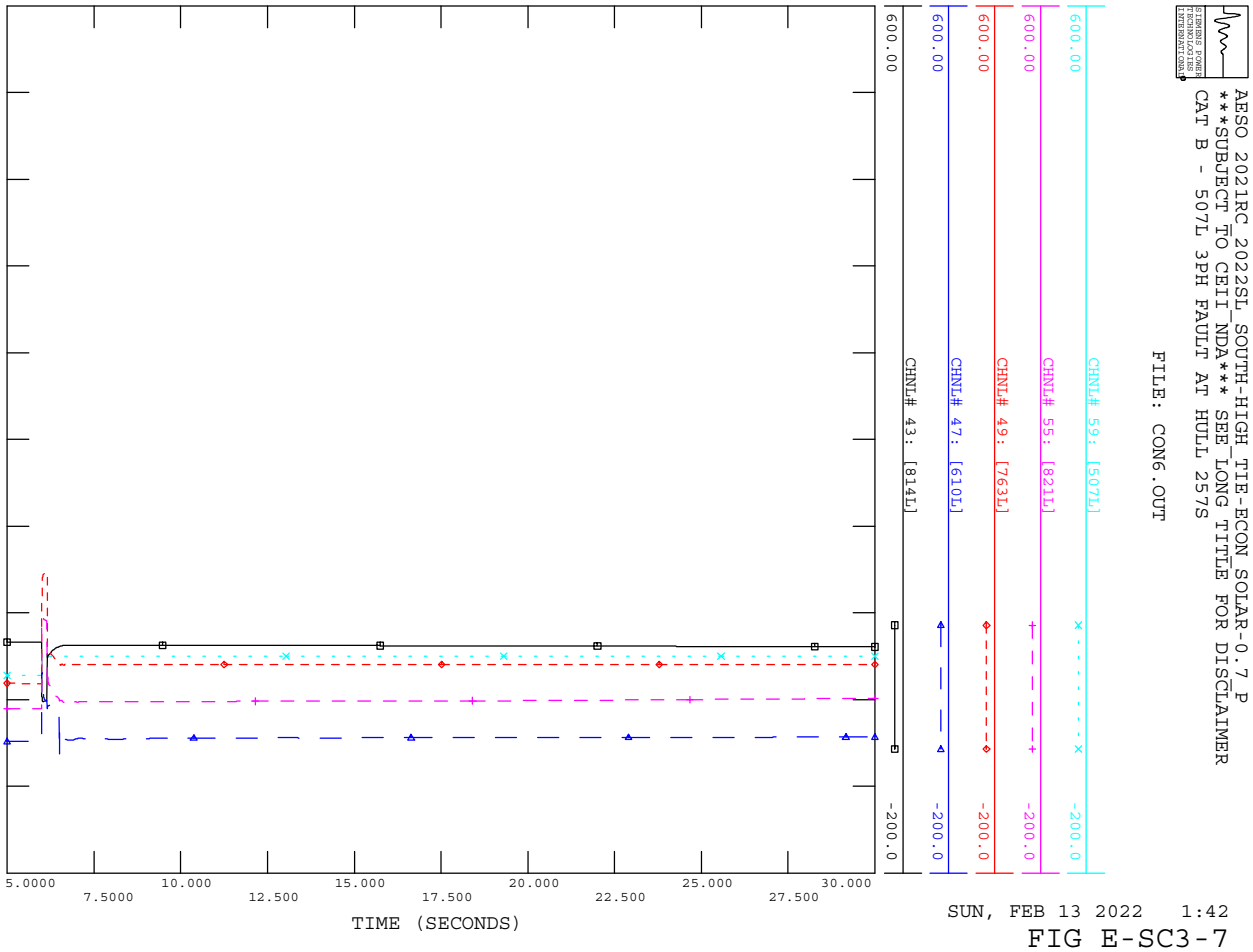


FIG E-SC3-7

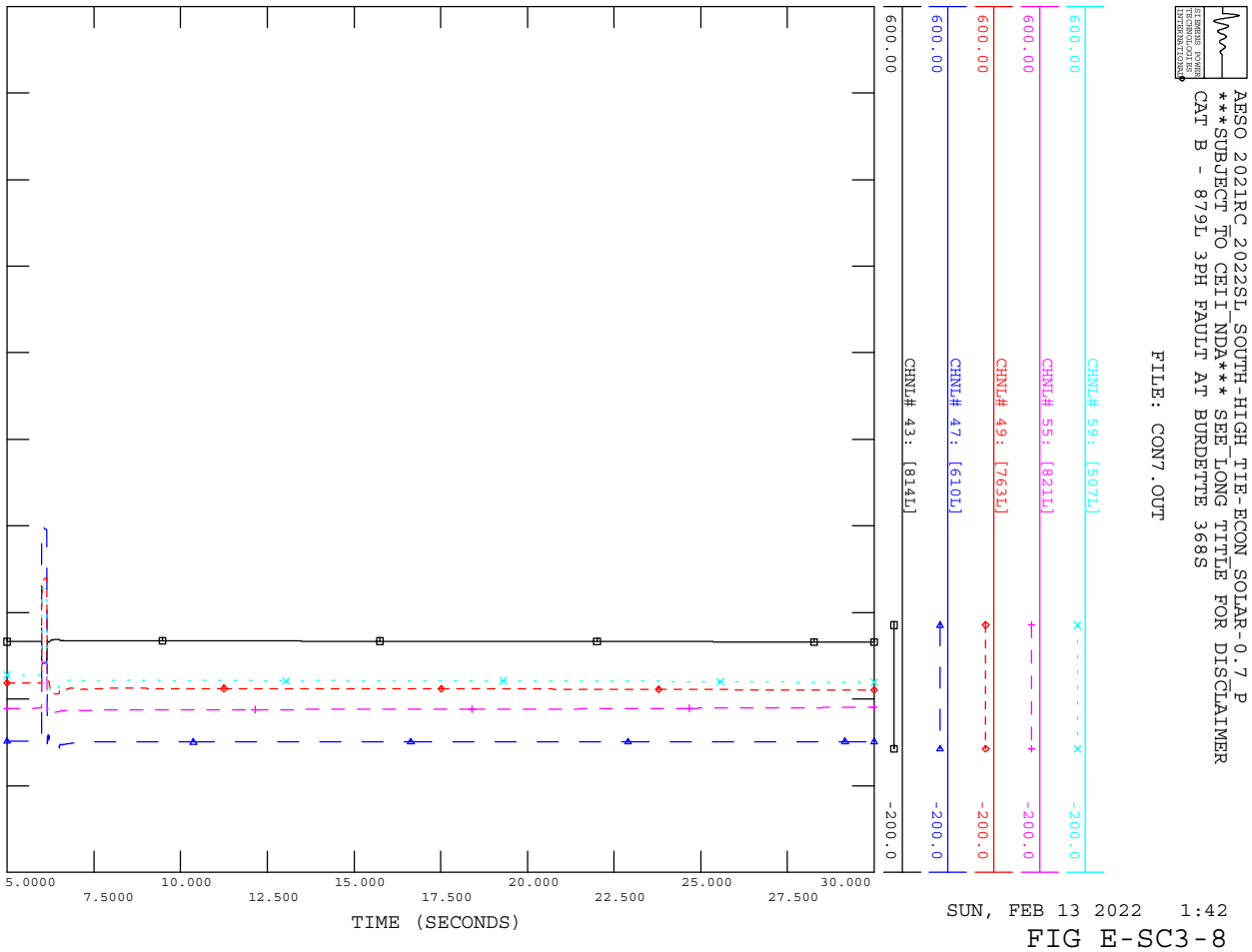


FIG E-SC3-8

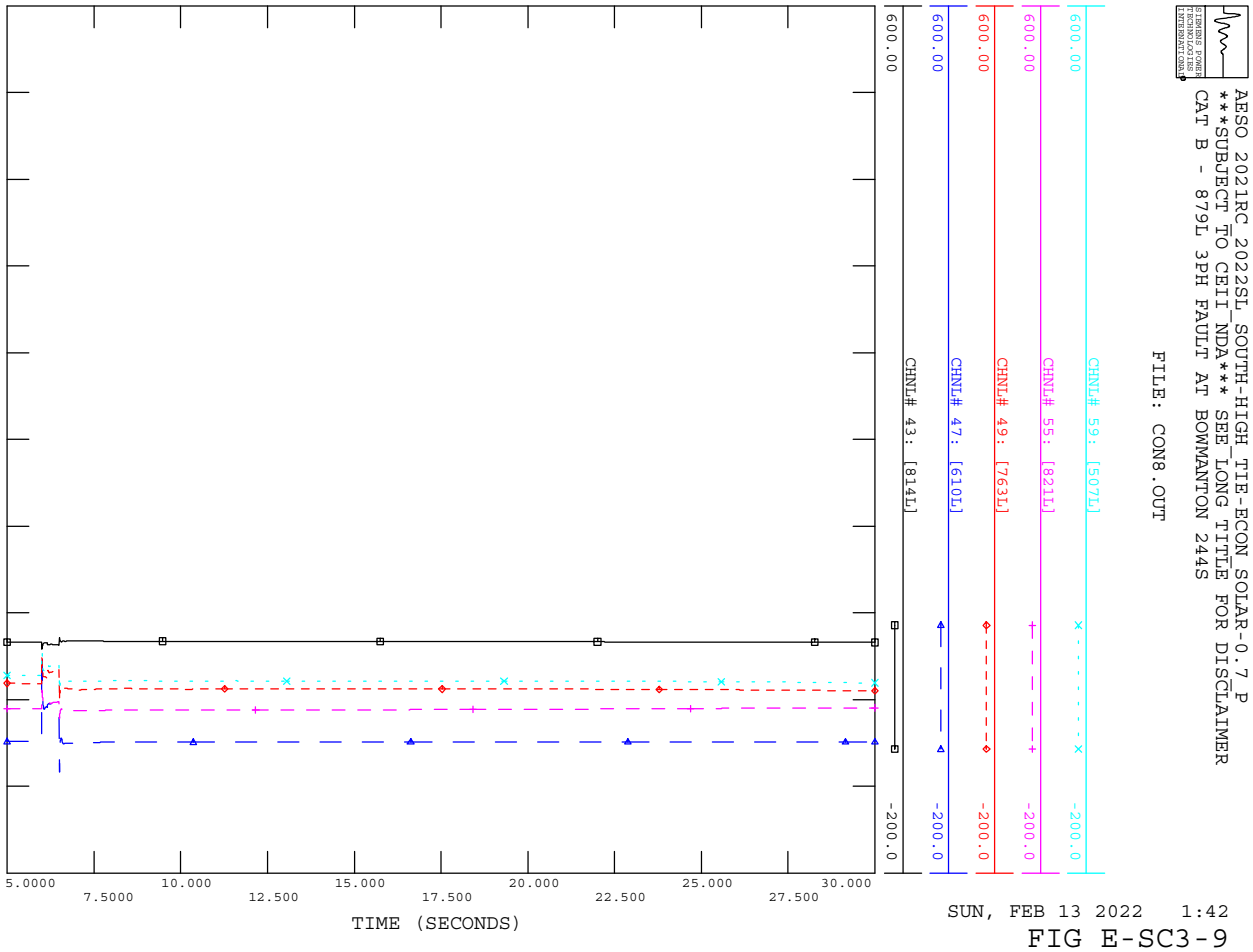


FIG E-SC3-9

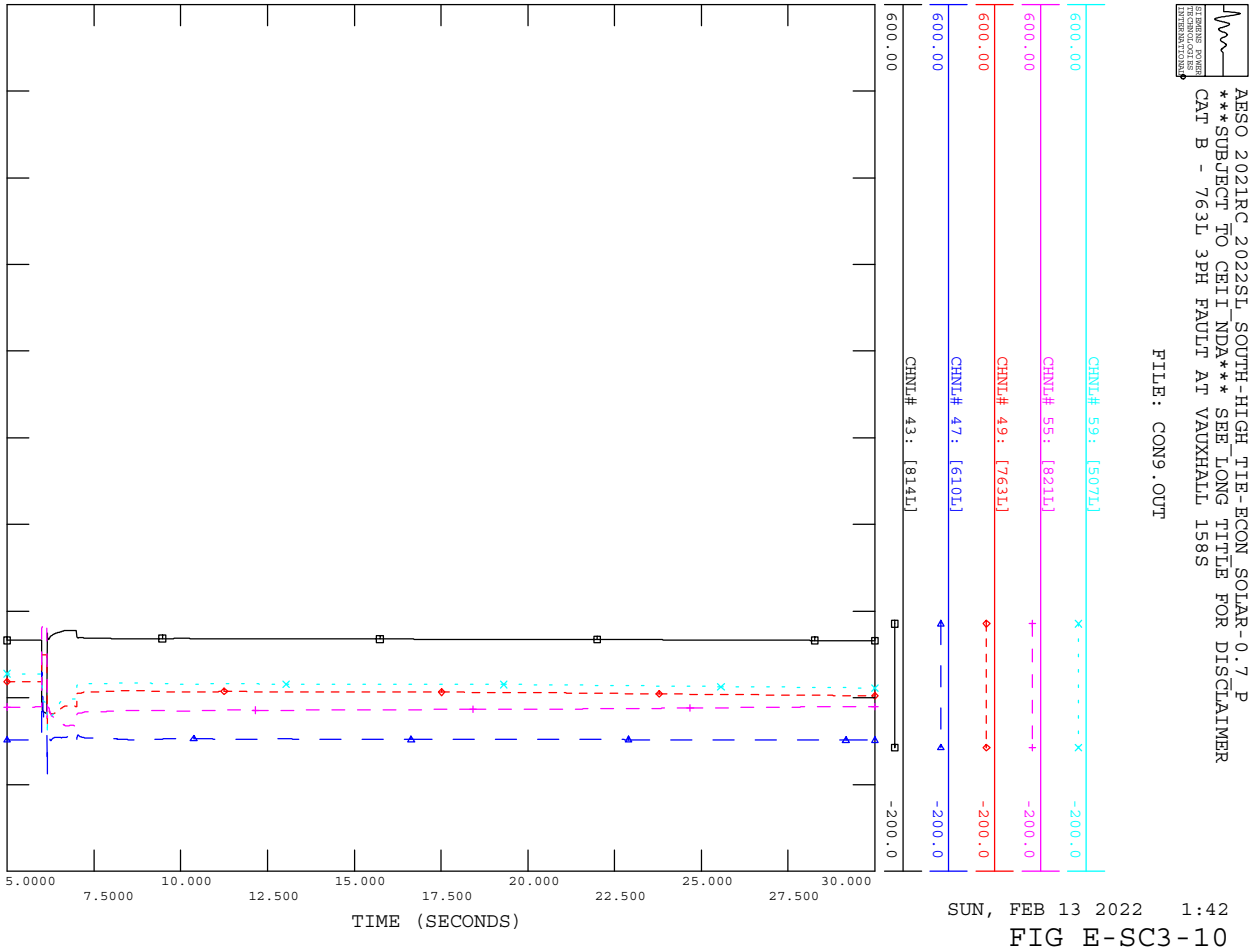


FIG E-SC3-10

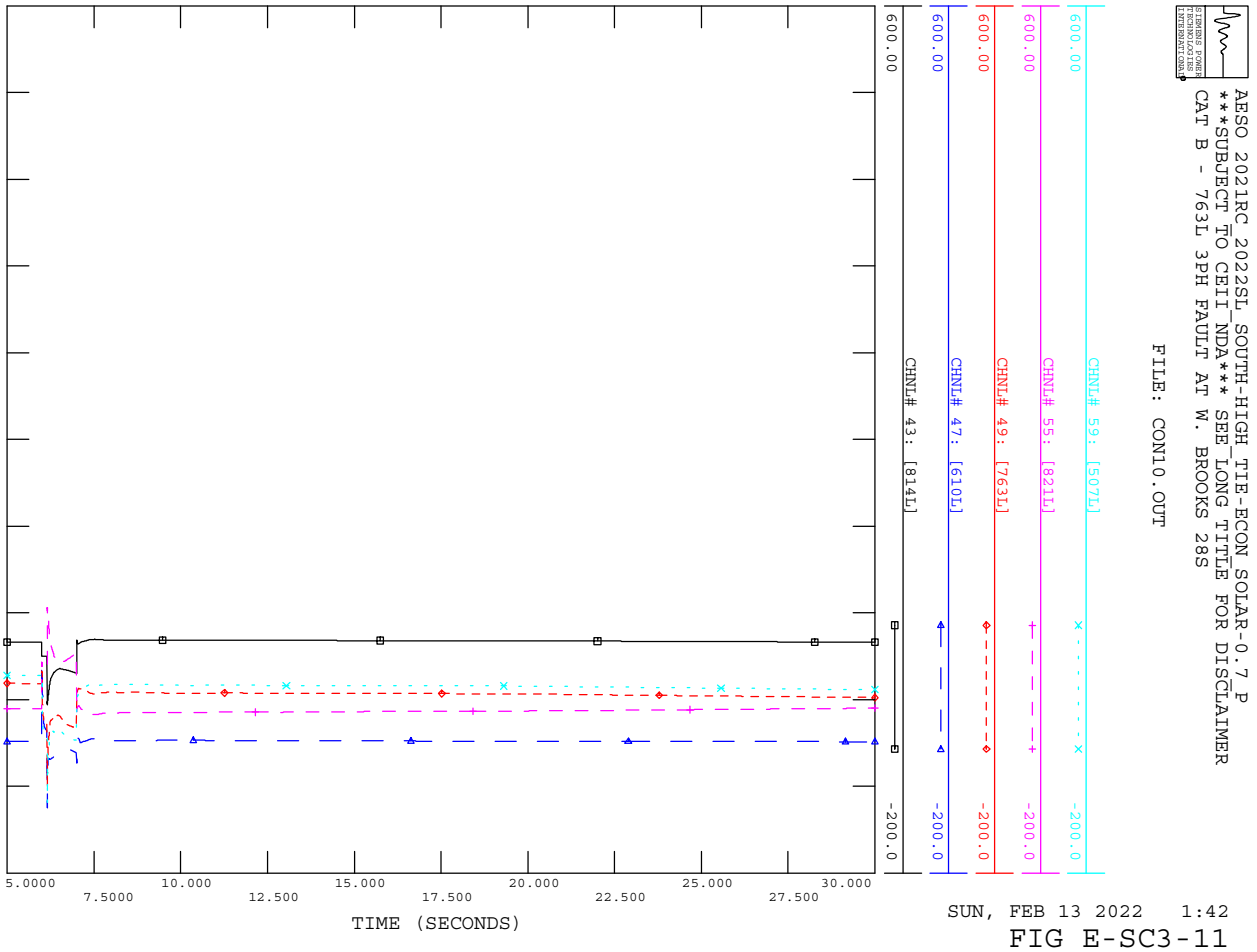


FIG E-SC3-11

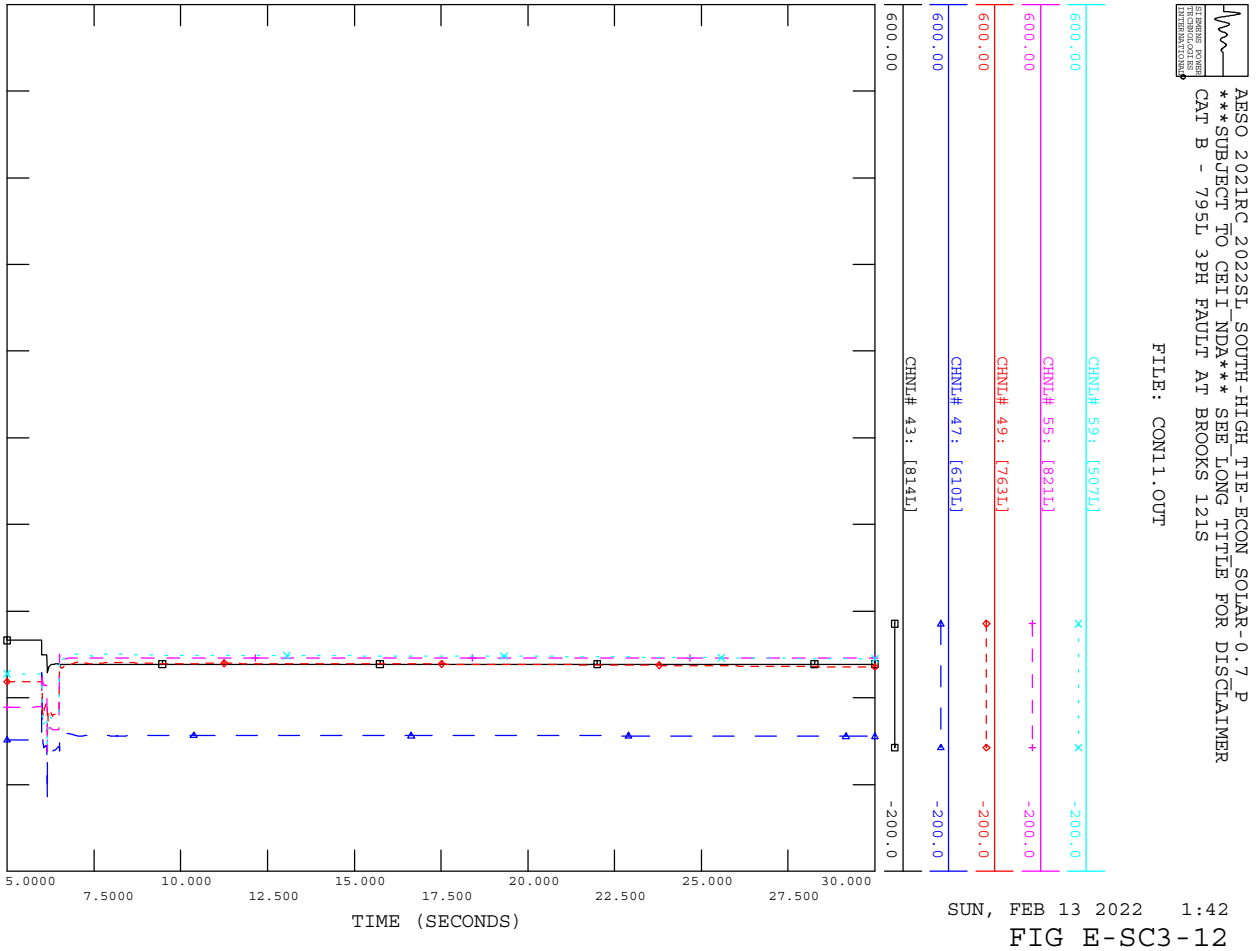


FIG E-SC3-12

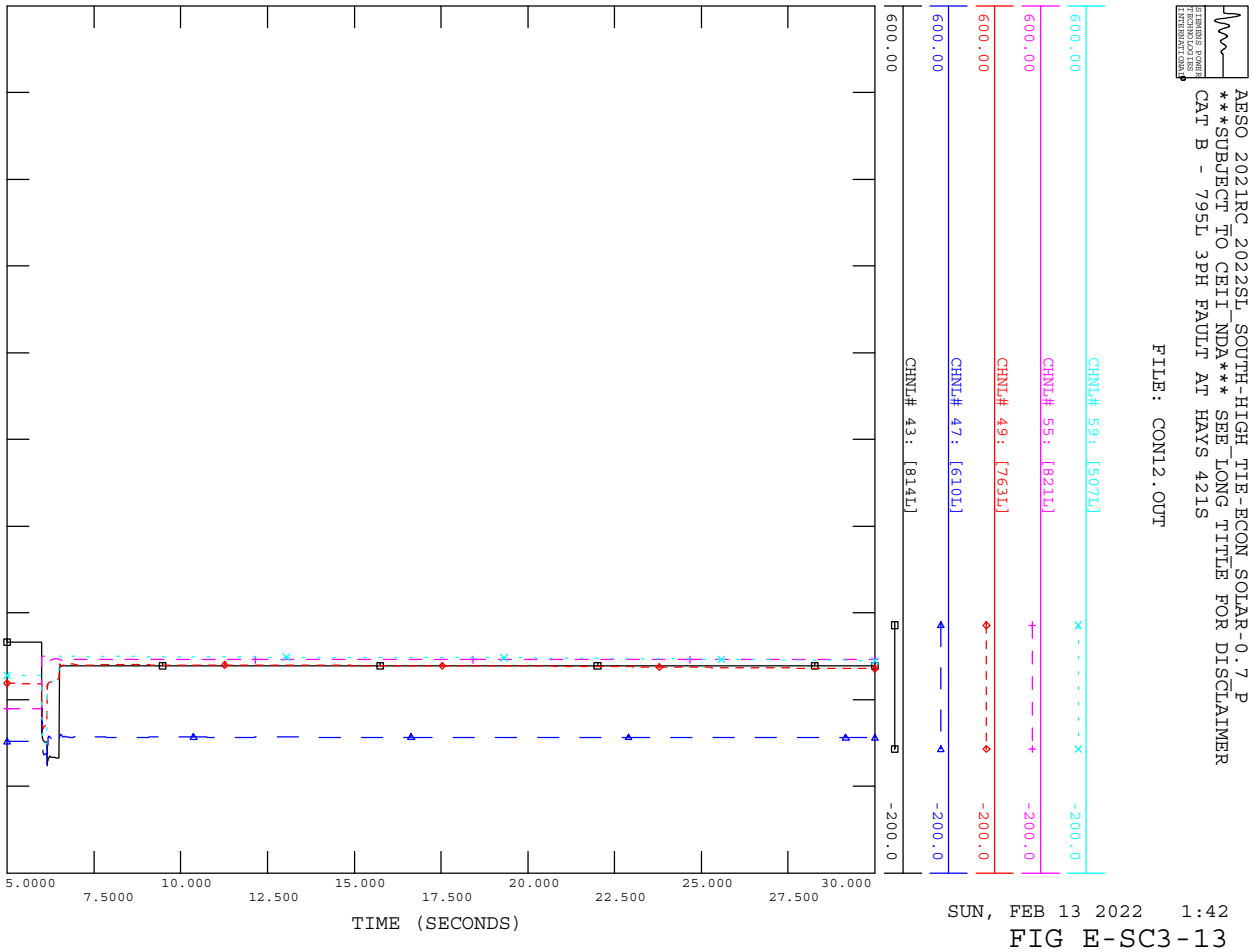


FIG E-SC3-13

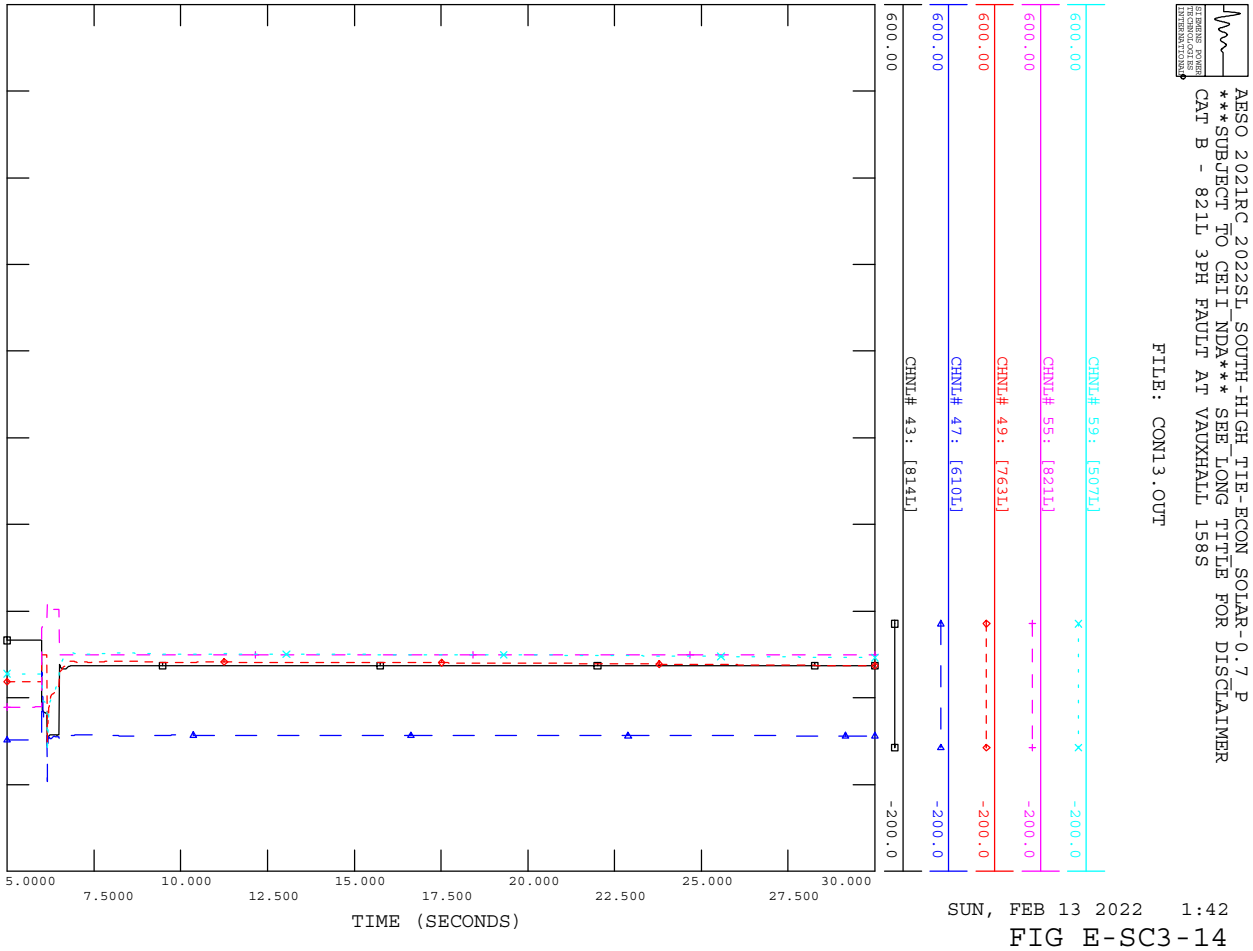


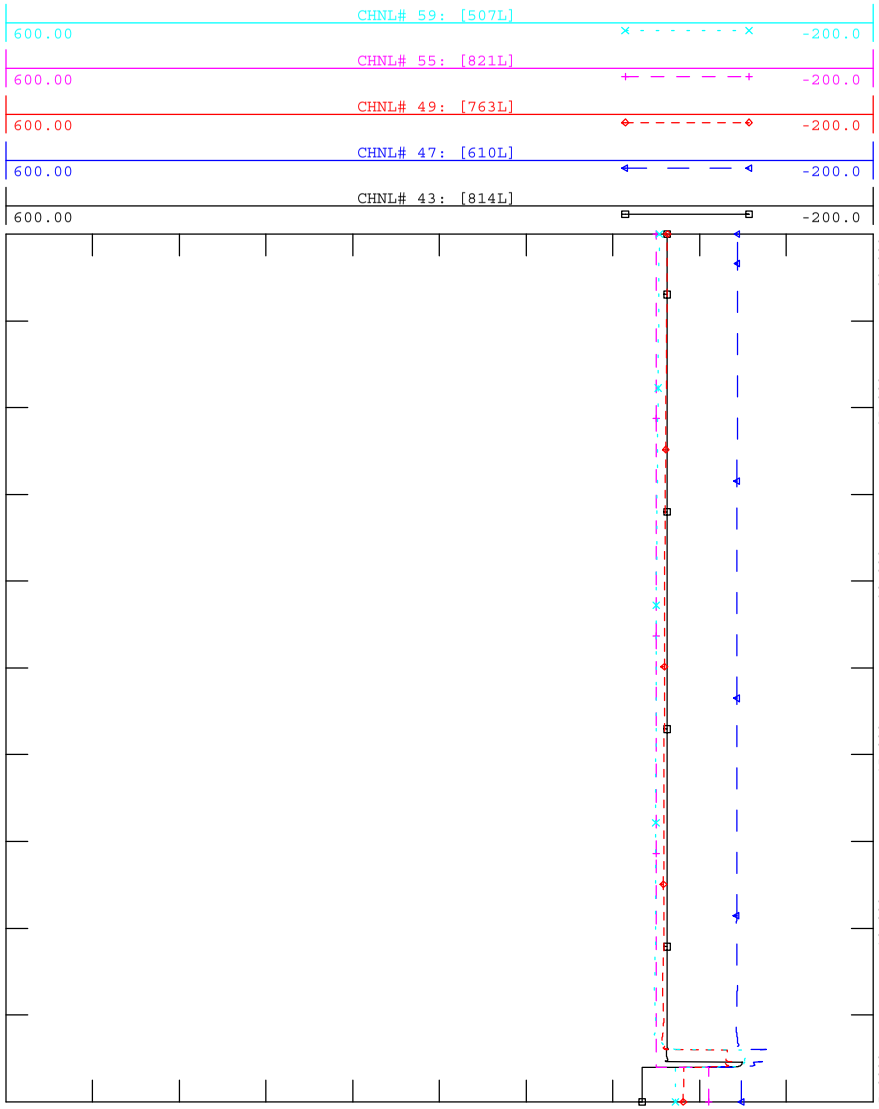
FIG E-SC3-14

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

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FIG E-SC3-15



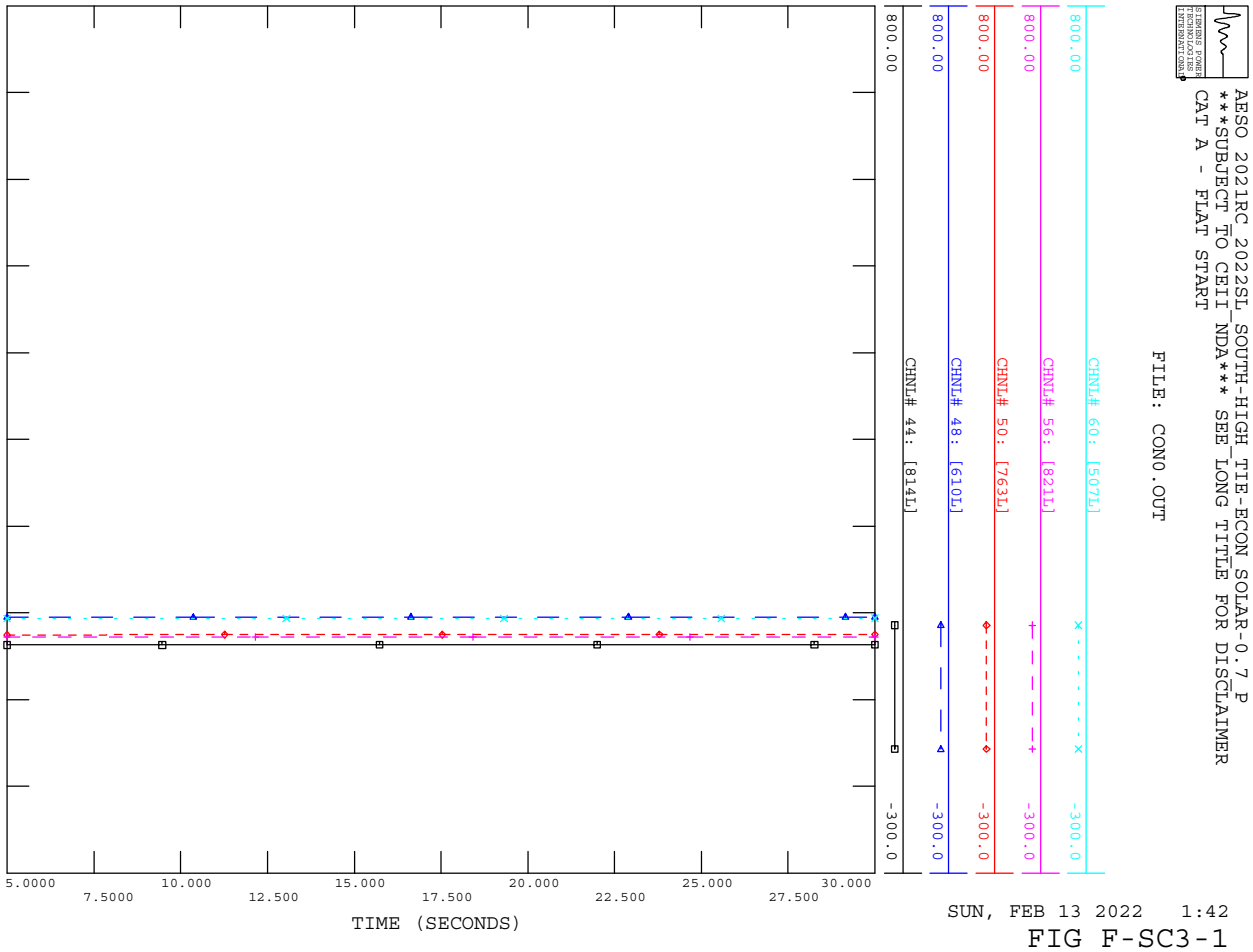


FIG F-SC3-1

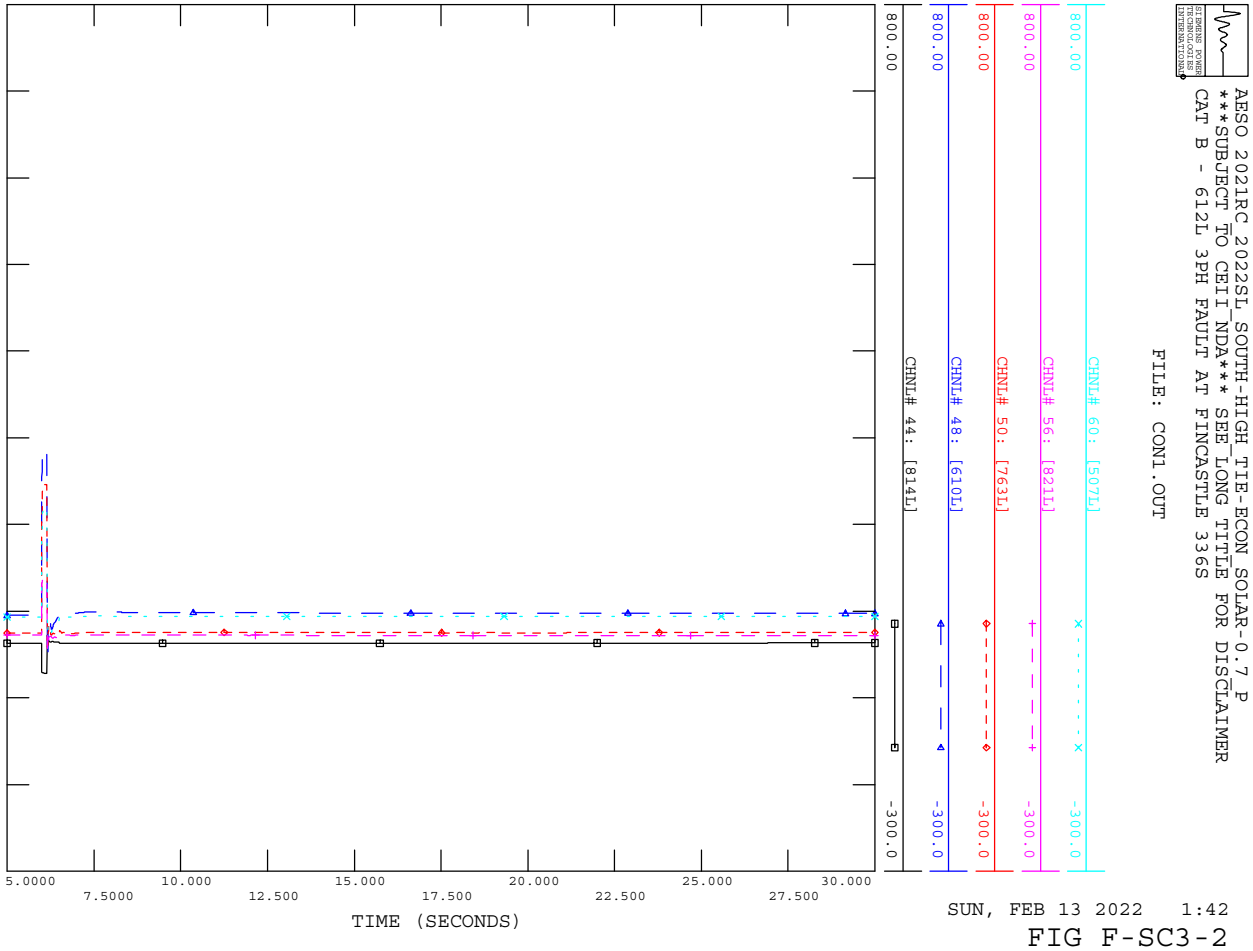


FIG F-SC3-2

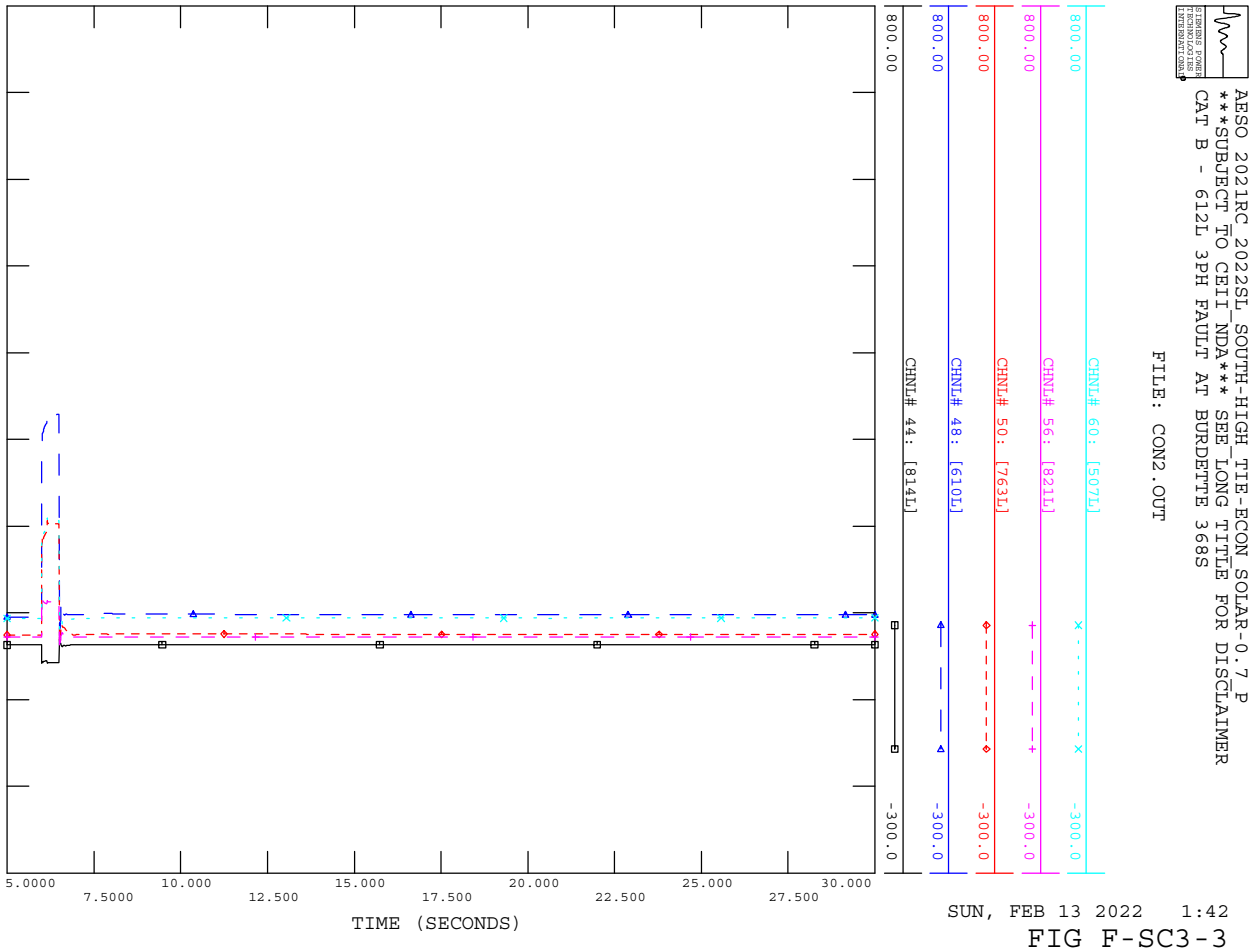


FIG F-SC3-3

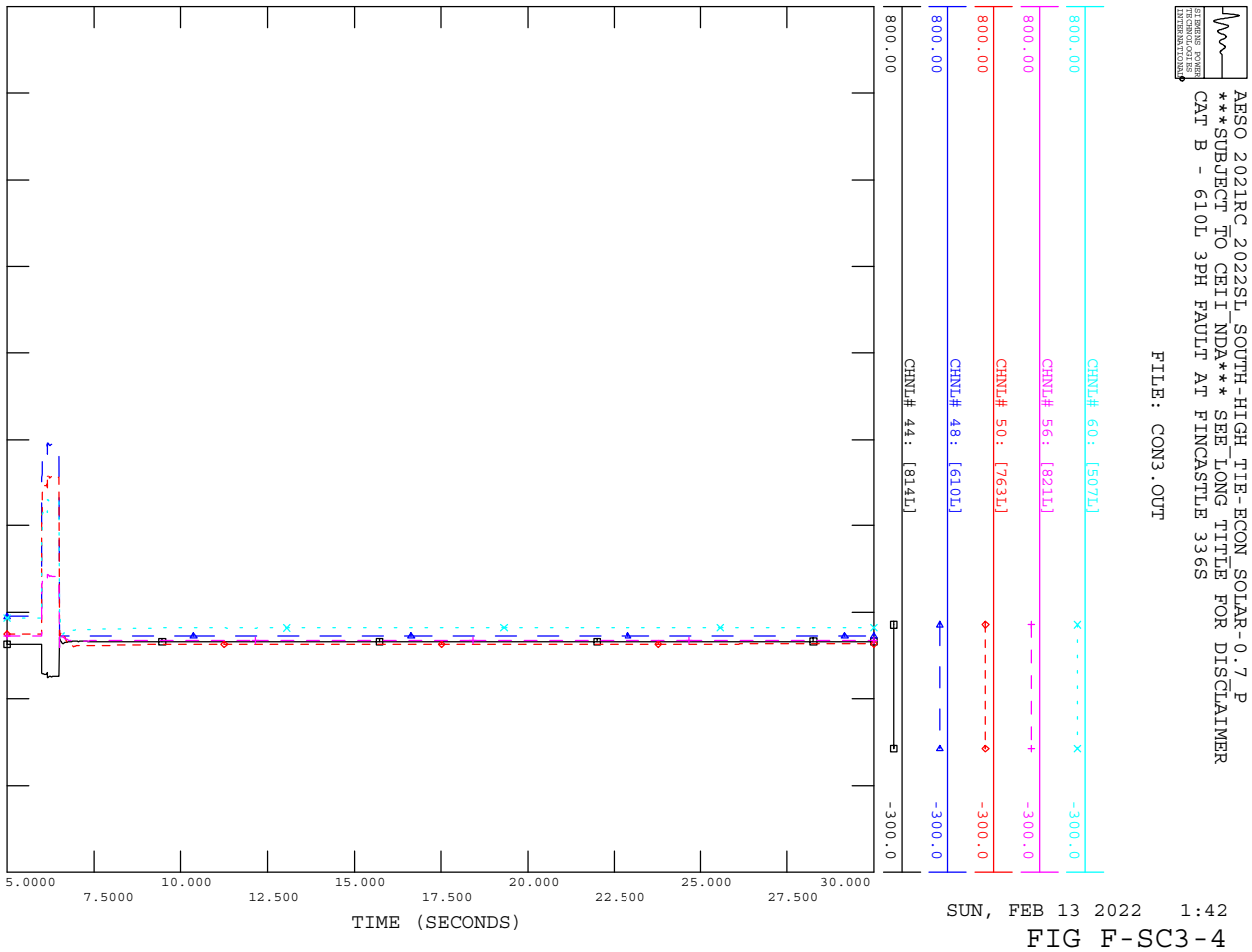


FIG F-SC3-4

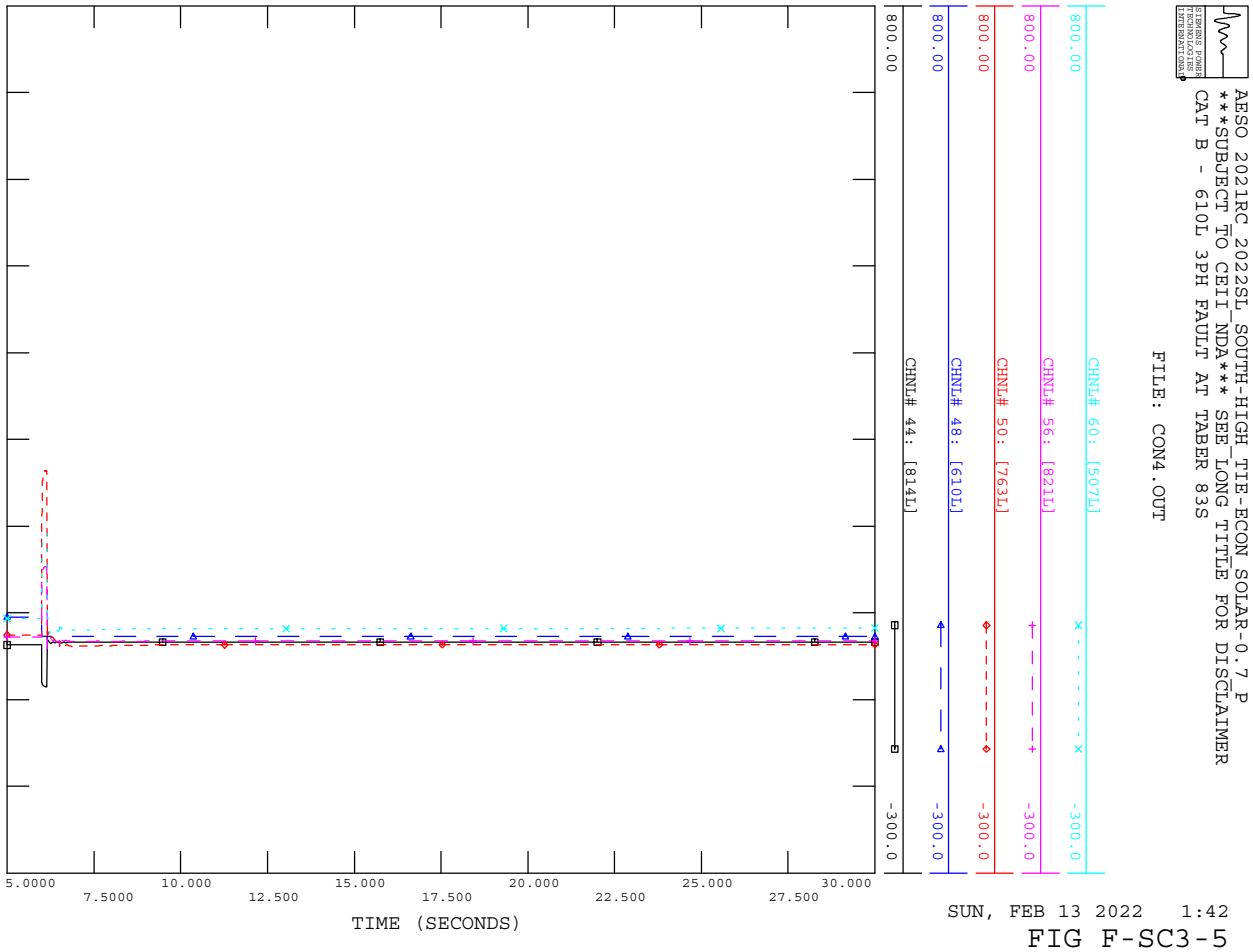


FIG F-SC3-5

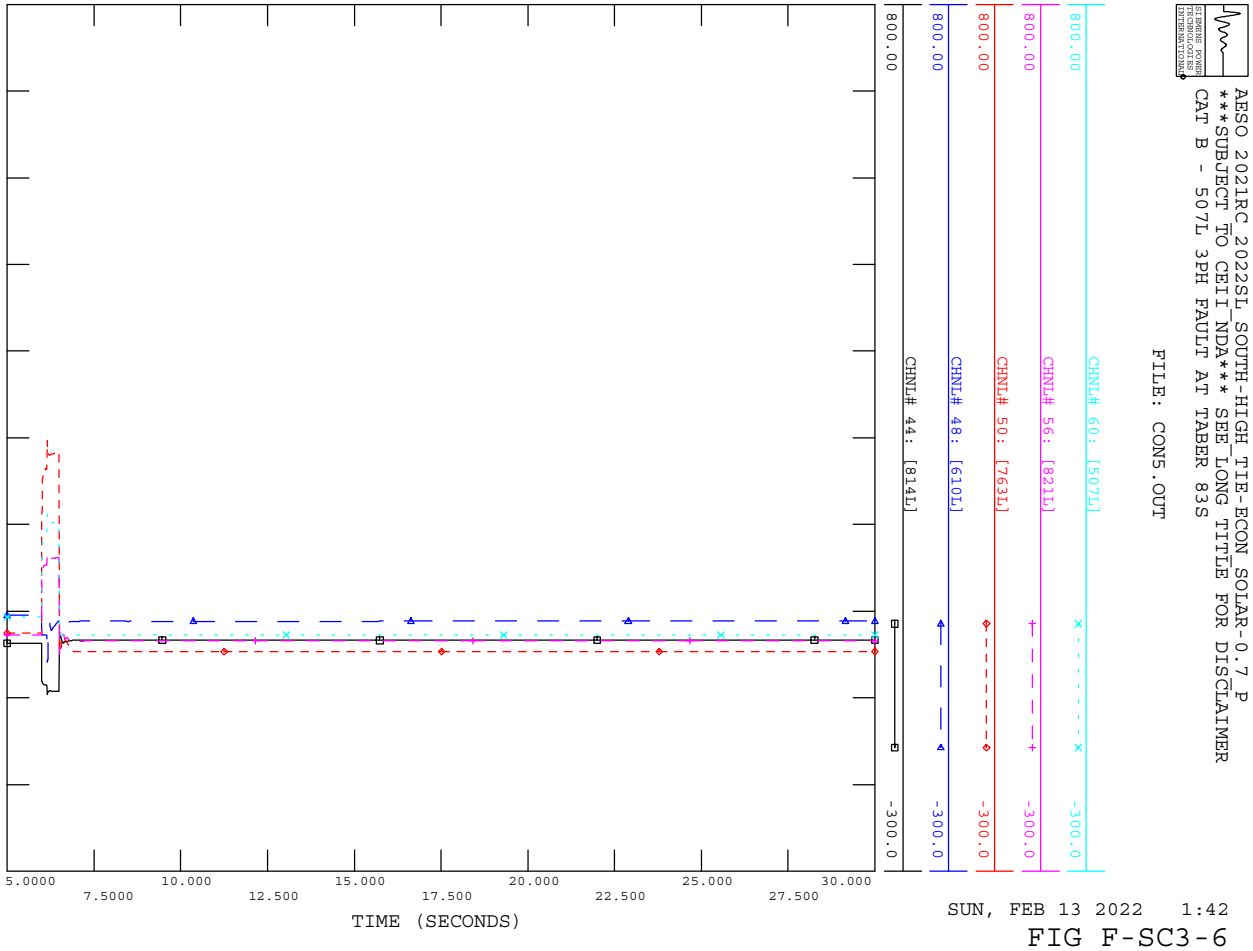


FIG F-SC3-6

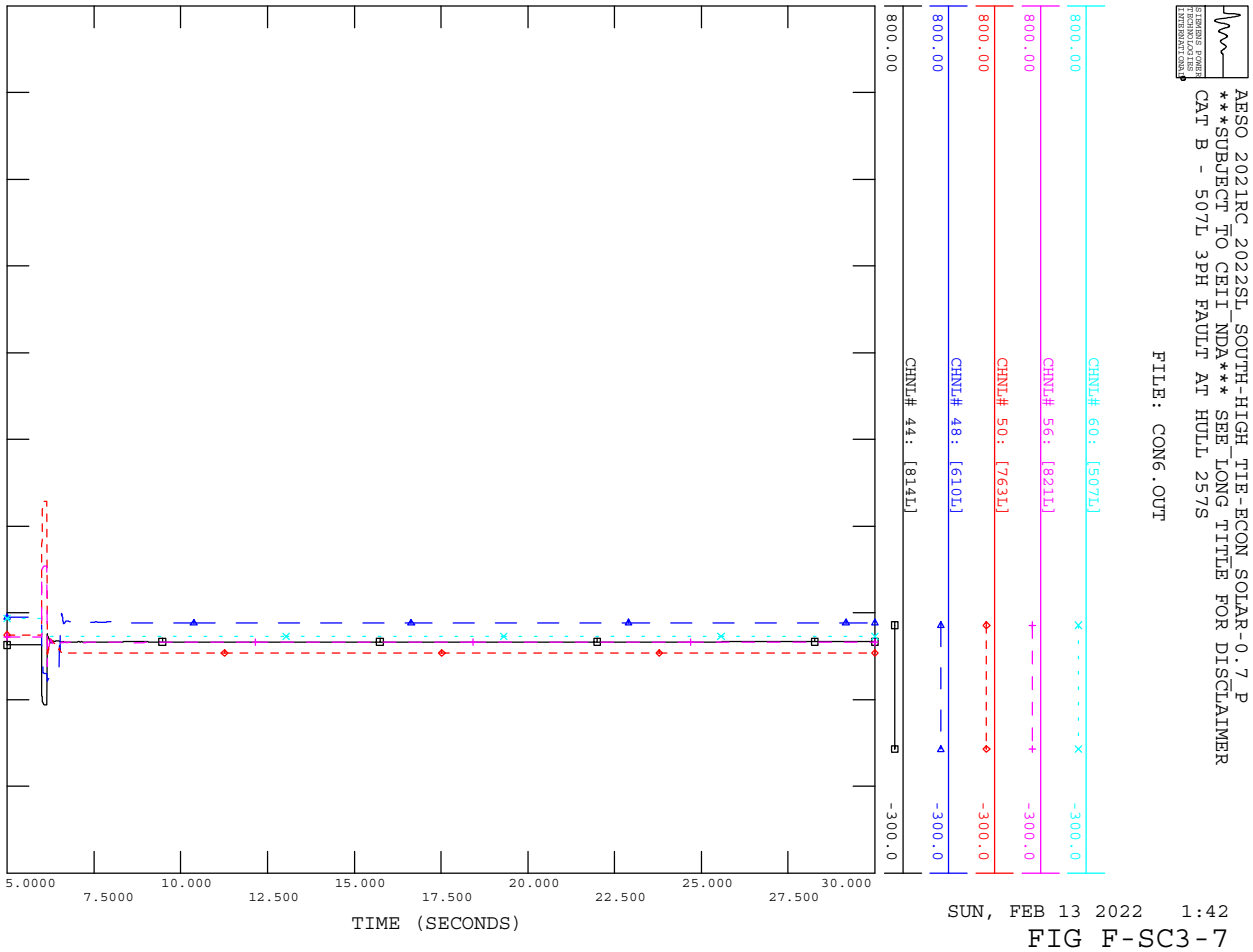


FIG F-SC3-7

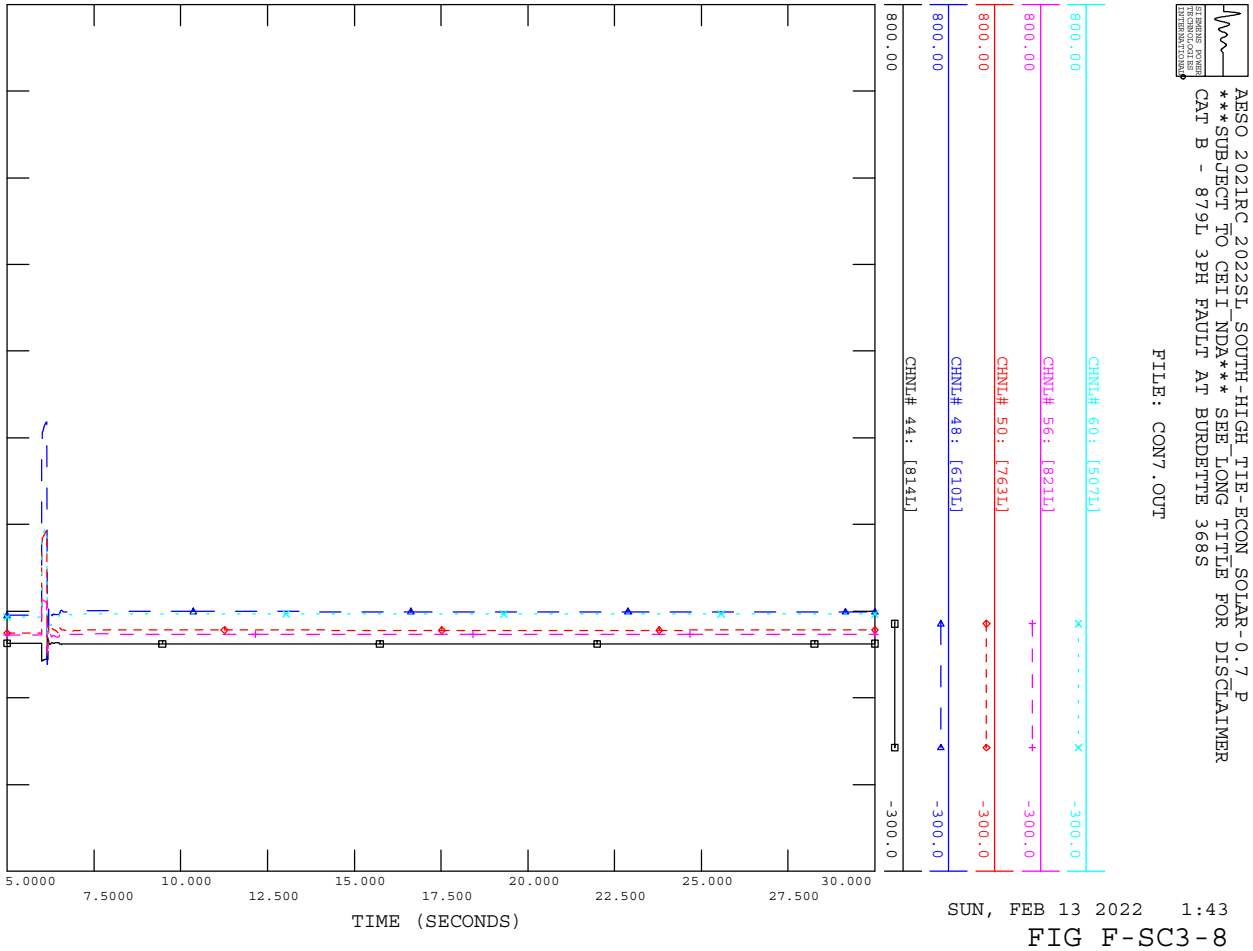


FIG F-SC3-8

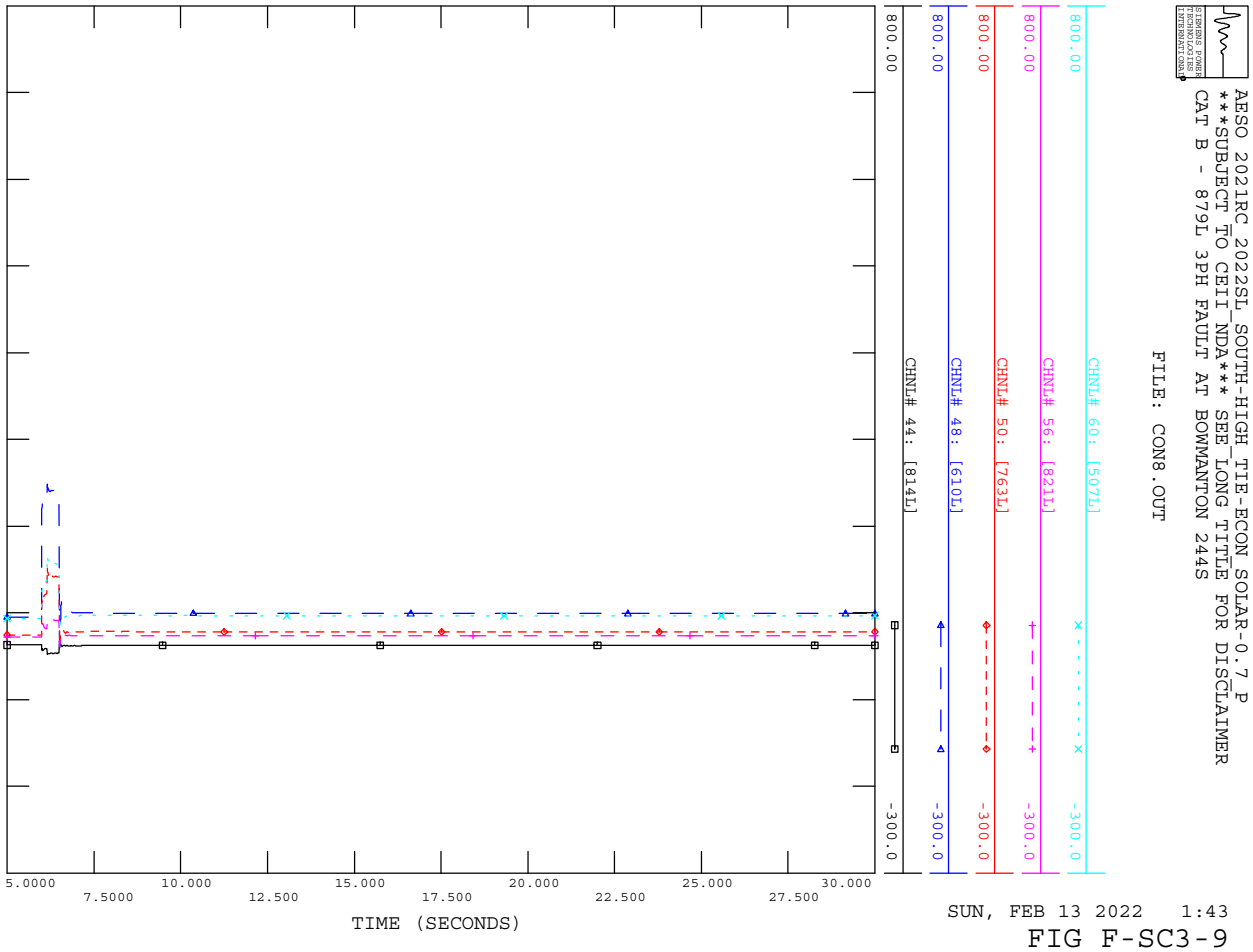


FIG F-SC3-9

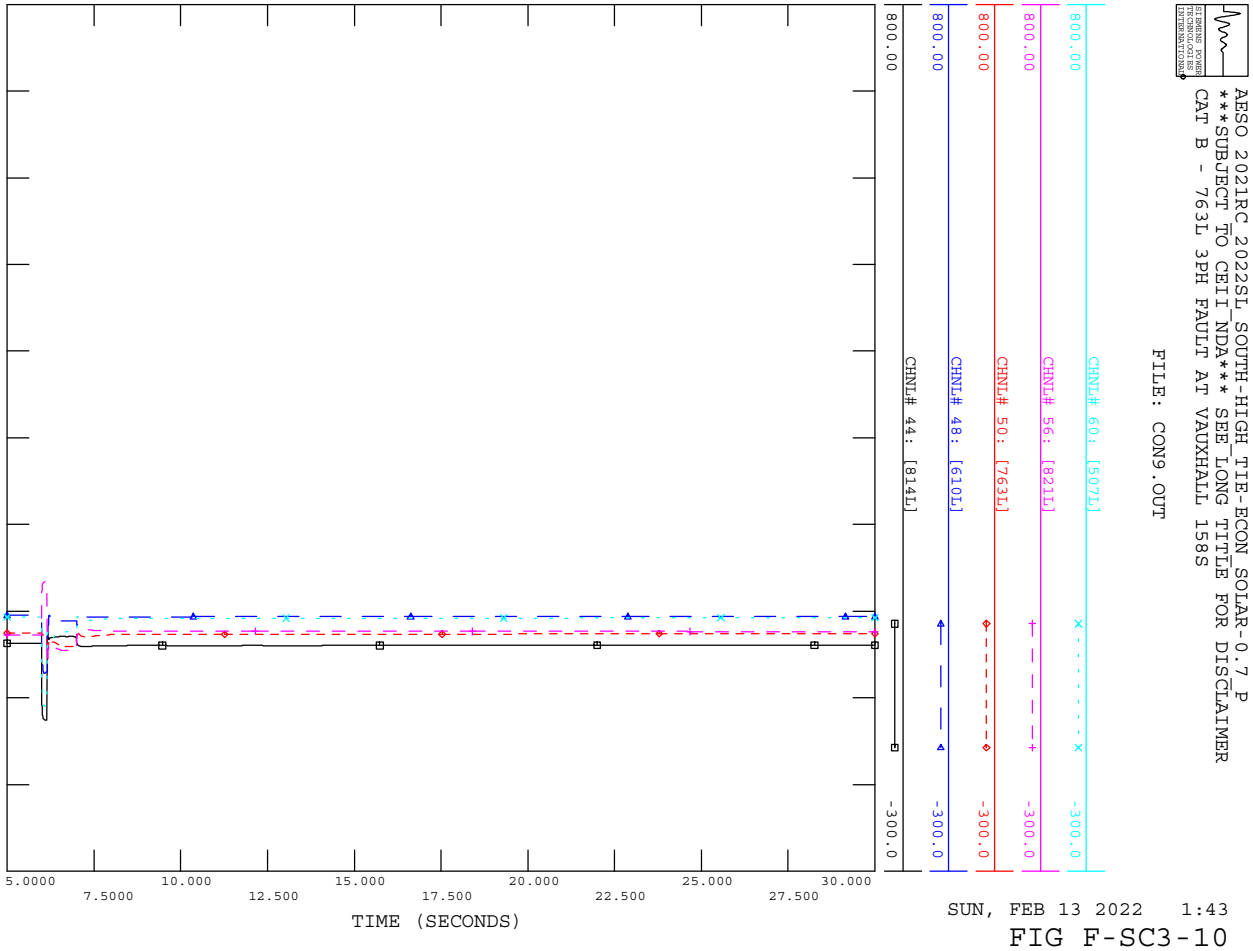
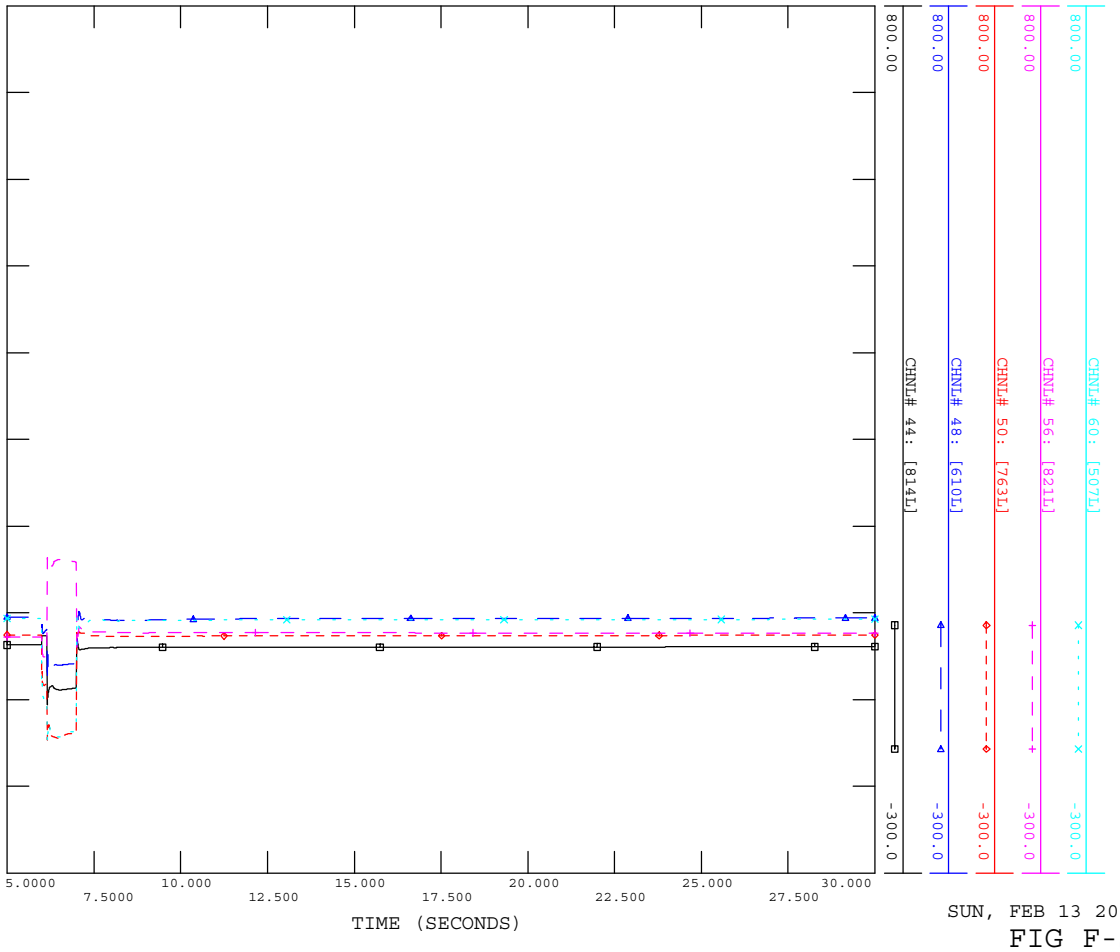


FIG F-SC3-10

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 763L 3PH FAULT AT W. BROOKS 28S

FILE: CON10.OUT

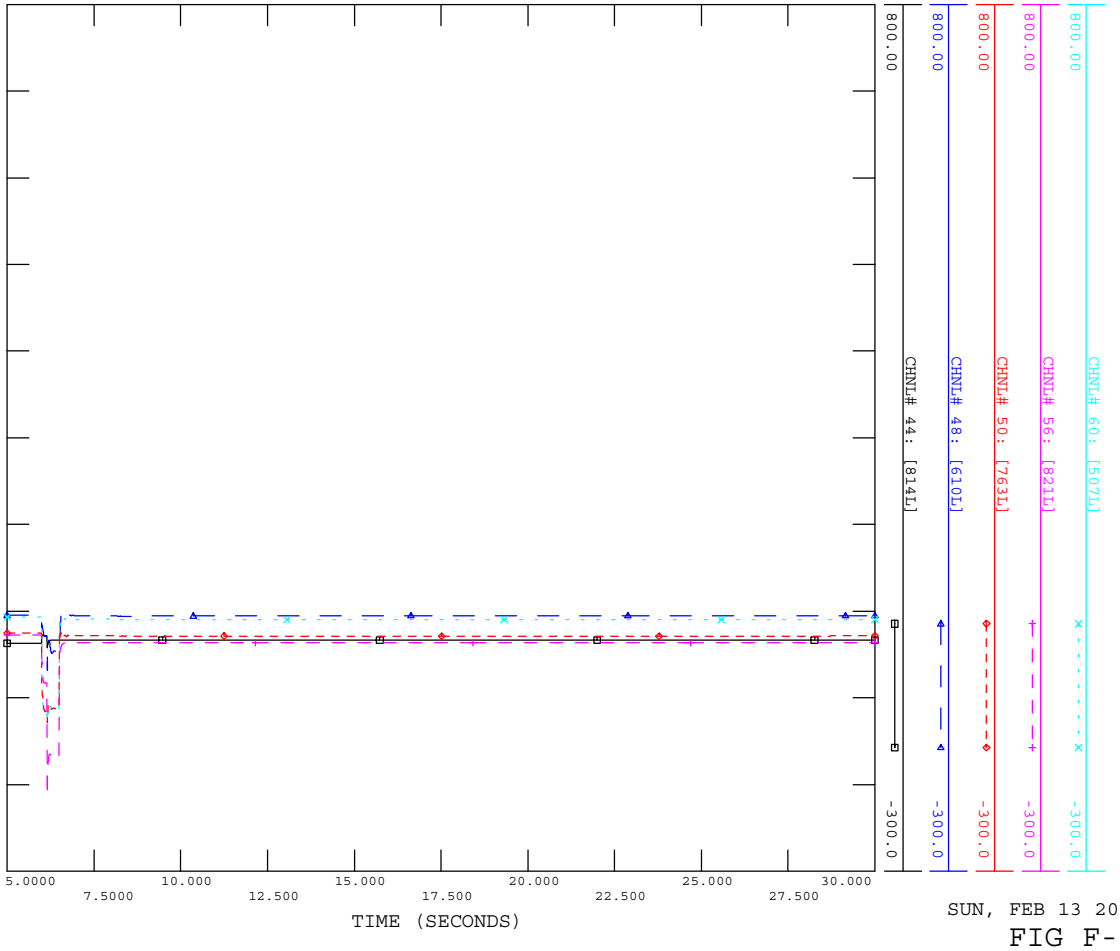


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FIG F-SC3-11

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 795L 3PH FAULT AT BROOKS 121S

FILE: CON11.OUT



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FIG F-SC3-12

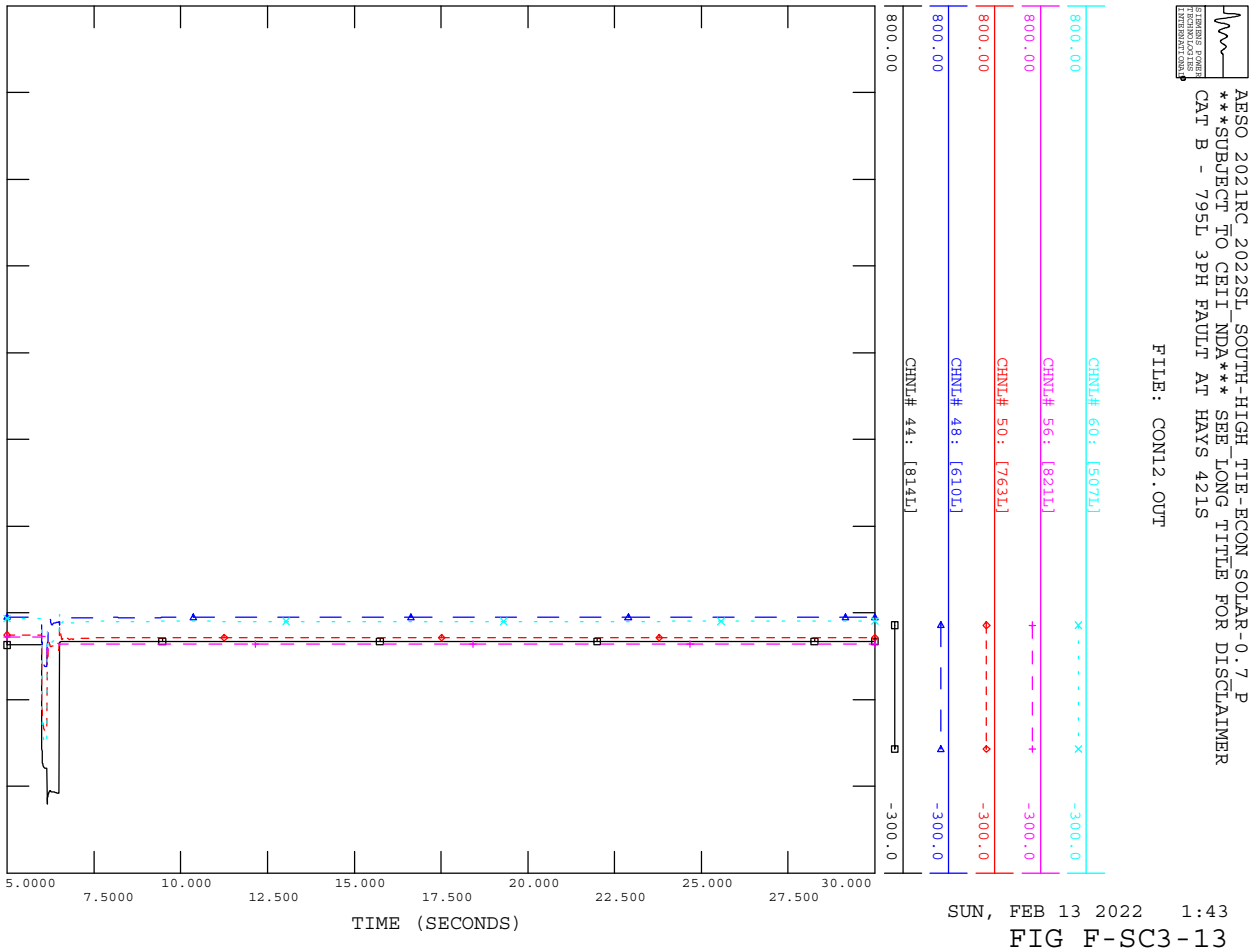


FIG F-SC3-13

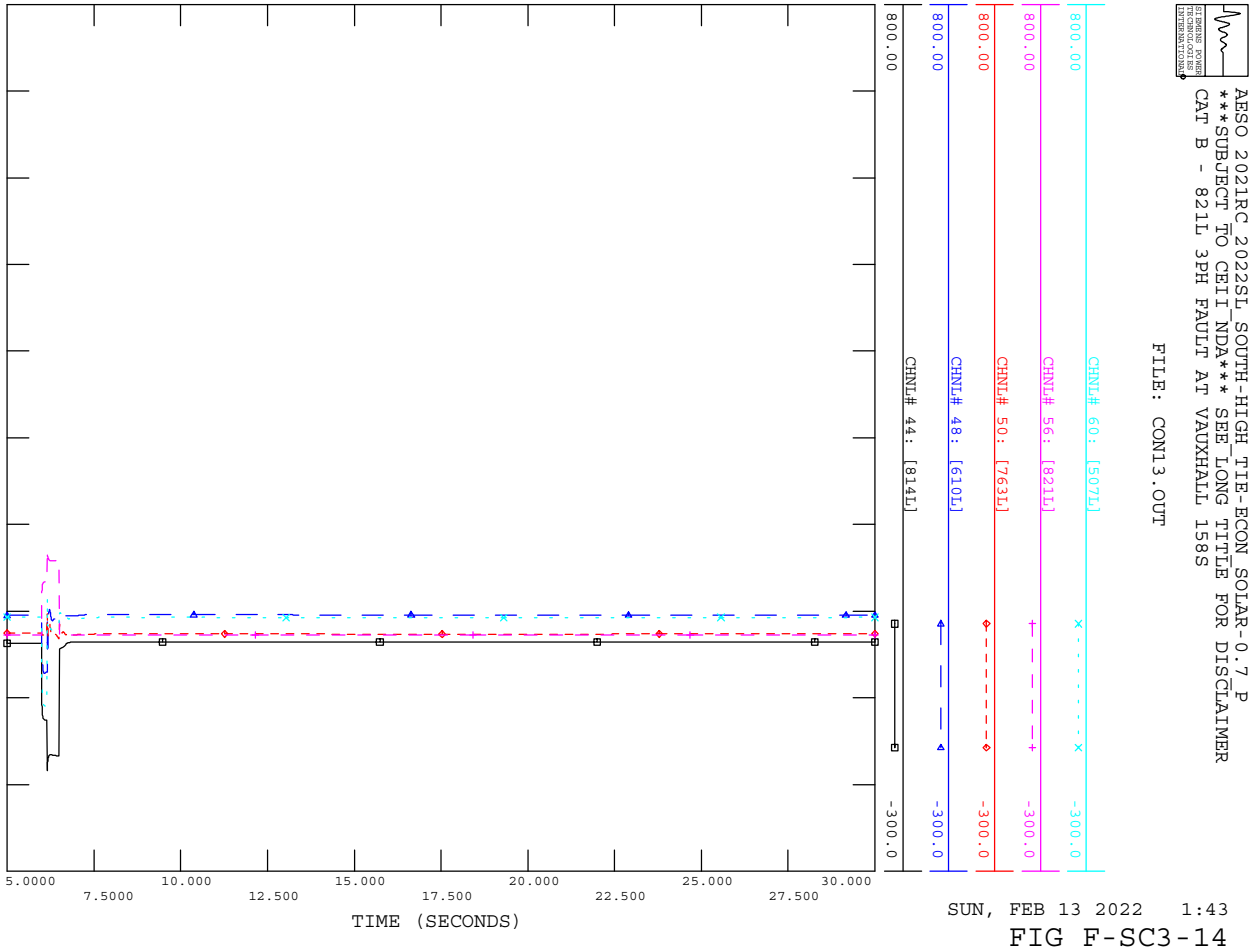


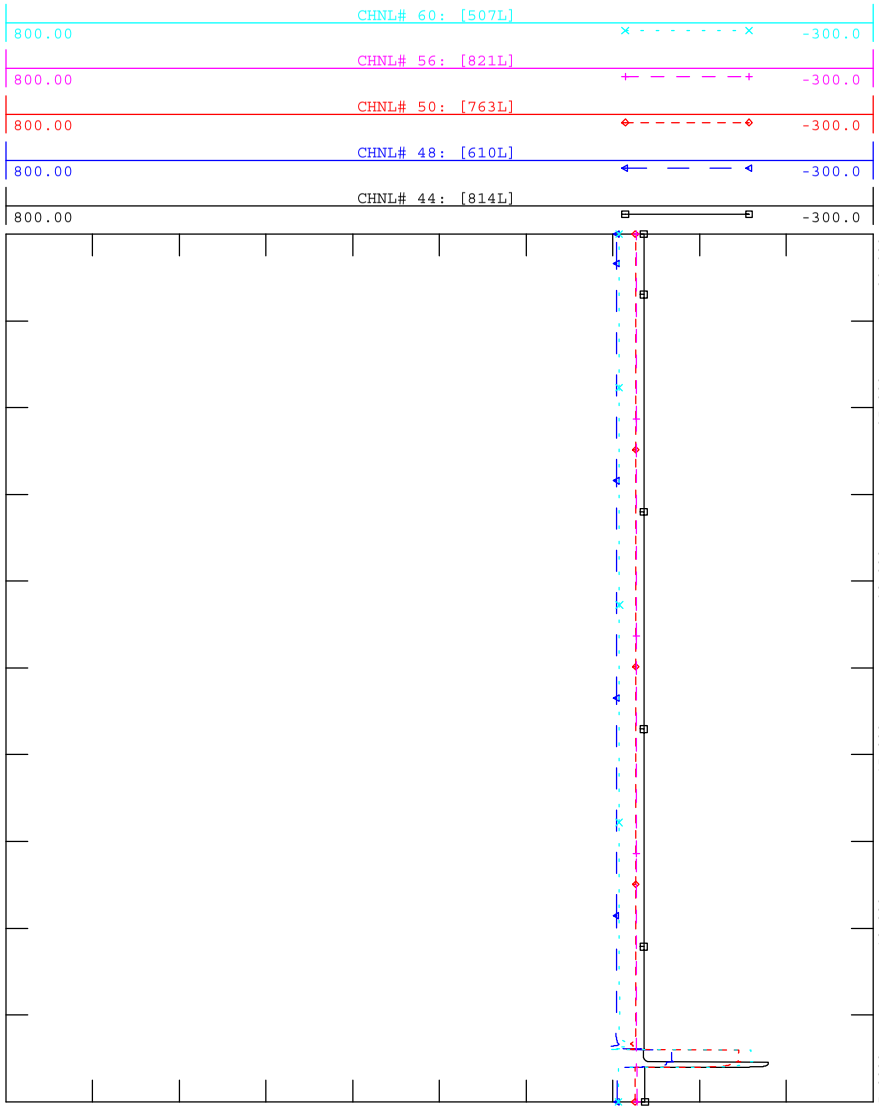
FIG F-SC3-14

AESO 2021RC_2022SL_SOUTH-HIGH_TIE-ECON_SOLAR-0.7_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT

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FIG F-SC3-15



Scenario 4

Summer Peak Post Project

Transient Response Plot Key

Table Summer Peak Post Project Figure Reference:

Scenario	Plots	Figure #
Summer Light Post Project	Angles Plots	A-SC4-1 to A-SC4-15
	Power Plots	B-SC4-1 to B-SC4-15
	Var Plots	C-SC4-1 to C-SC4-15
	Bus Voltage Plots	D-SC4-1 to D-SC4-15
	Branchflow MW Plots	E-SC4-1 to E-SC4-15
	Branchflow MVar Plots	F-SC4-1 to F-SC4-15

Table Summer Peak Post Project Figures:

Category	Line Element	Substation Terminals		Faulted End	Figure Reference
A	n/a	Flat Start		n/a	A-SC4-1 B-SC4-1 C-SC4-1 D-SC4-1 E-SC4-1 F-SC4-1
B	612L	Fincastle 336S	Burdett 368S	336S	A-SC4-2 B-SC4-2 C-SC4-2 D-SC4-2 E-SC4-2 F-SC4-2
				368S	A-SC4-3 B-SC4-3 C-SC4-3 D-SC4-3 E-SC4-3 F-SC4-3
B	610L	Fincastle 336S	Taber 83S	336S	A-SC4-4 B-SC4-4 C-SC4-4 D-SC4-4 E-SC4-4 F-SC4-4
				83S	A-SC4-5 B-SC4-5 C-SC4-5 D-SC4-5 E-SC4-5 F-SC4-5
B	507L	Taber 83S	Hull 257S	83S	A-SC4-6 B-SC4-6 C-SC4-6 D-SC4-6 E-SC4-6 F-SC4-6
				257S	A-SC4-7 B-SC4-7 C-SC4-7 D-SC4-7 E-SC4-7 F-SC4-7
B	879L	Burdett 368S	Bowmanton 244S	368S	A-SC4-8 B-SC4-8 C-SC4-8 D-SC4-8 E-SC4-8 F-SC4-8
				244S	A-SC4-9

					B-SC4-9 C-SC4-9 D-SC4-9 E-SC4-9 F-SC4-9
B	763L	Vauxhall 158S	West Brooks 28S	158S	A-SC4-10 B-SC4-10 C-SC4-10 D-SC4-10 E-SC4-10 F-SC4-10
				28S	A-SC4-11 B-SC4-11 C-SC4-11 D-SC4-11 E-SC4-11 F-SC4-11
B	795L	Brooks 121s	Hays 421S	121S	A-SC4-12 B-SC4-12 C-SC4-12 D-SC4-12 E-SC4-12 F-SC4-12
				421S	A-SC4-13 B-SC4-13 C-SC4-13 D-SC4-13 E-SC4-13 F-SC4-13
B	821L	Vauxhall 158S	Hays 421S	158S	A-SC4-14 B-SC4-14 C-SC4-14 D-SC4-14 E-SC4-14 F-SC4-14
				421S	A-SC4-15 B-SC4-15 C-SC4-15 D-SC4-15 E-SC4-15 F-SC4-15

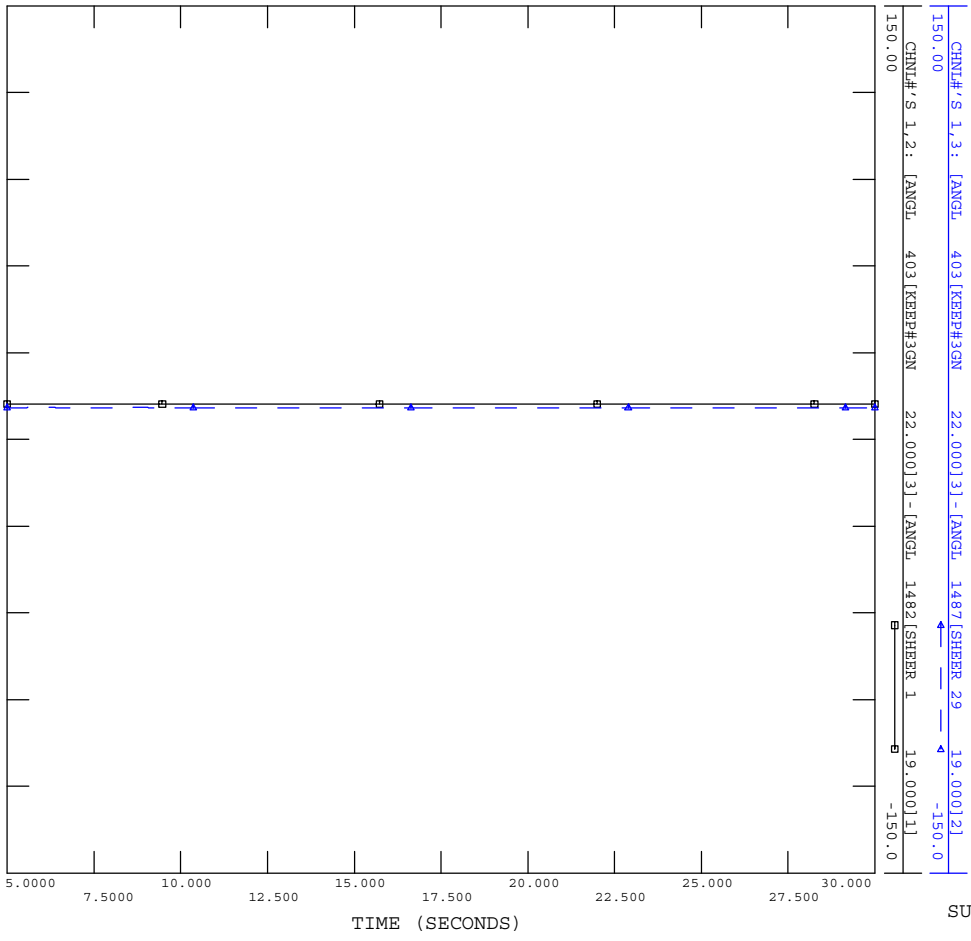


FIG A-SC4-1

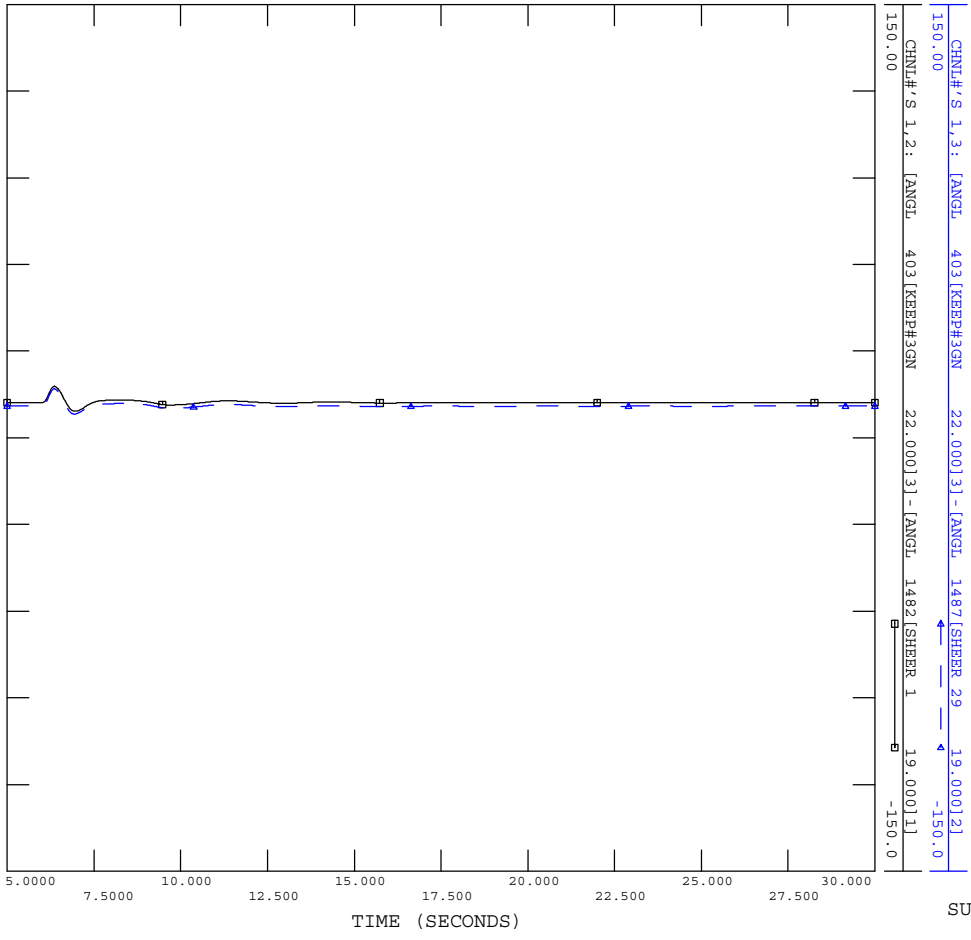


FIG A-SC4-2

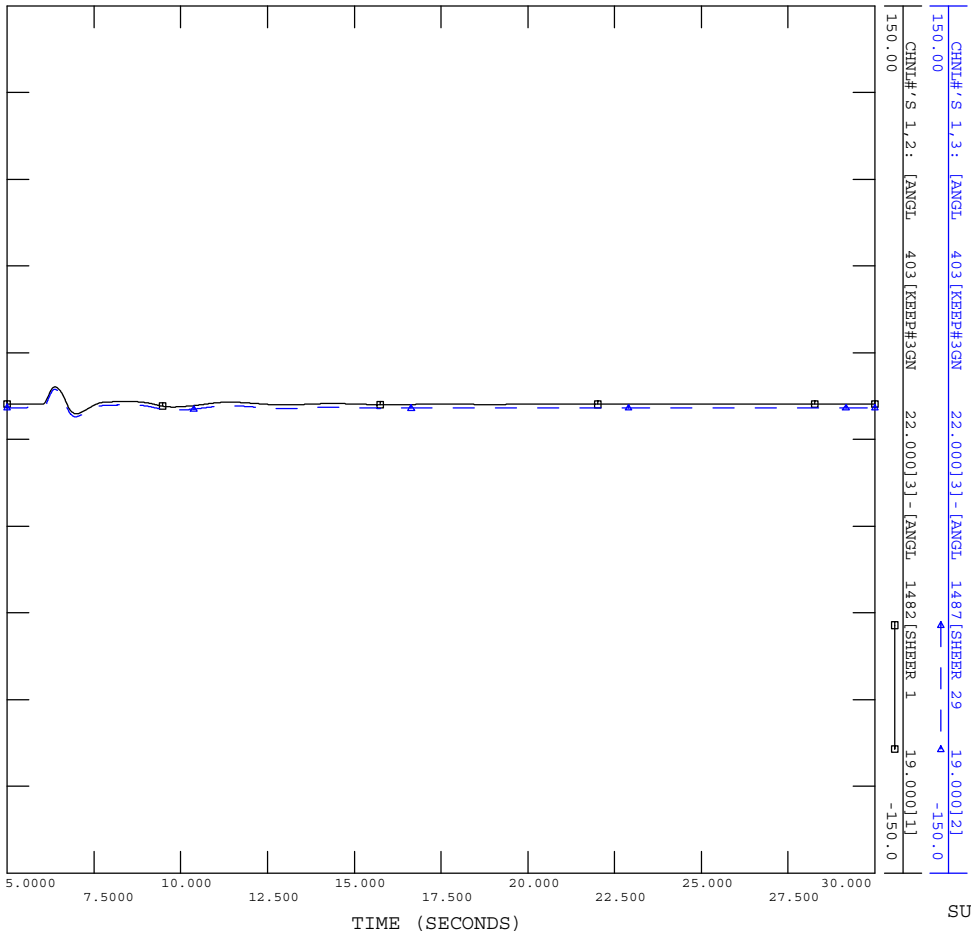


FIG A-SC4-3

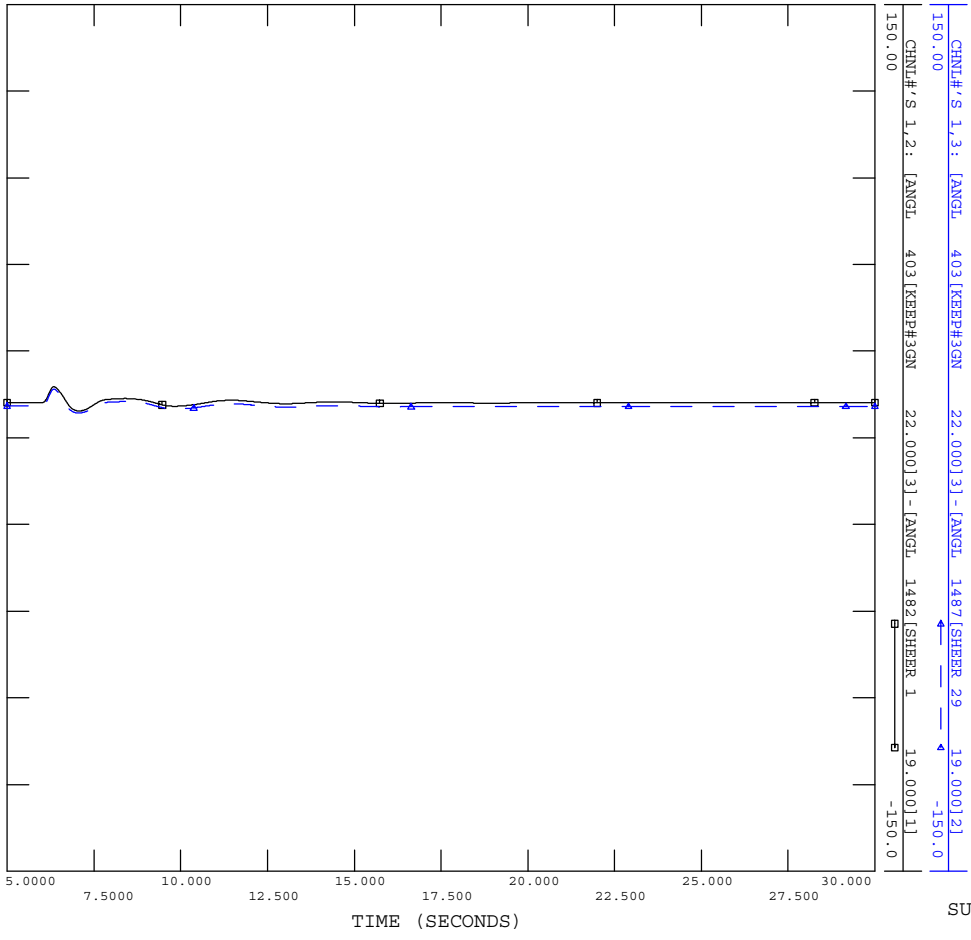


FIG A-SC4-4

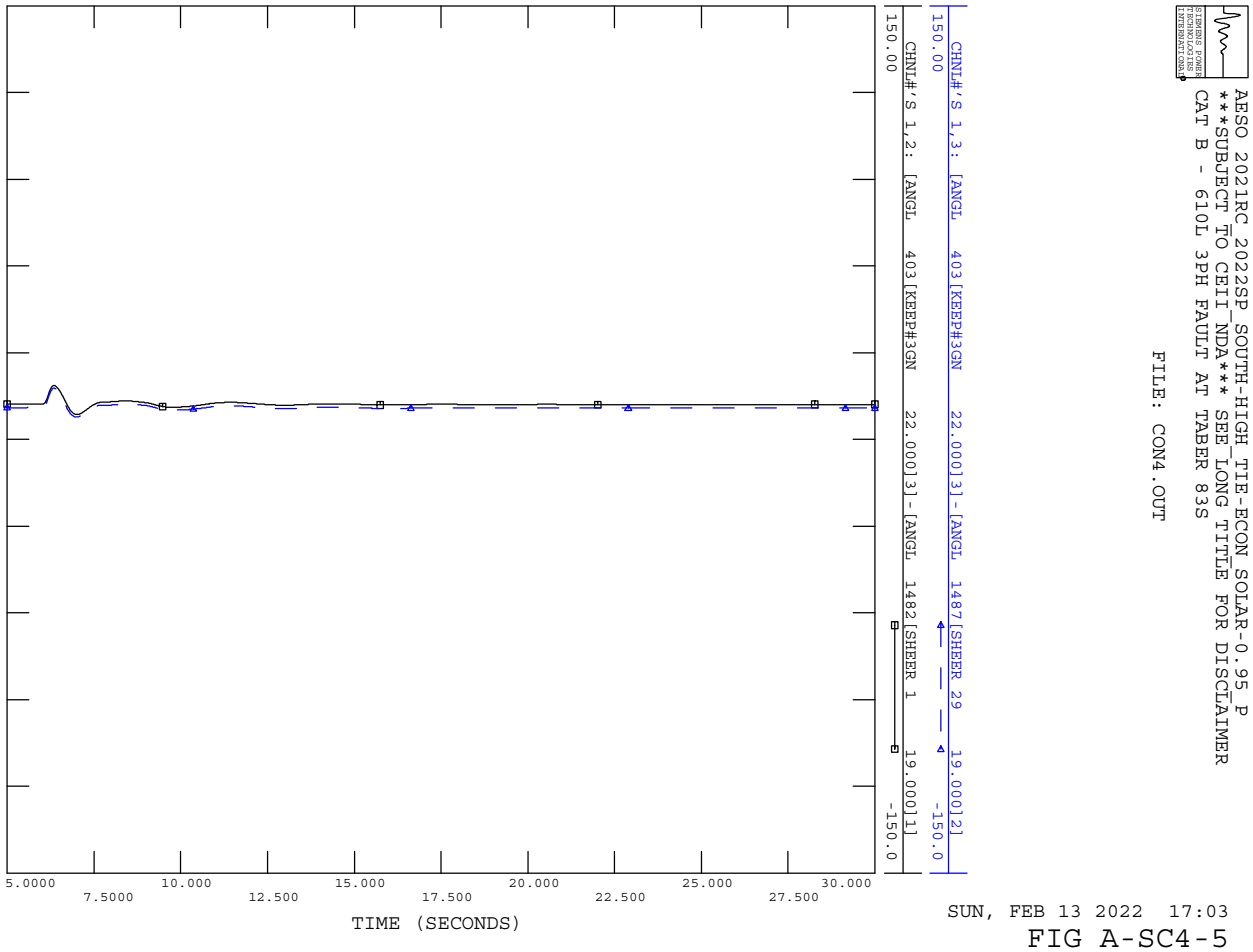


FIG A-SC4-5

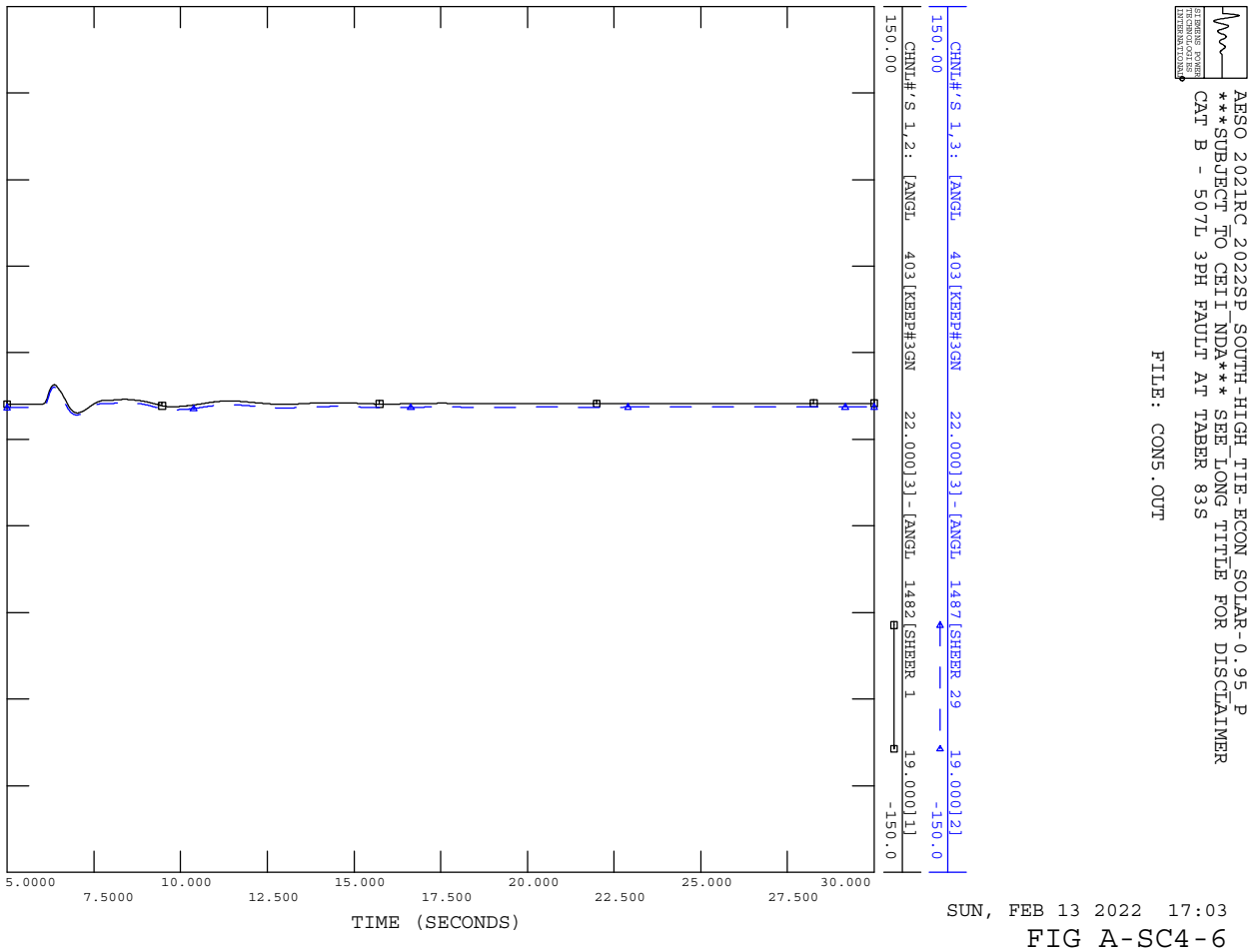


FIG A-SC4-6

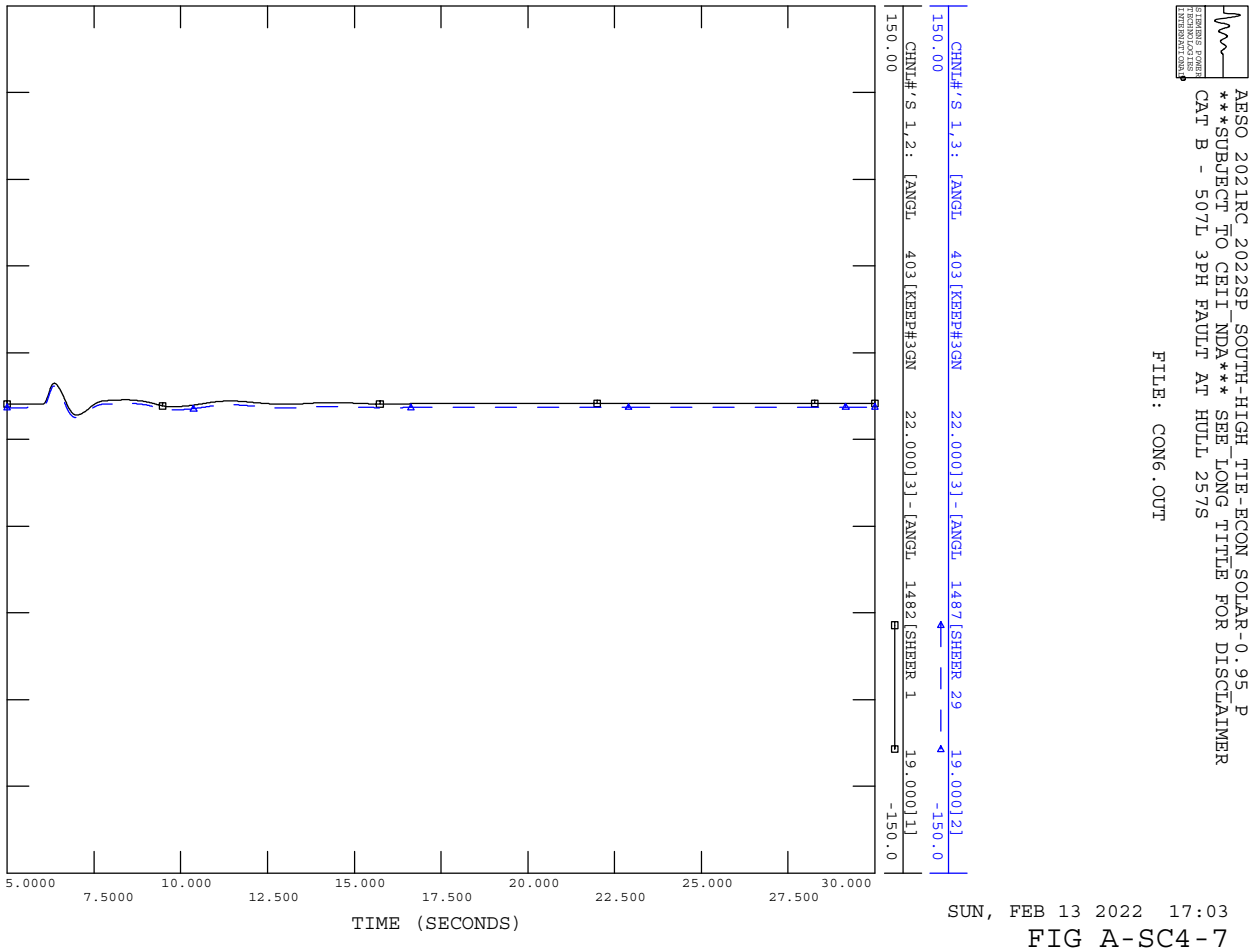


FIG A-SC4-7

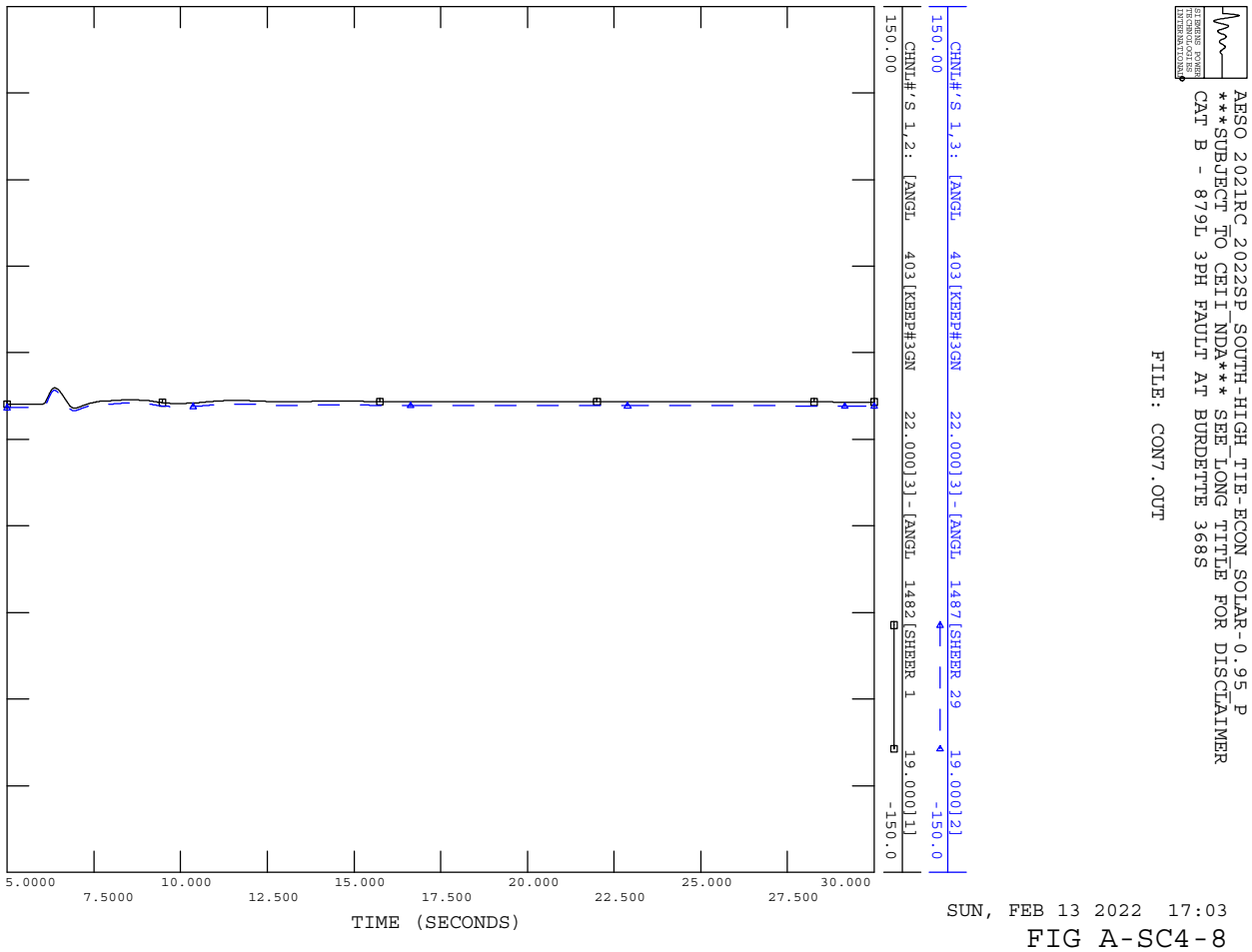


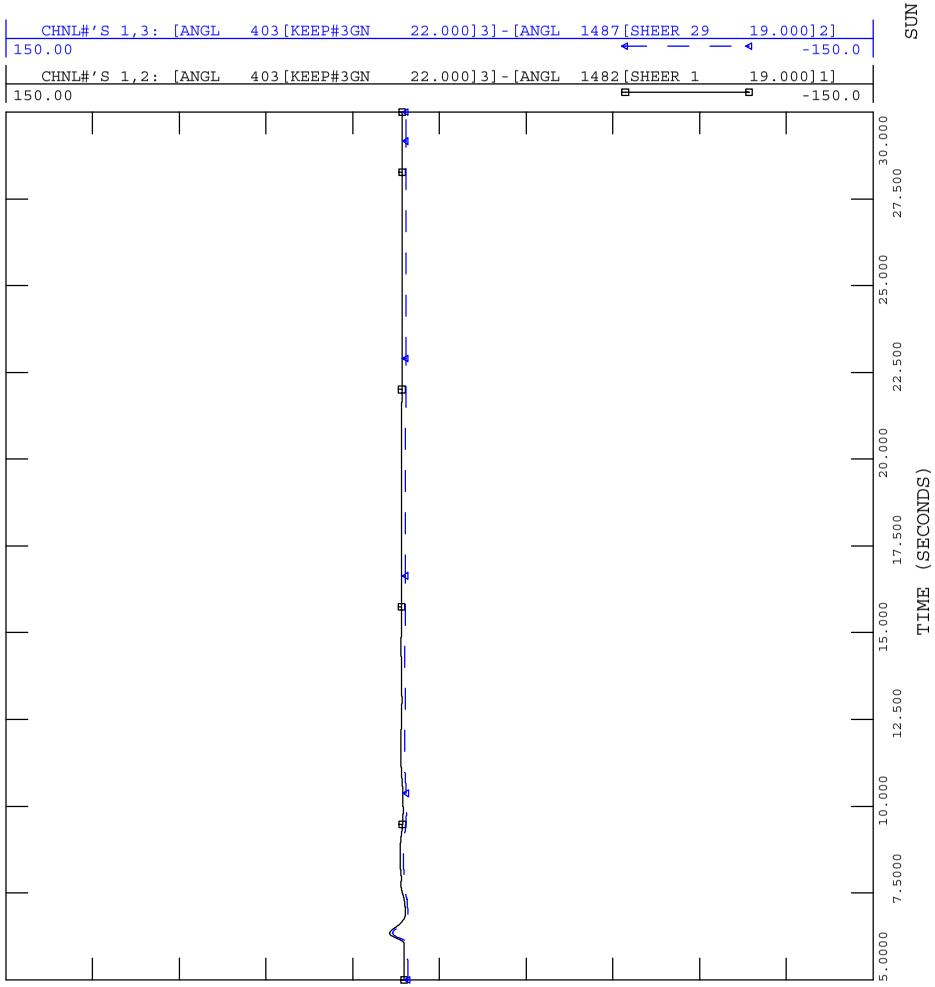
FIG A-SC4-8

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 879L 3PH FAULT AT BOWMANTON 244S

FILE: CON8.OUT

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FIG A-SC4-9

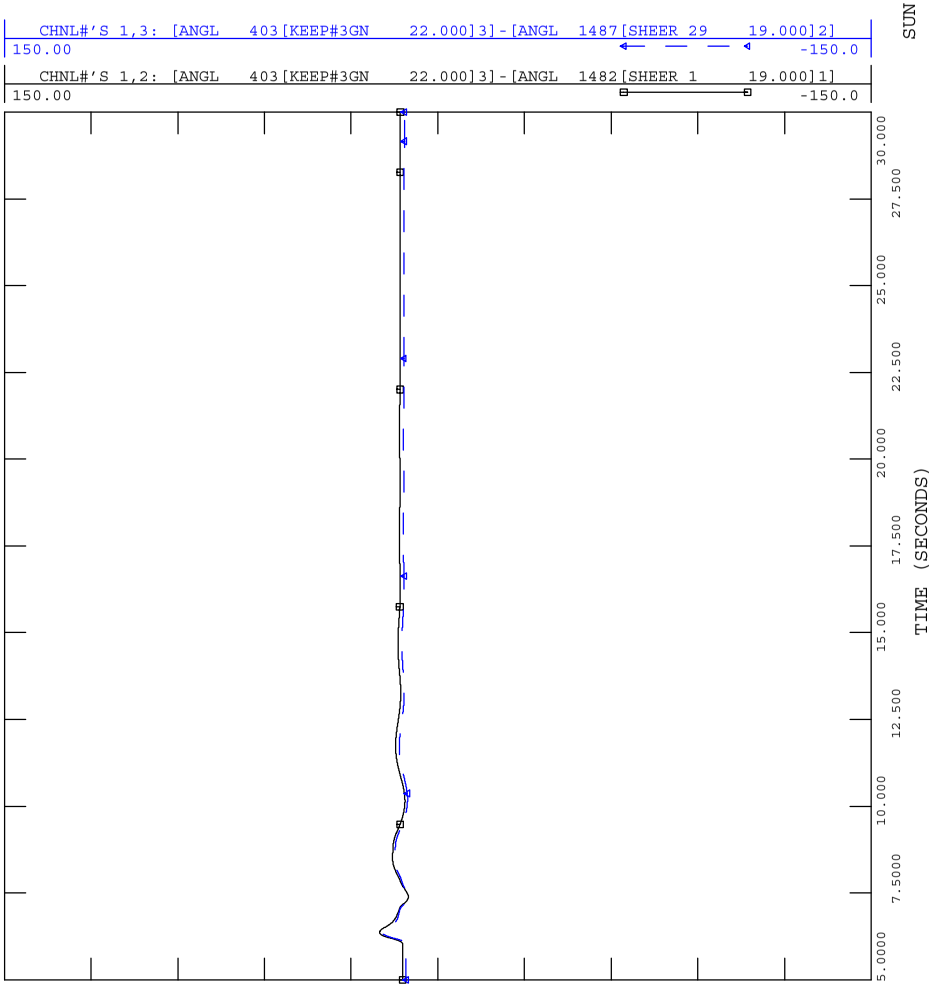


AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 763L 3PH FAULT AT VAUXHALL 158S

FILE: CON9.OUT

SUN, FEB 13 2022 17:03

FIG A-SC4-10

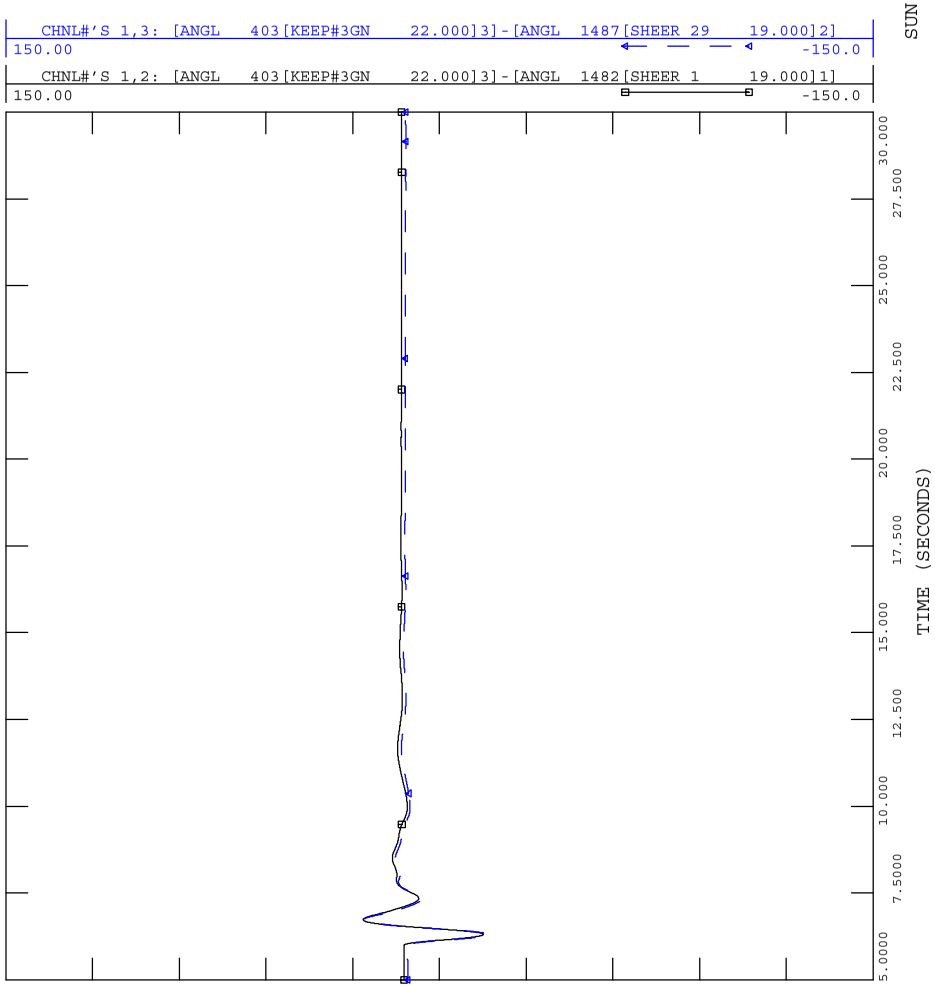


AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 763L 3PH FAULT AT W. BROOKS 28S

FILE: CON10.OUT

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FIG A-SC4-11

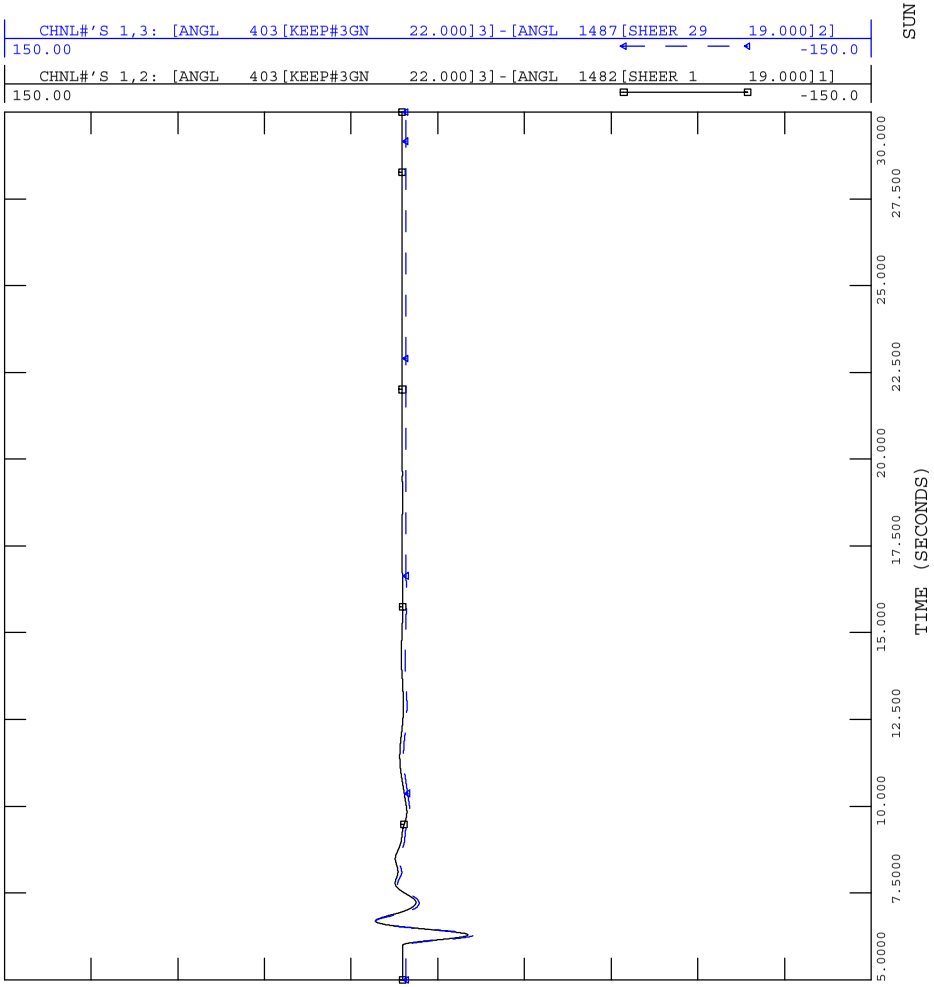


AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 795L 3PH FAULT AT BROOKS 121S

FILE: CON11.OUT

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FIG A-SC4-12

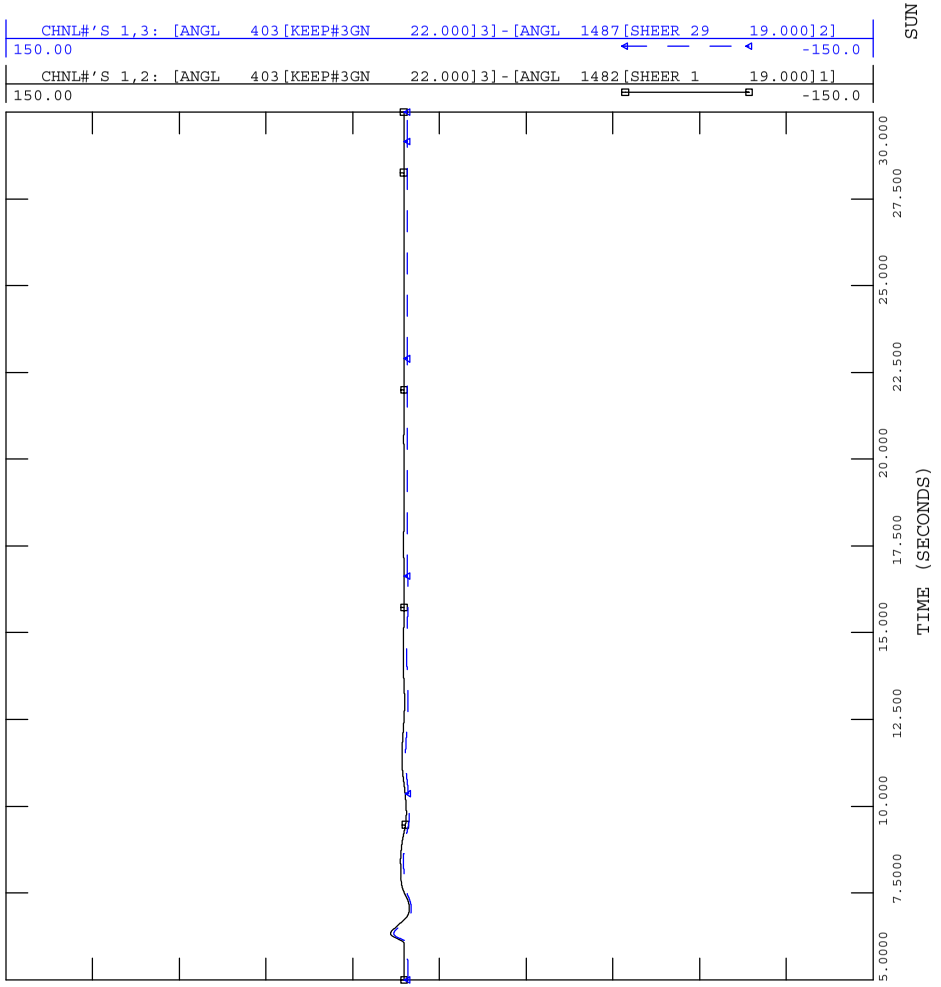


AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 795L 3PH FAULT AT HAYS 421S

FILE: CON12.OUT

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FIG A-SC4-13

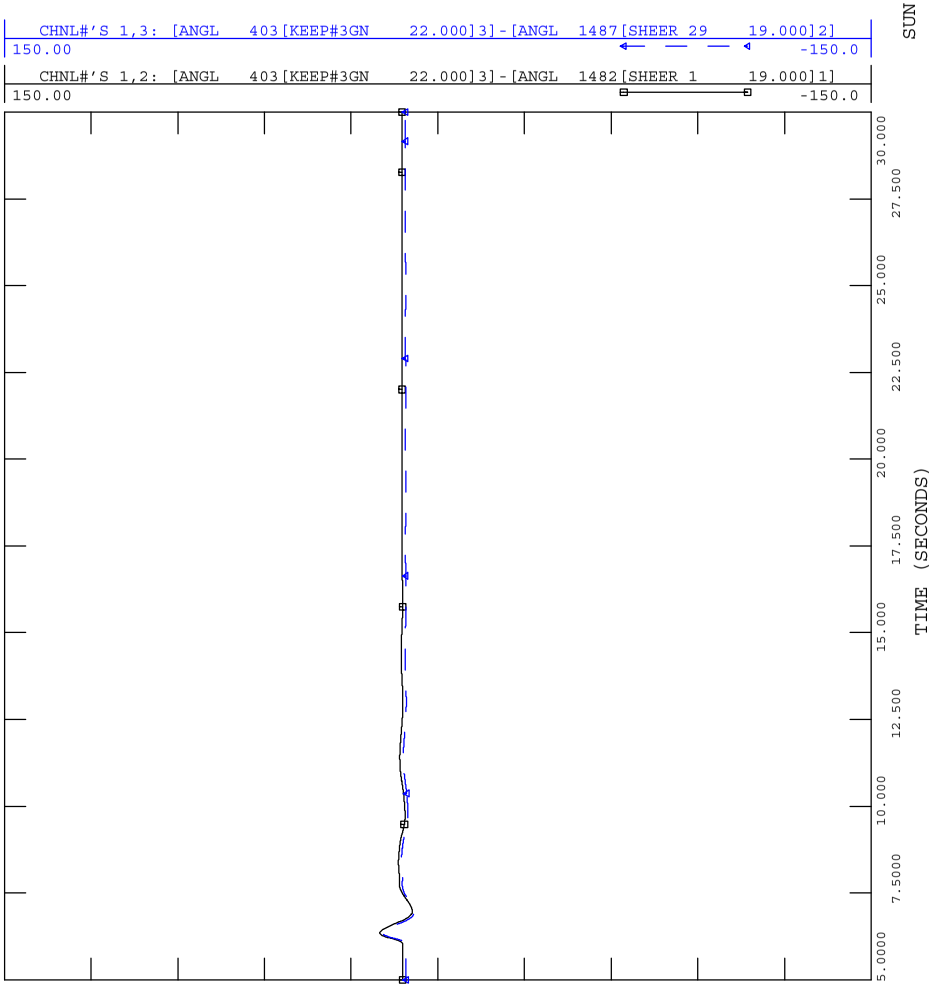


AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT VAUXHALL 158S

FILE: CON13.OUT

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FIG A-SC4-14

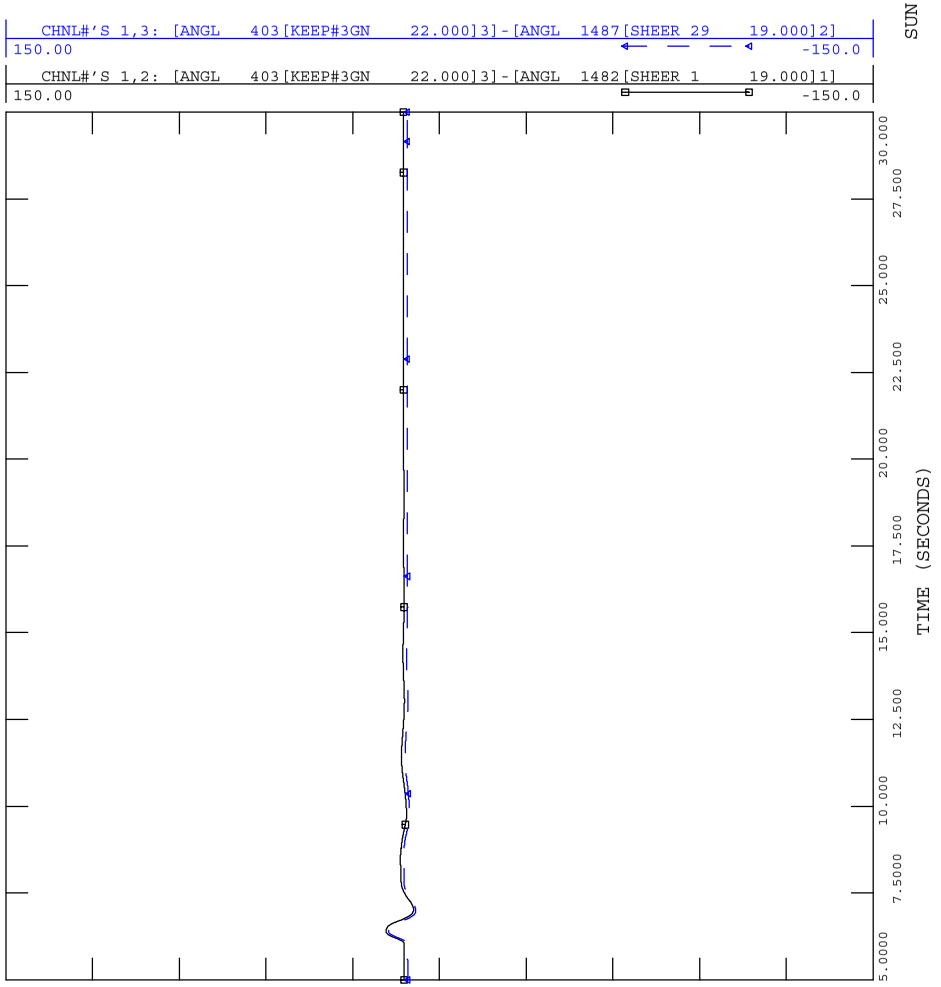


AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT

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FIG A-SC4-15



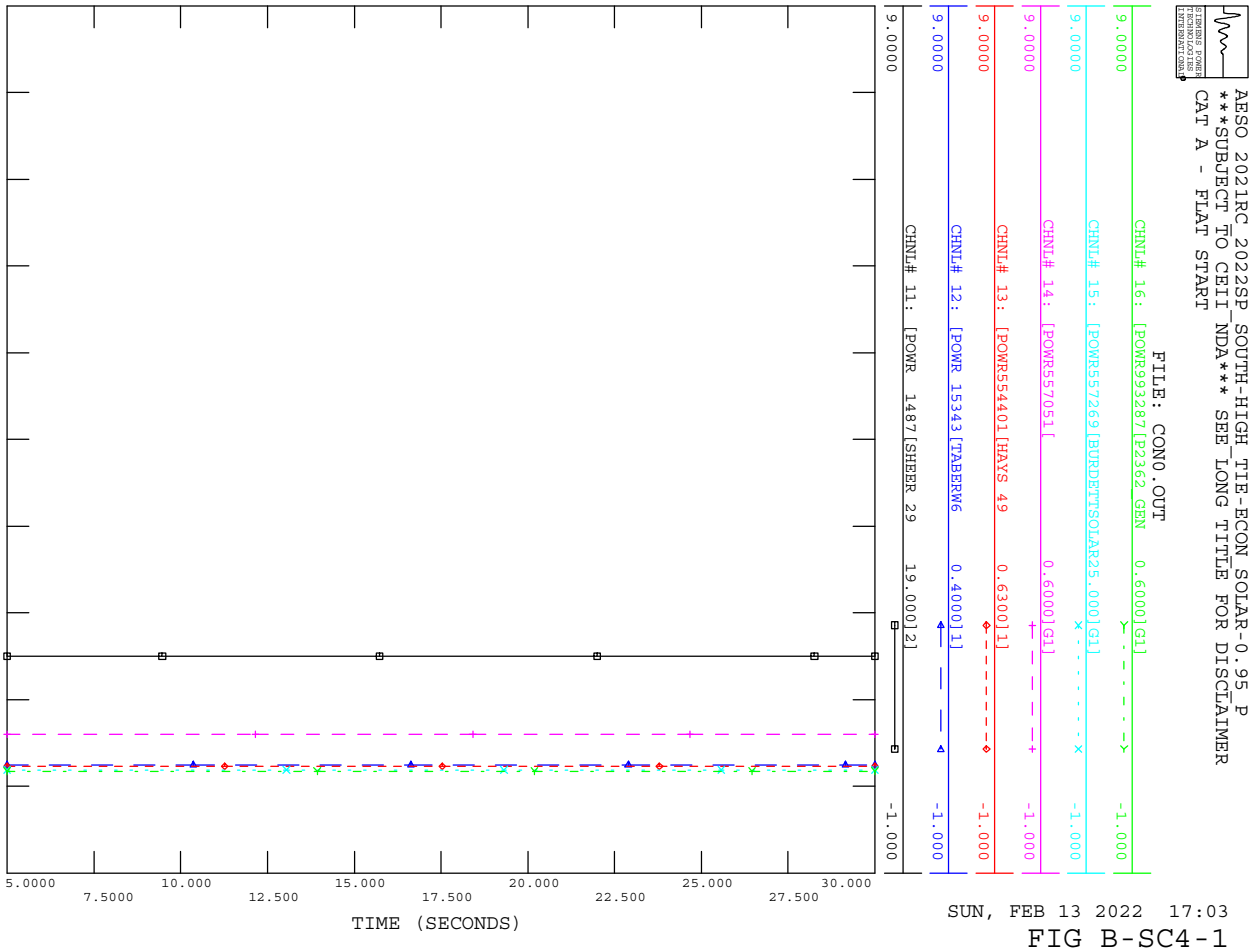


FIG B-SC4-1

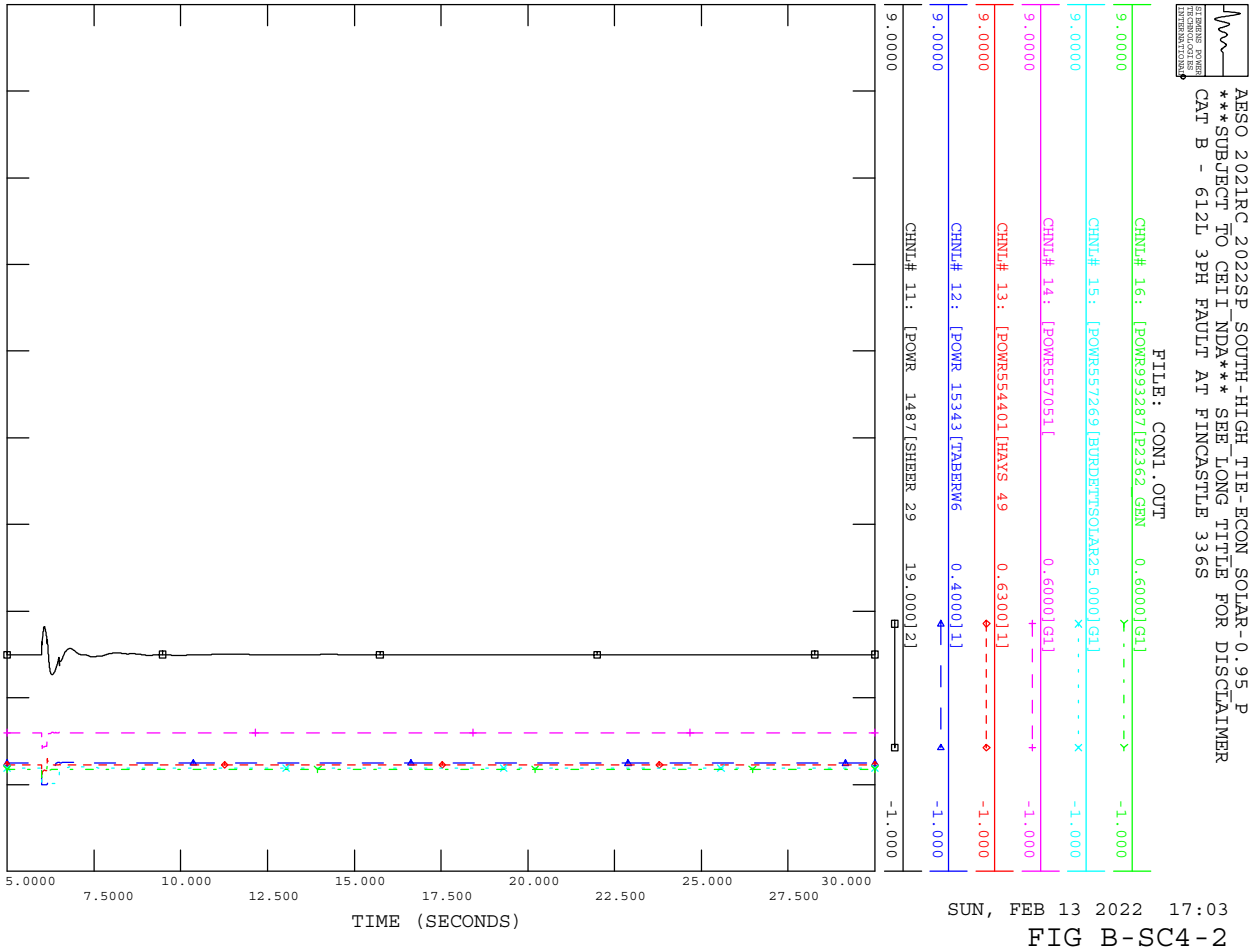


FIG B-SC4-2

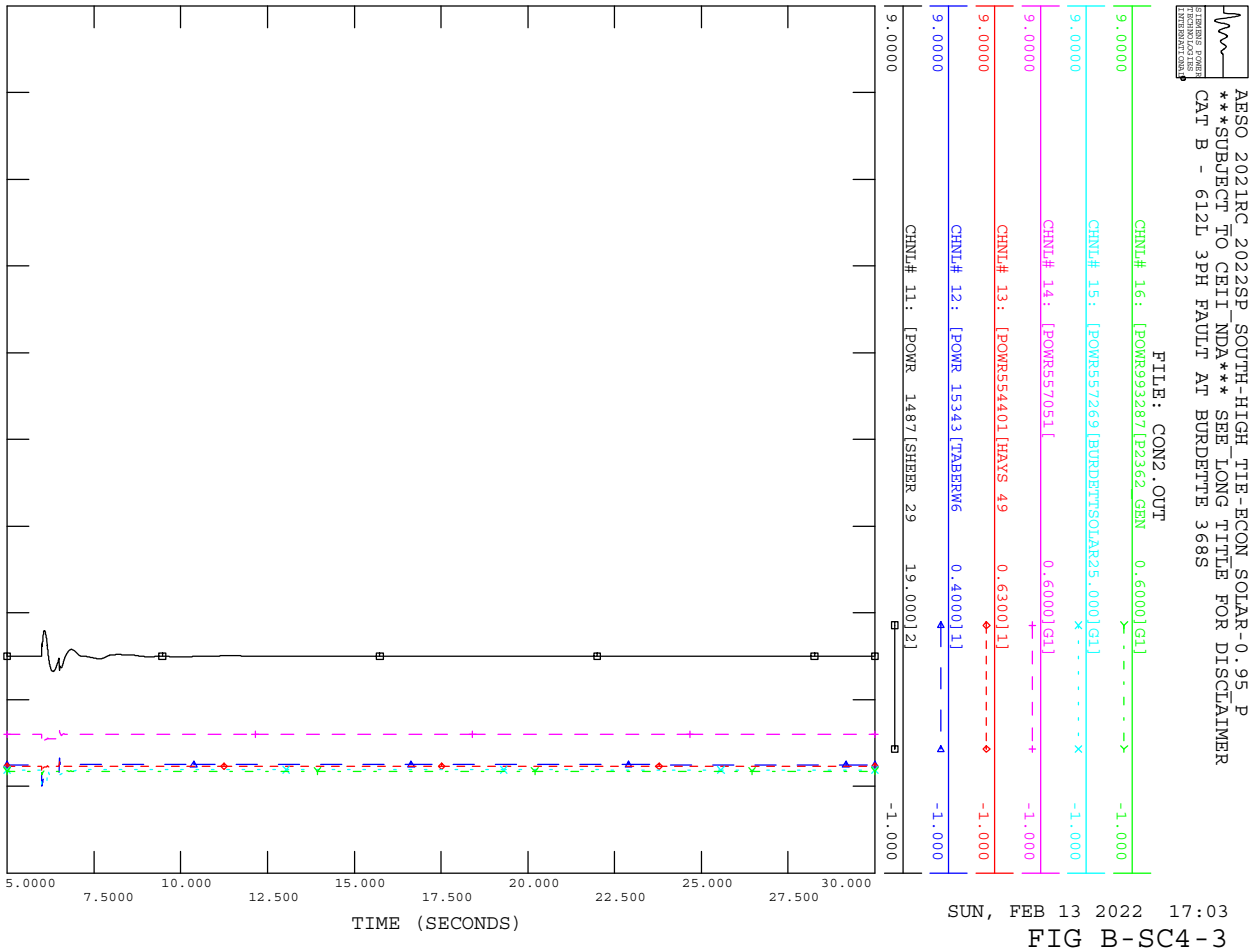


FIG B-SC4-3

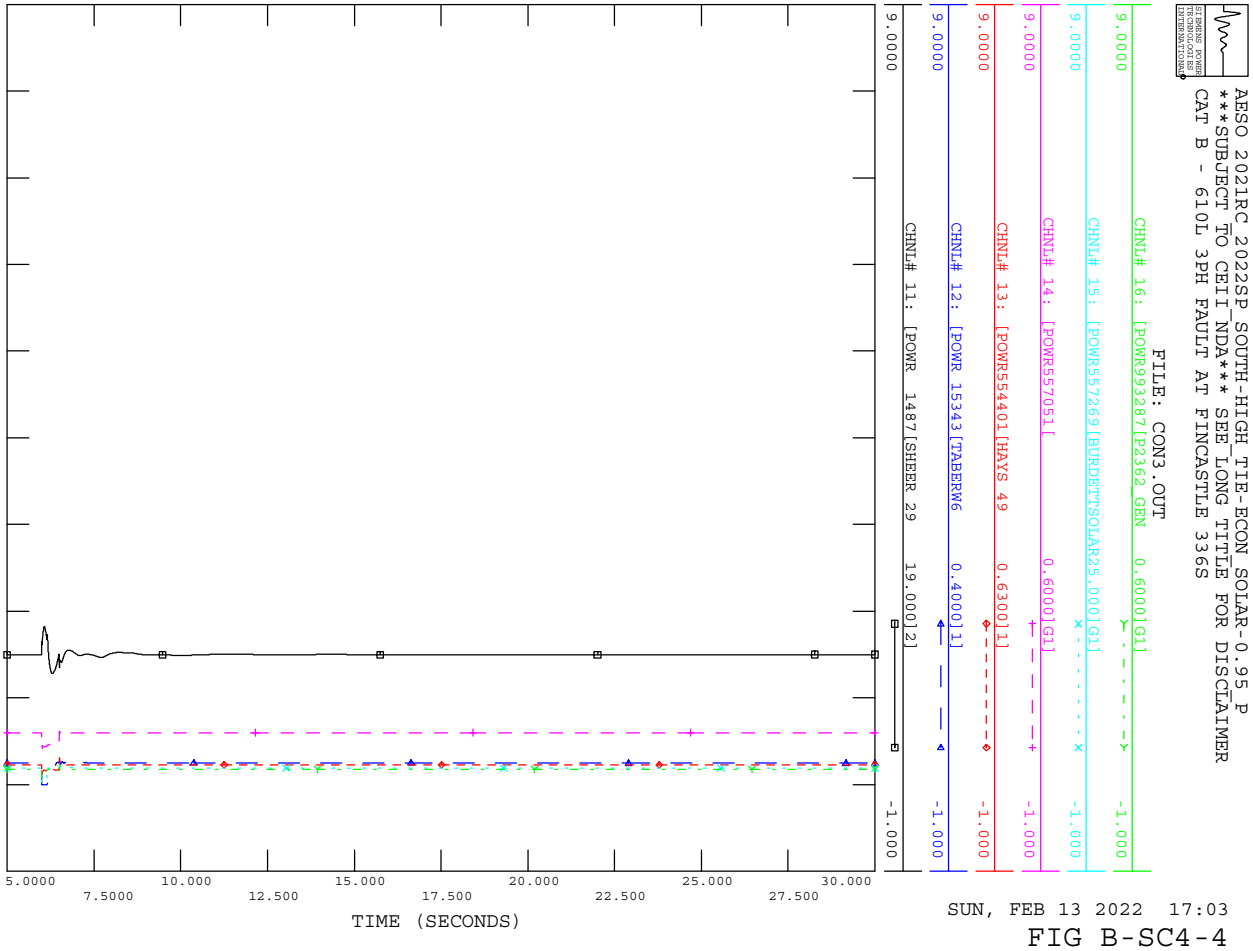


FIG B-SC4-4

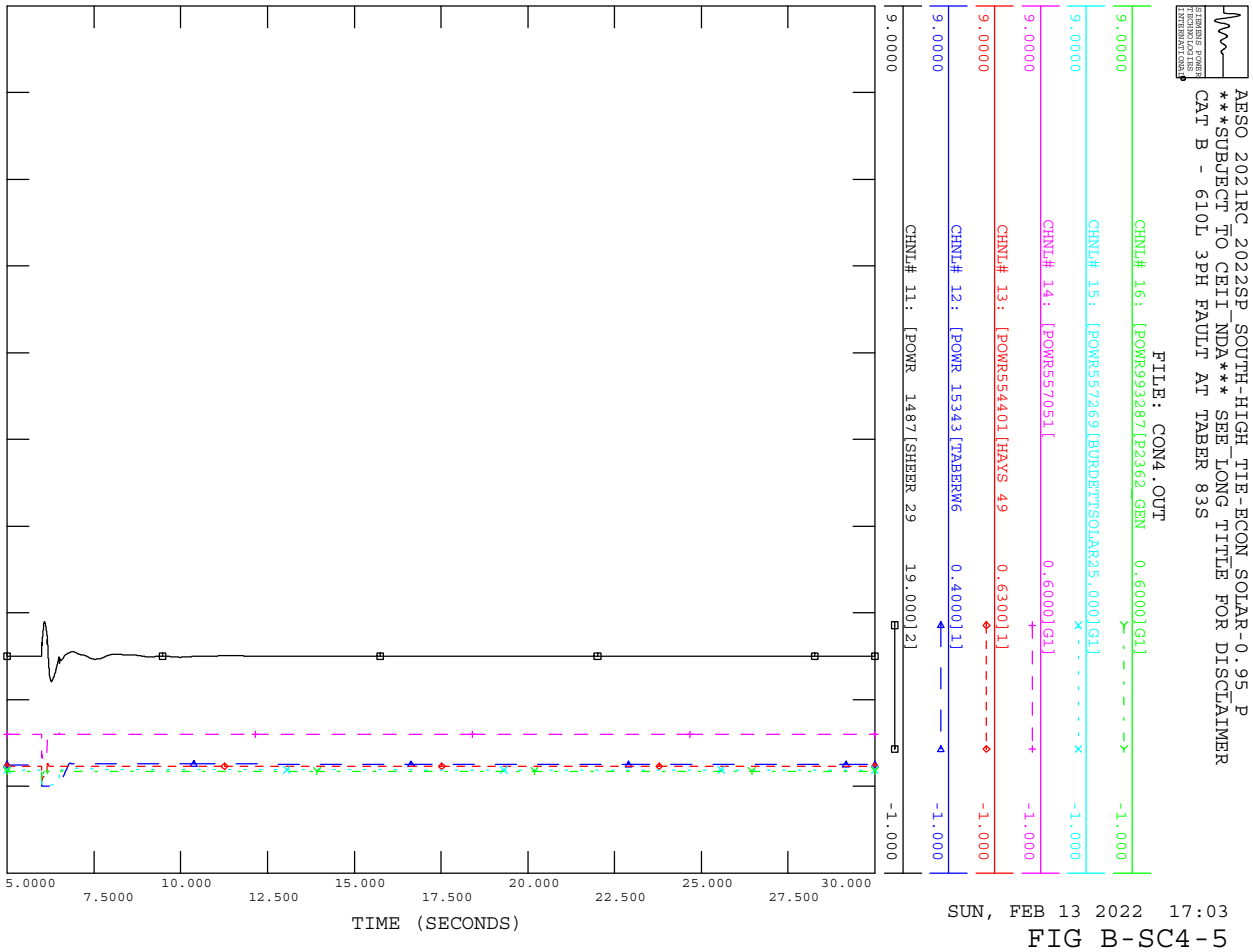


FIG B-SC4-5

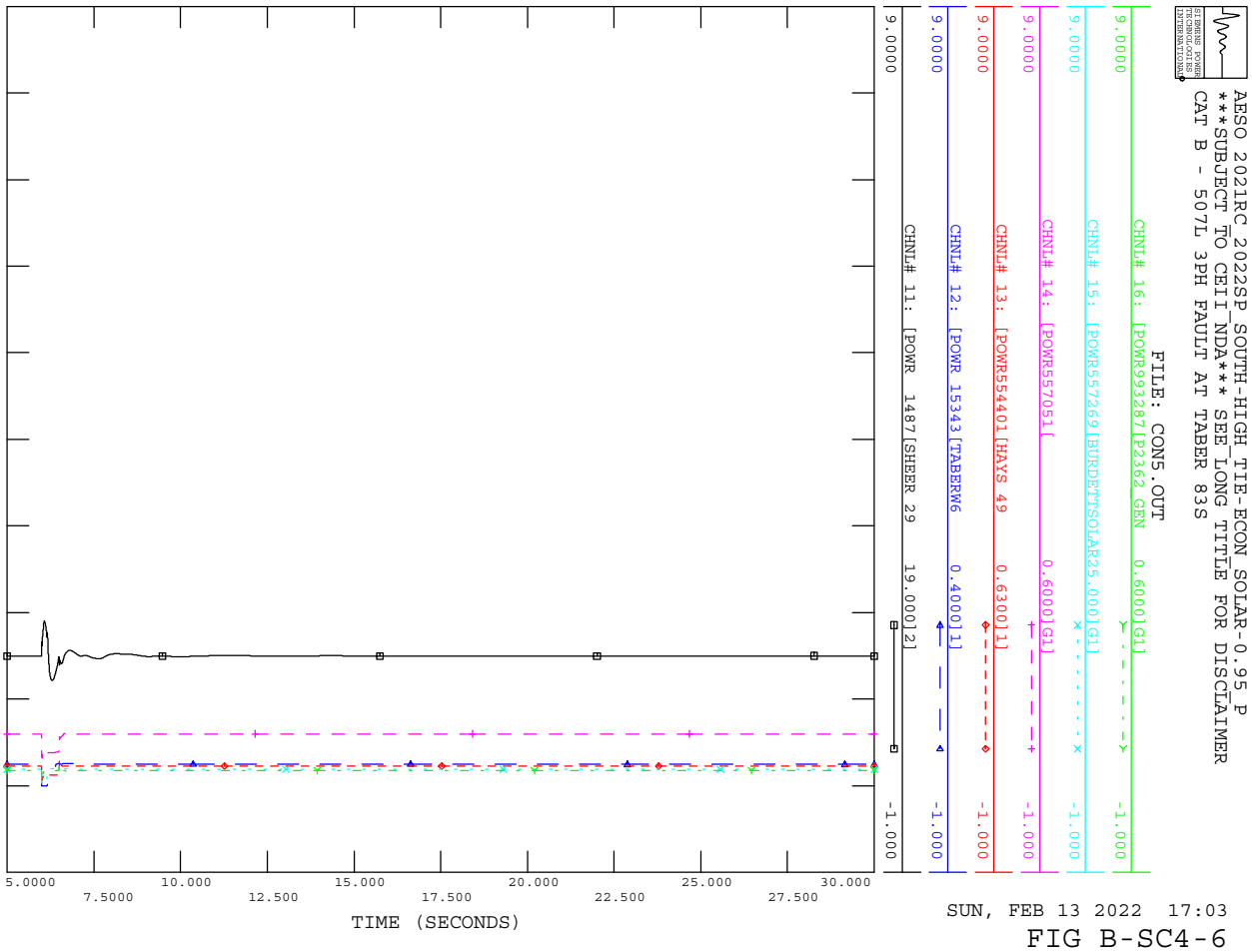


FIG B-SC4-6

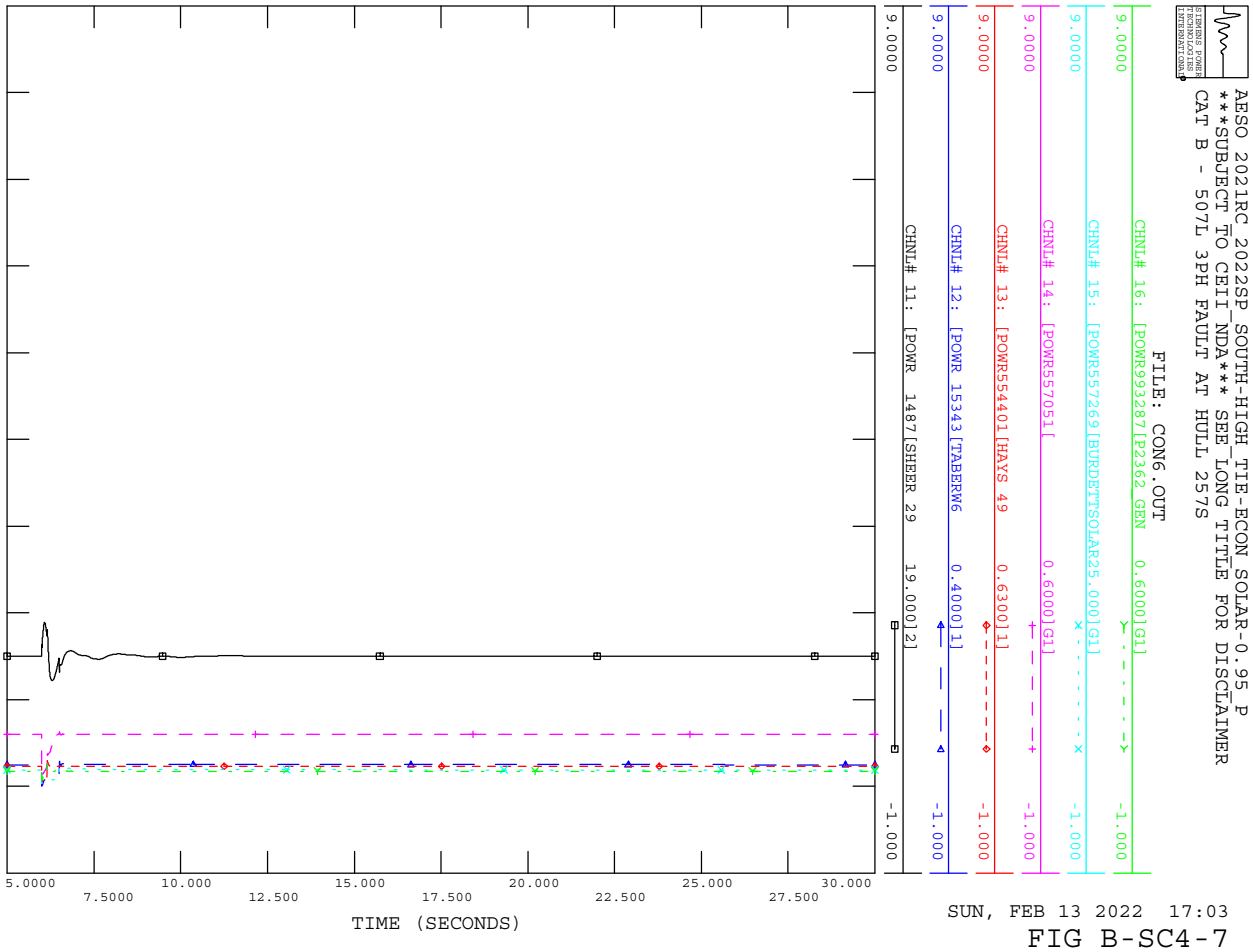


FIG B-SC4-7

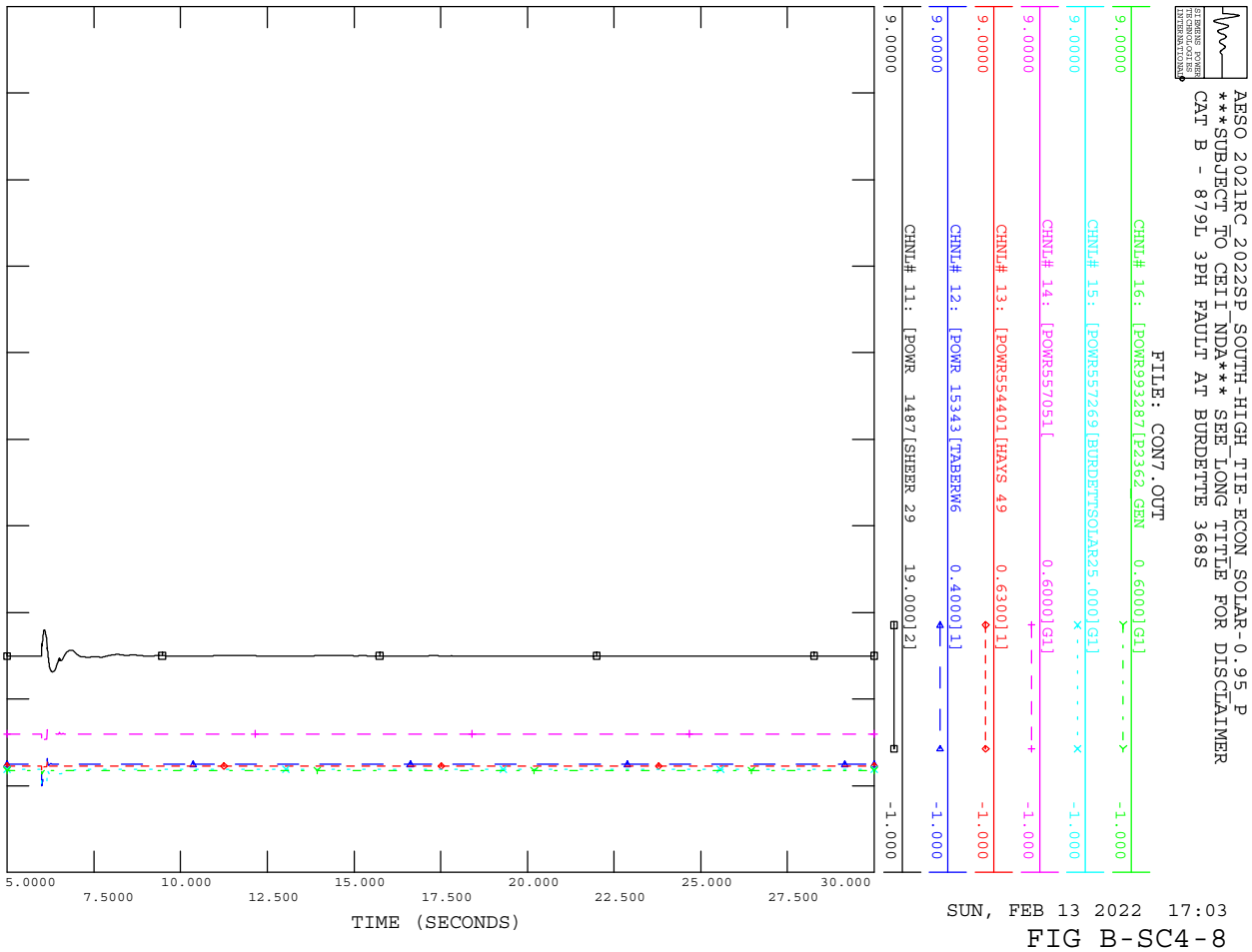


FIG B-SC4-8

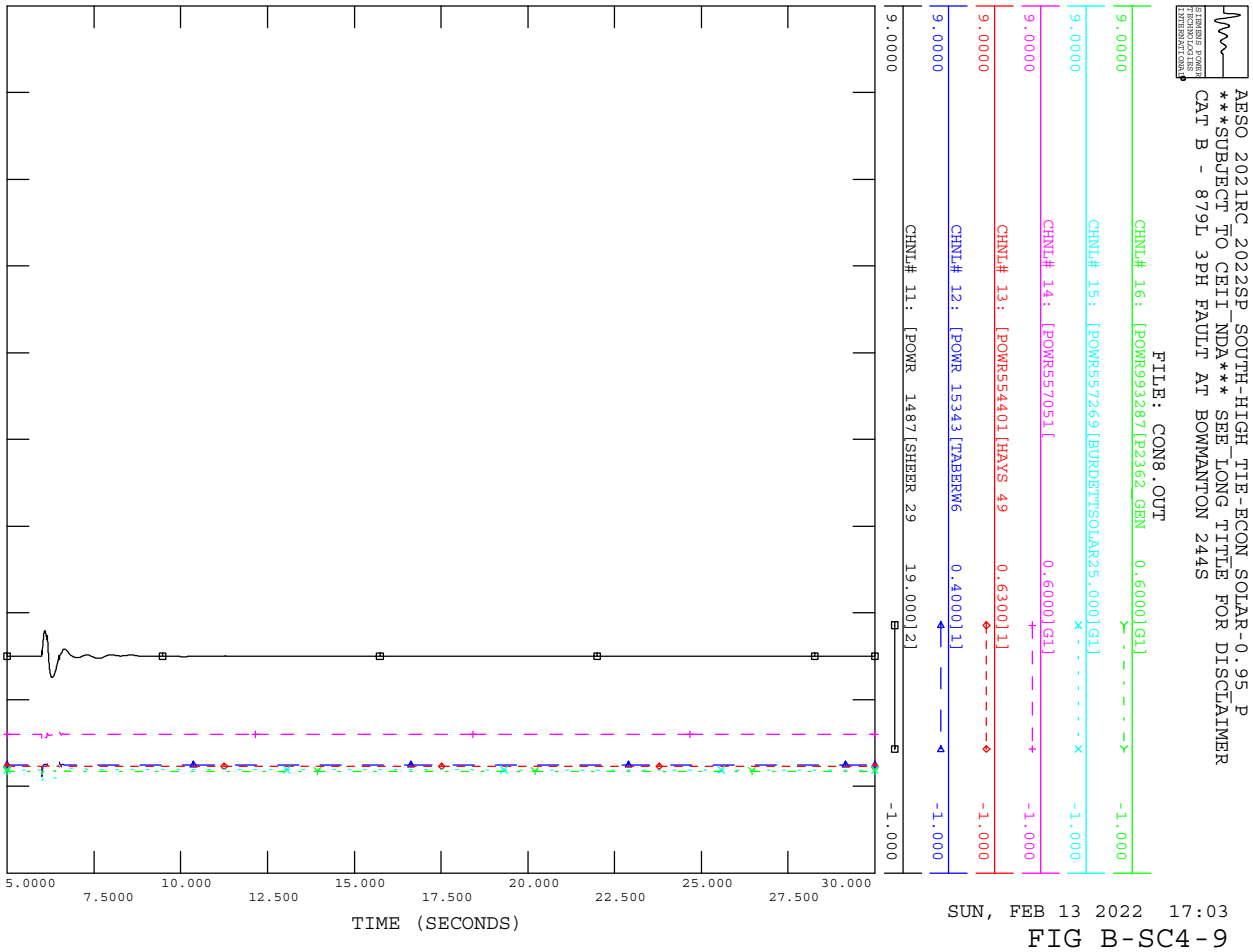


FIG B-SC4-9

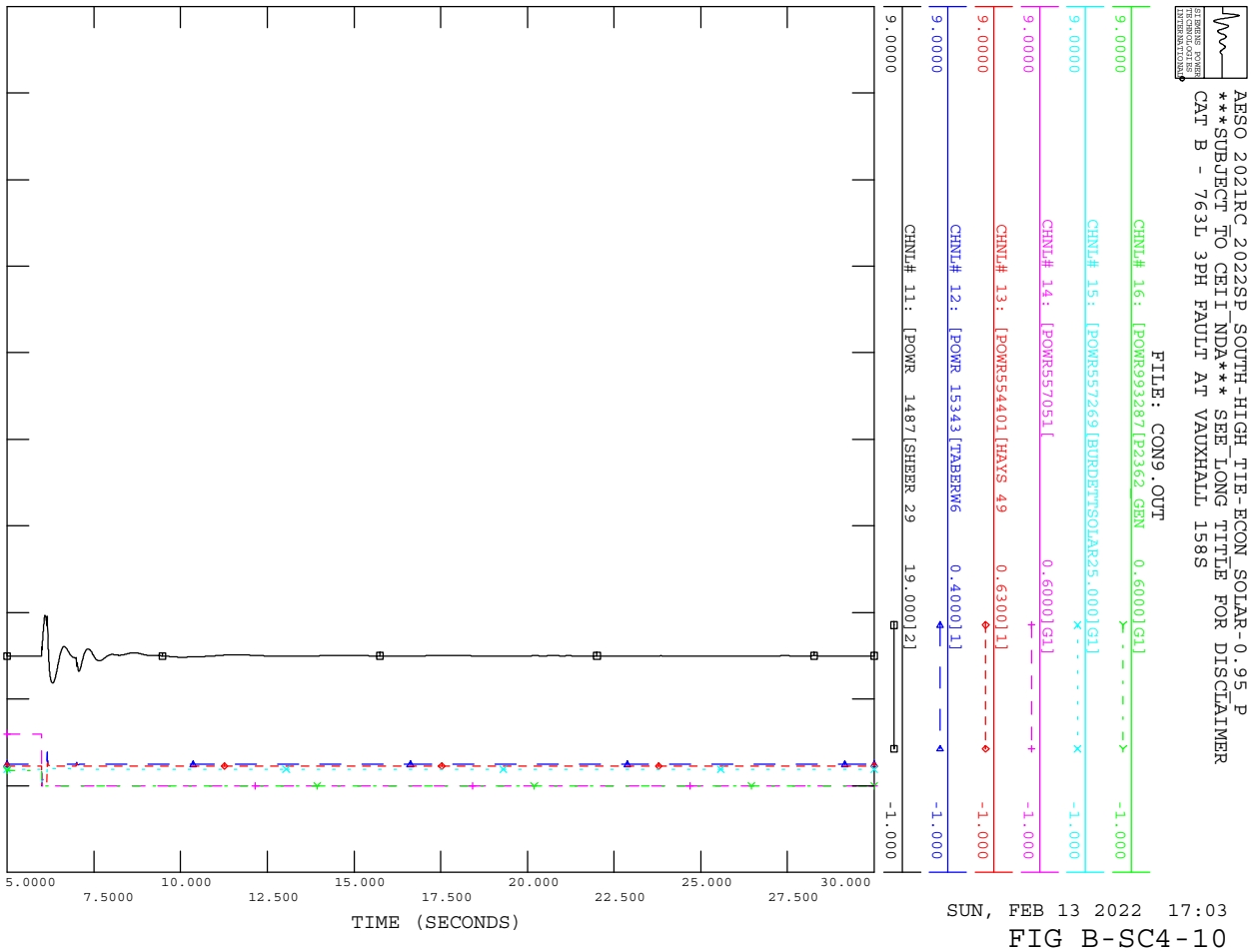


FIG B-SC4-10

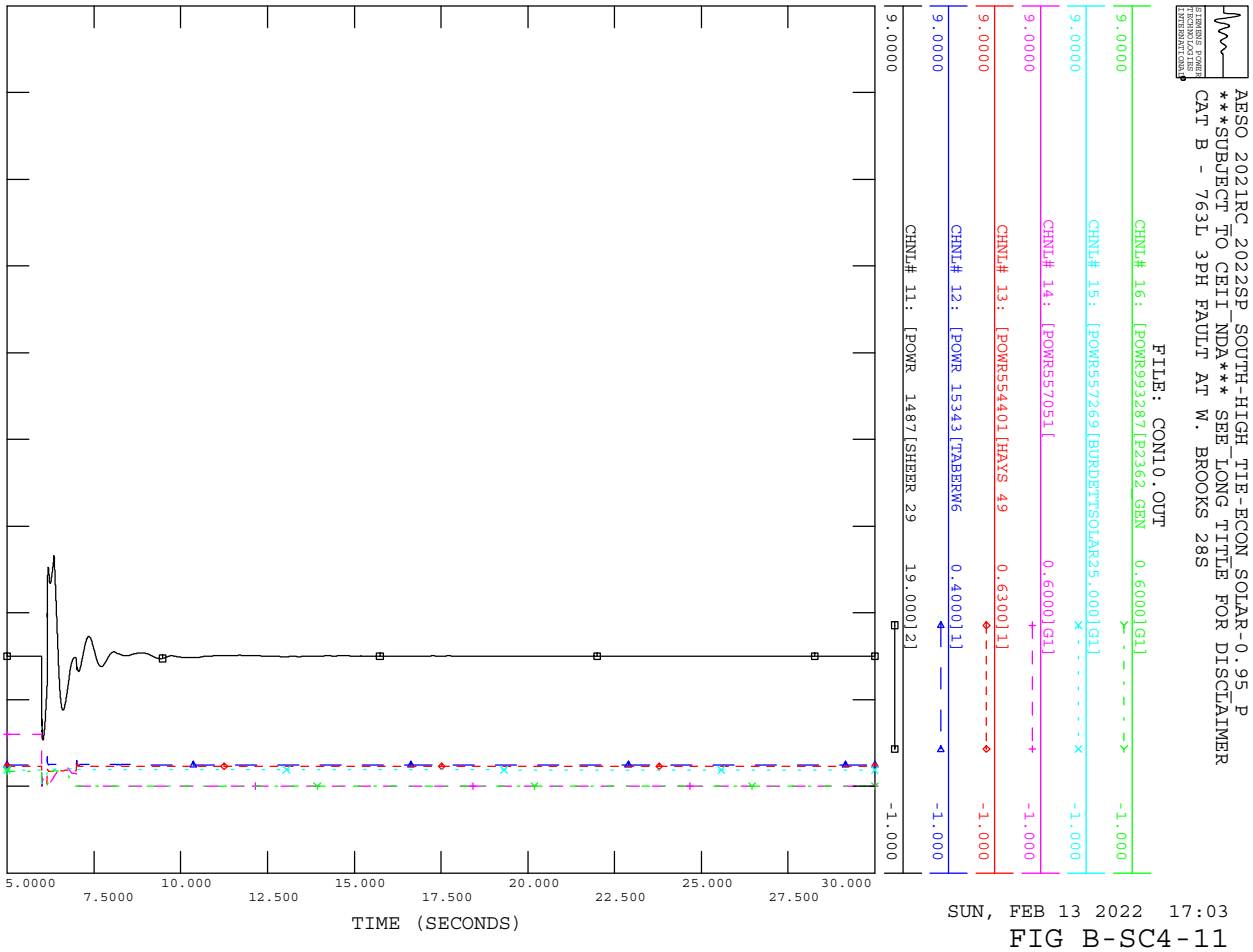


FIG B-SC4-11

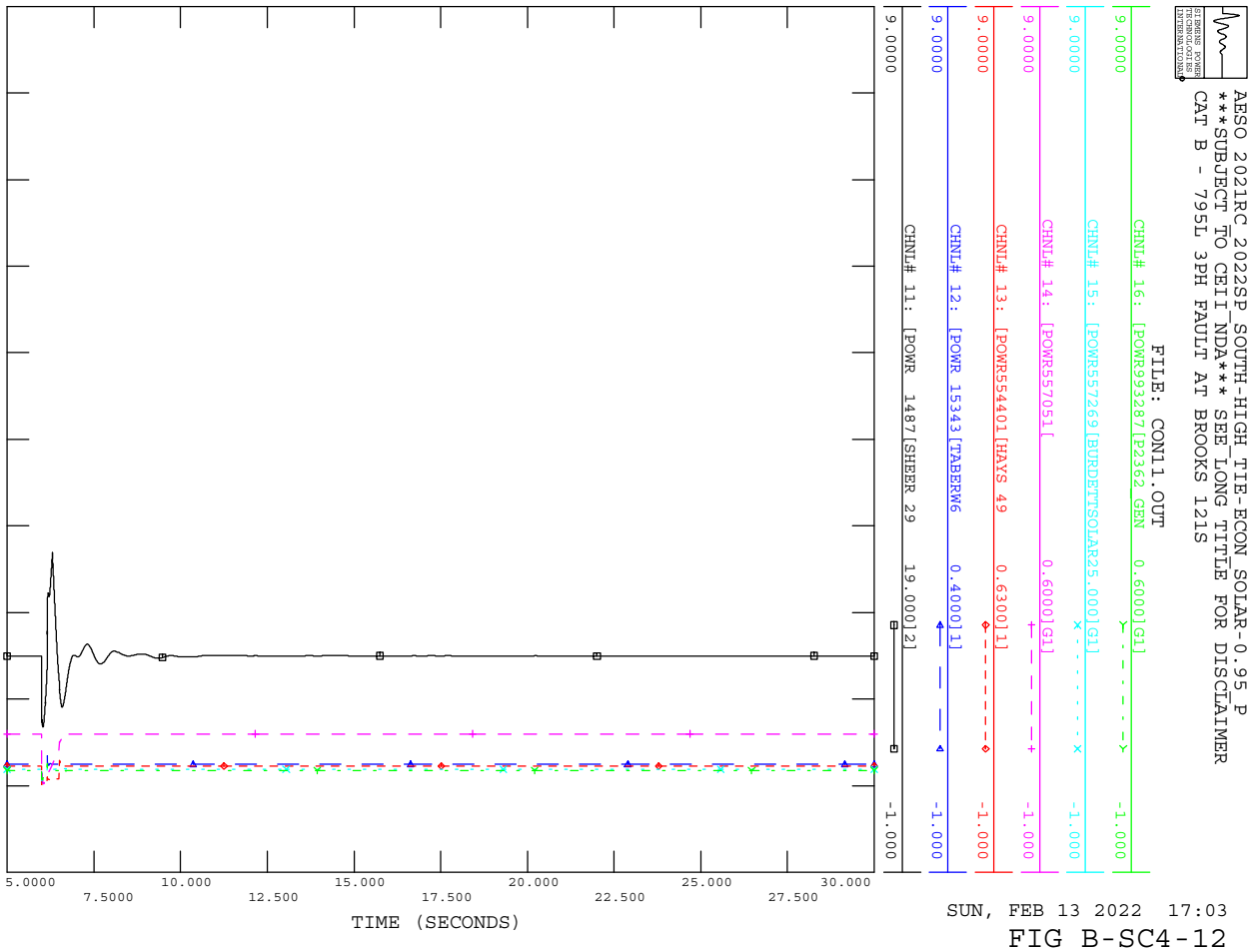


FIG B-SC4-12

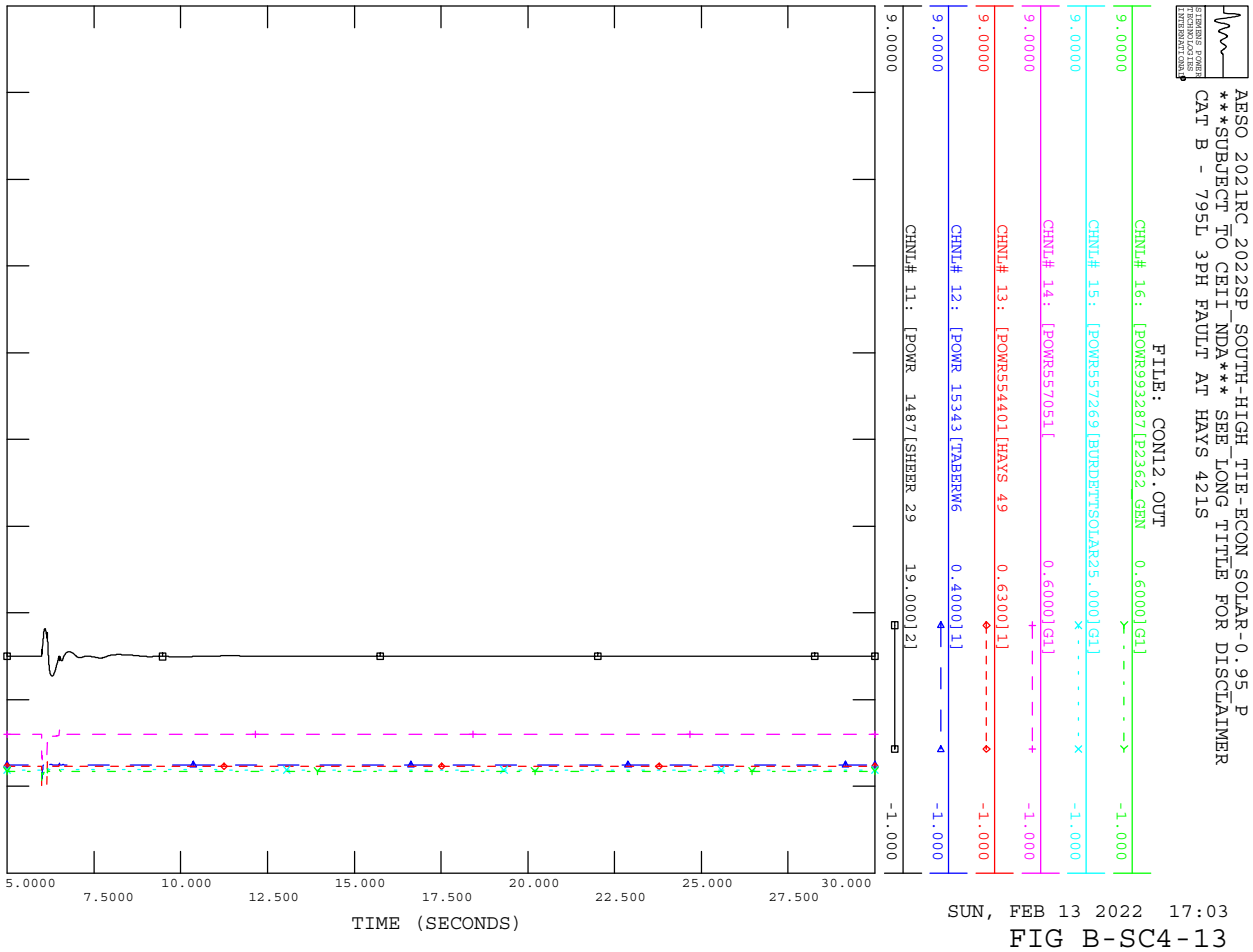


FIG B-SC4-13

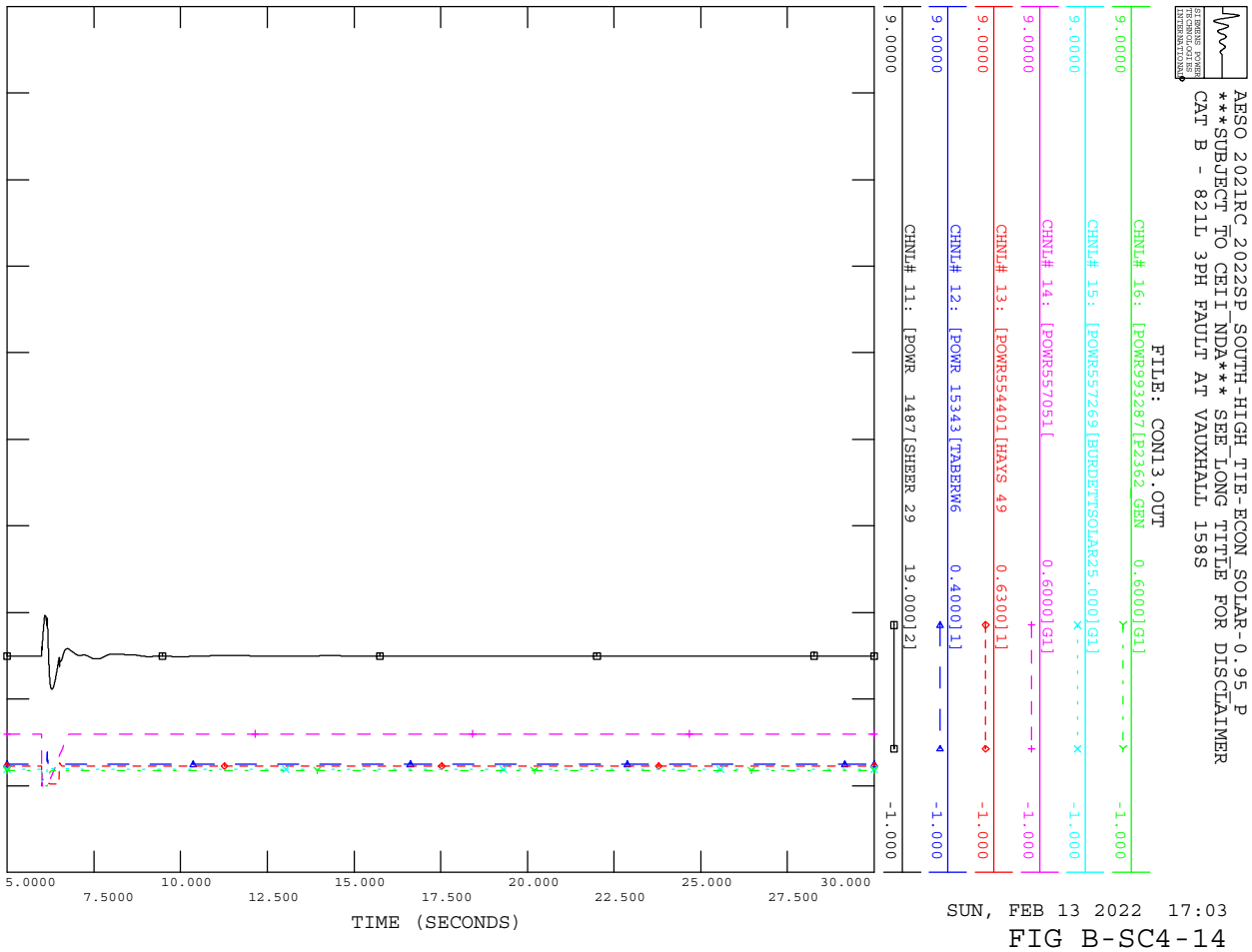
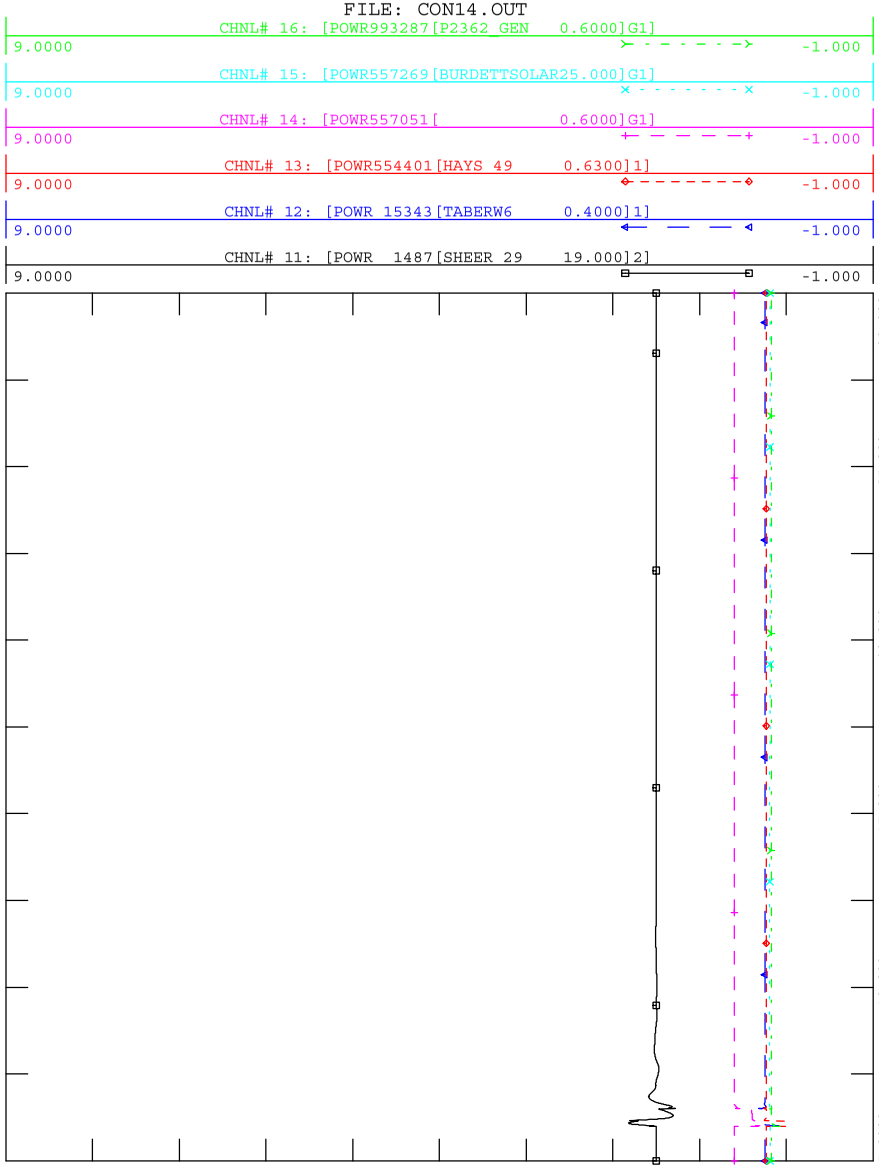


FIG B-SC4-14

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

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FIG B-SC4-15

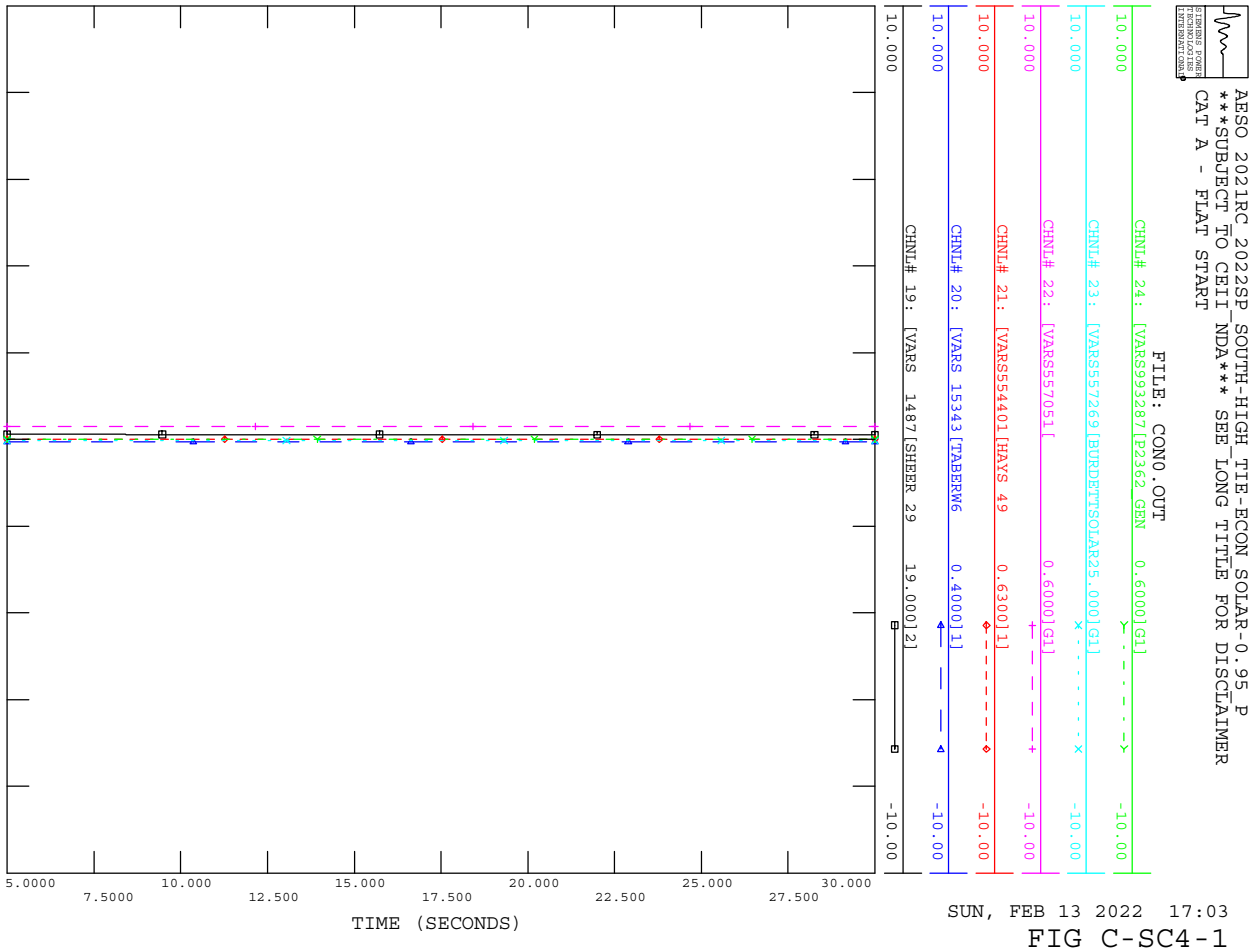


FIG C-SC4-1

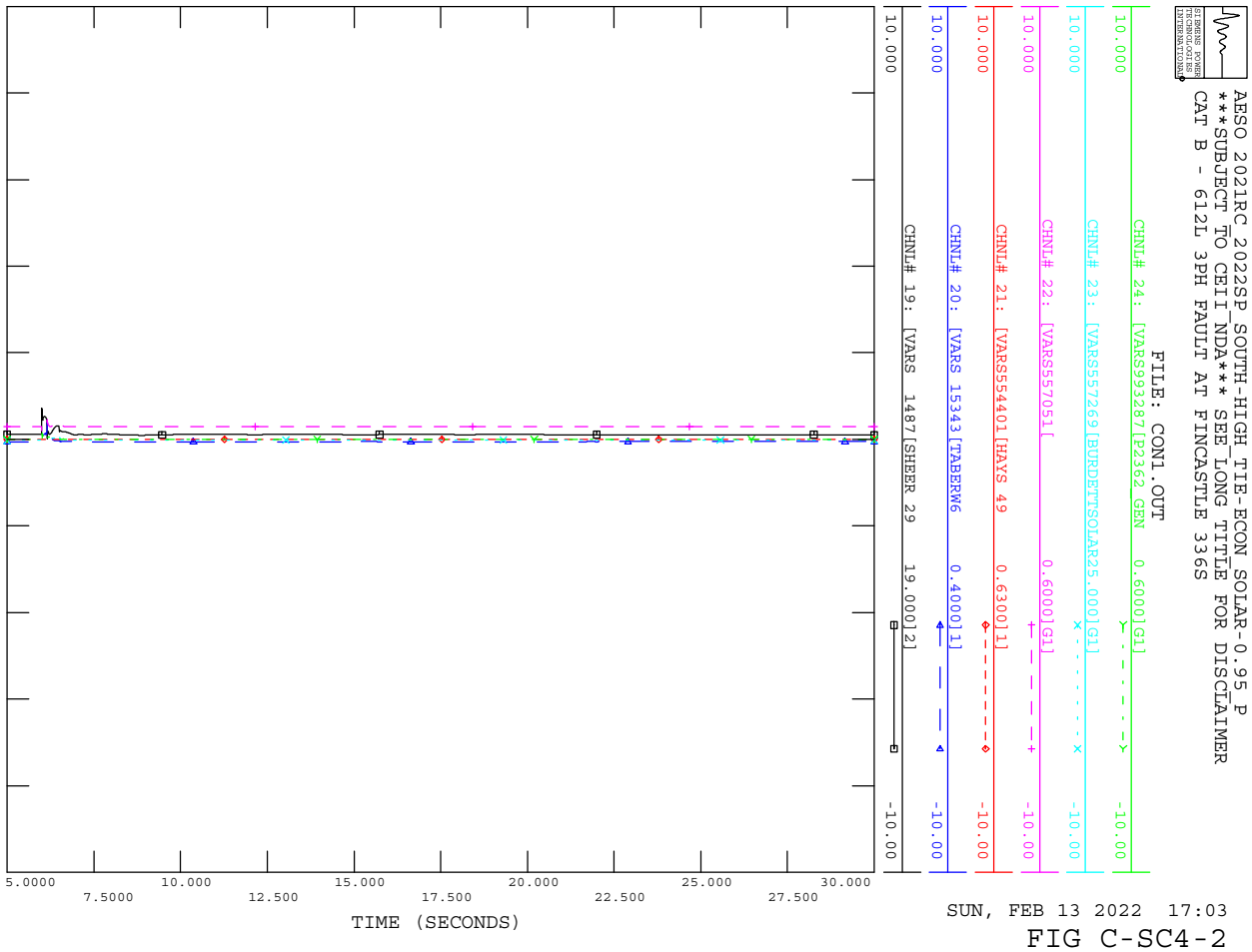


FIG C-SC4-2

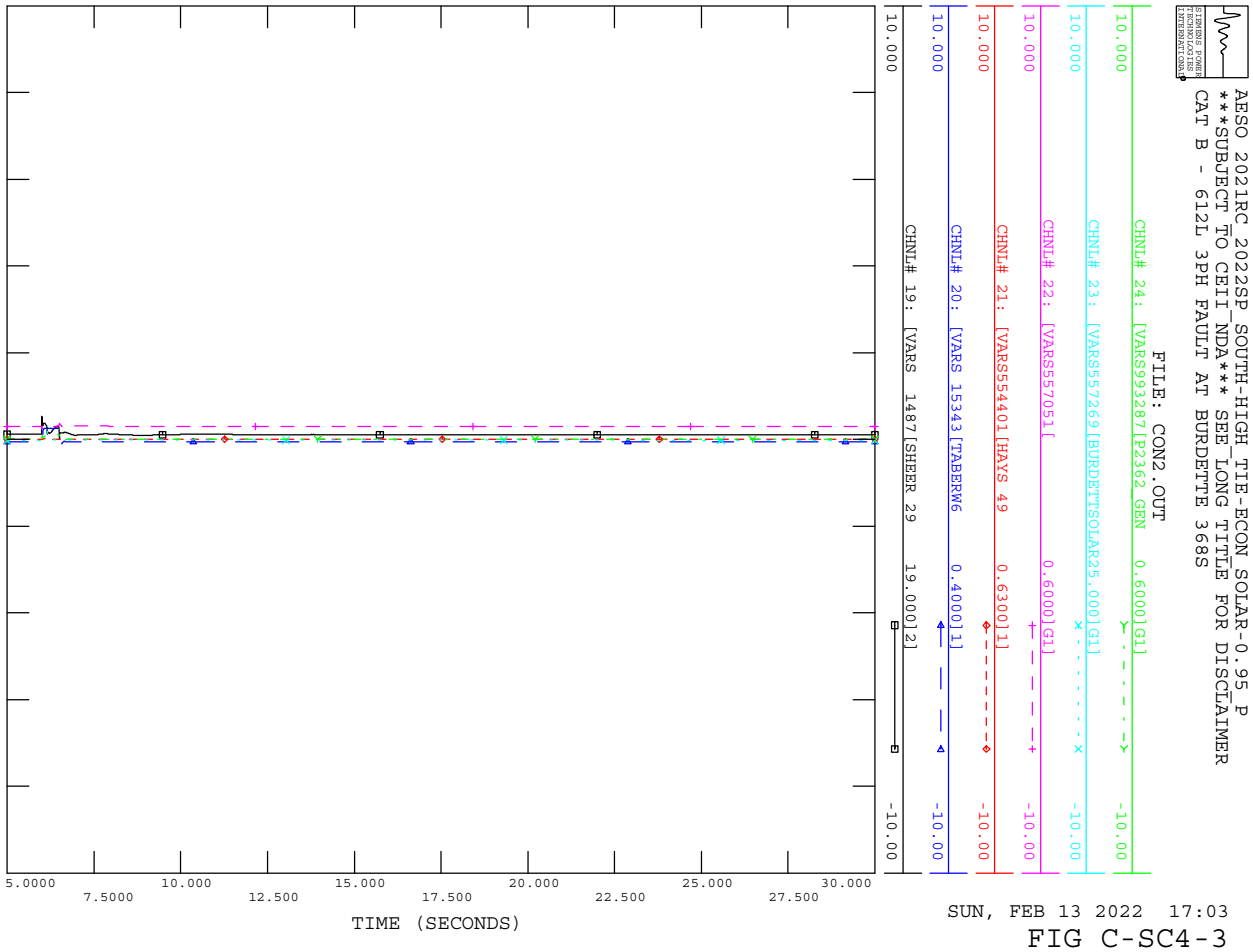


FIG C-SC4-3

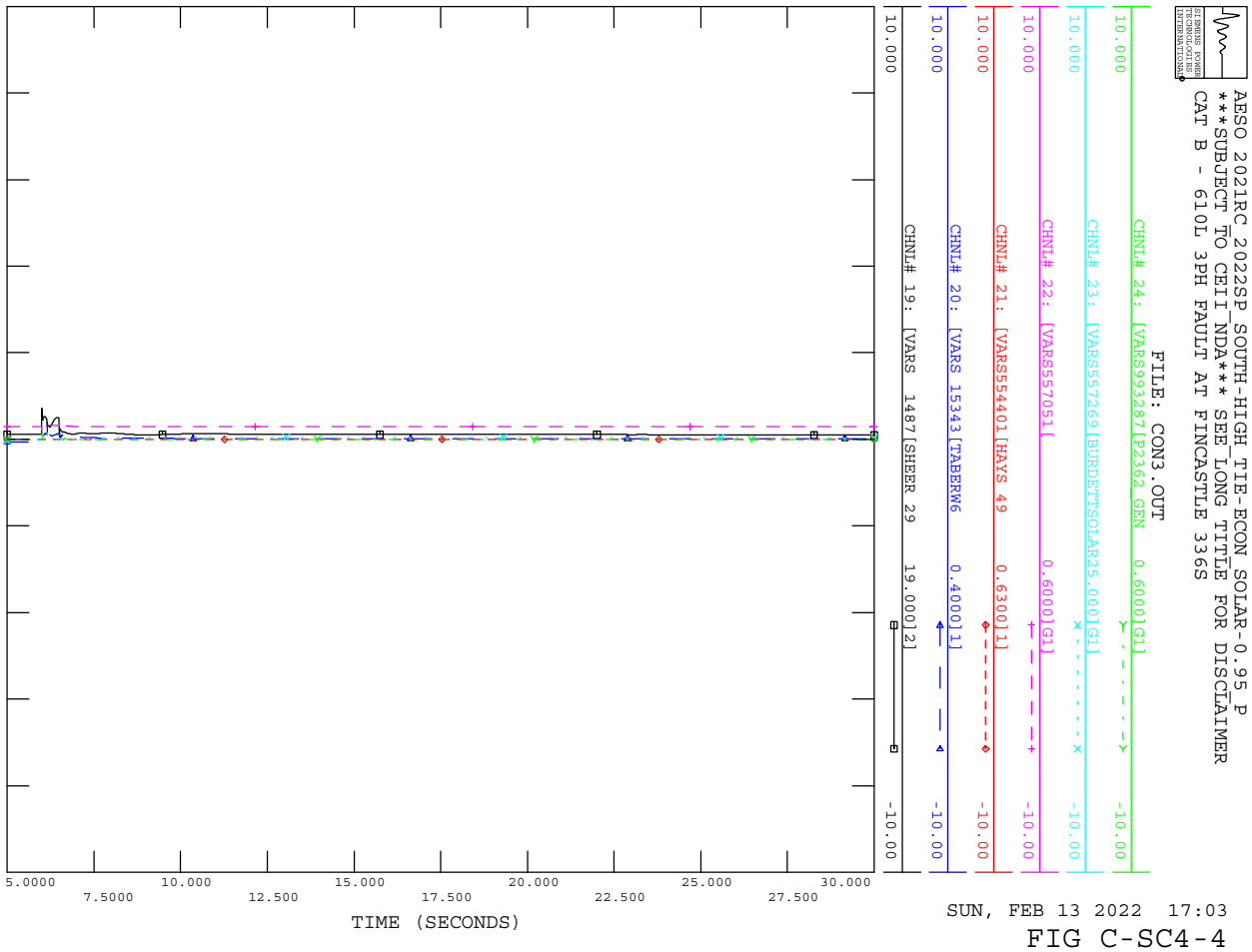


FIG C-SC4-4

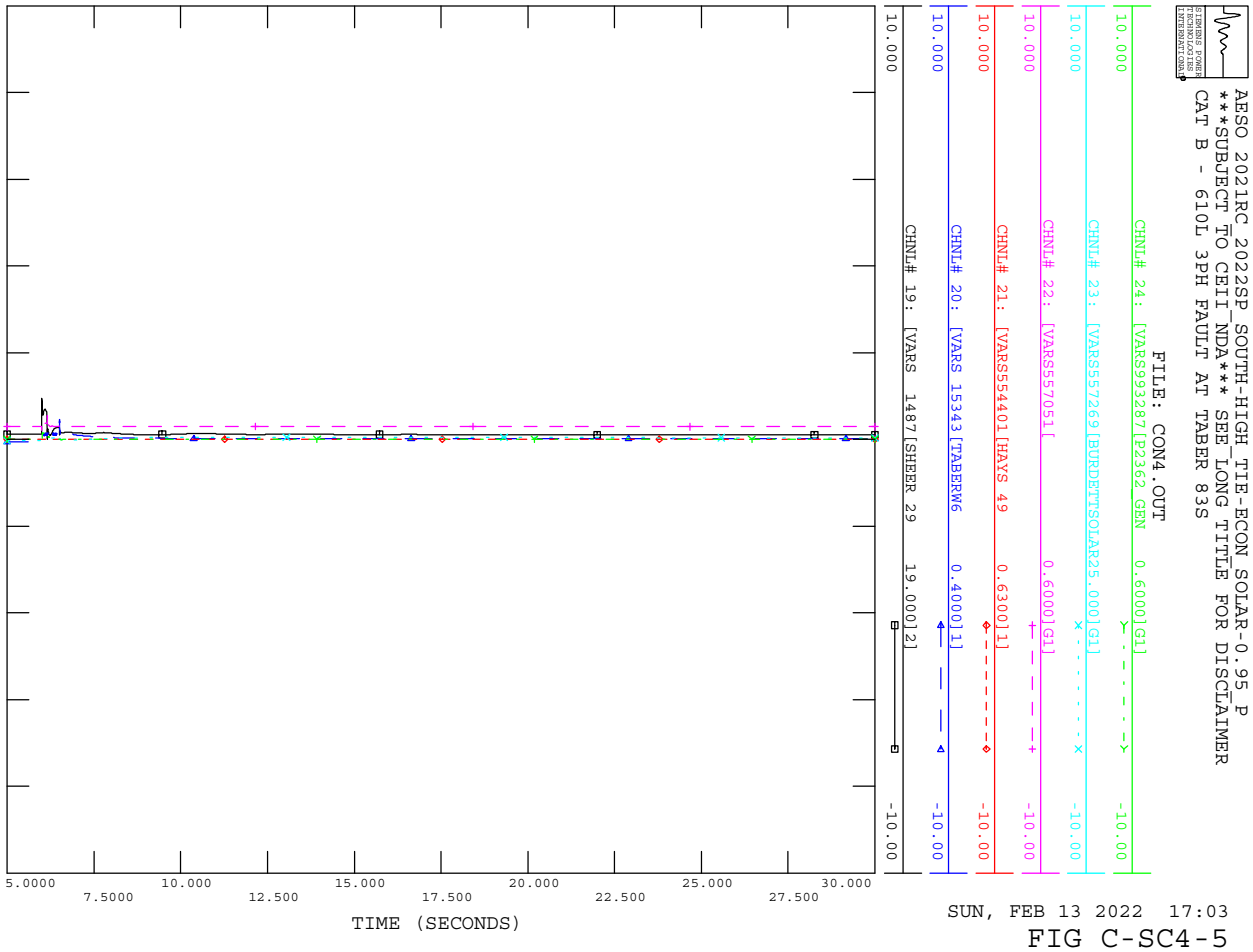


FIG C-SC4-5

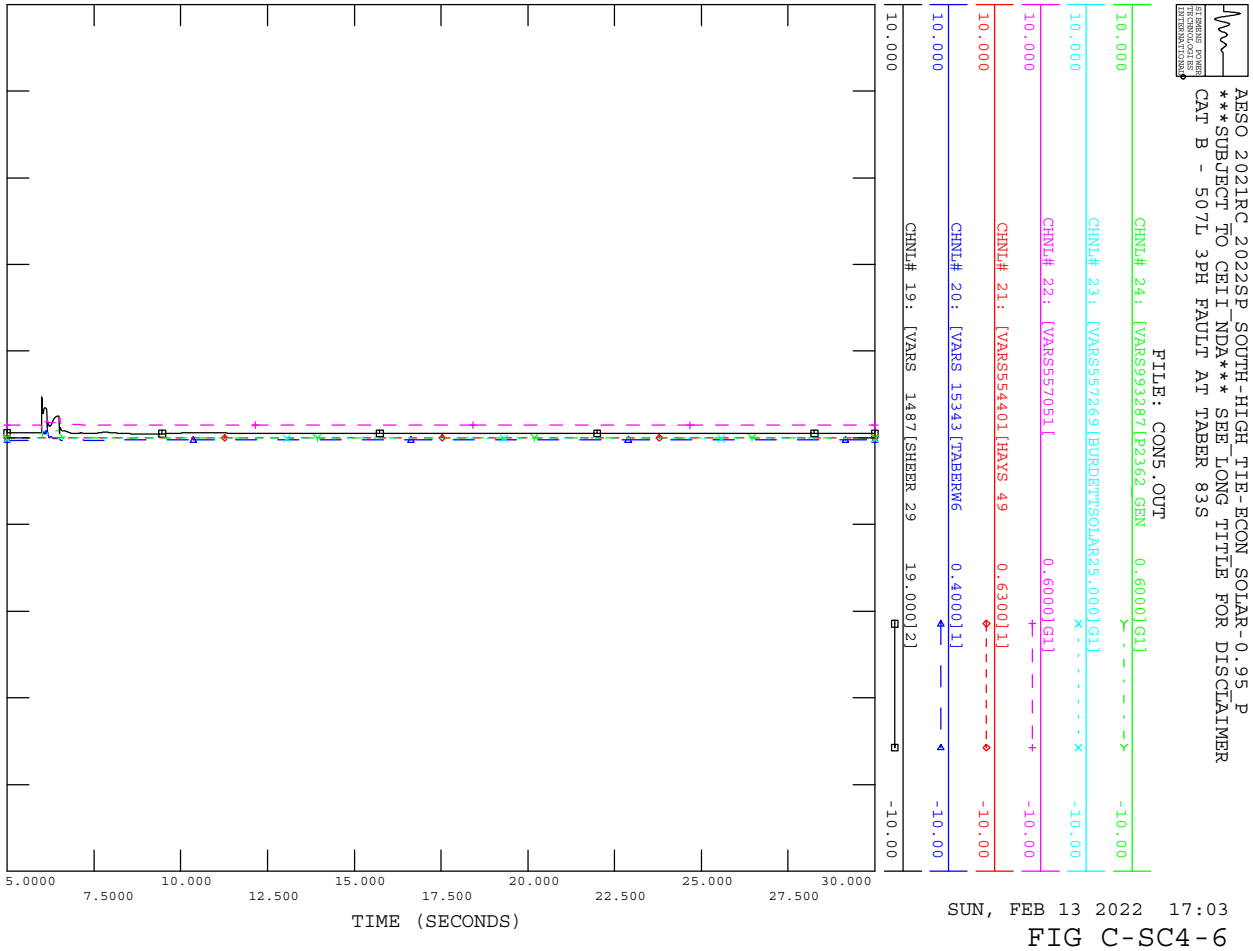
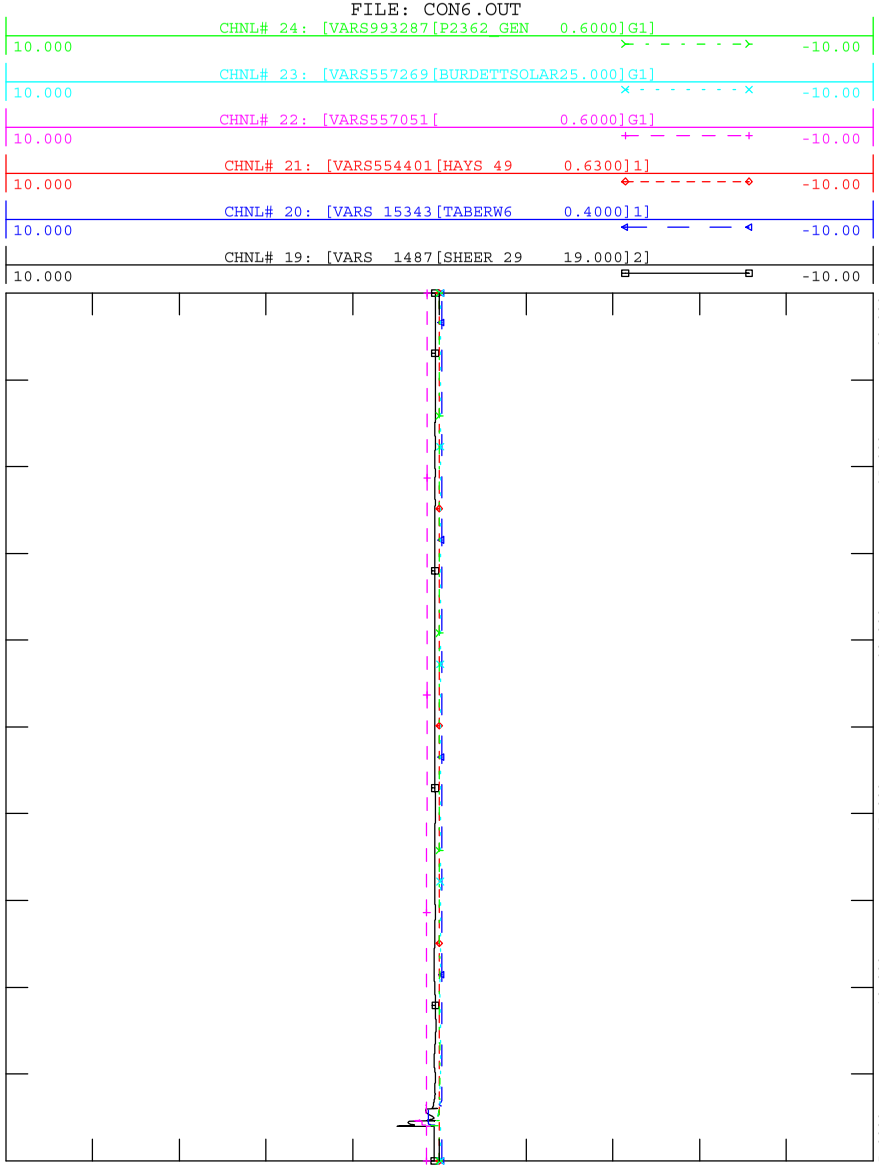


FIG C-SC4-6

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 507L 3PH FAULT AT HULL 257S

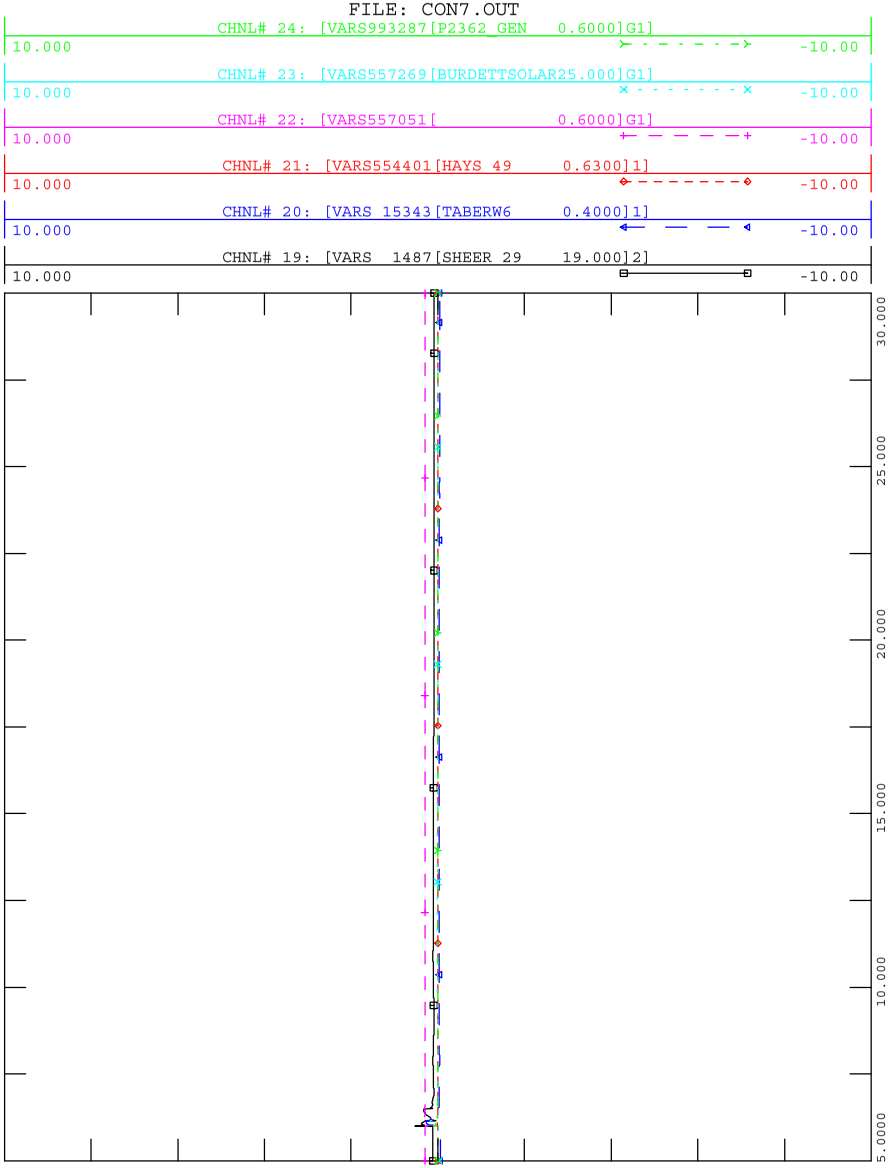
FILE: CON6.OUT



SUN, FEB 13 2022 17:03
FIG C-SC4-7

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 879L 3PH FAULT AT BURDETTE 368S

FILE: CON7.OUT



SUN, FEB 13 2022 17:03
FIG C-SC4-8

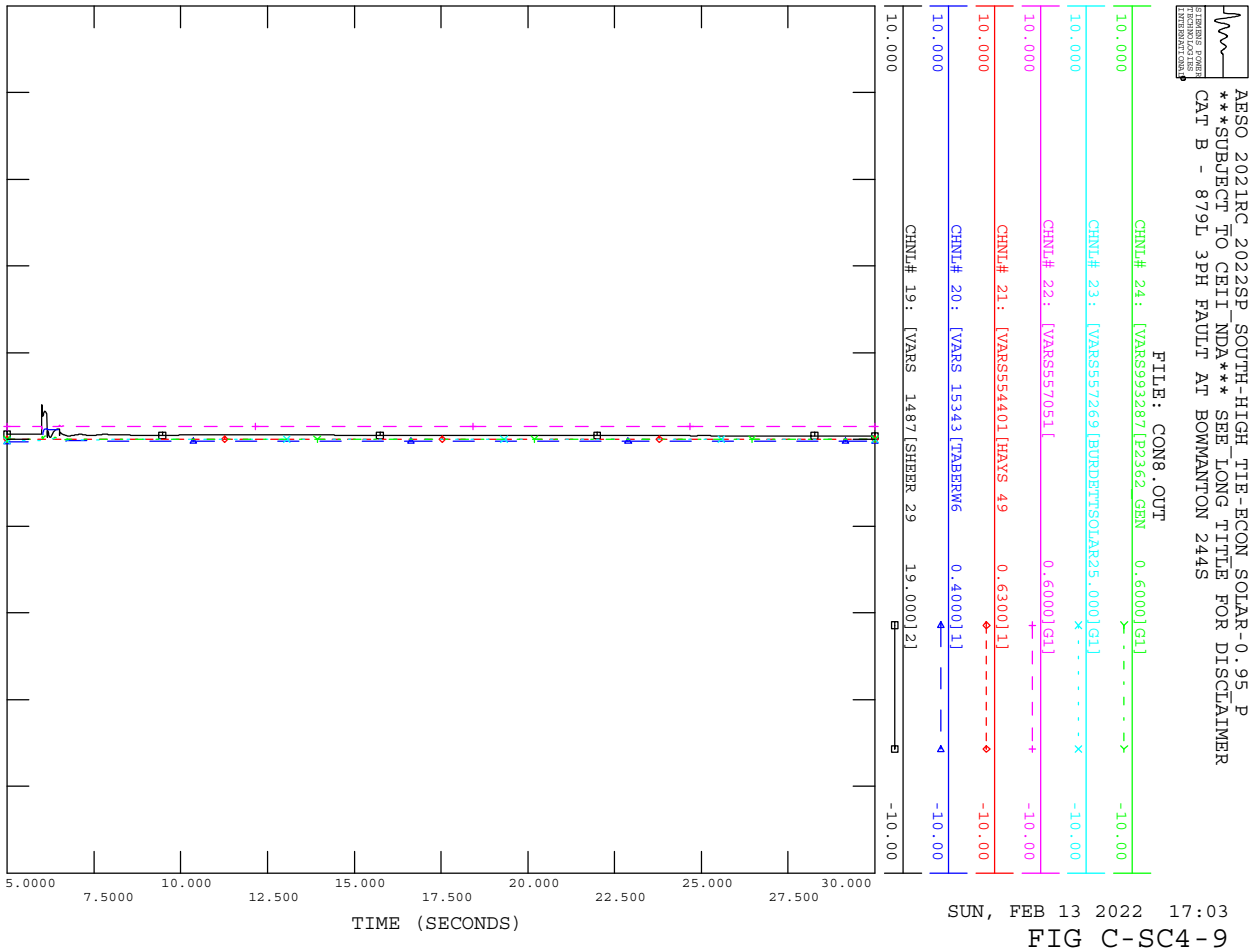


FIG C-SC4-9

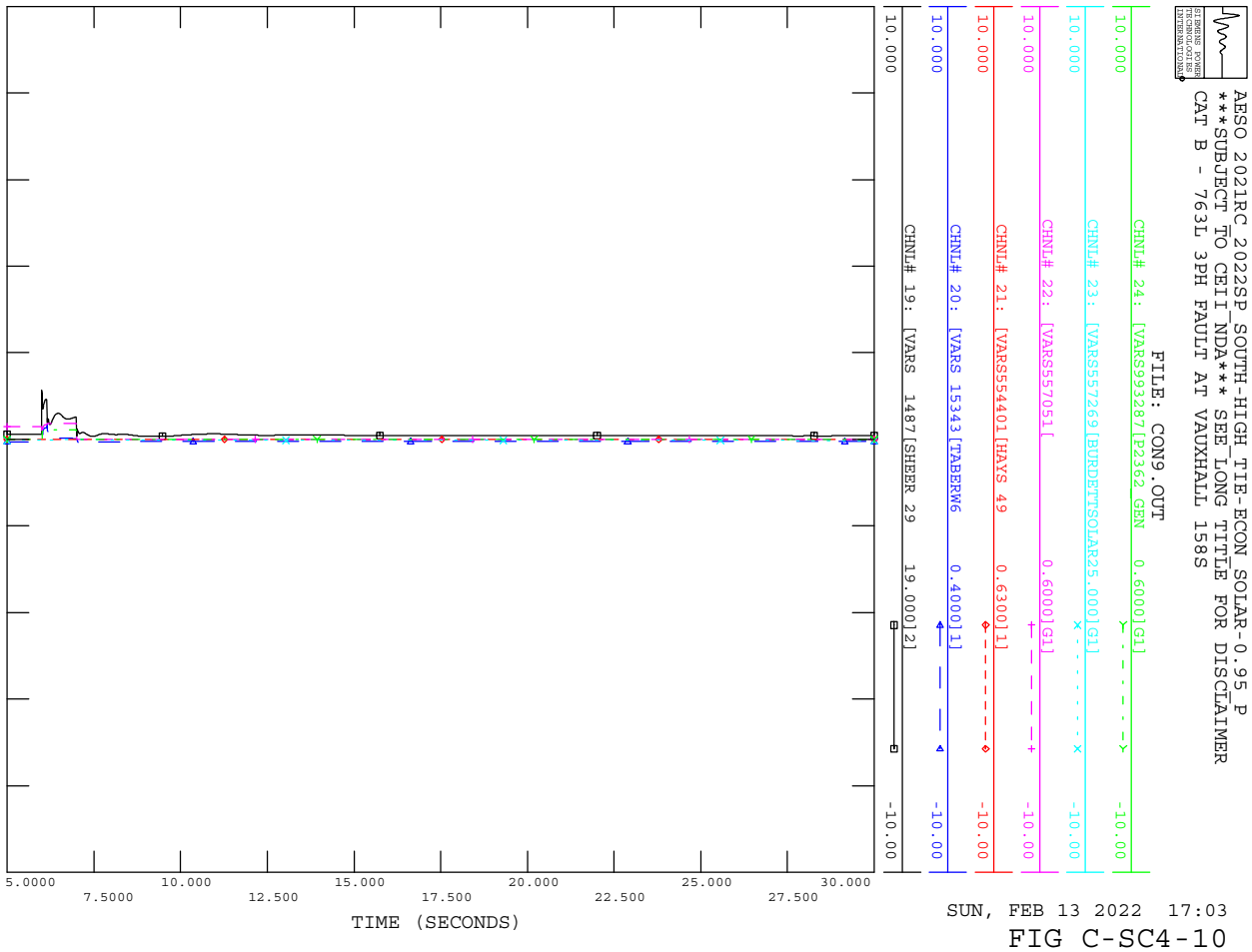
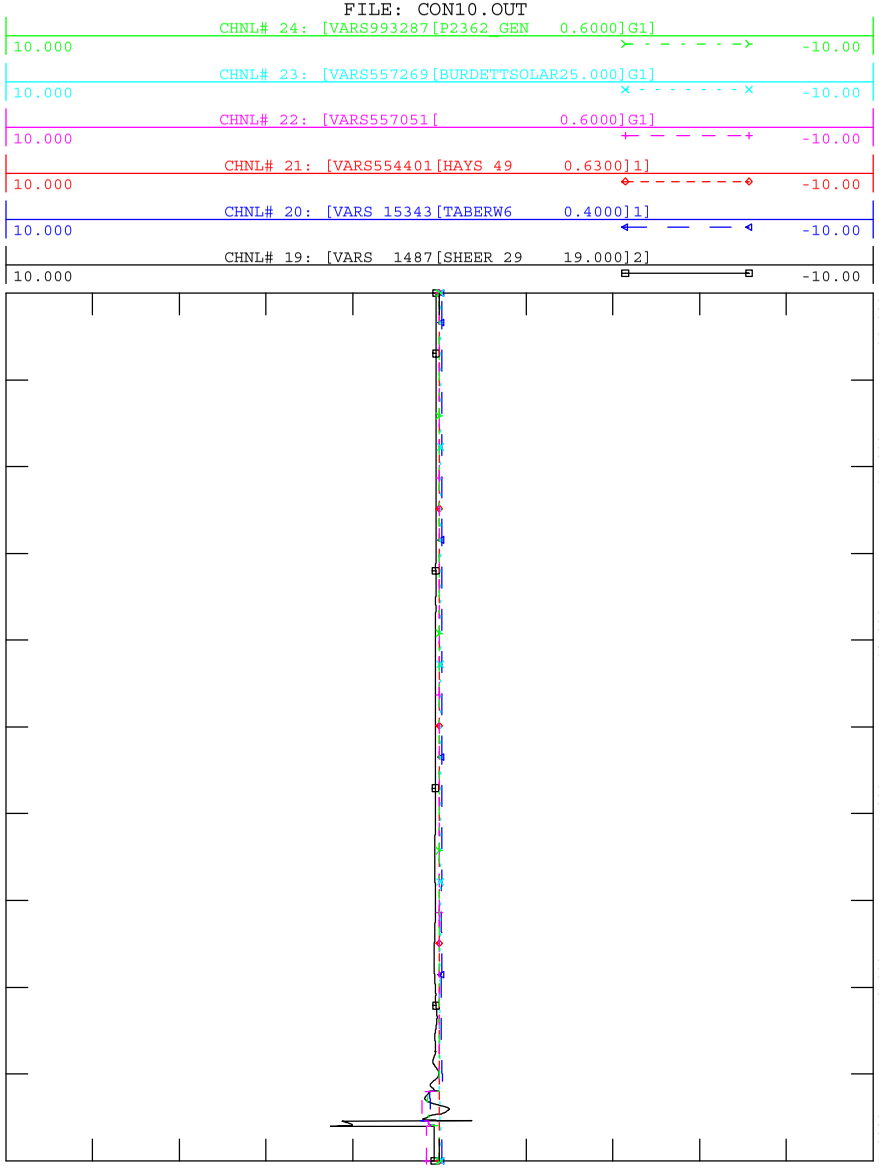


FIG C-SC4-10

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 763L 3PH FAULT AT W. BROOKS 28S

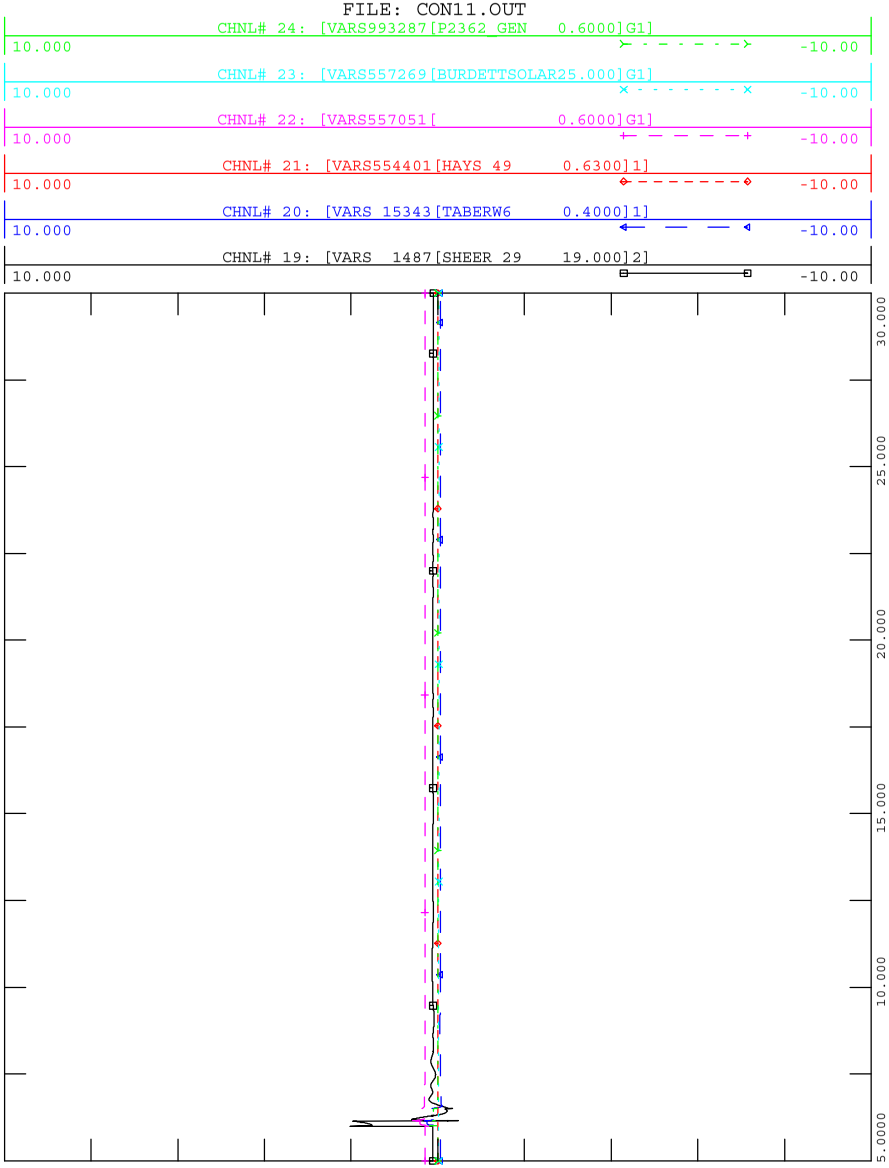
FILE: CON10.OUT



SUN, FEB 13 2022 17:03
FIG C-SC4-11

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 795L 3PH FAULT AT BROOKS 121S

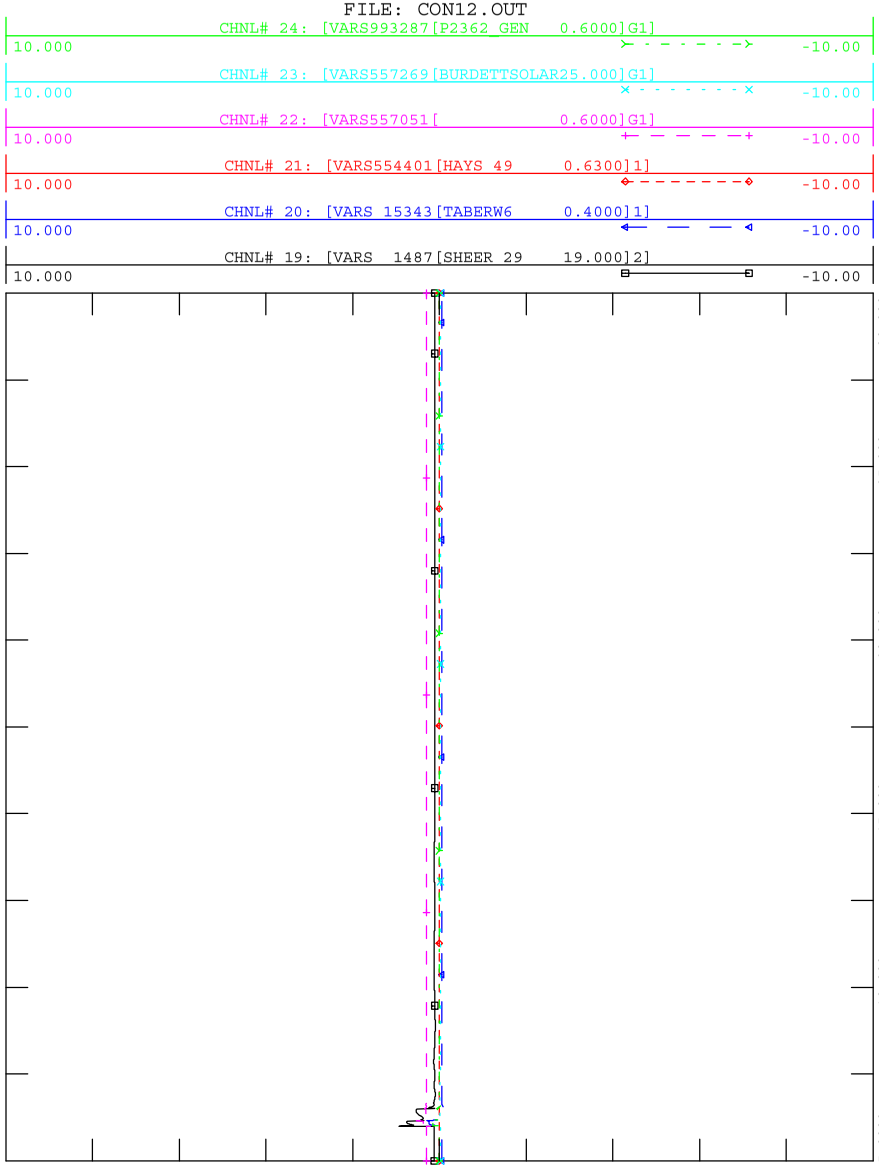
FILE: CON11.OUT



SUN, FEB 13 2022 17:03
FIG C-SC4-12

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 795L 3PH FAULT AT HAYS 421S

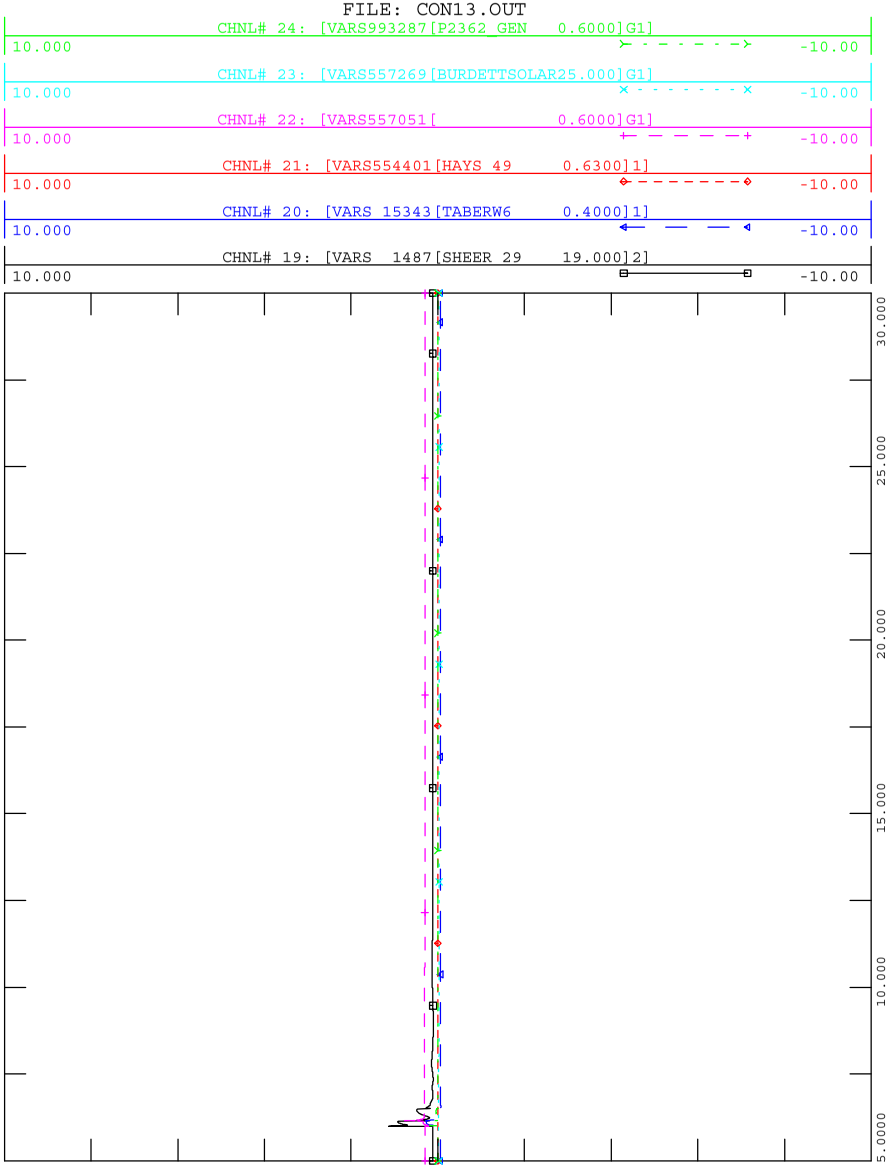
FILE: CON12.OUT



SUN, FEB 13 2022 17:03
FIG C-SC4-13

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT VAUXHALL 158S

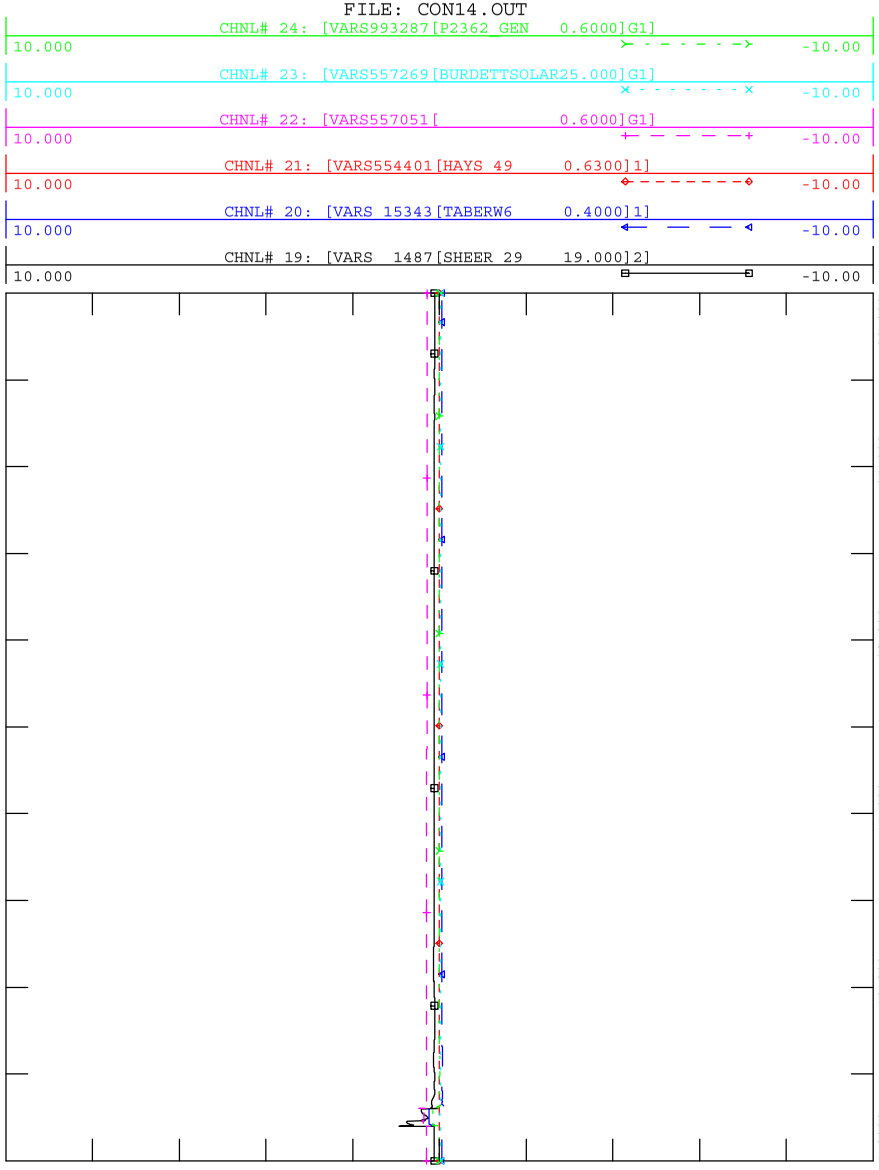
FILE: CON13.OUT



SUN, FEB 13 2022 17:03
FIG C-SC4-14

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT



SUN, FEB 13 2022 17:03

FIG C-SC4-15

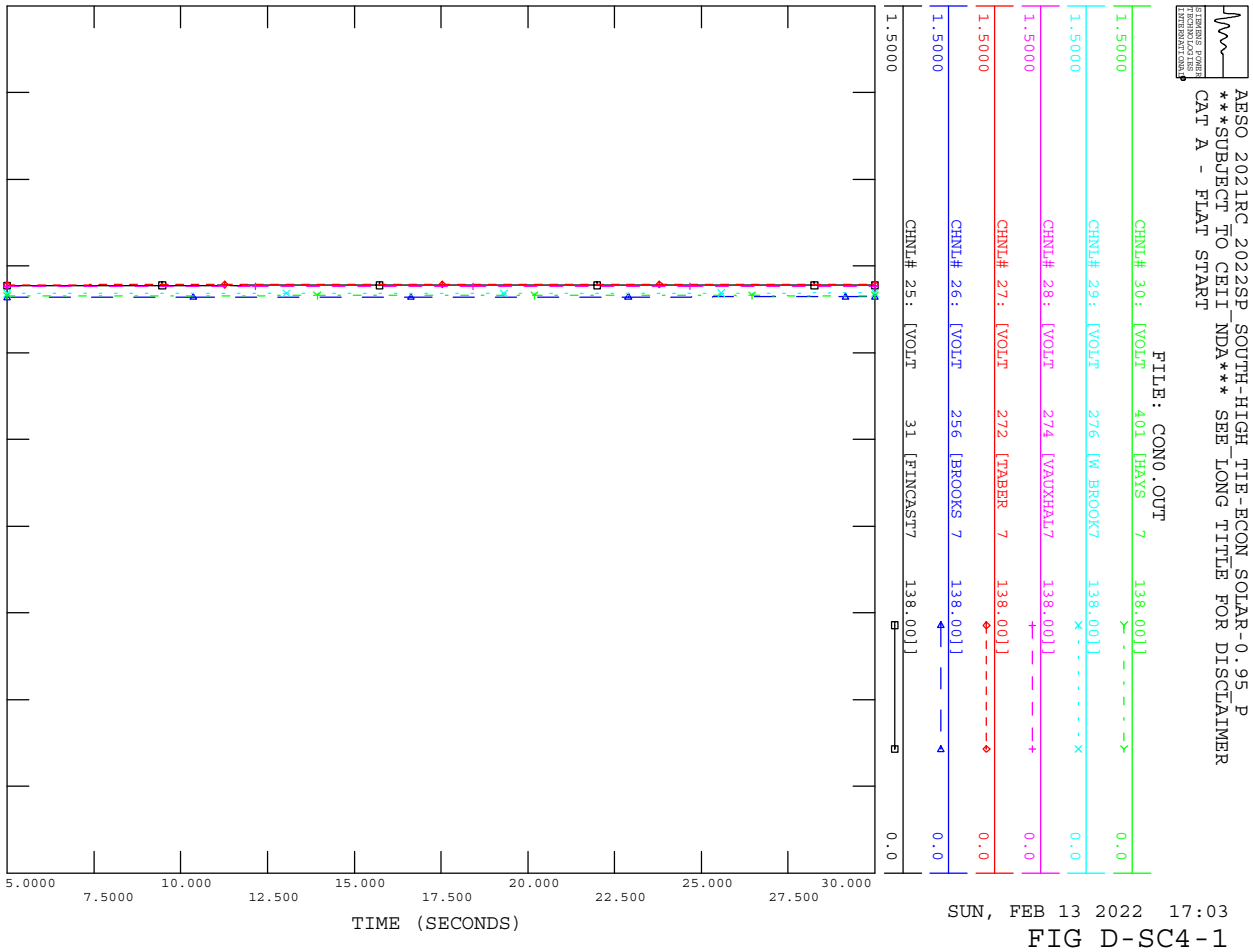


FIG D-SC4-1

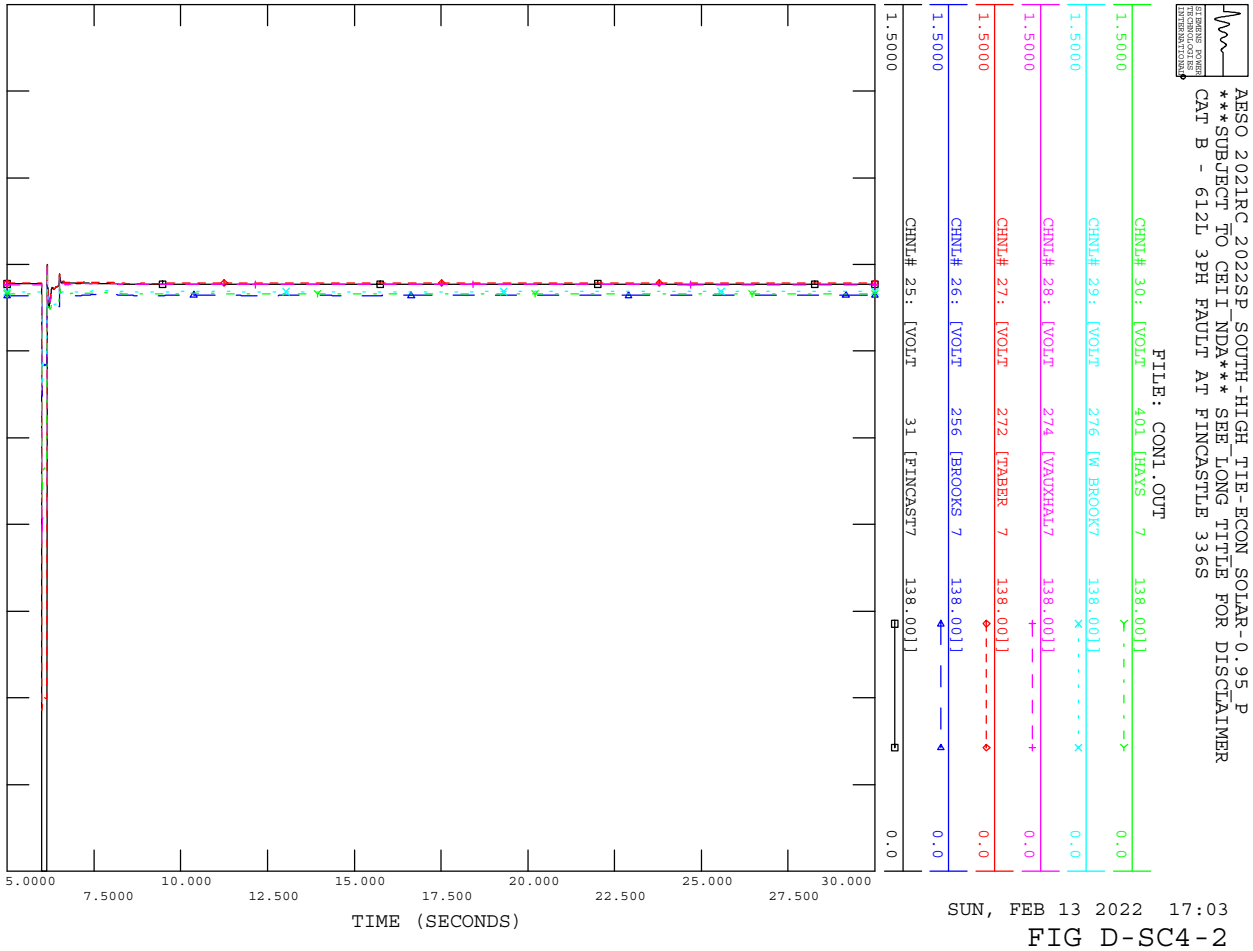


FIG D-SC4-2

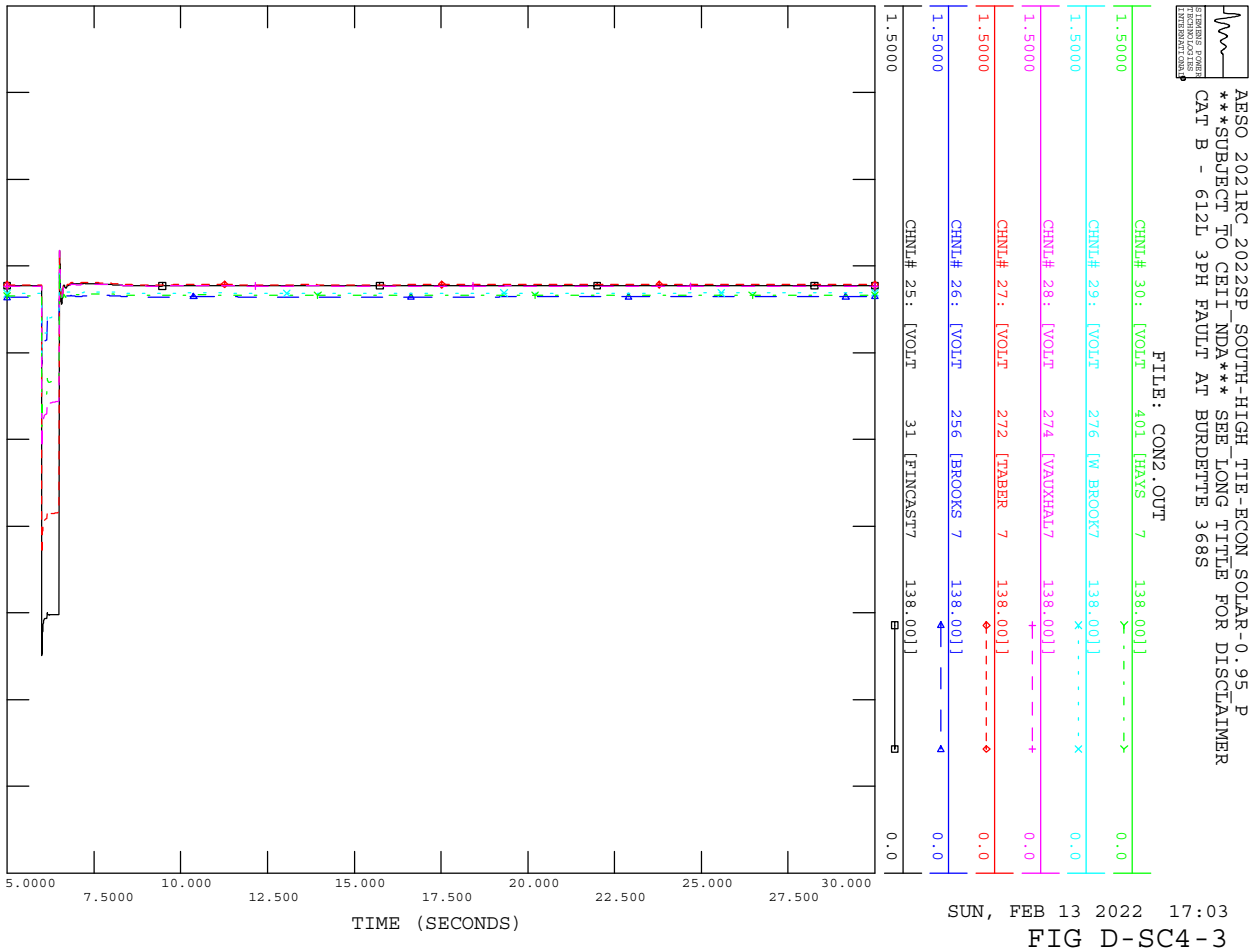


FIG D-SC4-3

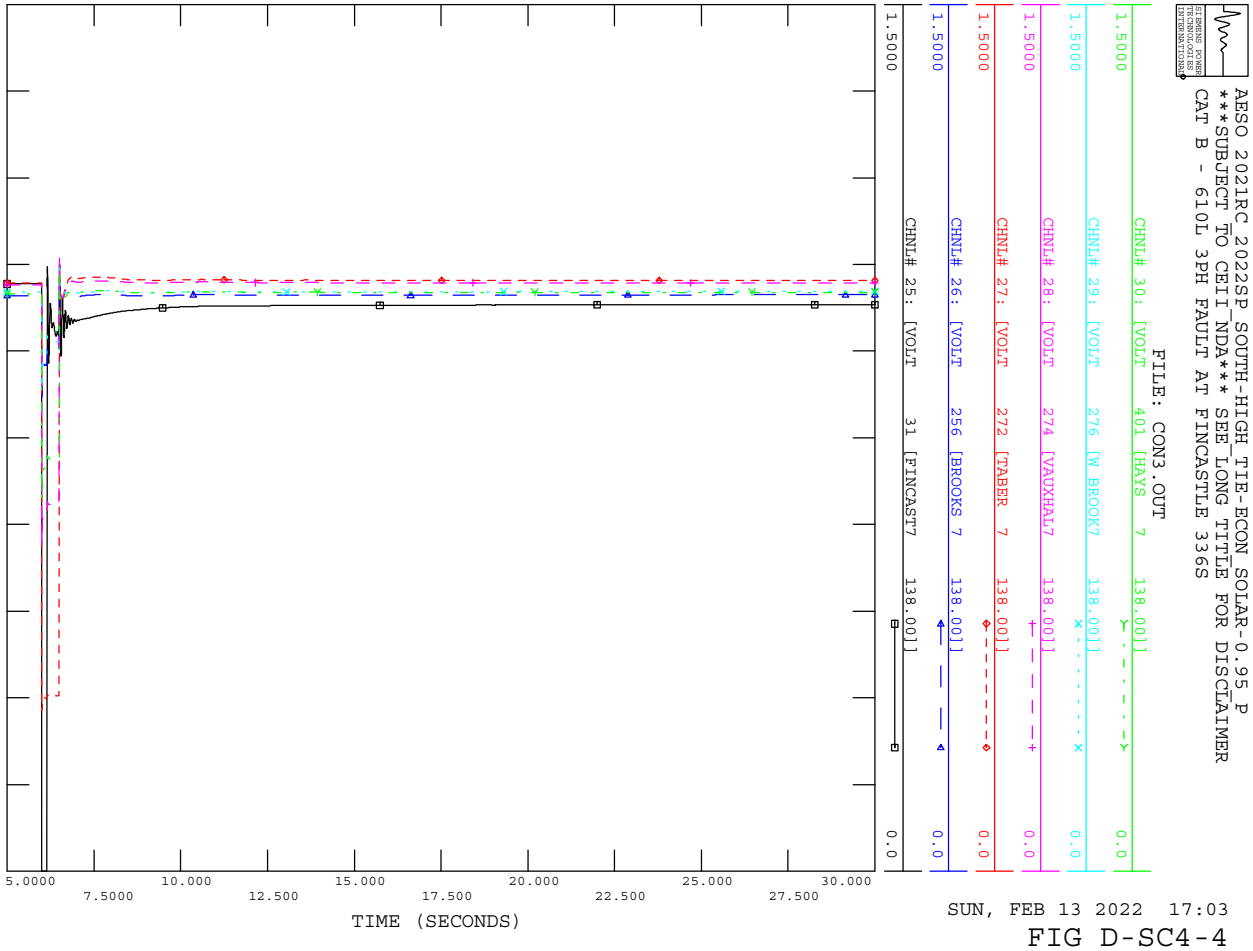


FIG D-SC4-4

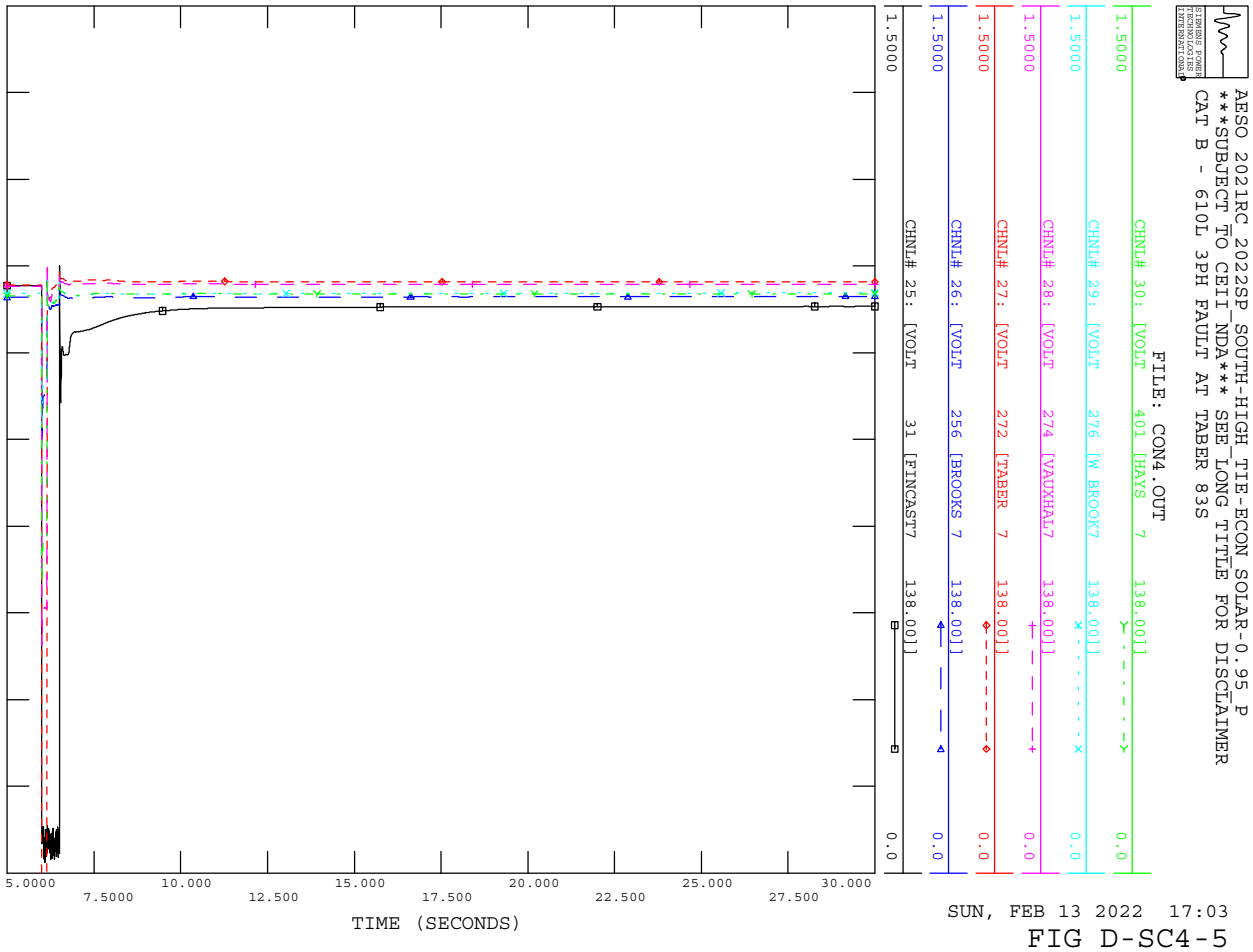


FIG D-SC4-5

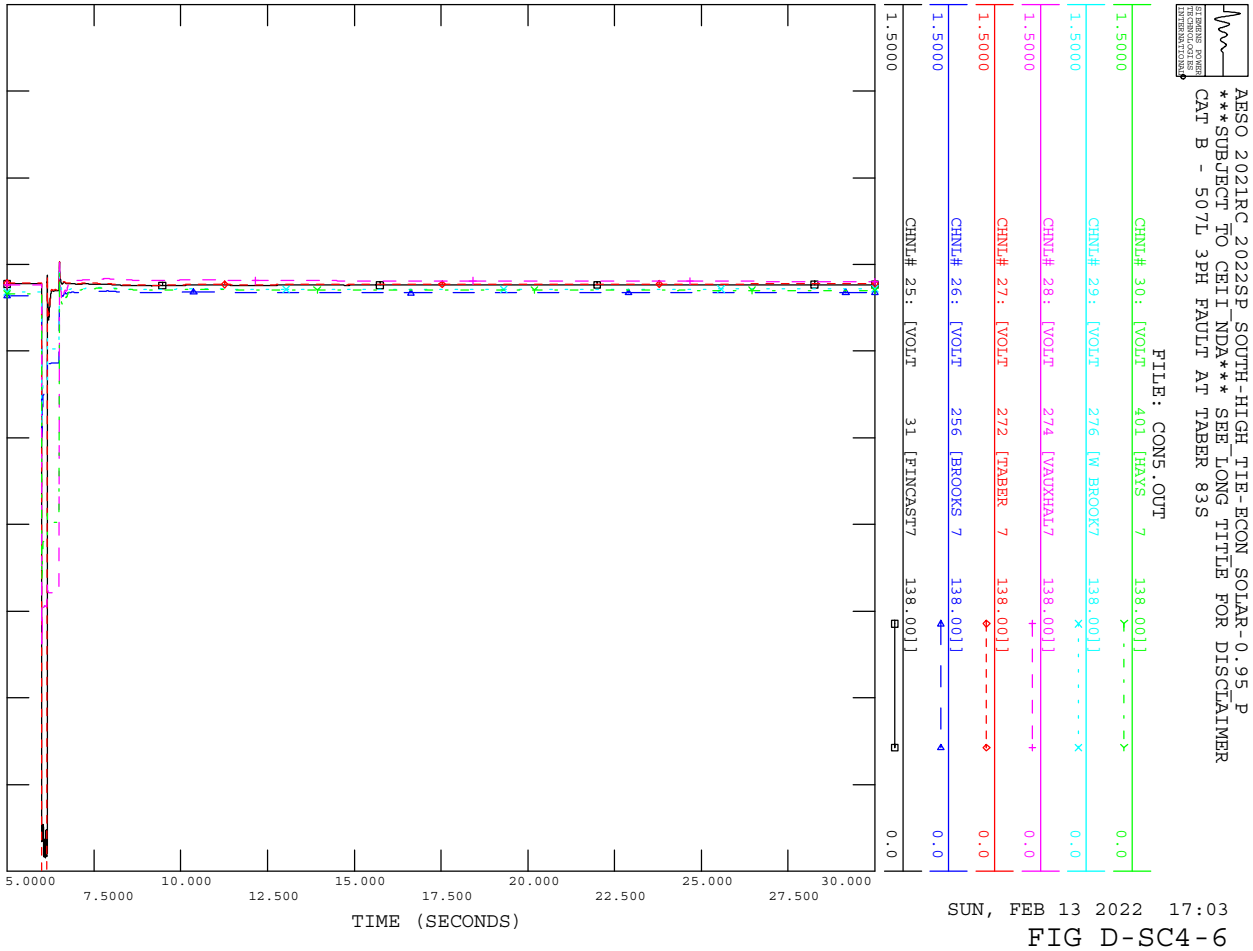
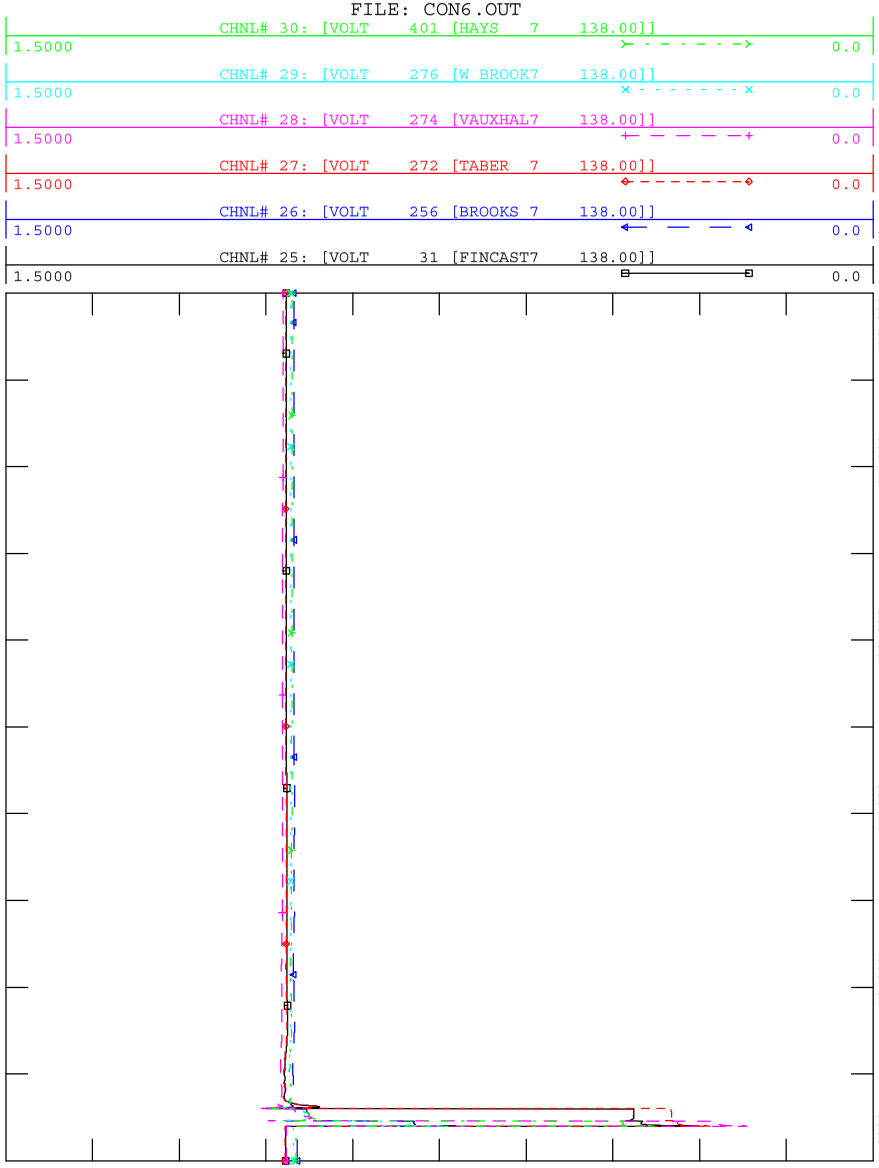


FIG D-SC4-6

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 507L 3PH FAULT AT HULL 257S

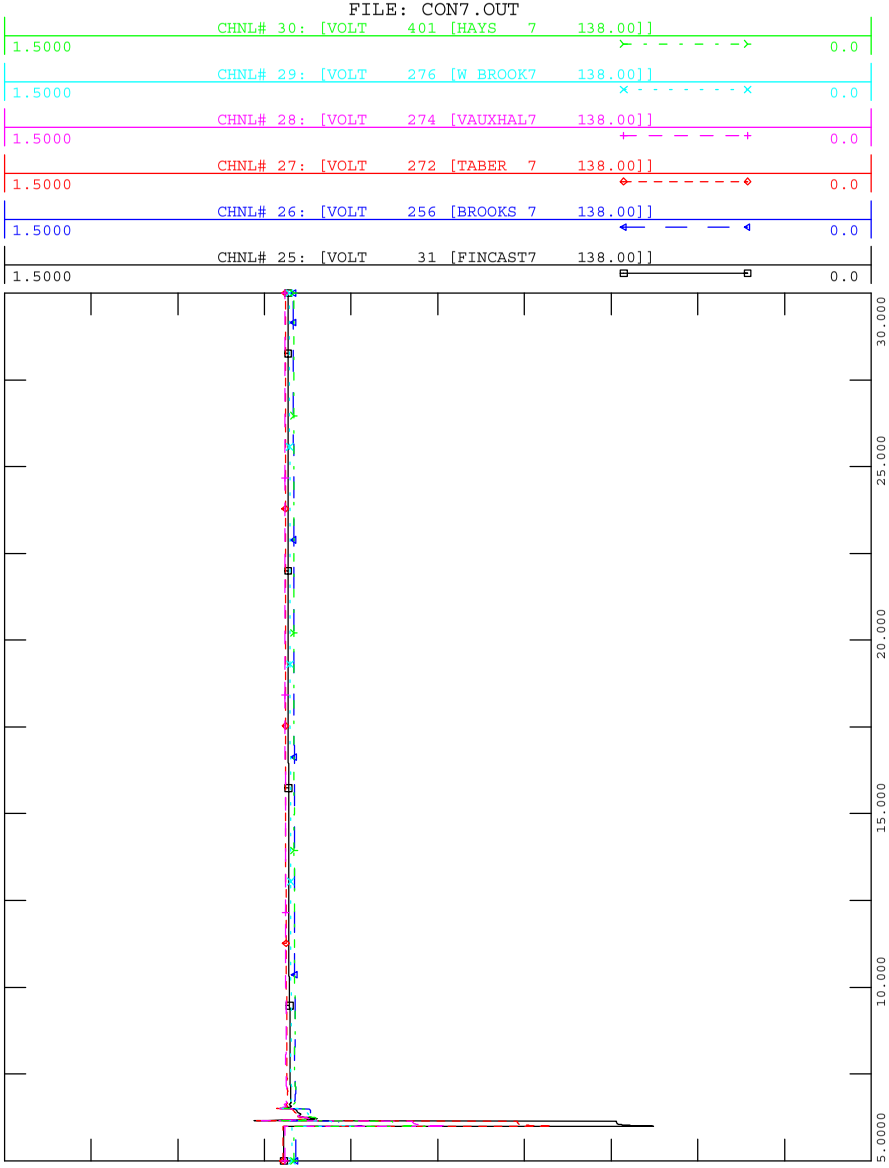
FILE: CON6.OUT



SUN, FEB 13 2022 17:03
FIG D-SC4-7

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 879L 3PH FAULT AT BURDETTE 368S

FILE: CON7.OUT



SUN, FEB 13 2022 17:03
FIG D-SC4-8

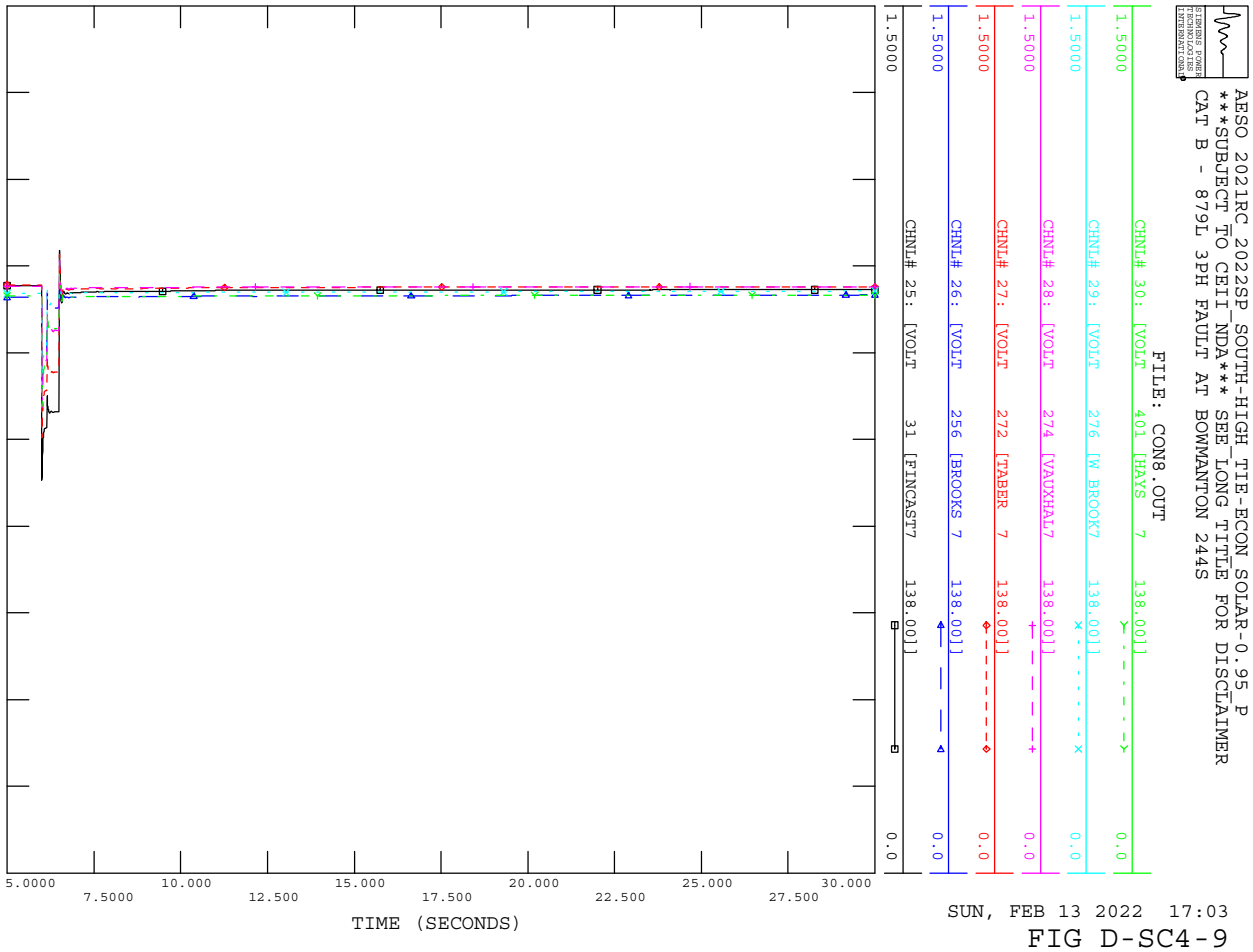


FIG D-SC4-9

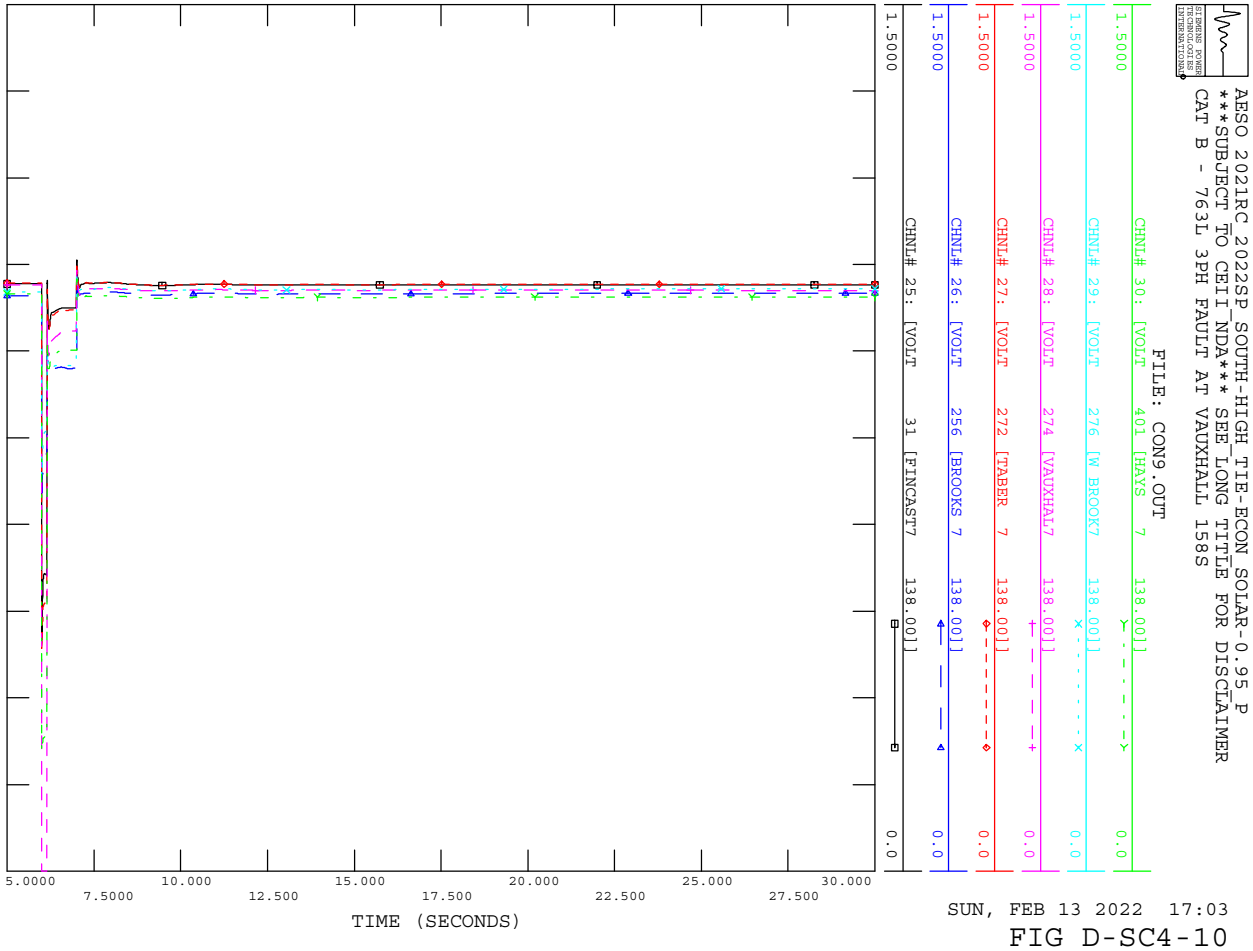


FIG D-SC4-10

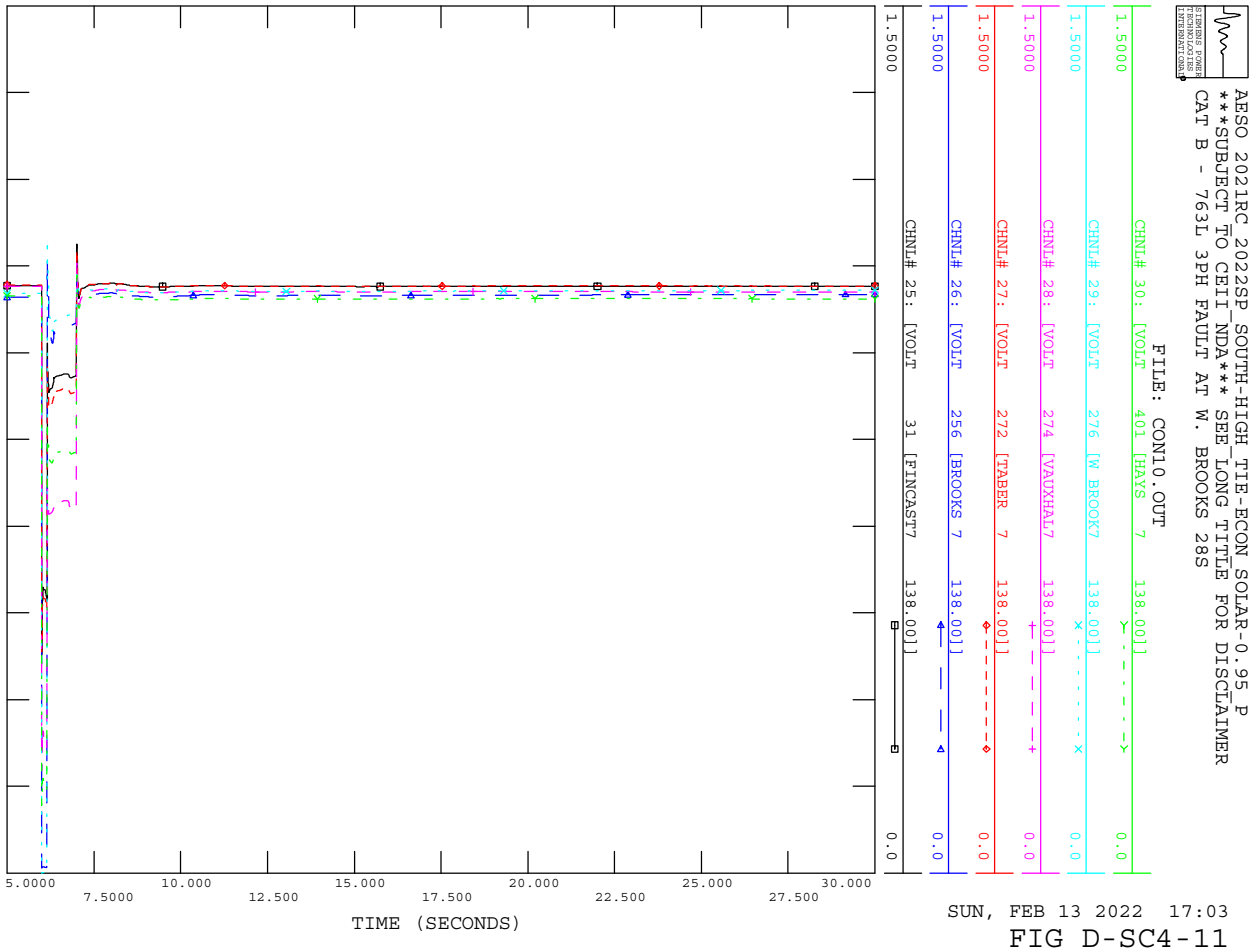


FIG D-SC4-11

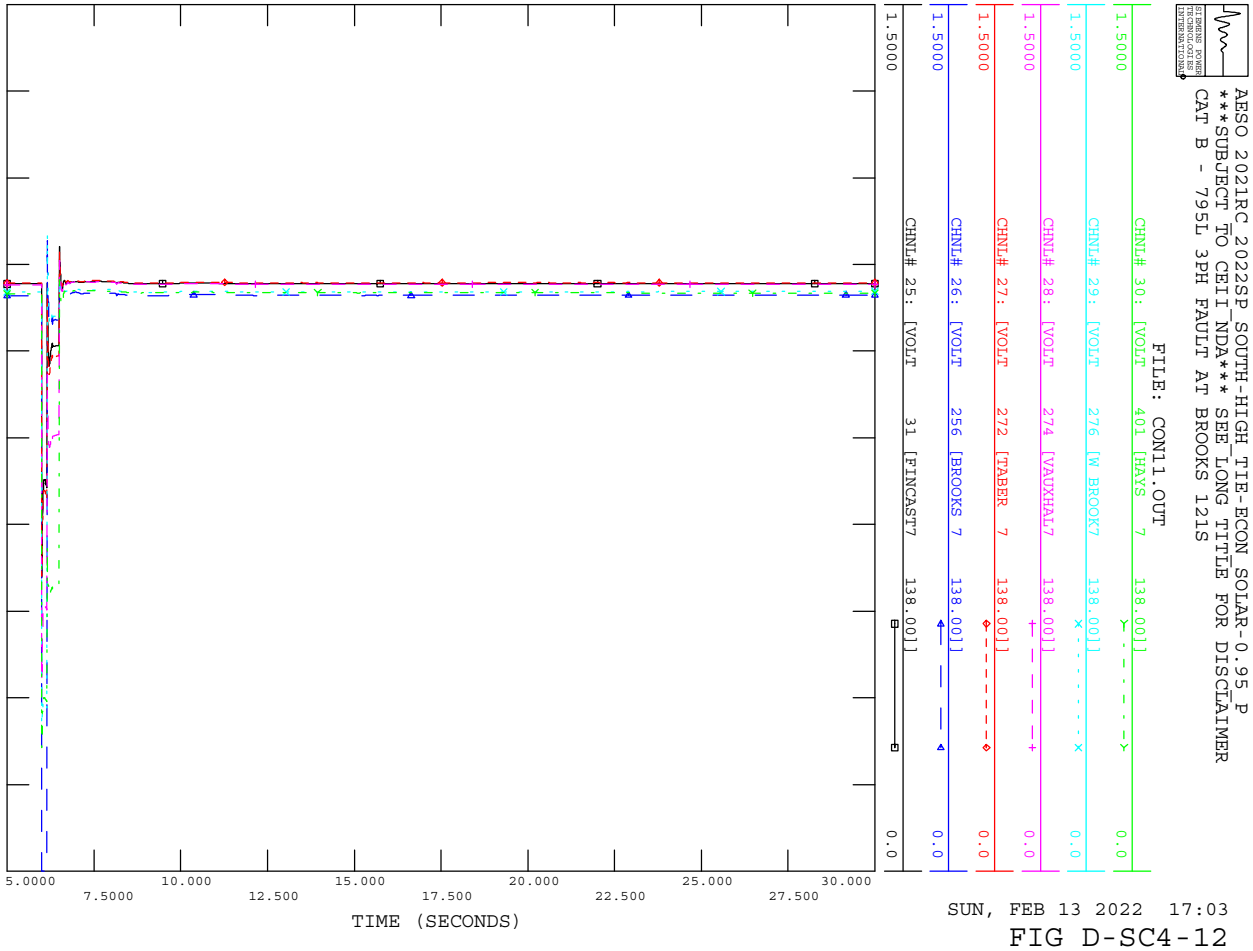


FIG D-SC4-12

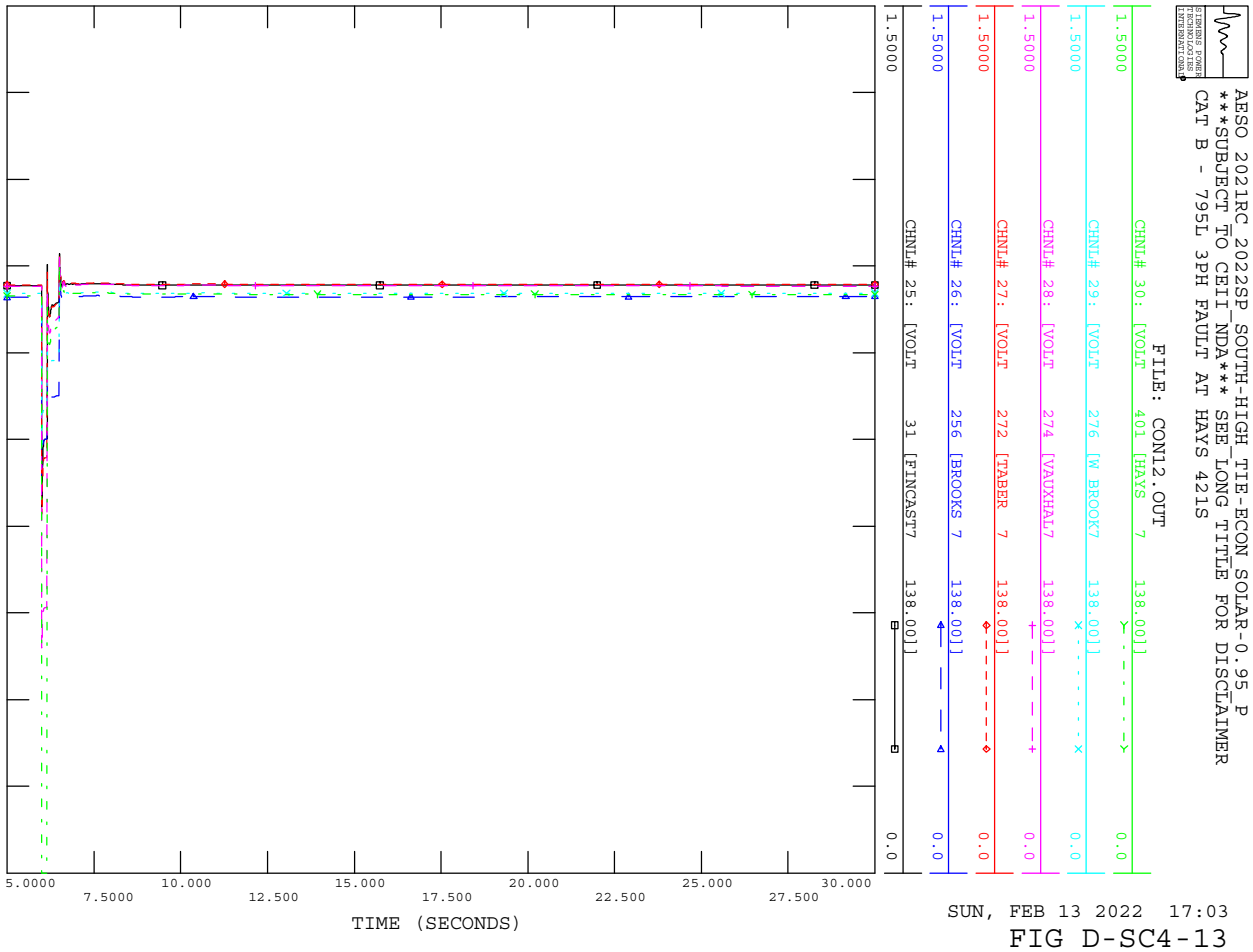


FIG D-SC4-13

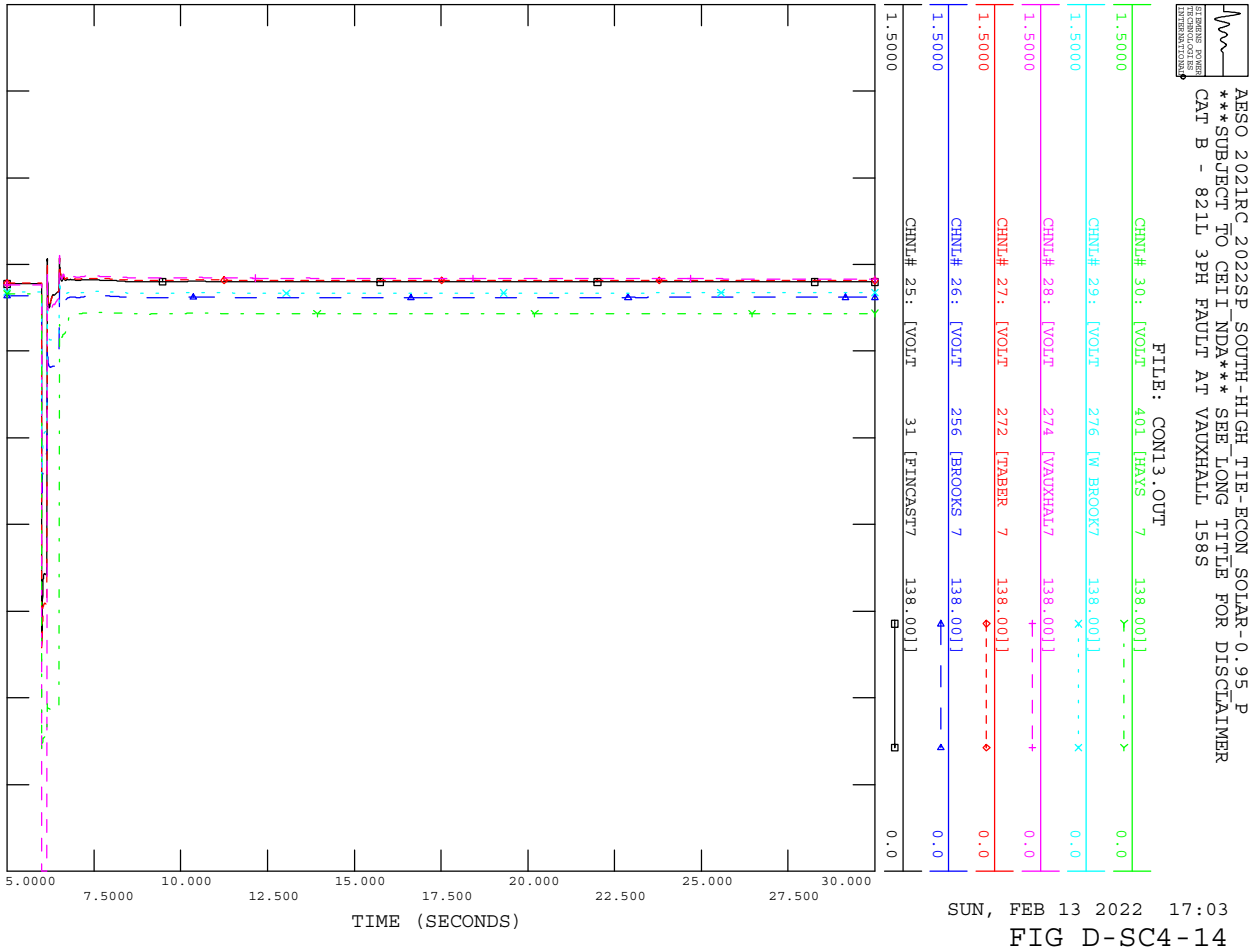
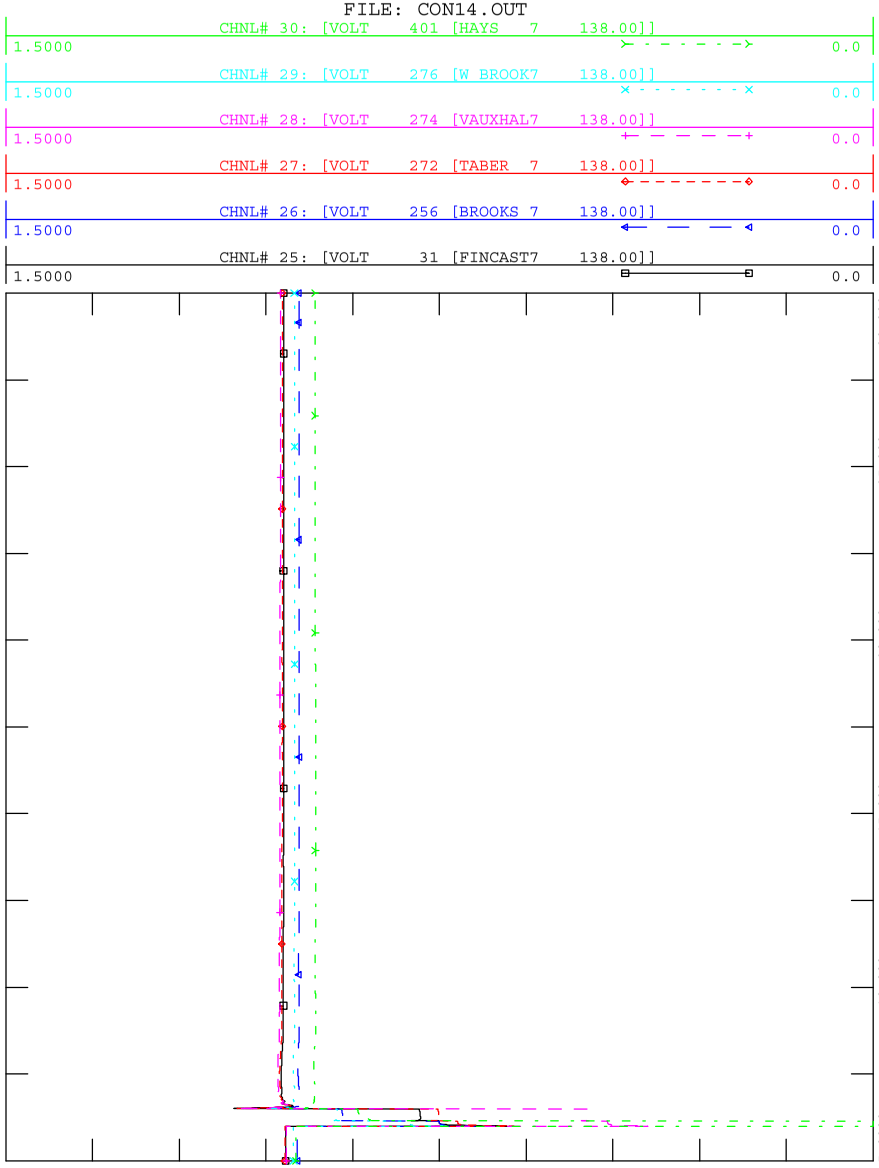


FIG D-SC4-14

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT



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FIG D-SC4-15

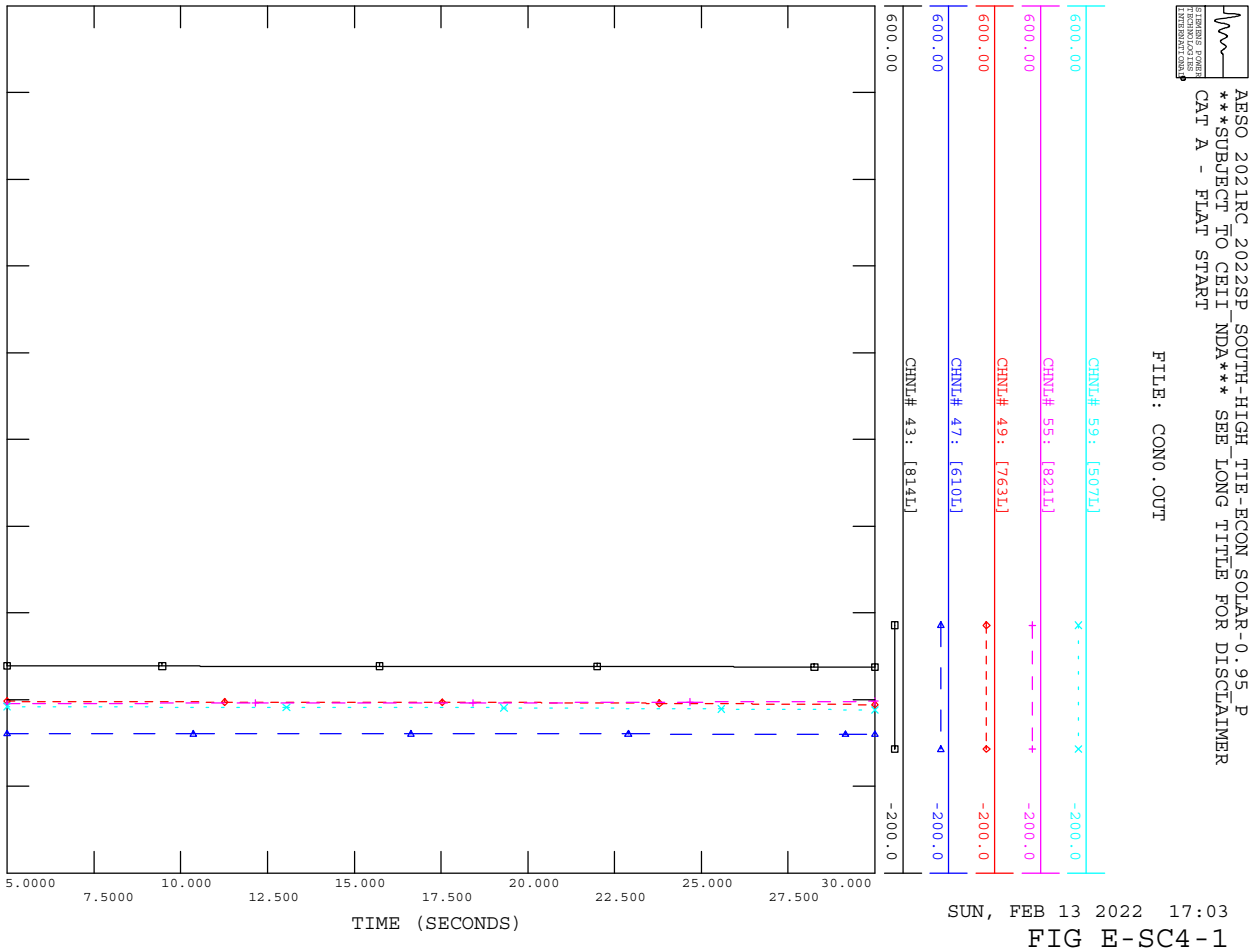


FIG E-SC4-1

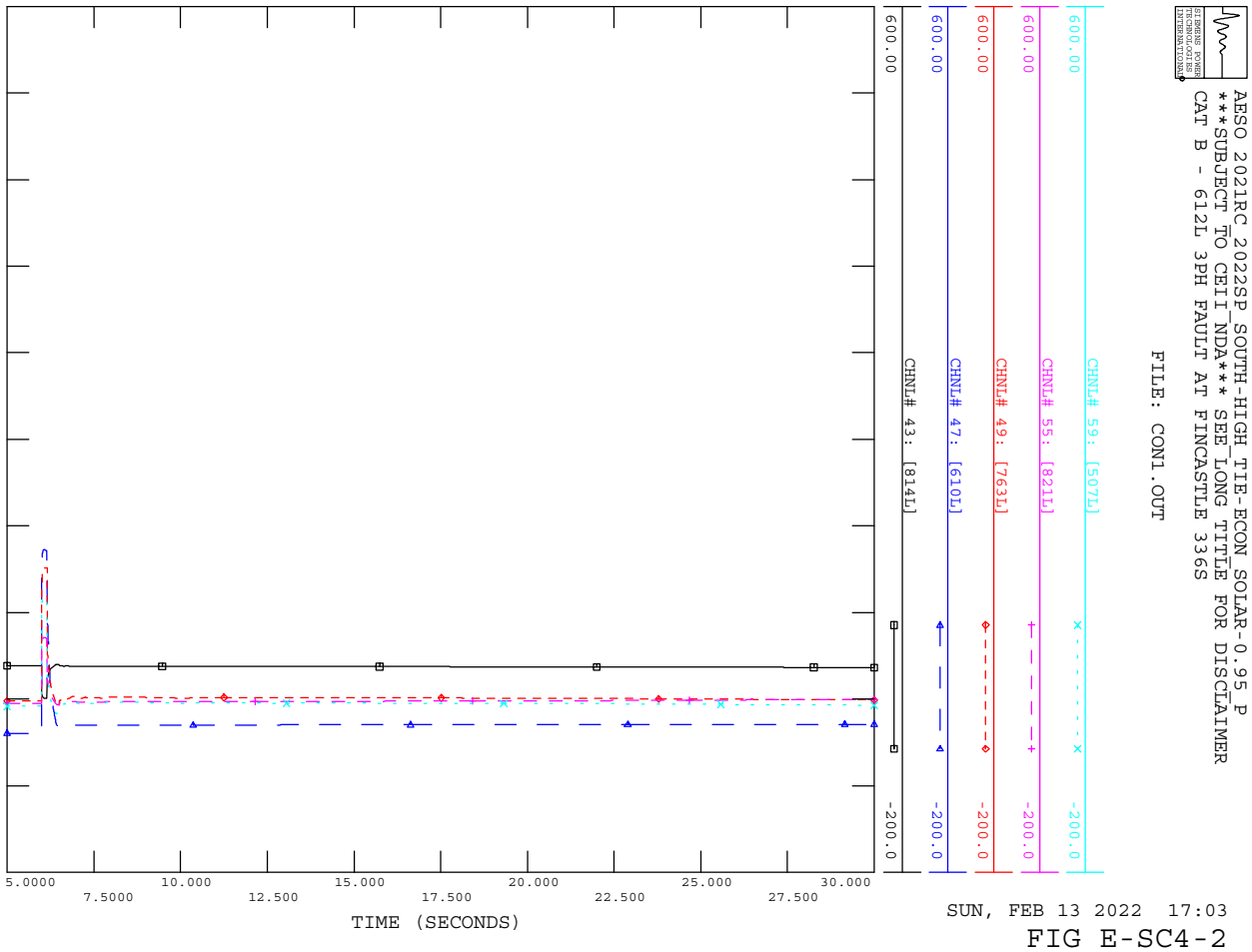


FIG E-SC4-2

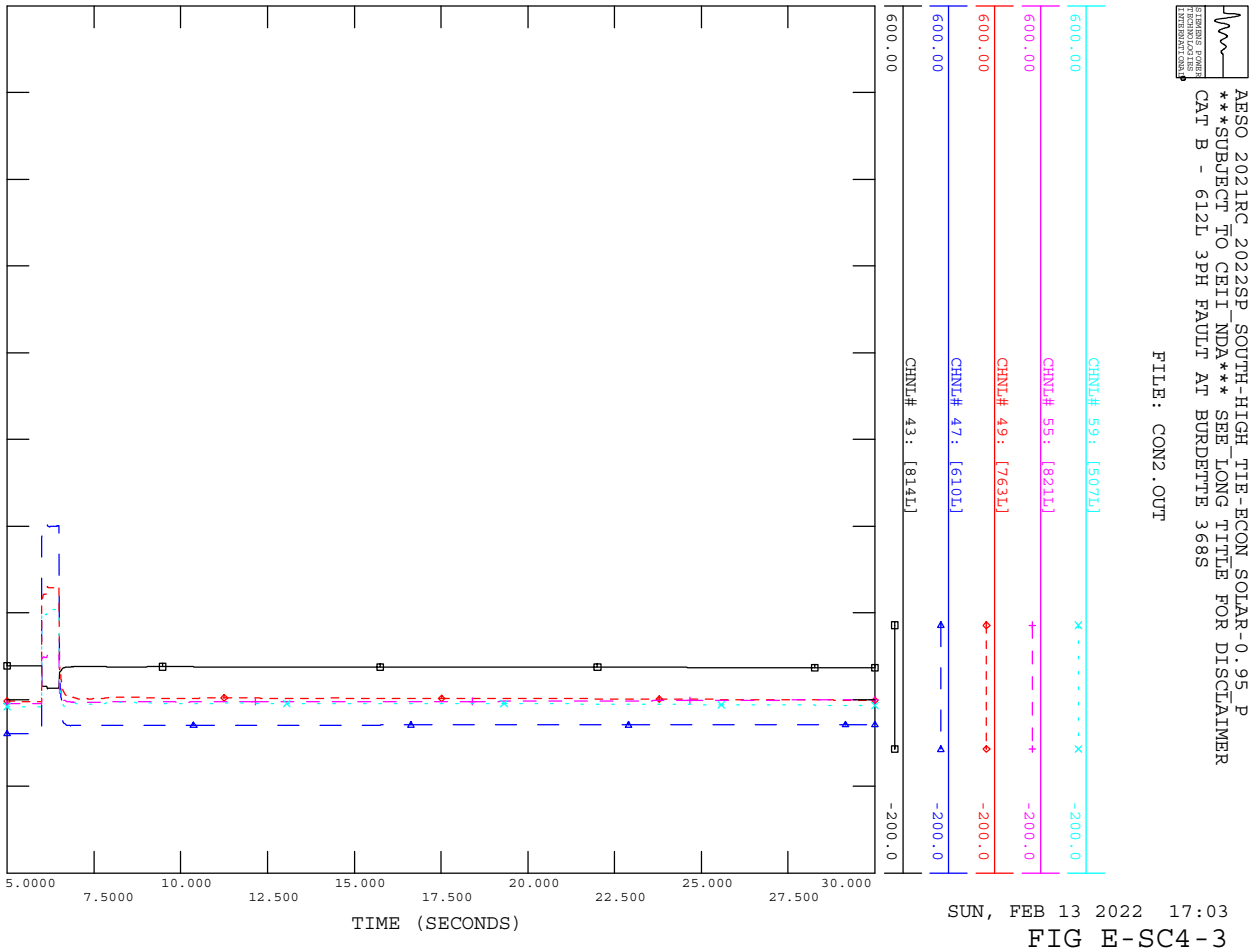


FIG E-SC4-3

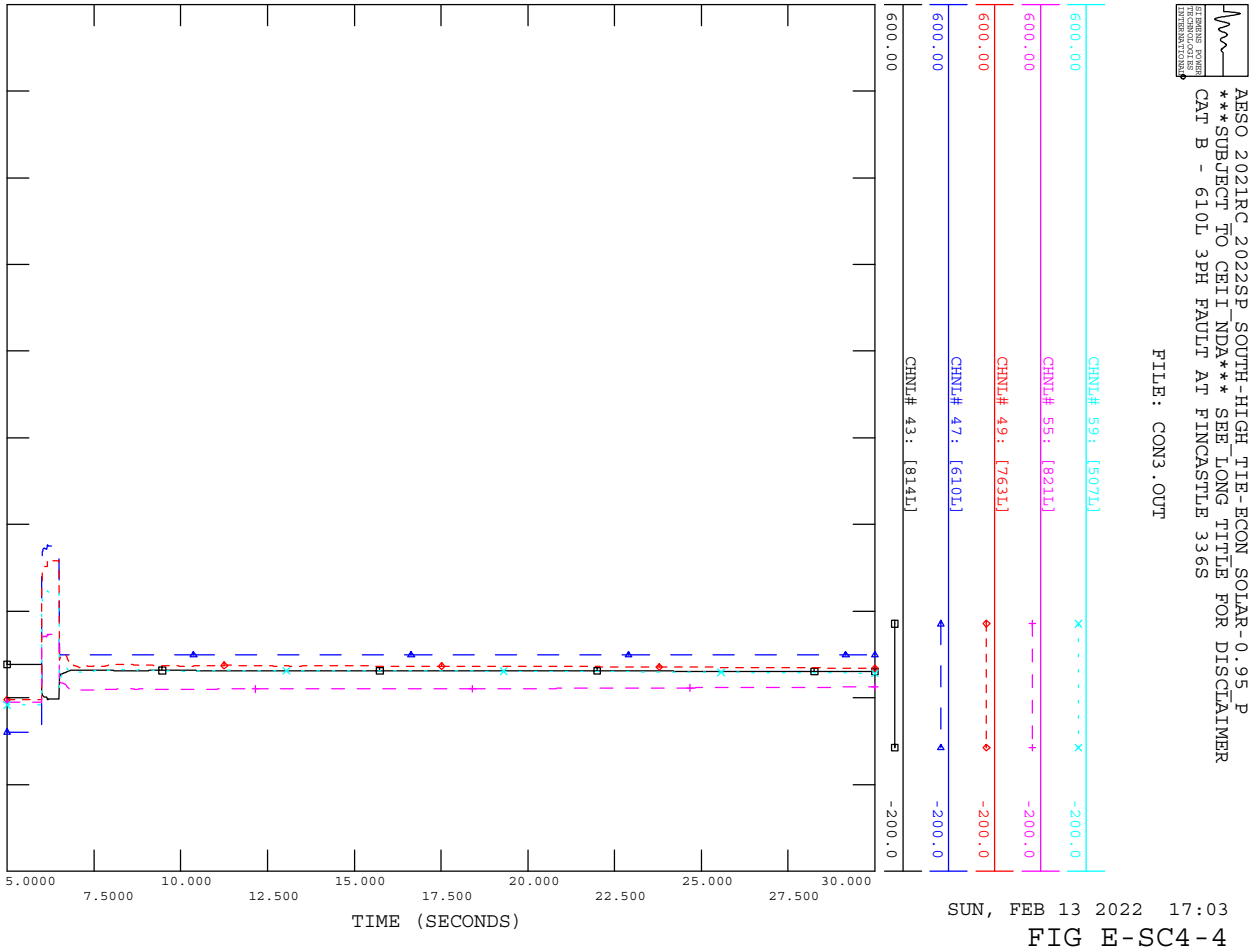
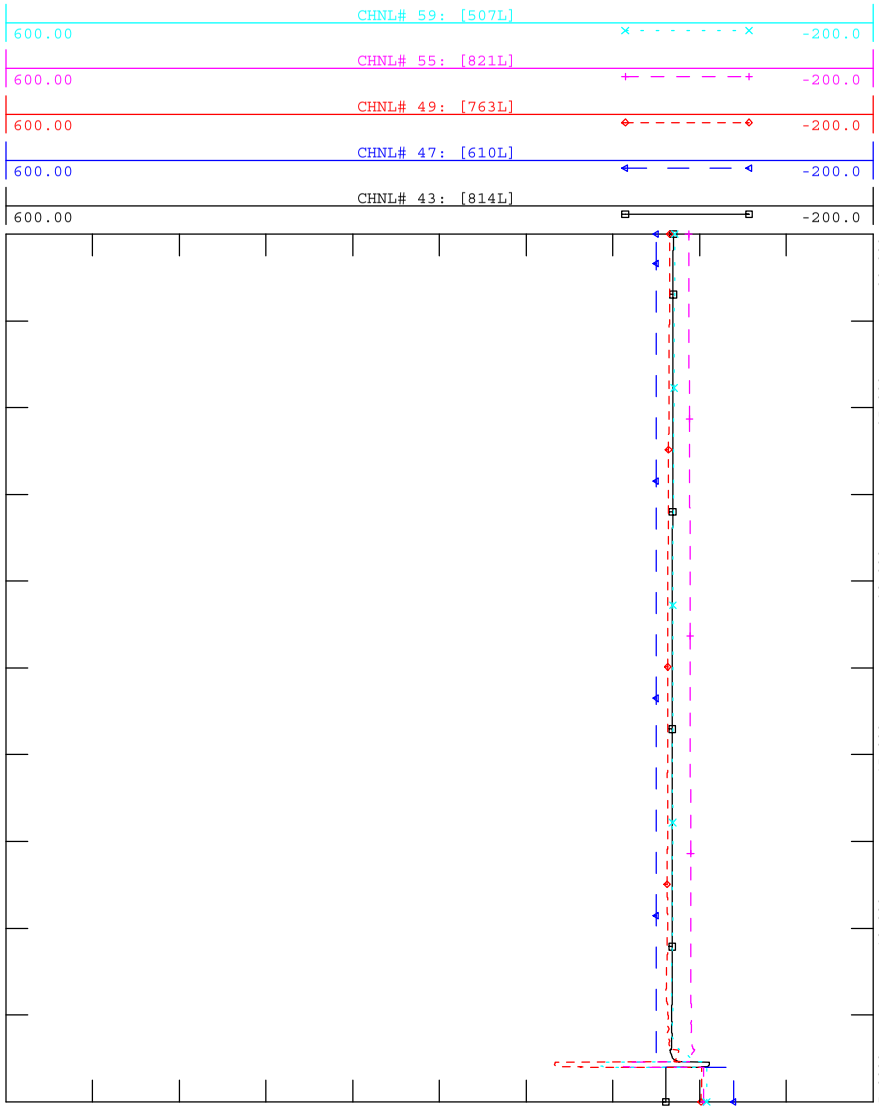


FIG E-SC4-4

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 610L 3PH FAULT AT TABER 83S

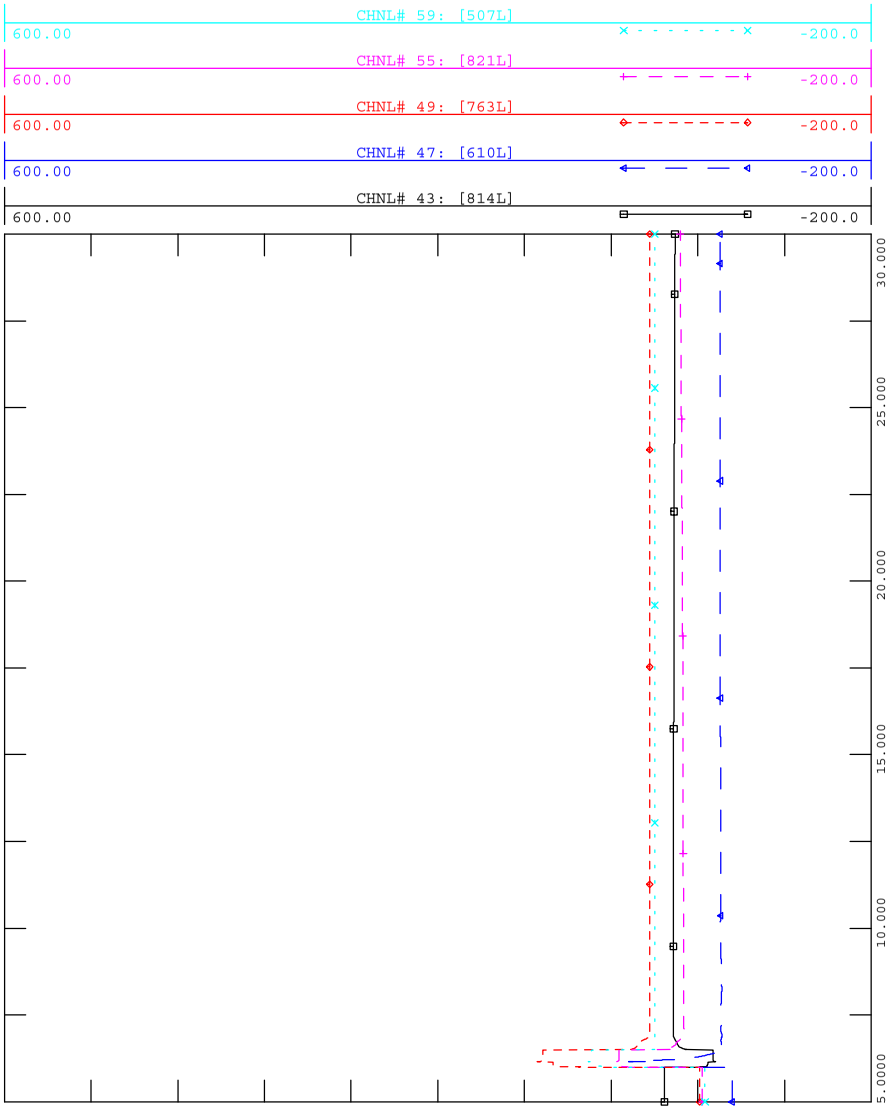
FILE: CON4.OUT



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FIG E-SC4-5

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 507L 3PH FAULT AT TABER 83S

FILE: CON5.OUT



SUN, FEB 13 2022 17:03
FIG E-SC4-6

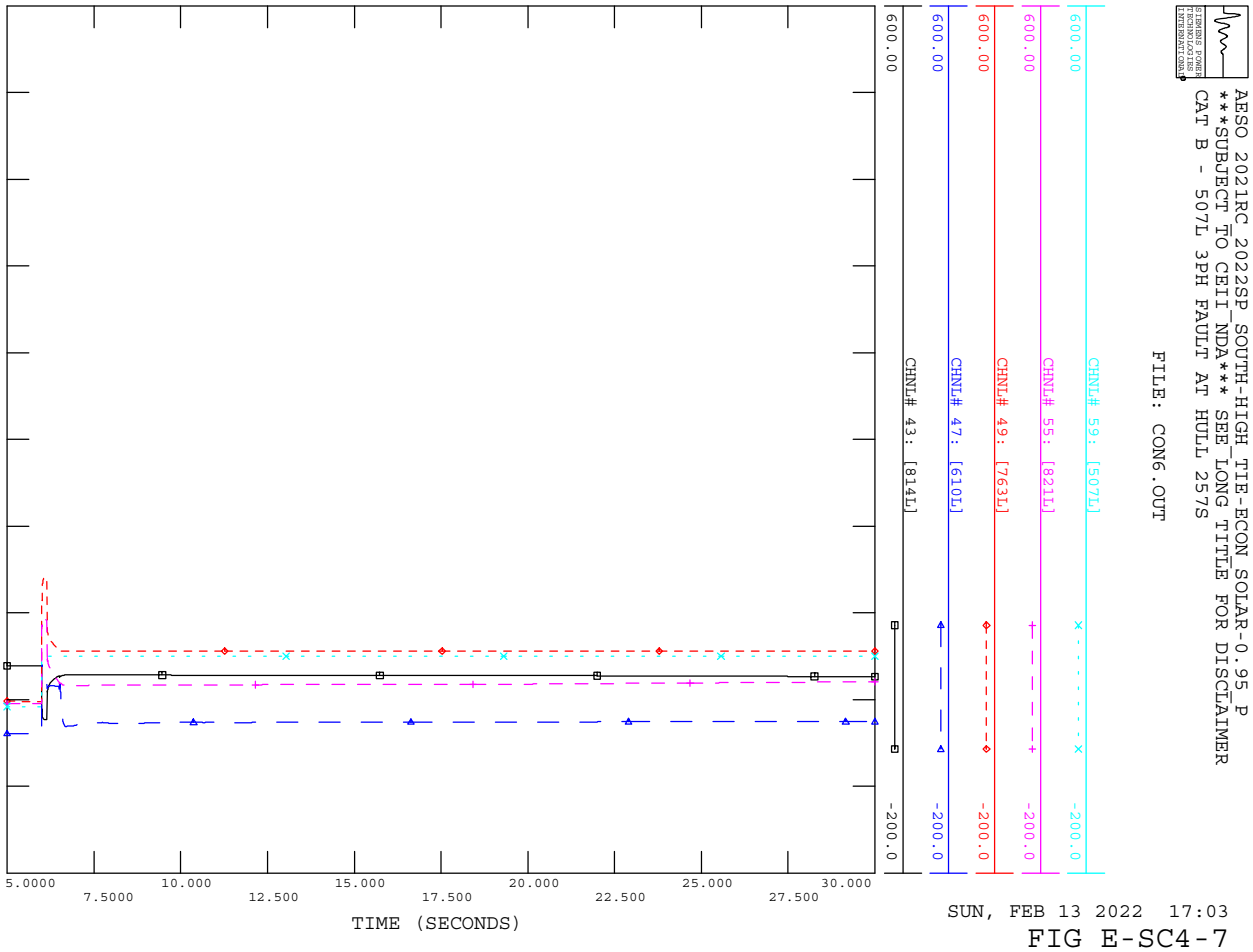


FIG E-SC4-7

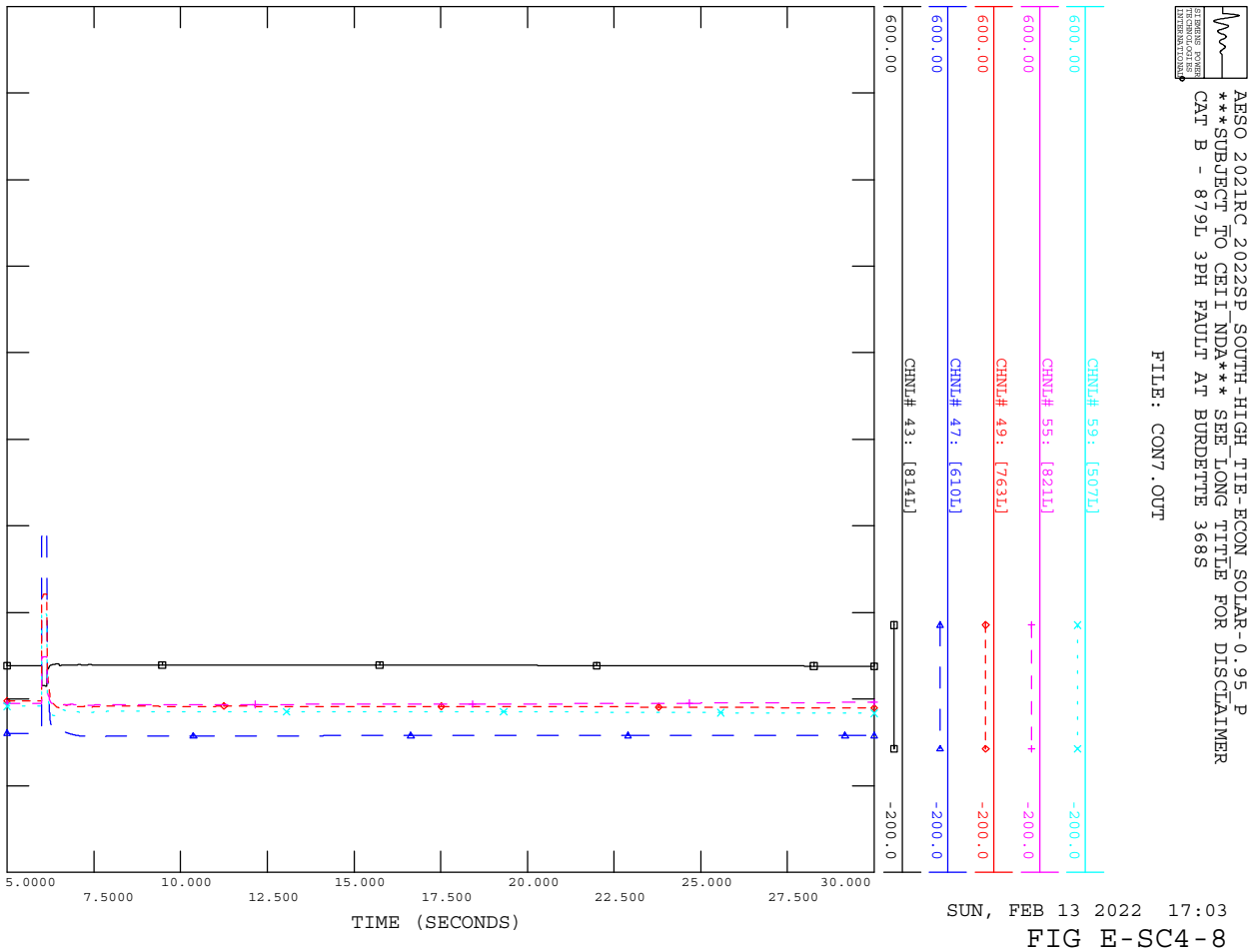


FIG E-SC4-8

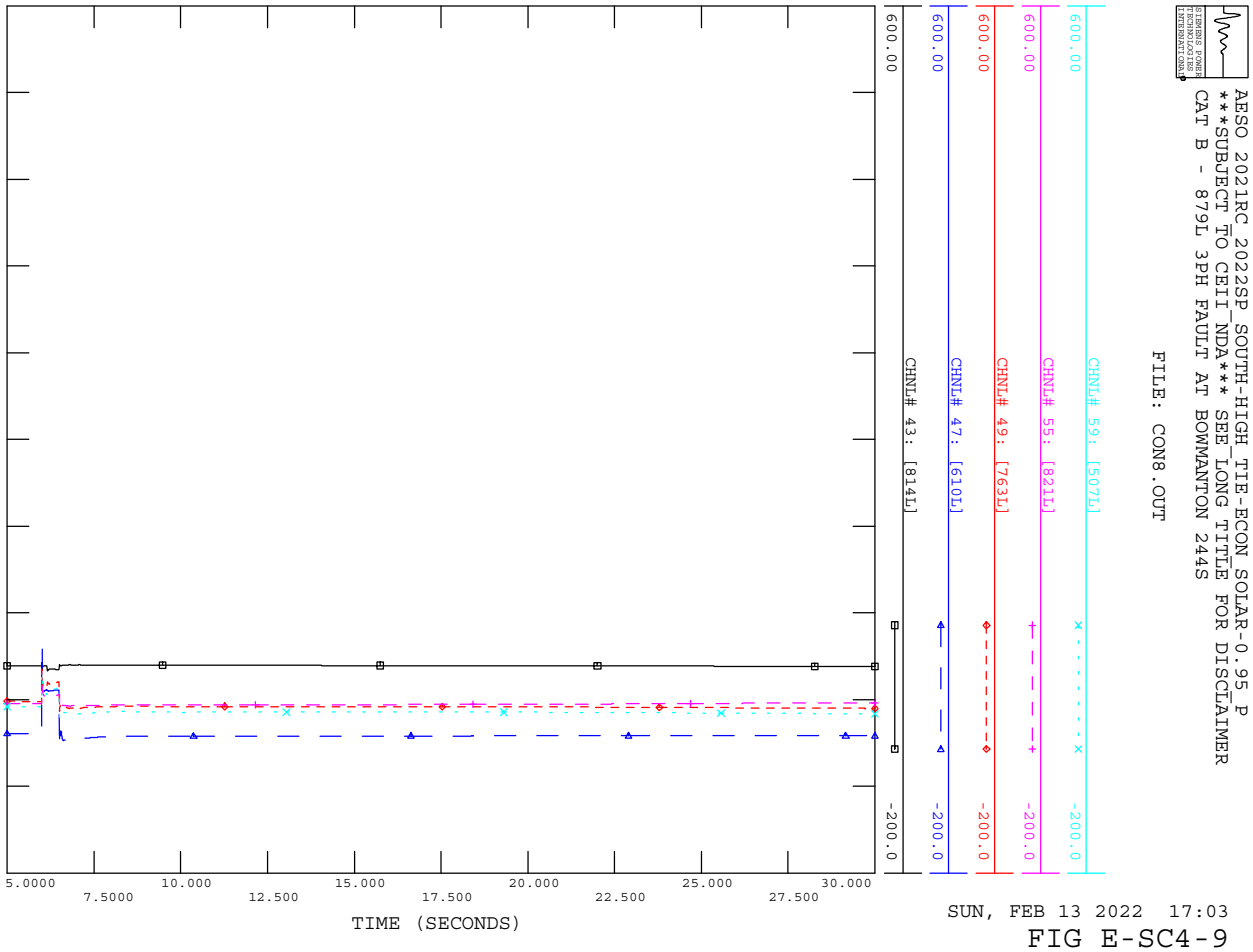


FIG E-SC4-9

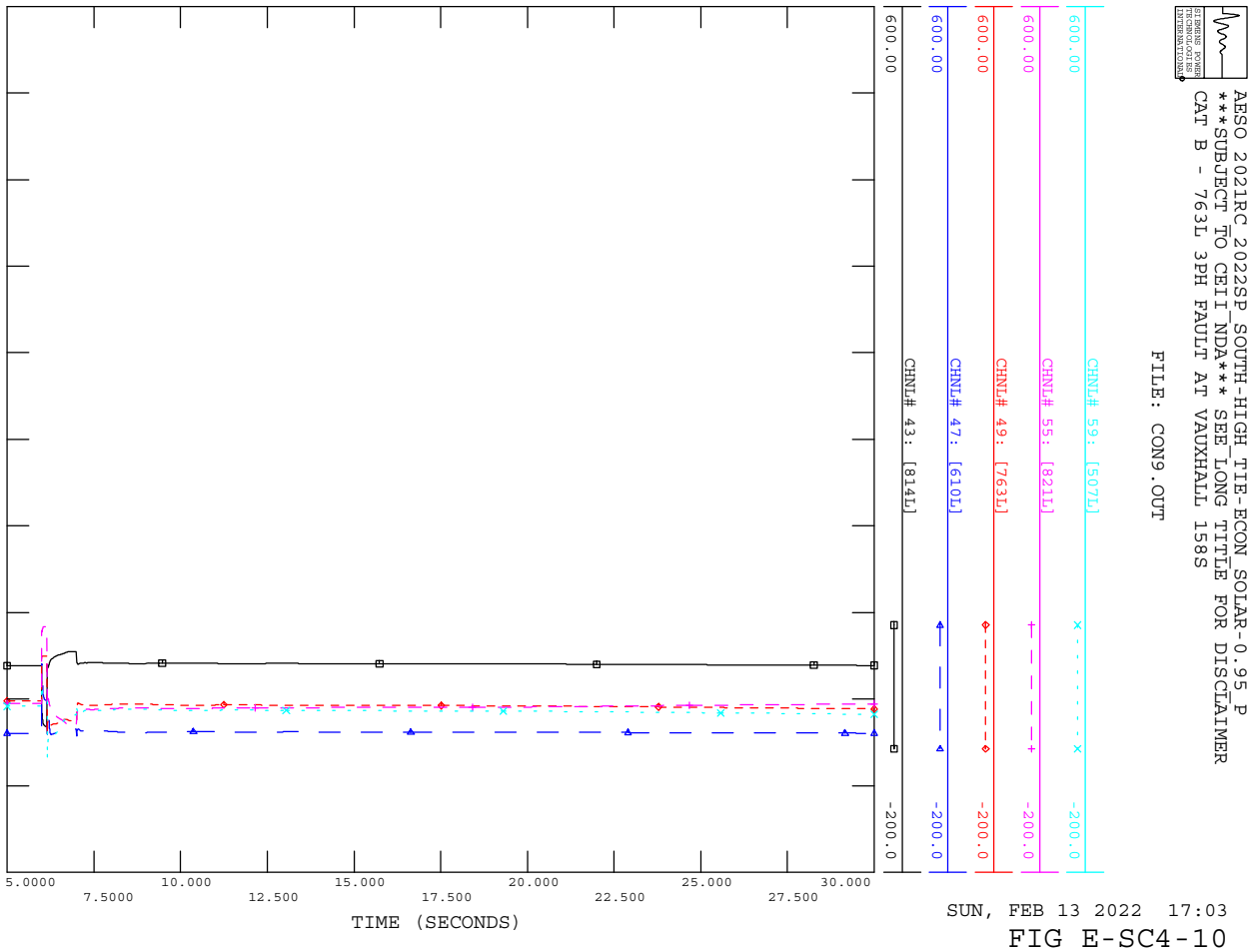


FIG E-SC4-10

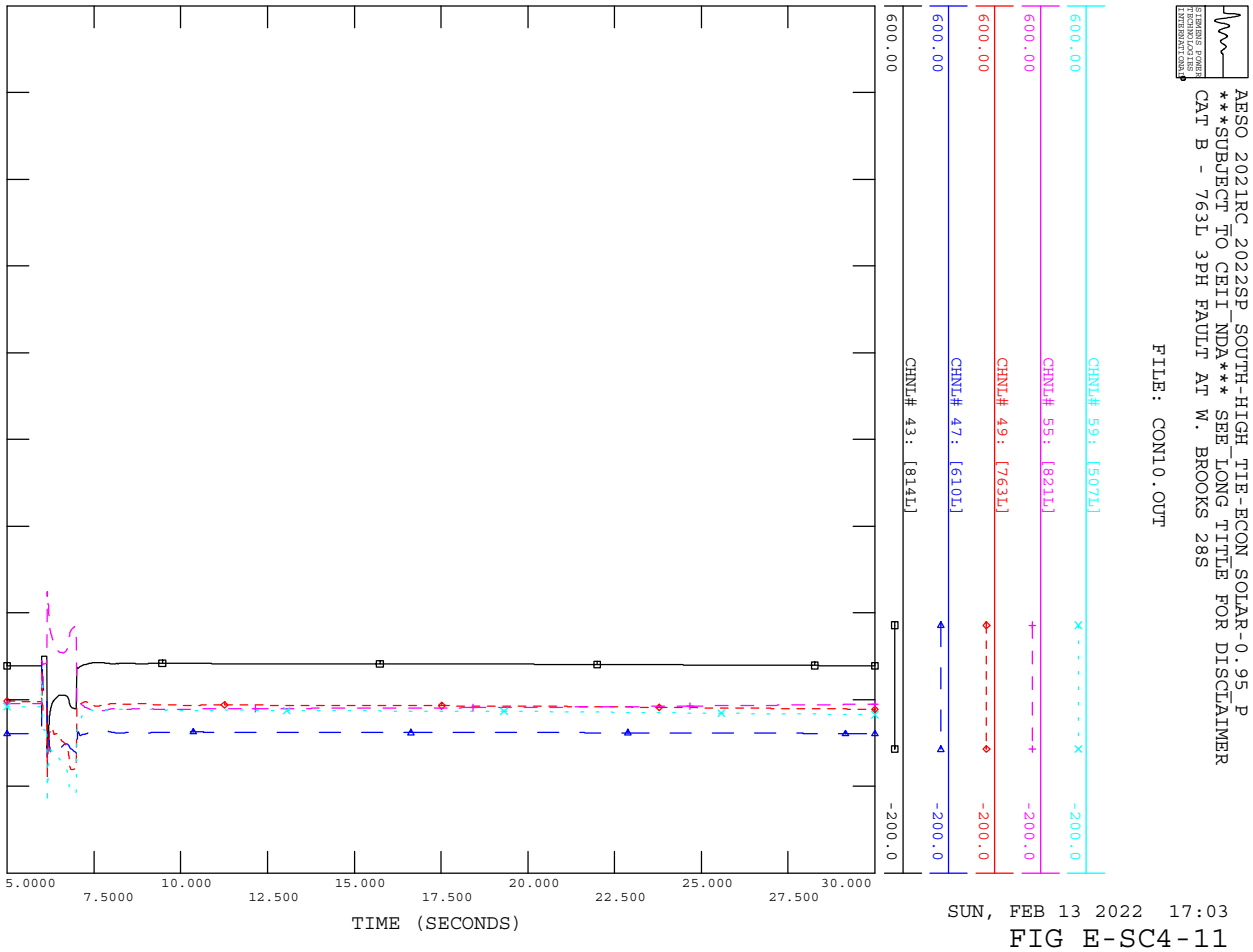


FIG E-SC4-11

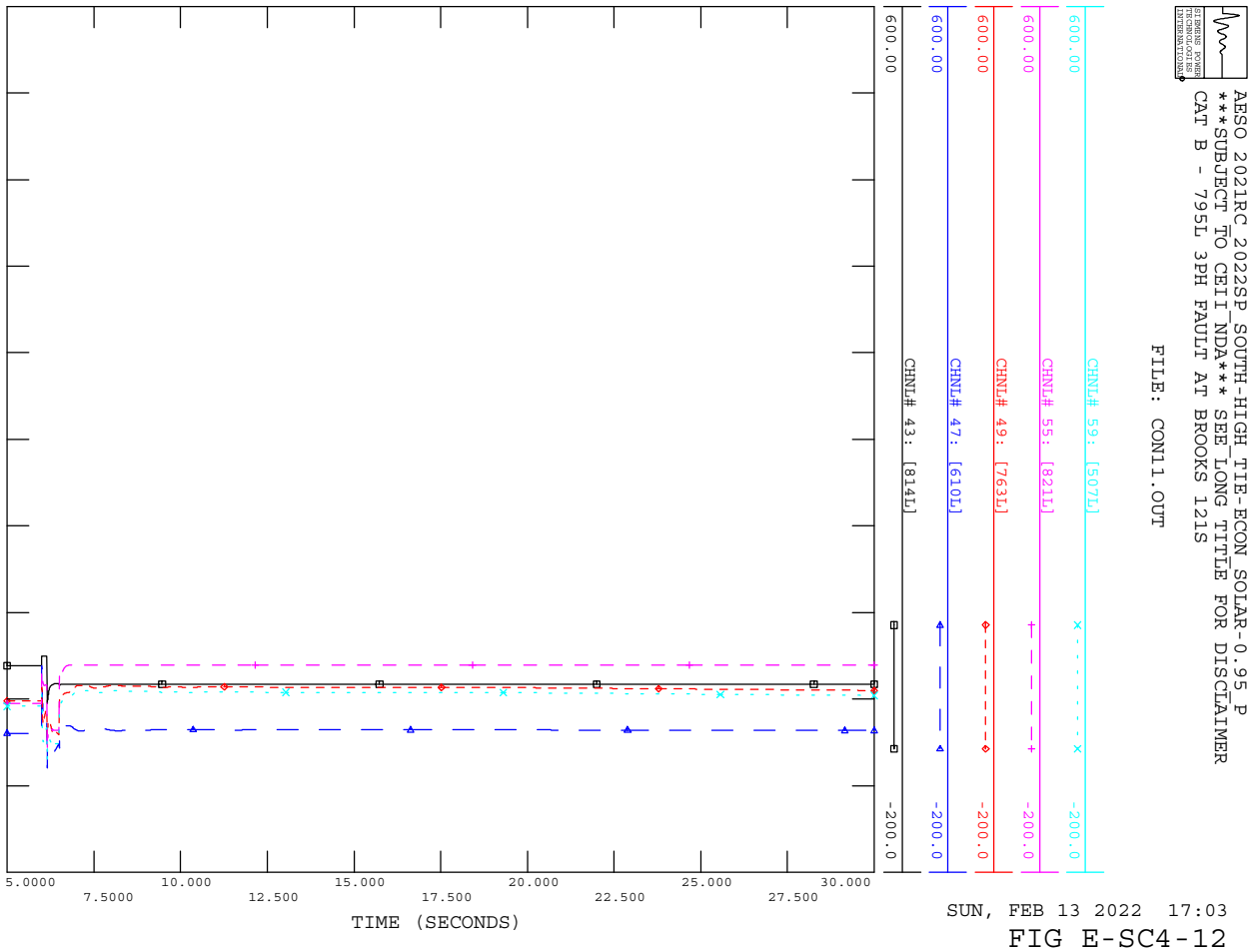


FIG E-SC4-12

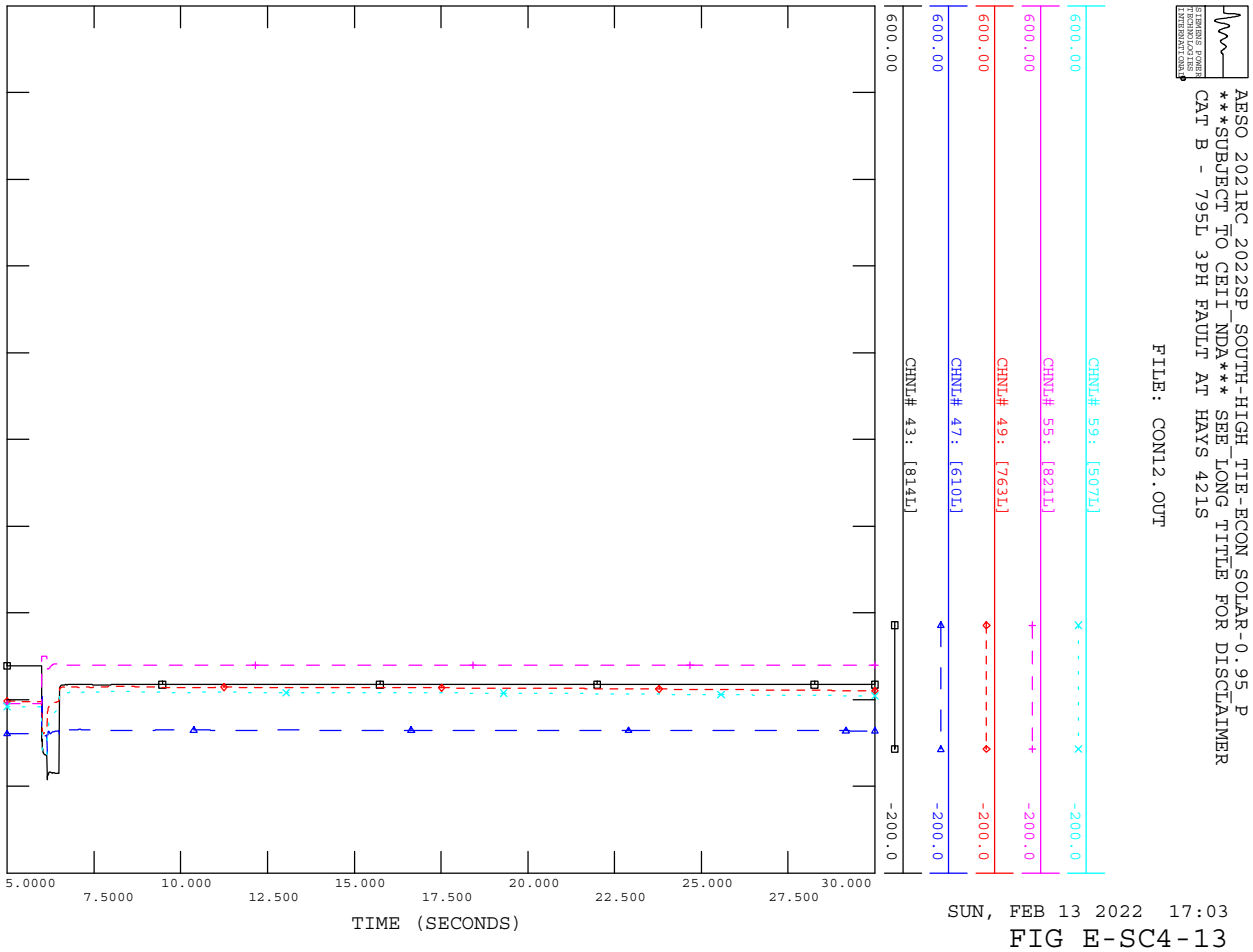


FIG E-SC4-13

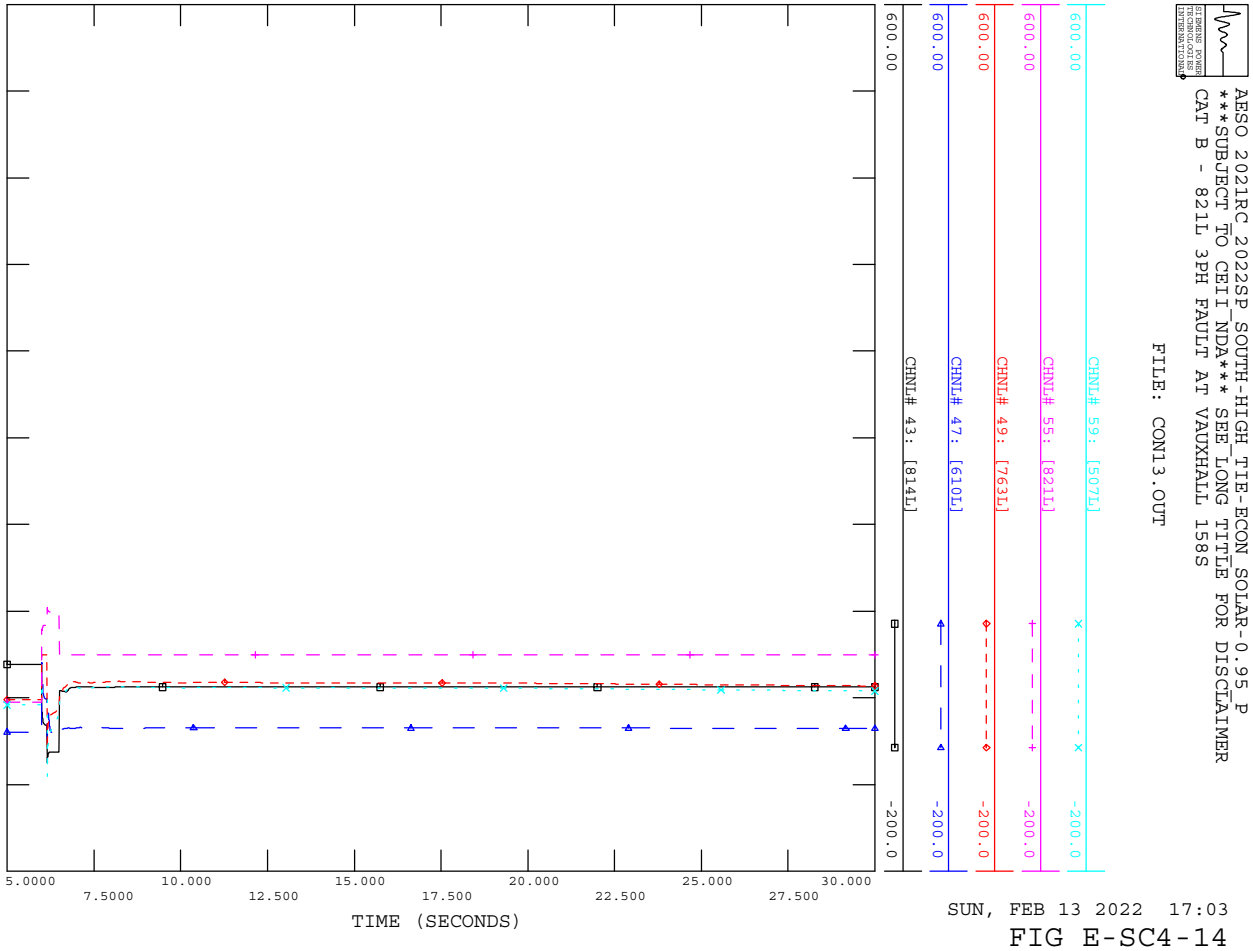


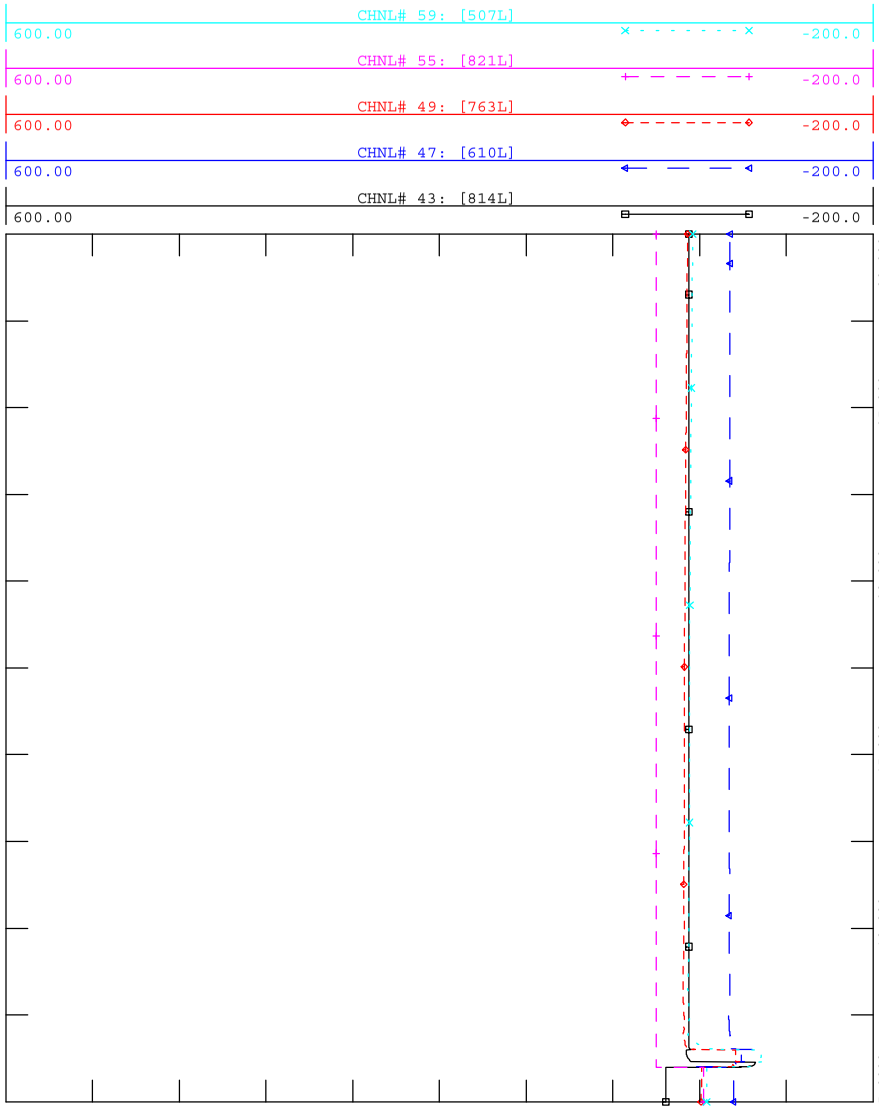
FIG E-SC4-14

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
CAT B - 821L 3PH FAULT AT HAYS 421S

FILE: CON14.OUT

SUN, FEB 13 2022 17:03

FIG E-SC4-15



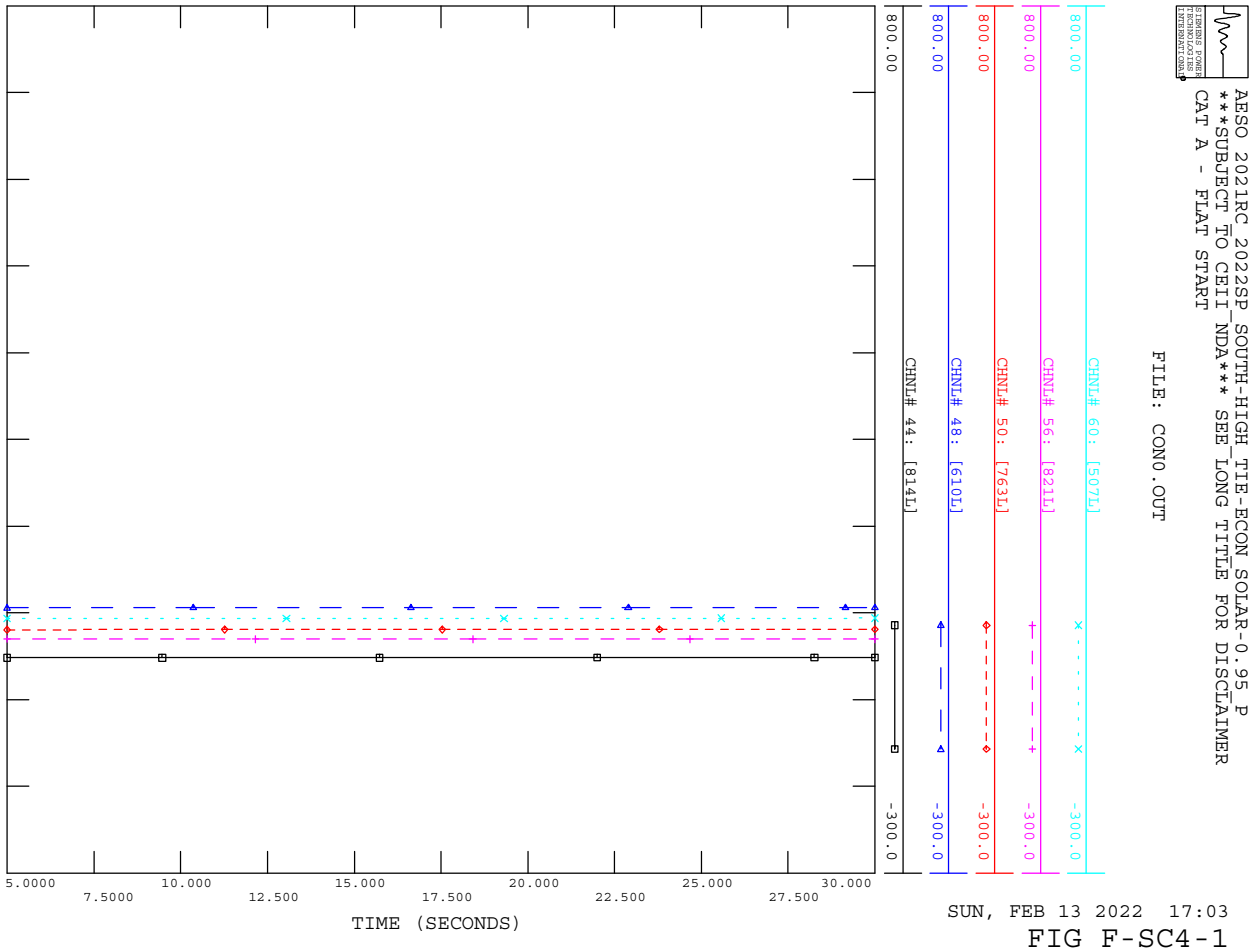


FIG F-SC4-1

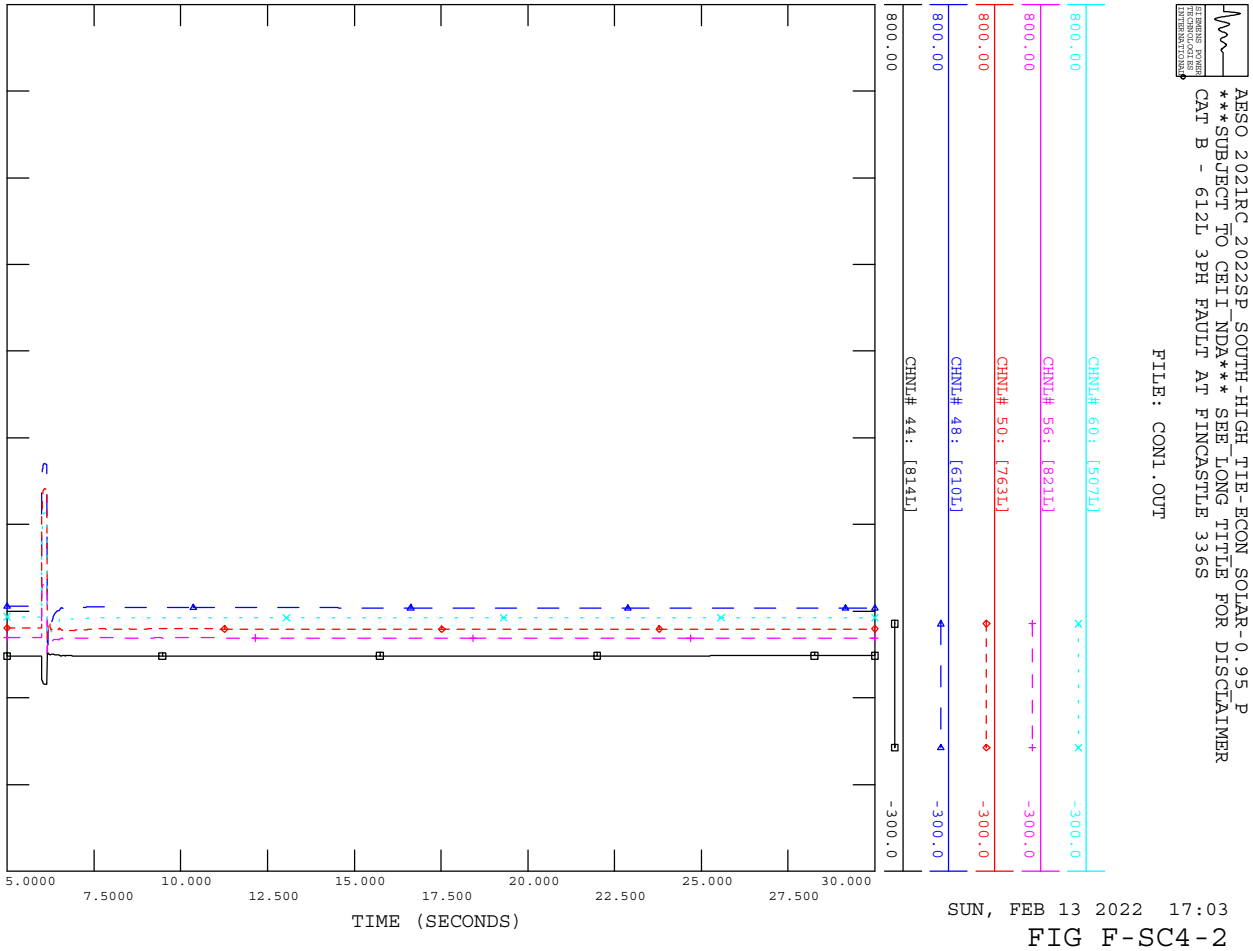


FIG F-SC4-2

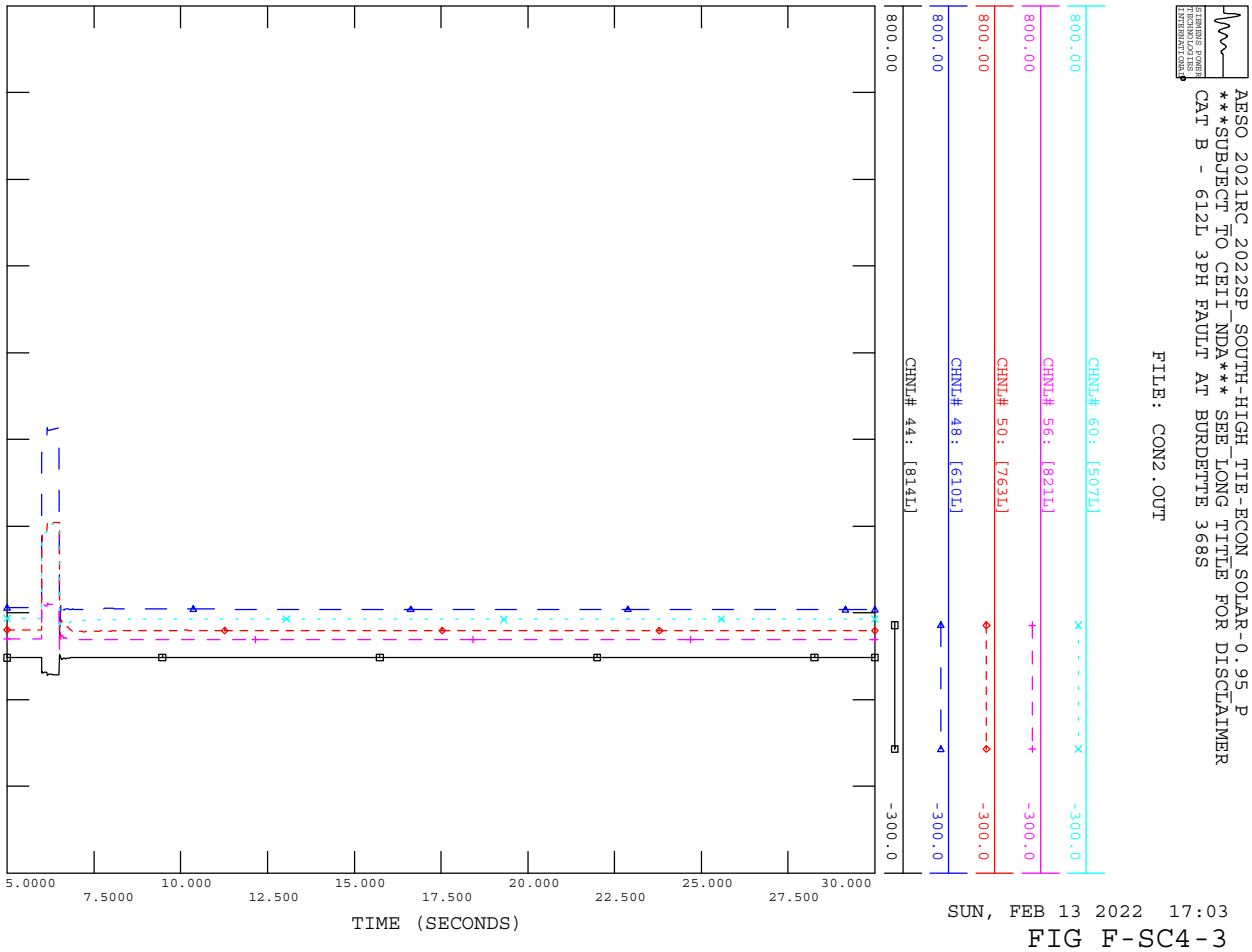


FIG F-SC4-3

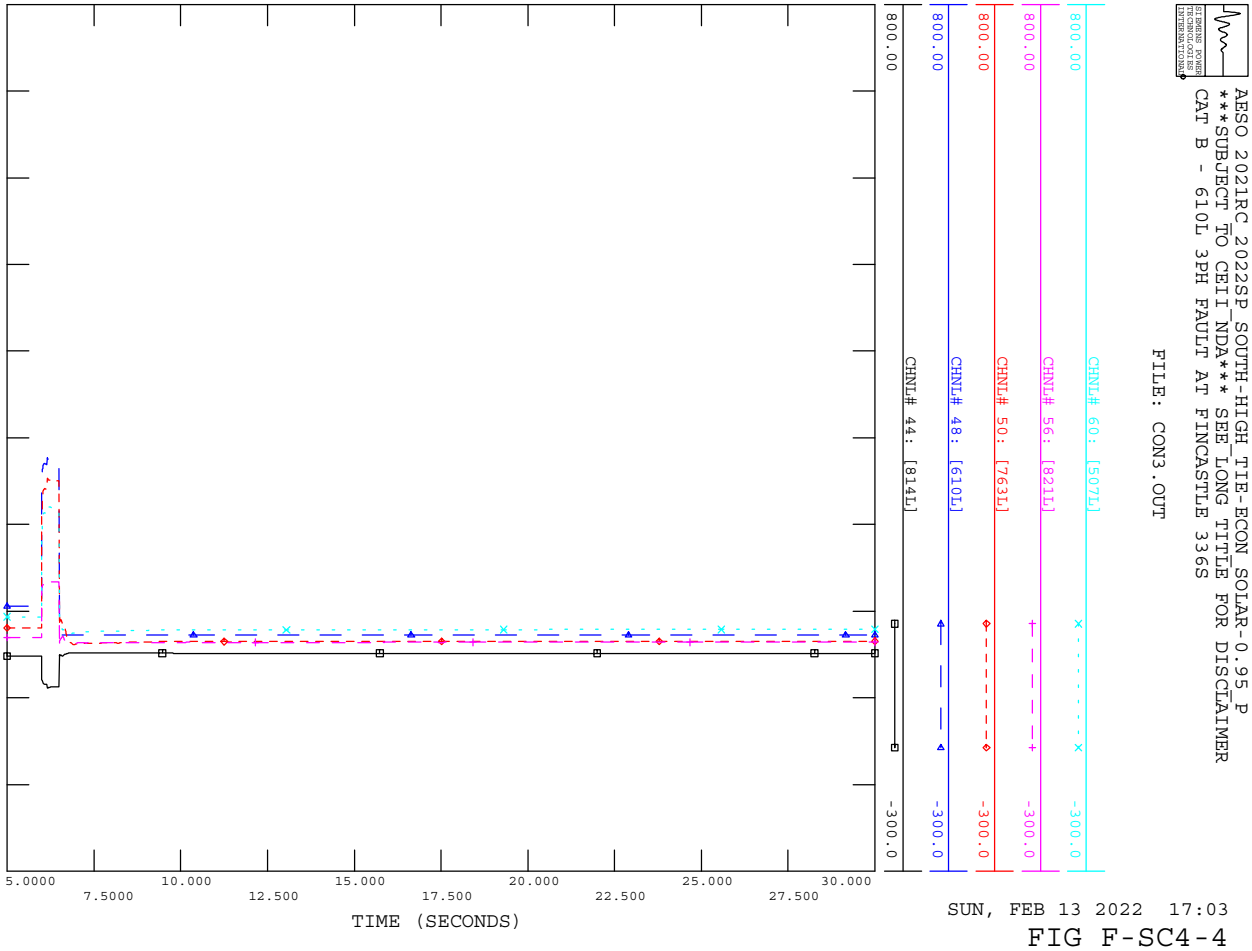


FIG F-SC4-4

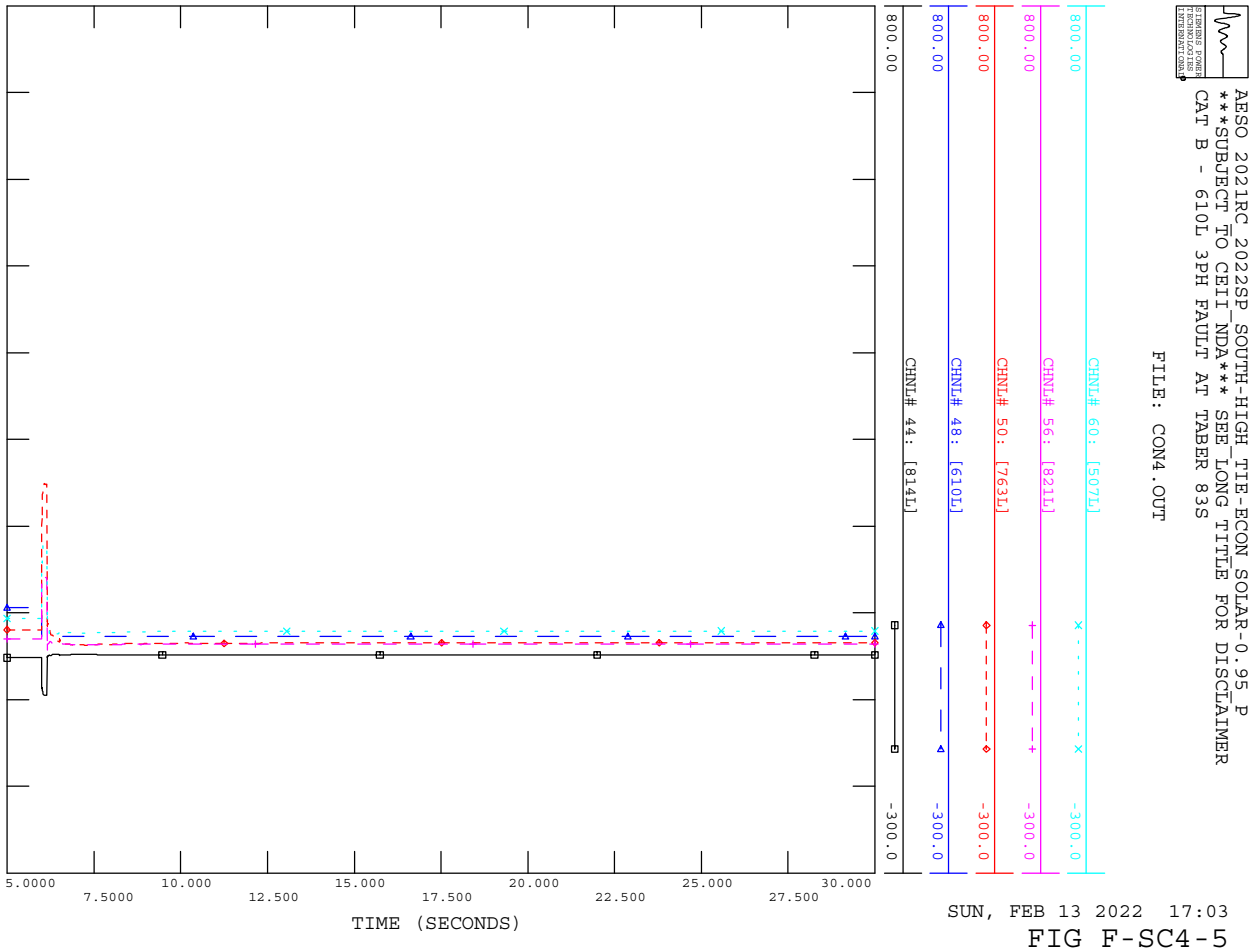


FIG F-SC4-5

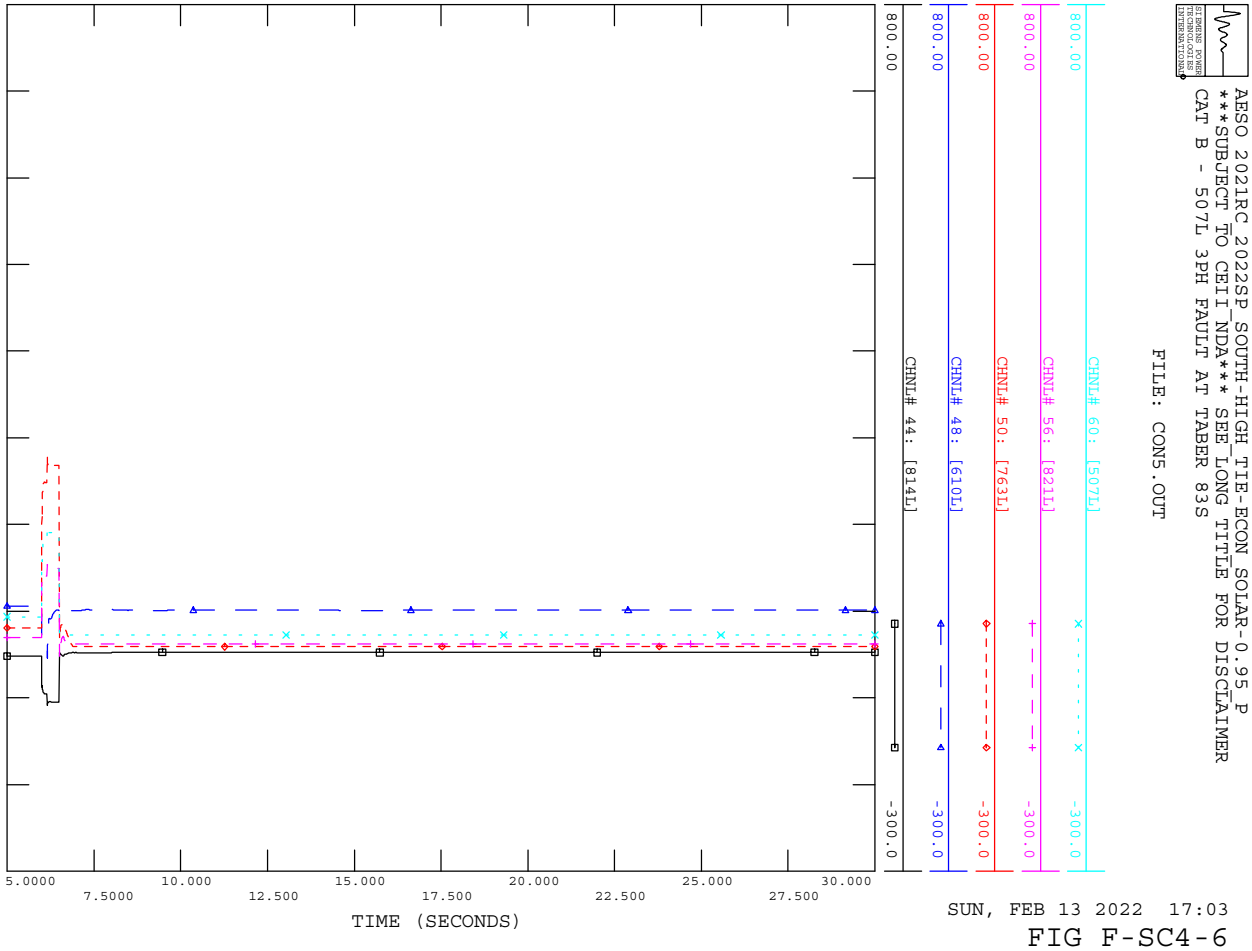


FIG F-SC4-6

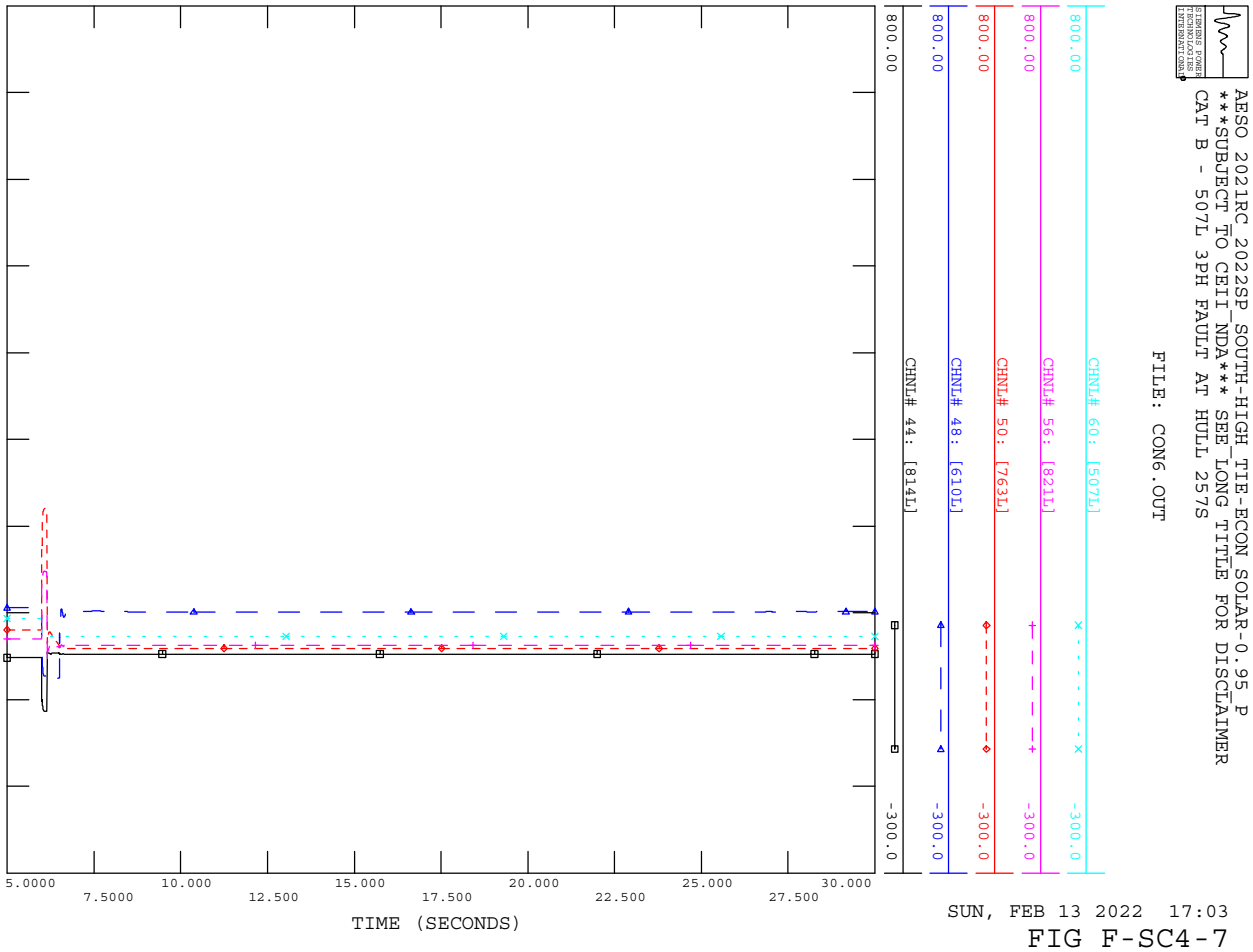


FIG F-SC4-7

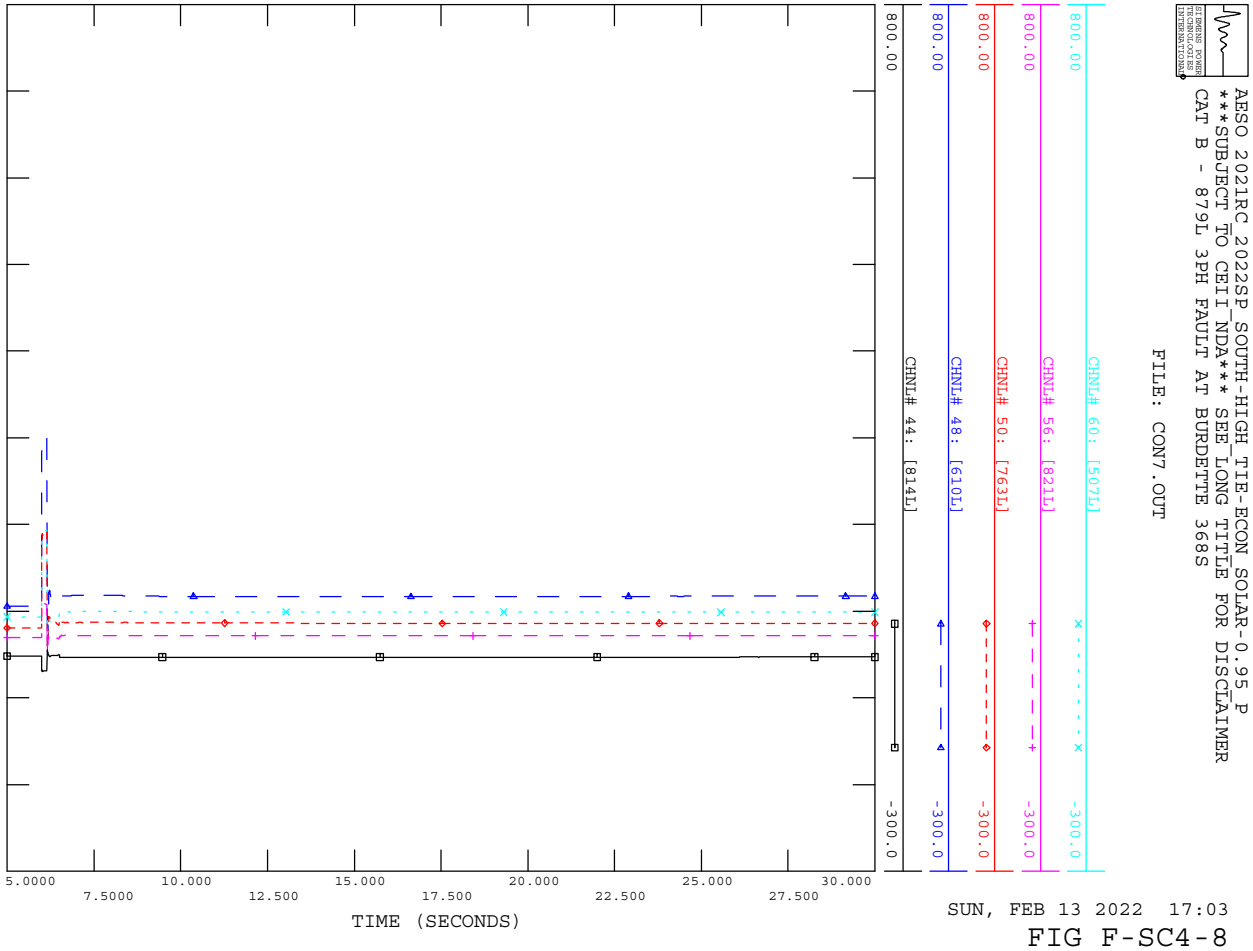


FIG F-SC4-8

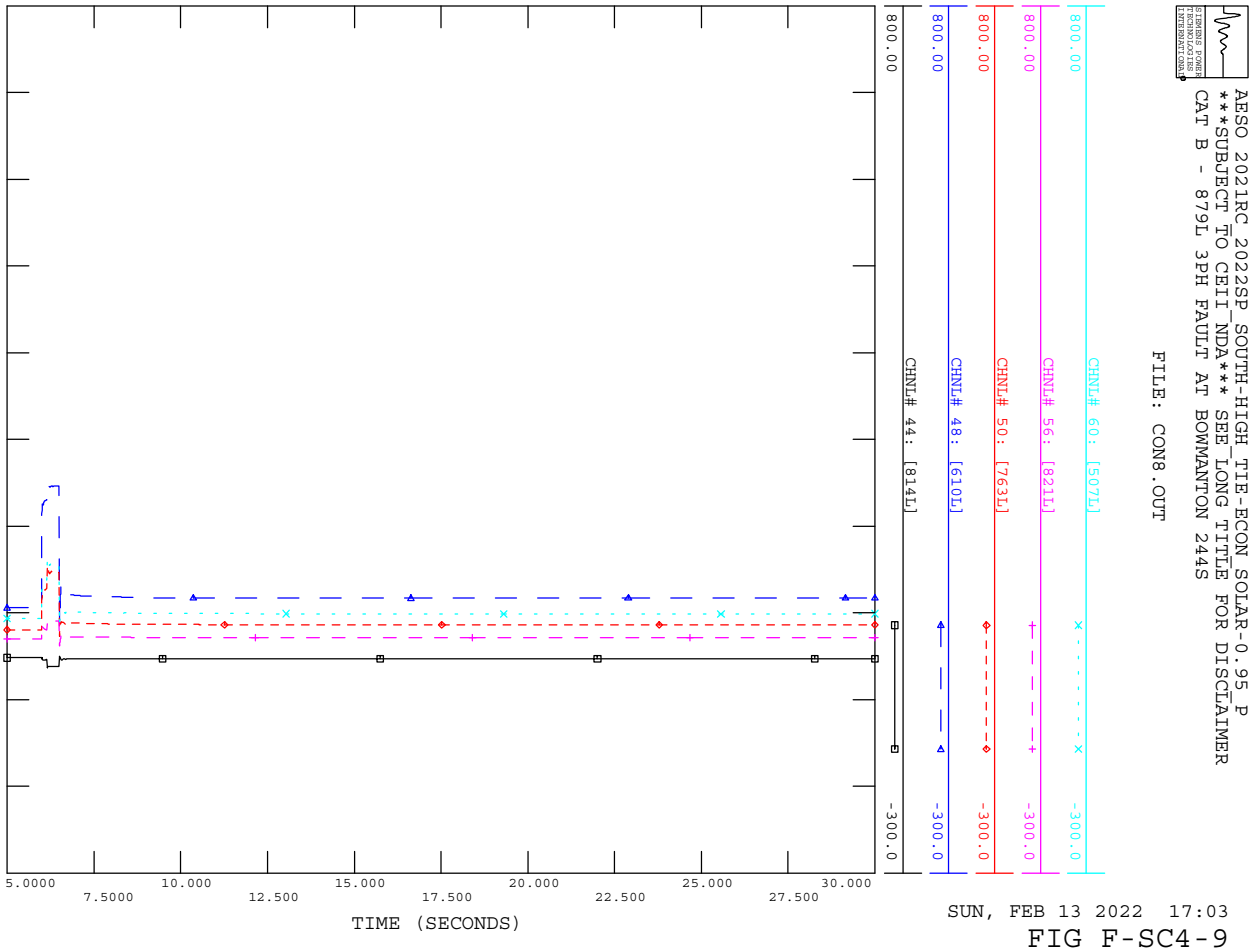


FIG F-SC4-9

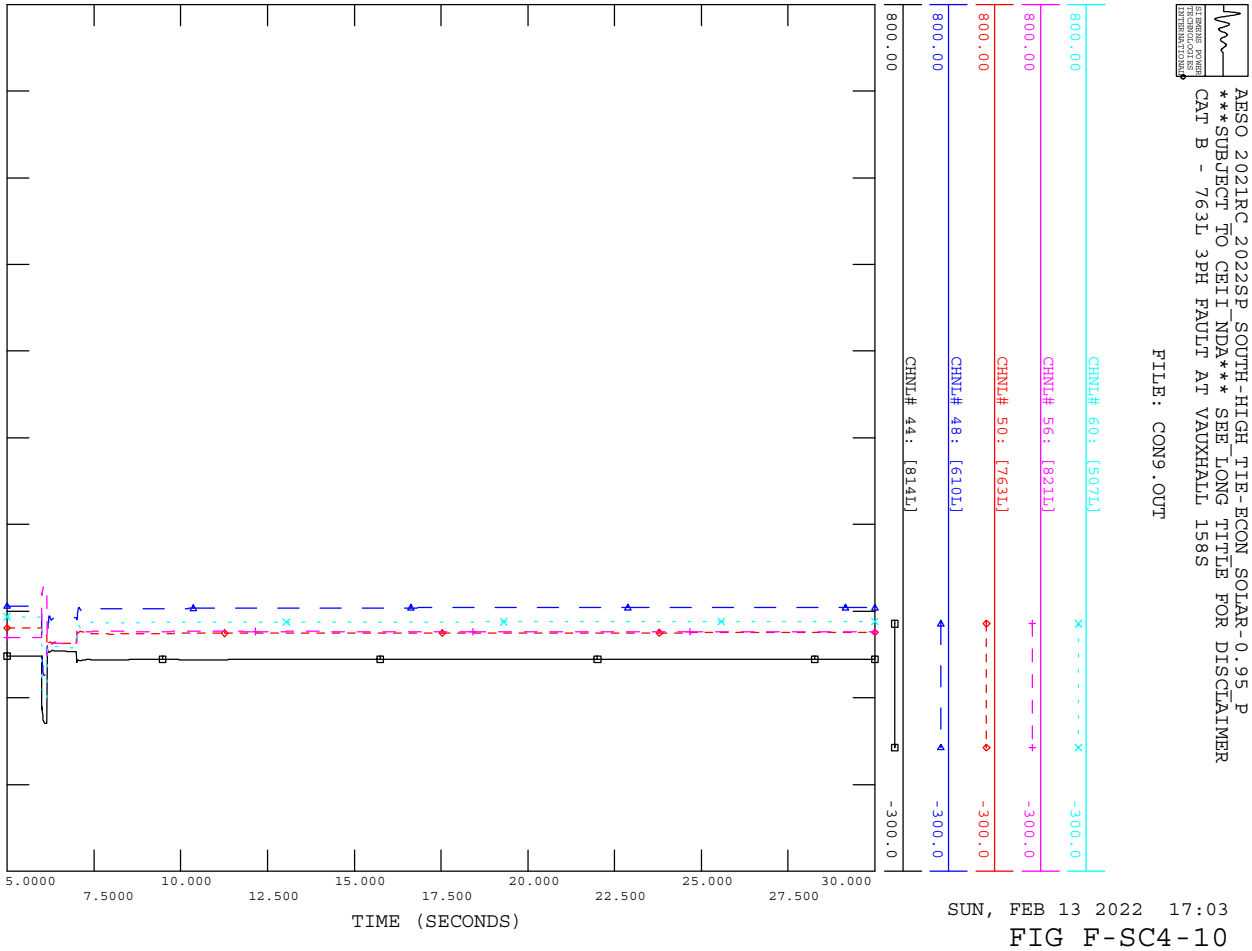


FIG F-SC4-10

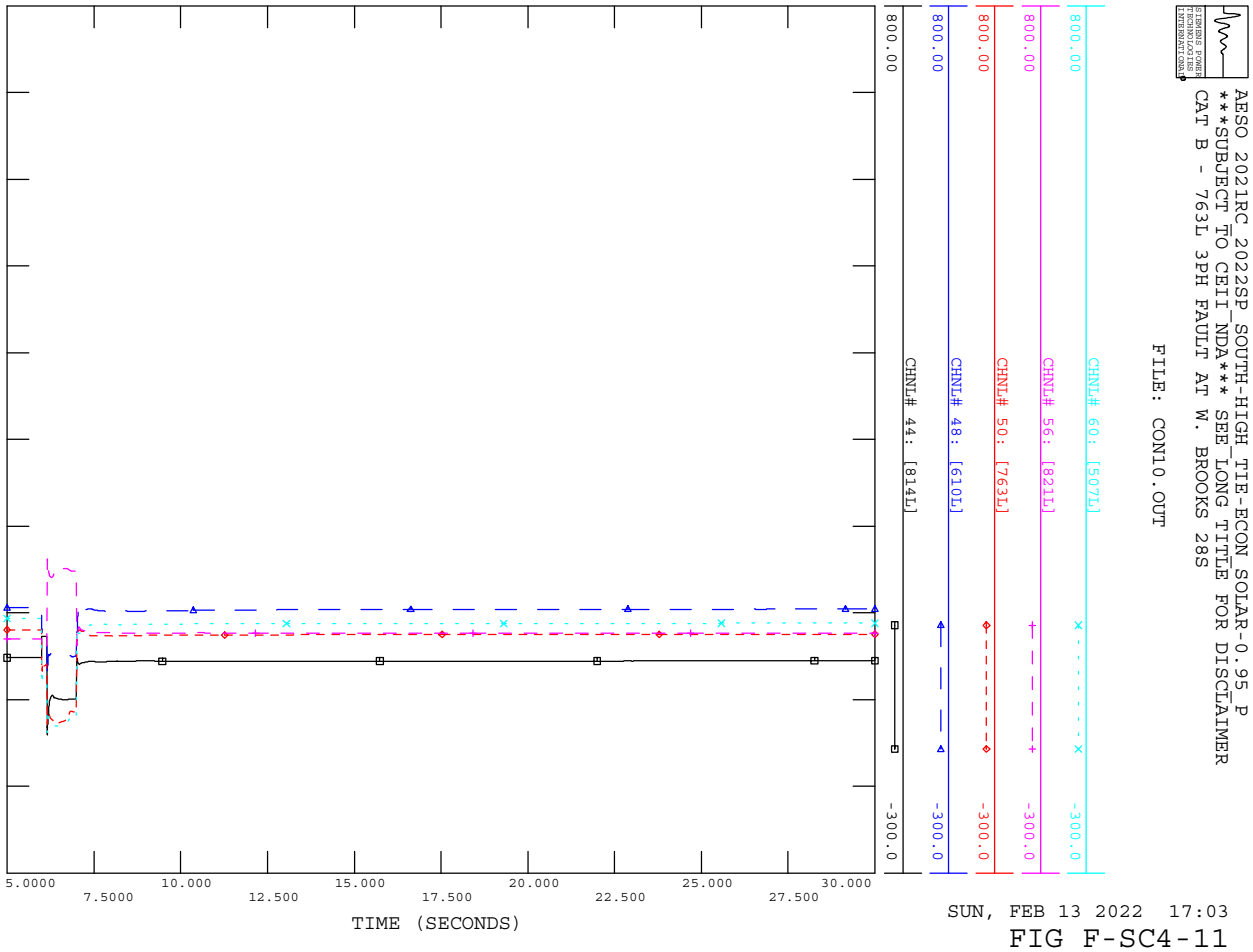


FIG F-SC4-11

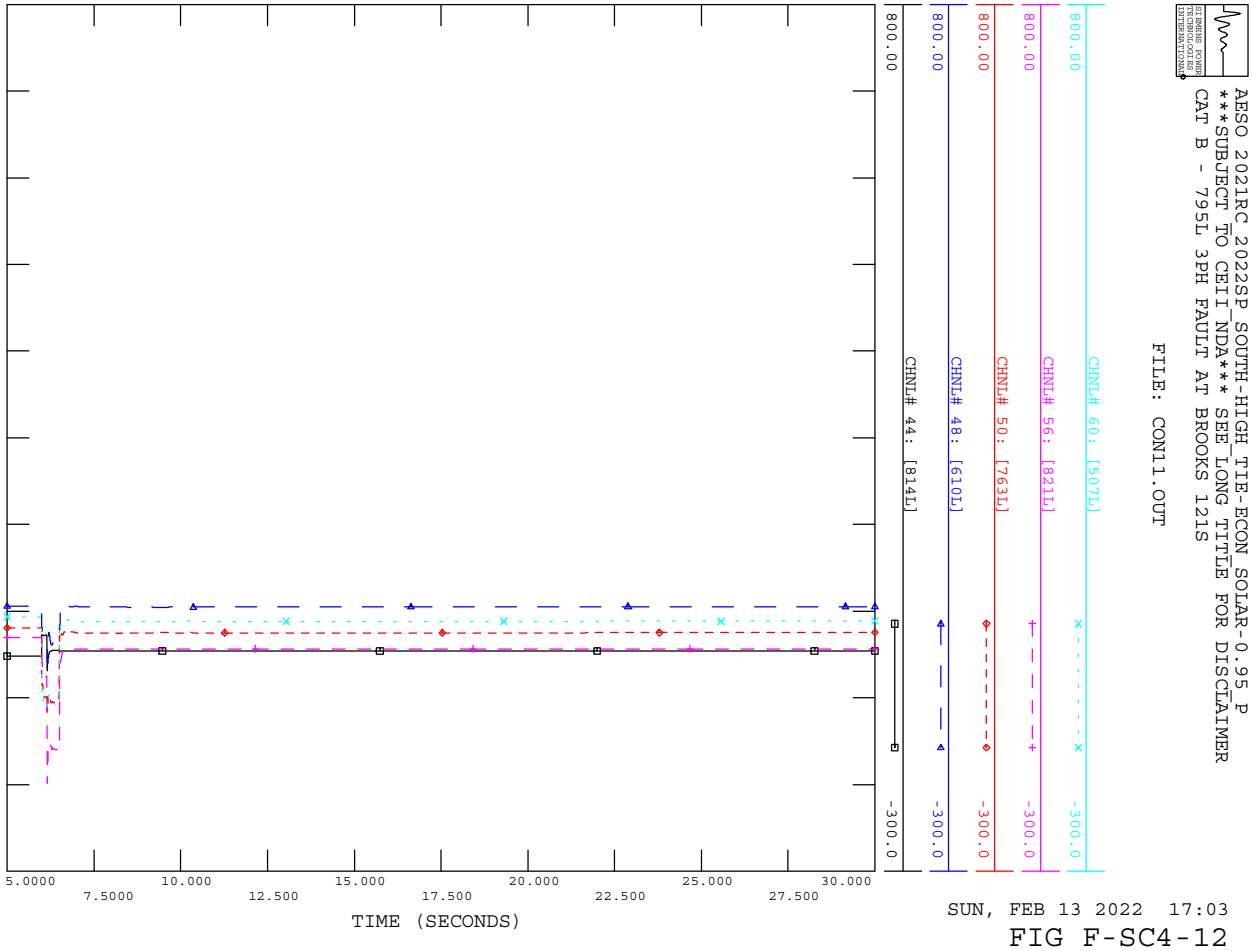


FIG F-SC4-12

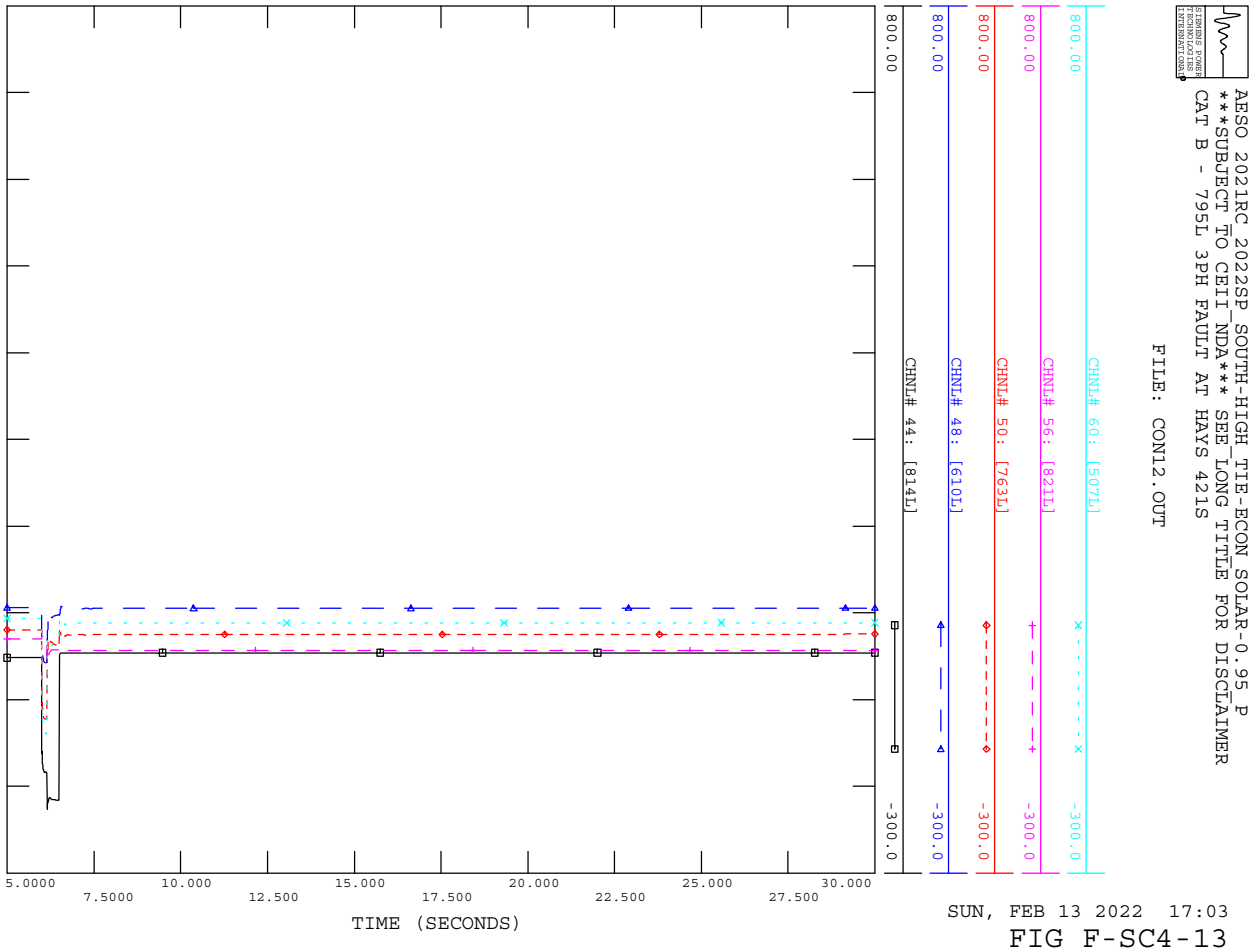


FIG F-SC4-13

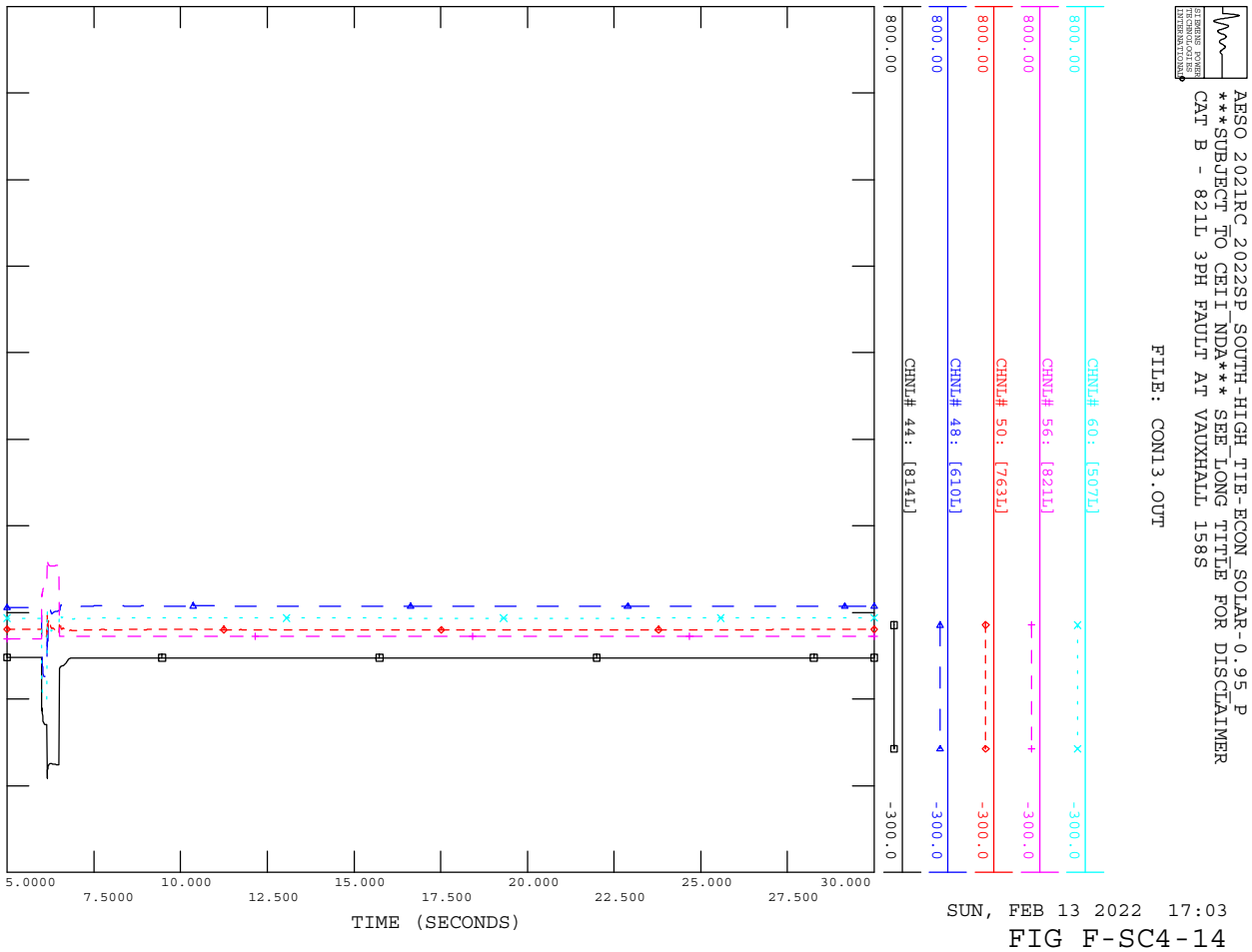


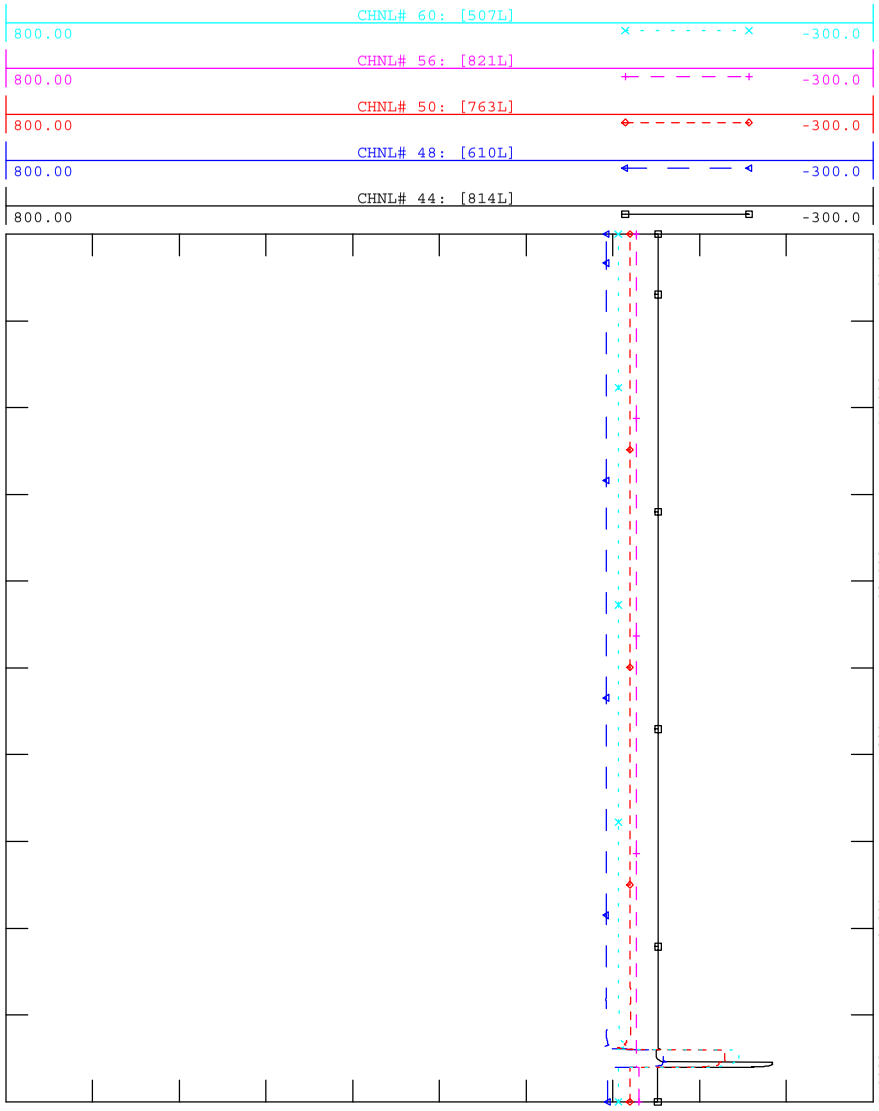
FIG F-SC4-14

AESO 2021RC_2022SP_SOUTH-HIGH_TIE-ECON_SOLAR-0.95_P
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CAT B - 821L 3PH FAULT AT HAYS 421S

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FIG F-SC4-15



Attachment A5
Dynamic Data and Assumptions

Study Area load representation assumed for the transient studies is in Table A5-1

Table A5-1: Transient Stability Analysis Load Representation

Planning Areas	% of load specified as Large Motors	% of load specified as Small Motors	The Remainder of the Load (excluding Motor loads)	
			Active Power	Reactive Power
			Constant Current	Constant Impedance
Areas in NW and NE regions	*40%*	*30%*	*100%*	*100%*
Areas in other regions	*10%*	*10%*	*100%*	*100%*

The subsequent tables below are the dynamic data for the generator modelling used to conduct studies for this project:

Table A5-2: REGCAU1

Wind Turbine Dynamic Data (REGCAU1 model)											
Tg	**Rrpwr**	**Brkpt**	**Zerox**	**Lvpl1**	**Volim**	**Lvpnt1**	**Lvpnt0**	**Iolim**	**Tfltr**	**Khv**	**Iqrmax**
0.02	1.4	0.9	0.5	1.1	1.1	0.05	0.01	-1.0	0.01	2.0	20.0
Iqrmin	**Accel**	**M**									
-20.0	0.7	1									

Table A5-3: REECBU1

Wind Turbine Dynamic Data (REECAU1 model)											
Vdip (pu)	**Vup (pu)**	**Trv (s)**	**dbd1 (pu)**	**dbd2 (pu)**	**Kqv (pu)**	**Iqhl (pu)**	**Iqll (pu)**	**Vref0 (pu)**	**Tp (s)**	**QMax (pu)**	**QMin (pu)**
0.9	1.1	0.01	-0.1	0.1	2.0	1.0	-1.0	1.0	0.01	0.6	-0.6
VMAX (pu)	**VMIN (pu)**	**Kqp (pu)**	**Kqi (pu)**	**Kvp (pu)**	**Kvi (pu)**	**Tiq (s)**	**dPmax**	**dPmin**	**PMAX (pu)**	**PMIN (pu)**	**Imax (pu)**
1.15	0.85	1.0	1.0	1.0	1.0	0.01	1.0	-1.0	1.0	0.0	1.0
Tpord (s)	**M**	**M1**	**M2**	**M3**	**M4**						
0.01	0	0	1	0	0						

Table A5-4: REPCTAU1

Wind Turbine Dynamic Data (REPCTAU1 model)											
Tfltr	**Kp**	**Ki**	**Tft**	**Tfv**	**Vfrz**	**Rc**	**Xc**	**Kc**	**emax**	**emin**	**dbd1**
0.1	0.1	0.5	0.0	0.1	0.9	0.0019	0.007	0.04	999.0	-999.0	0.0
dbd2	**Qmax**	**Qmin**	**Kpg**	**Kig**	**Tp**	**fdbd1**	**Fdbd2**	**femax**	**femin**	**Pmax**	**Pmin**
0.0	0.6	-0.6	0.1	0.2	0.1	0.0	0.0	999.0	-999.0	1.0	0.0
Tg	**Ddn**	**Dup**	**M**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**		
0.1	0.0	0.0	0	0	0	0	0	1	0		

Attachment A6
Post-Mitigation Power Flow Diagrams

Table A6: Post-Mitigation Power Flow Diagram for Summer Light Scenario 3

Figure	Contingency	RAS Action
A6-SC3-1	158S VAUXHALL TRANSFORMER T1 (Hull 257S - Vauxhall 158S – Hays 421S, Stone 2020S - Vauxhall 158S)	Planned RAS 180
A6-SC3-2	421S HAYS TRANSFORMER T2 (Hays 421S - Vauxhall 158S – West Brooks 28S)	New RAS 195
A6-SC3-3	674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	Planned RAS 181
A6-SC3-4	121S BROOKS TRANSFORMER T2 (Brooks 121S - West Brooks 28S - Hays 421S)	New RAS 195
A6-SC3-5	795L (Brooks 121S - Hays 421S)	New RAS 195
A6-SC3-6	821L (Vauxhall 158S – Hays 421S)	New RAS 195
A6-SC3-7	610L (Fincastle 336S – Taber 83S)	Planned RAS 180

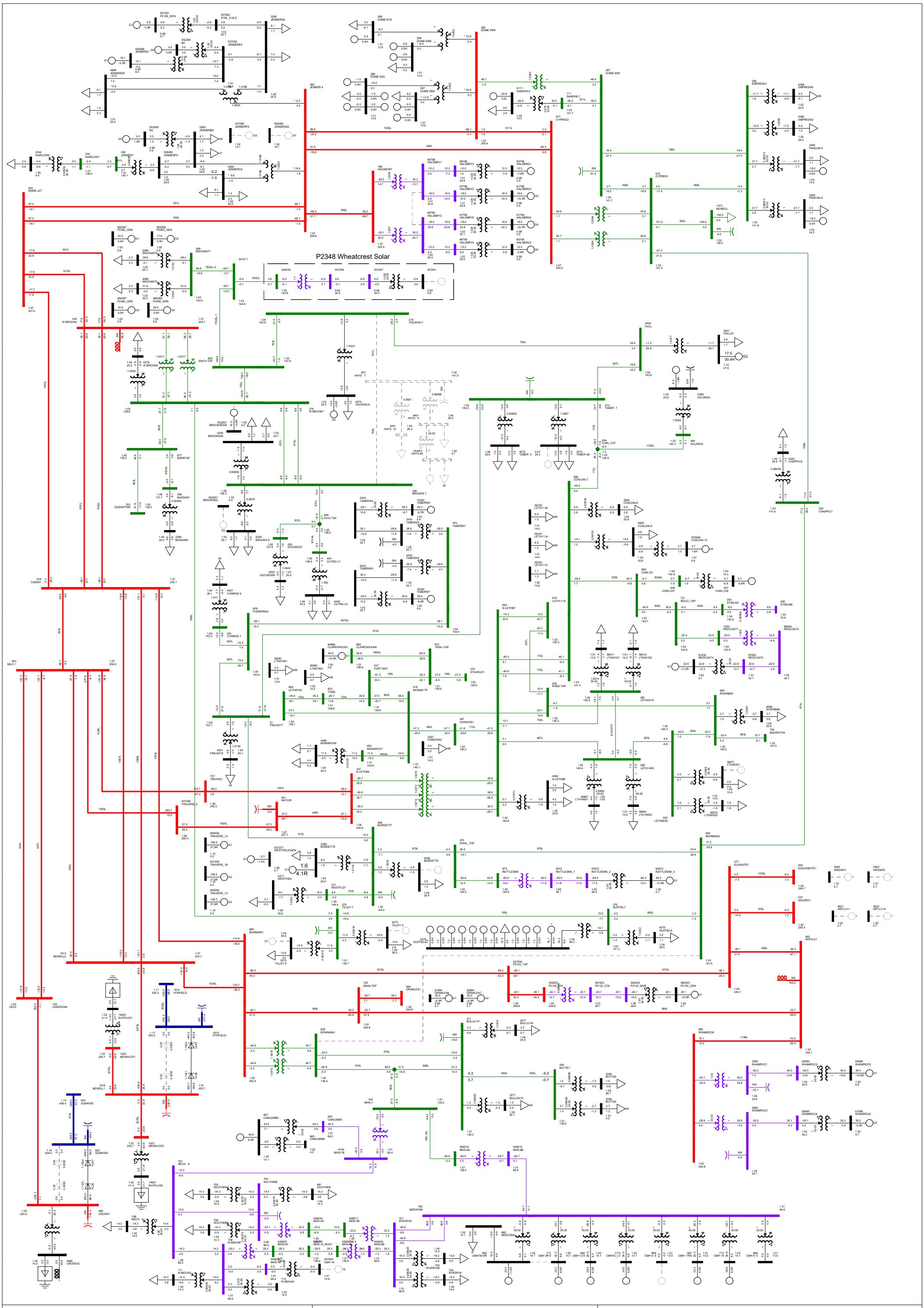
P2348 Wheatcrest Solar

2022SL POST SCENARIO 3
158S TRANSFORMER T1 CONTINGENCY
THU, JUN 30 2022 14:04

Figure A6-SC3-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

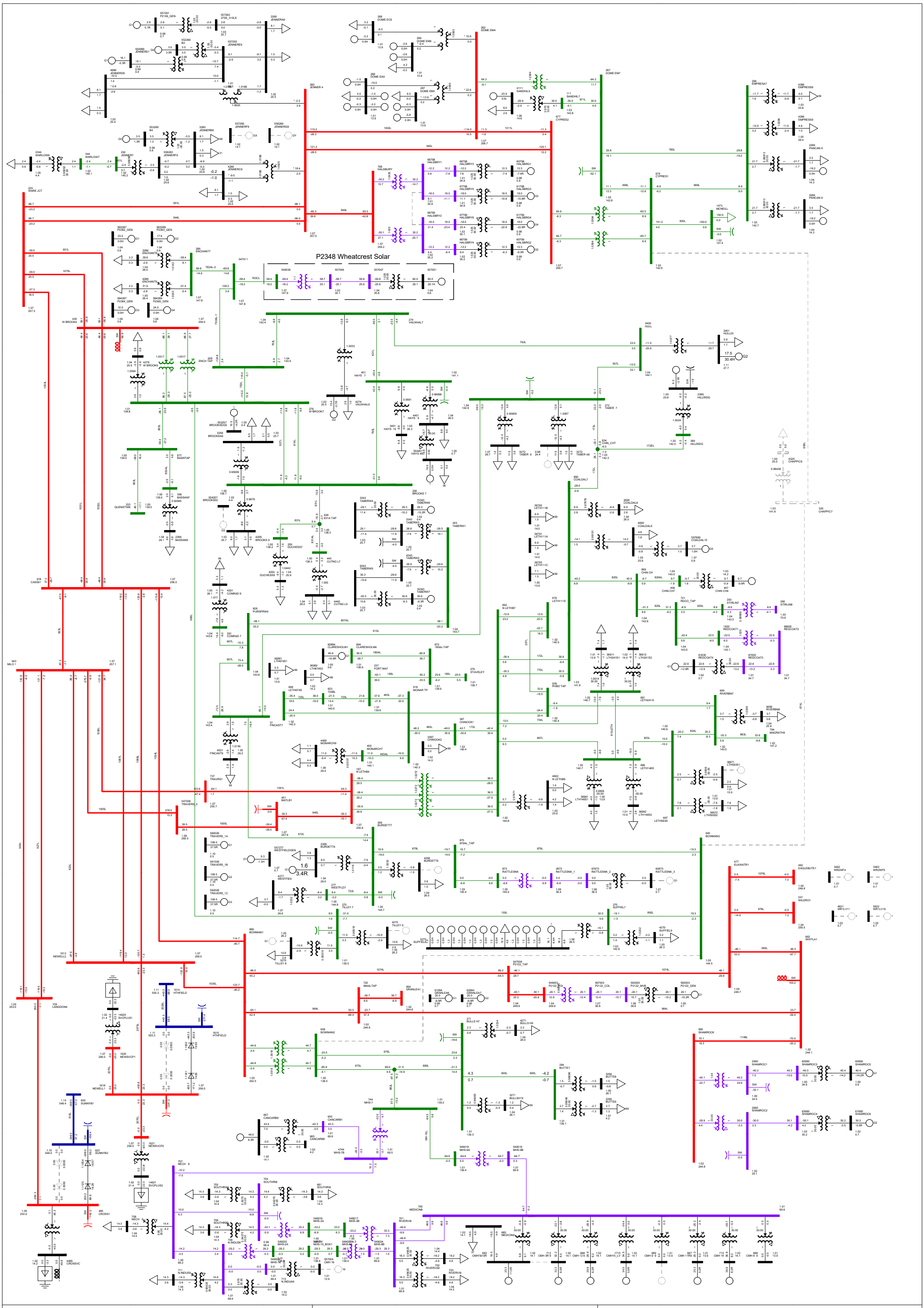


2022SL POST SCENARIO 3
421S HAYS TRANSFORMER T2 CONTINGENCY
THU, JUN 30 2022 14:03

Figure A6-SC3-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SCENARIO 3
674L AND 658L (BOWMANTON 244S - CHAPPICE LAKE 649S - CYPRESS
THU, JUN 30 2022 14:03

Figure A6-SC3-3

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

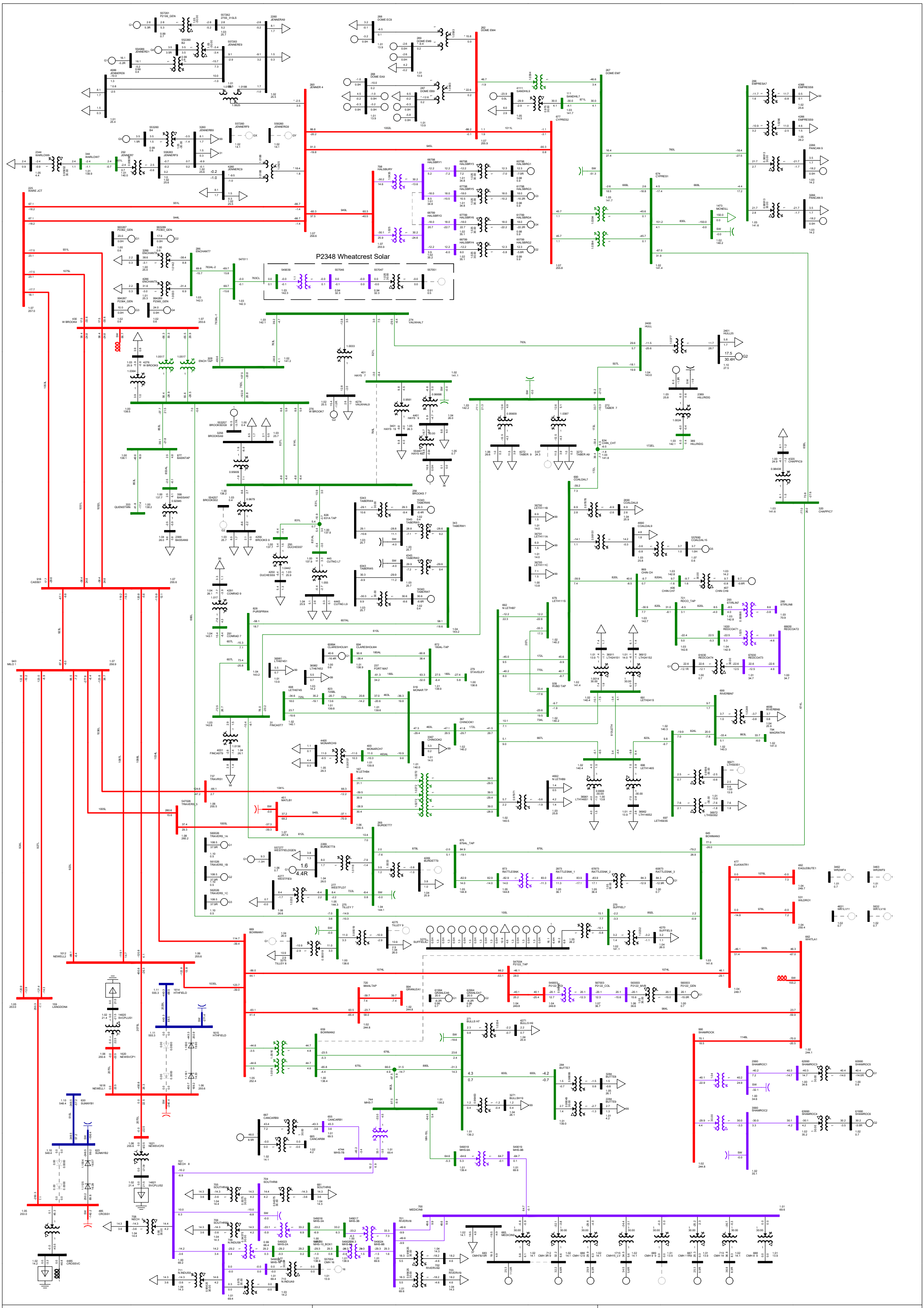
P2348 Wheatcrest Solar

2022SL POST SCENARIO 3
121S T2 BROOKS CONTINGENCY
THU, JUN 30 2022 14:04

Figure A6-SC3-4

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

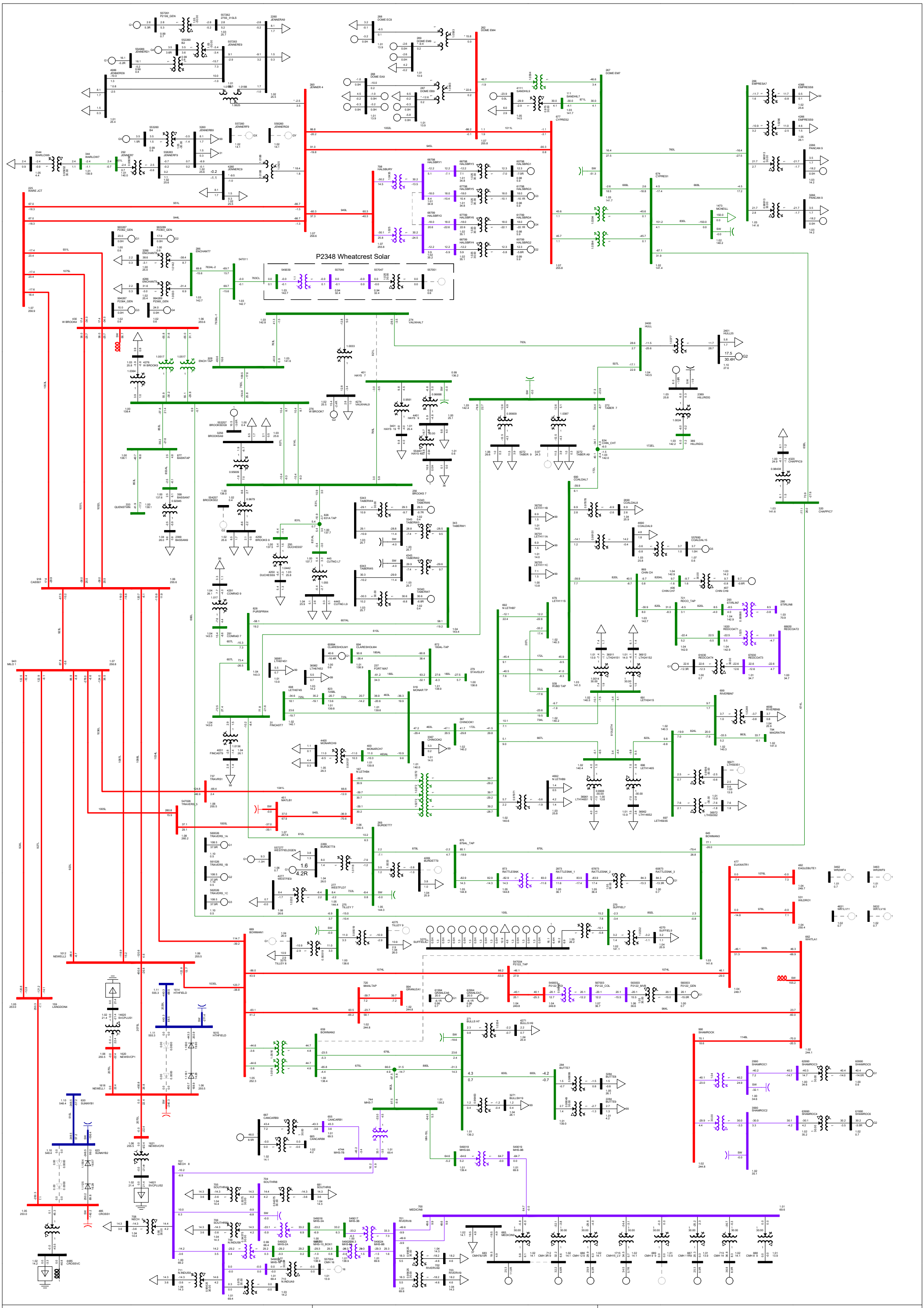


2022SL POST SCENARIO 3
795L BROOKS 121S BUS 256 - HAYS 421S BUS 401 CONTINGENCY
THU, JUN 30 2022 14:04

Figure A6-SC3-5

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SL POST SCENARIO 3
821L VAUXHALL 158S BUS 274 - HAYS 421S BUS 401 CONTINGENCY
THU, JUN 30 2022 14:04

Figure A6-SC3-6

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

P2348 Wheatcrest Solar

2022SL POST SCENARIO 3
610L FINCASTLE 336S BUS 31 - TABER 83S BUS 272 CONTINGENCY
THU, JUN 30 2022 14:04

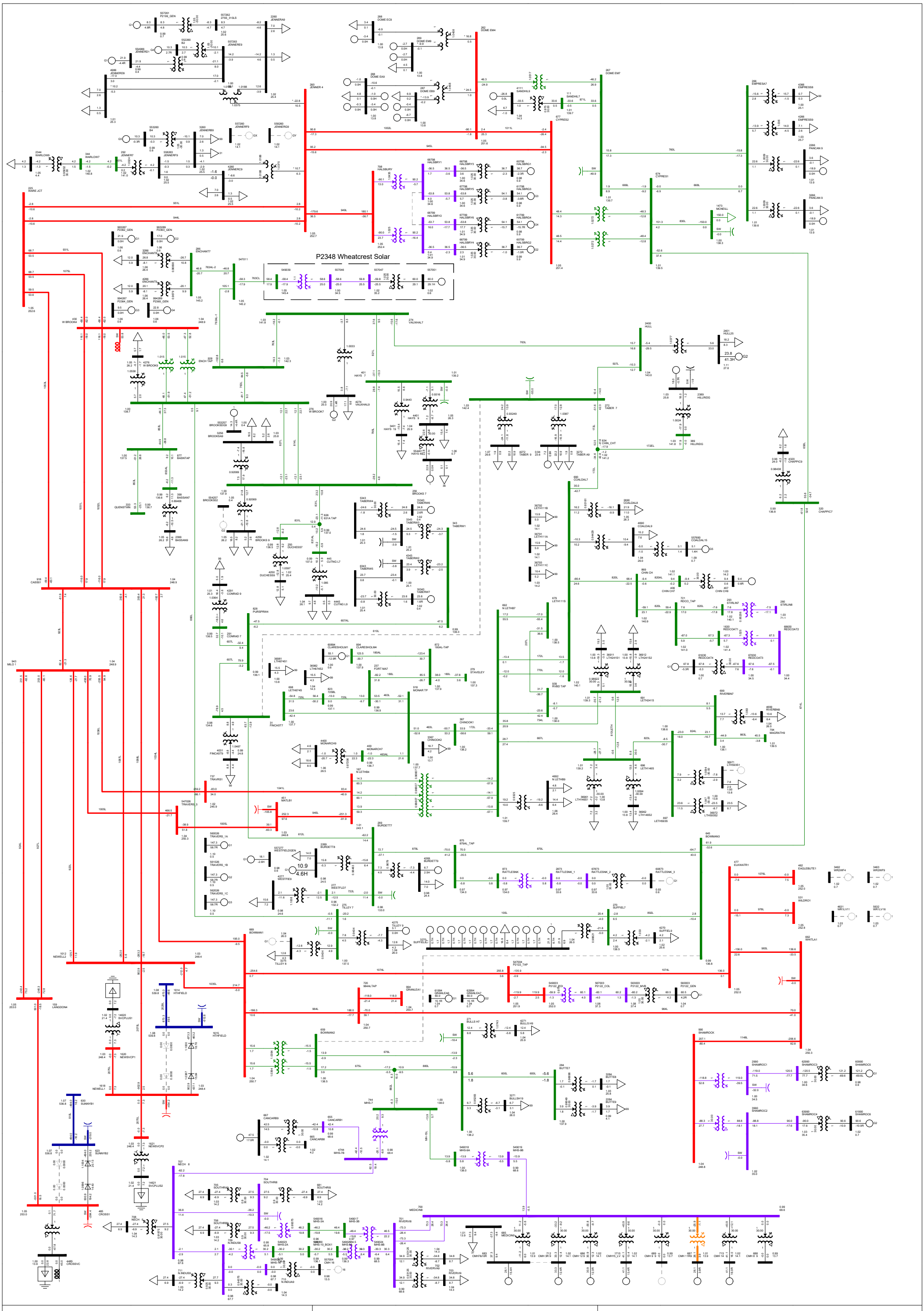
Figure A6-SC3-7

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Table A6: Post-Mitigation Power Flow Diagram for Summer Peak Scenario 4

Figure	Contingency	RAS Action
A6-SC4-1	610L (Fincastle 336S – Taber 83S)	Planned RAS 180
A6-SC4-2	674L AND 658L (Bowmanton 244S - Chappice Lake 649S – Cypress 562S)	Planned RAS 181
A6-SC4-3	1036L ((Milo 356S – Travers 554S)	Planned RAS 170



2022SP POST SC4
610L (FINCASTLE 336S - TABER 83S) CONTINGENCY
THU, JUN 30 2022 14:04

Figure A6-SC4-1

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

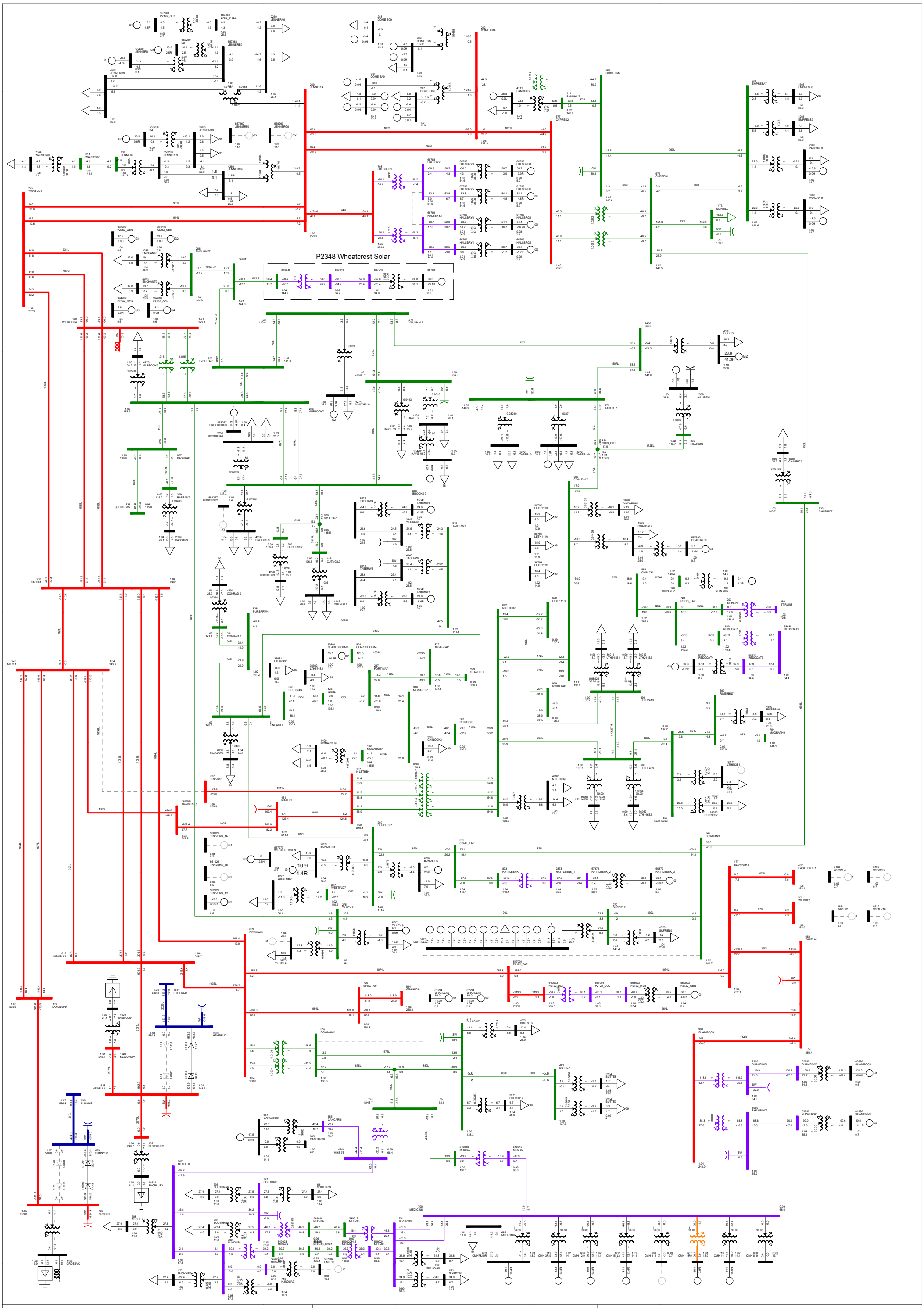
P2348 Wheatcrest Solar

2022SP POST SC4
674L AND 658L (BOWMANTON 244S - CHAPPICE LAKE 649S - CYPRESS
THU, JUN 30 2022 14:04

Figure A6-SC4-2

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



2022SP POST SCENARIO 4
1036L MILO 356S BUS 943 - TRAVERS 554S BUS 737 CONTINGENCY
THU, JUN 30 2022 14:04

Figure A6-SC4-3

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A7
Constraint Effective Factors Table

Table A7-1: Generator Types

Plant	Cancarb/ CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock/ Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
Type	Gas	Solar	Solar	Gas	Gas	Gas	Wind	Solar	Wind	Wind	Solar	Solar	Solar	Solar	Solar

Table A7-2: 2022 Summer Light Post Project Scenario 3 Generators Effectiveness Factors (BC Sink) for Category A(N-0) Condition at 50 MW

Condition	Plant / Line	Cancarb & CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock / Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
Cells with red text indicated that the unit is offline in the study case	Red cells indicate the unit with the highest effectiveness factor for the specified contingency and thermal violation															
CATEGORY A	610L (Fincastle 336S - Taber 83S)	1.44%	69.48%	13.49%	-12.36%	6.13%	0.82%	82.06%	0%	55.17%	1.44%	0.82%	82.06%	-3.45%	-3.23%	-8.38%
CATEGORY A	879L (Bowmanton 244S - Rattlesnake 719S)	-1.44%	30.52%	-13.49%	12.36	-6.13%	-0.82%	17.93%	0%	44.82%	-1.44%	-0.82%	17.93%	3.45%	3.23%	8.38%

Table A7-3: 2022 Summer Light Post Project Scenario 3 Generators Effectiveness Factors (BC Sink) for Category B (N-1) Condition at 60 MW

Contingency	Plant / Line	Cancarb & CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock / Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
Cells with red text indicated that the unit is offline in the study case	Red cells indicate the unit with the highest effectiveness factor for the specified contingency and thermal violation															
158S VAUXHALL TRANSFORMER T1 (Hull 257S – Vauxhall 158S – Hays 421S, Stone 2020S – Vauxhall 158S)	879L (Bowmanton 244S – Rattlesnake 719S)	-2.61%	36.76%	-13.93%	20.67%	-7.63%	-3.36%	25.61%	0%	49.44%	-2.61%	-3.36%	25.61%	-3.36%	-3.36%	20.67%
257S HULL TRANSFORMER T1 (Taber 83S – Hull 257S – Vauxhall 158S)	879L (Bowmanton 244S – Rattlesnake 719S)	-2.61%	36.76%	-13.93%	20.67%	-7.63%	-3.36%	25.61%	0%	49.44%	-2.61%	-3.36%	25.61%	-3.36%	-3.36%	-2.61%
257S HULL TRANSFORMER T1 (Taber 83S – Hull 257S – Vauxhall 158S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
421S HAYS TRANSFORMER T2 (Hays 421S – Vauxhall 158S – West Brooks 28S)	763L (West Brooks 28S – Enchant 447S tap point)	-4.17%	22.22%	-1.57%	29.58%	-5.33%	-7.88%	27.32%	0%	16.42%	-4.17%	-7.88%	27.32%	0.00%	67.12%	43.76%
421S HAYS TRANSFORMER T2 (Hays 421S – Vauxhall	879L (Bowmanton 244S – Rattlenake 719S)	-1.61%	31.42%	-13.55%	13.56%	-6.34%	-1.46%	19.04%	0%	45.49%	-1.61%	-1.46%	19.04%	0.00%	4.54%	10.15%

Contingency	Plant / Line	Cancarb & CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock / Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
158S – West Brooks 28S)																
336S FINCASTLE TRANSFORMER T1 (Taber 83S – Fincastle 336S– Burdett 368S, Fincastle 336S – 607AL)	879L (Bowmanton 244S – Rattlesnake 719S)	0%	99.99%	0%	0%	0%	0%	0%	0%	99.99%	0%	0%	0%	0%	0%	0%
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	879L (Bowmanton 244S – Rattlesnake 719S)	0.20%	41.83%	-9.51%	26.15%	-2.92%	2.13%	30.96%	0%	54.17%	0.20%	2.13%	30.96%	9.91%	9.52%	18.90%
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	763L (West Brooks 28S – Enchant 447S tap point)	-0.13%	36.27%	5.93%	46.05%	1.82%	1.65%	43.05%	0%	28.57%	-0.13%	1.65%	43.05%	36.44 %	69.54%	50.57%
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
674L AND 658L (Bowmanton 244S – Chappice Lake 649S – Cypress 562S)	610L (Fincastle 336S – Taber 83S)	1.16%	78.27%	25.37%	-8.43%	11.47%	1.81%	87.49%	0%	67.79%	1.16%	1.81%	87.49%	-1.50%	-1.34%	-5.34%
674L AND 658L (Bowmanton 244S – Chappice Lake 649S – Cypress 562S)	763L (West Brooks 28S – Enchant 447S tap point)	-3.11%	18.36%	1.79%	22.53%	-2.57%	-3.35%	21.25%	0%	15.08%	-3.11%	-3.35%	21.25%	25.44 %	58.84%	32.65%
674L AND 658L (Bowmanton 244S – Chappice Lake 649S – Cypress 562S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
121S BROOKS TRANSFORMER T2 (Brooks 121S – West Brooks 28S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	-4.17%	22.22%	-1.57%	29.58%	-5.33%	-7.88%	27.32%	0%	16.42%	-4.17%	-7.88%	27.32%	53.76 %	67.12%	43.76%
121S BROOKS TRANSFORMER T2 (Brooks 121S – West Brooks 28S – Hays 421S)	879L (Bowmanton 244S – Rattlesnake 719S)	-1.61%	31.42%	-13.55%	13.56%	-6.34%	-1.46%	19.04%	0%	45.49%	-1.61%	-1.46%	19.04%	7.75%	4.54%	10.15%
795L (Brooks 121S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	-4.17%	22.22%	-1.57%	29.58%	-5.33%	-7.88%	27.32%	0%	16.42%	-4.17%	-7.88%	27.32%	53.76 %	67.12%	43.76%
795L (Brooks 121S – Hays 421S)	879L (Bowmanton 244S – Rattlesnake 719S)	-1.61%	31.42%	-13.55%	13.56%	-6.34%	-1.46%	19.04%	0%	45.49%	-1.61%	-1.46%	19.04%	7.75%	4.54%	10.15%
612L (Fincastle 336S – Burdett 368S)	879L (Bowmanton 244S – Rattlesnake 719S)	0%	99.99%	0%	0%	0%	0%	0%	0%	99.99%	0%	0%	0%	0%	0%	0%
612L (Fincastle 336S – Burdett 368S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
610L (Fincastle 336S – Taber 83S)	674L (Chappice Lake 649S – Bowmanton 244S)	0.25%	62.64%	35.44%	1.44%	15.97%	2.77%	62.64%	0%	62.64%	0.25%	2.77%	62.64%	2.34%	2.36%	1.84%
610L (Fincastle 336S – Taber 83S)	658L (Chappice Lake 649S – Cypress 562S)	0.25%	62.64%	35.44%	1.44%	15.97%	2.77%	62.64%	0%	62.64%	0.25%	2.77%	62.64%	2.34%	2.36%	1.84%

Contingency	Plant / Line	Cancarb & CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock / Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
610L (Fincastle 336S – Taber 83S)	879L (Bowmanton 244S – Rattlesnake 719S)	0%	99.99%	0%	0%	0%	0%	99.99%	0%	99.99%	0%	0%	99.99%	0%	0%	0%
507L (Taber 83S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	-2.61%	36.76%	-13.93%	20.67%	-7.63%	-3.36%	25.61%	0%	49.44%	-2.61%	-3.36%	25.61%	-3.36%	-3.36%	-3.36%
821L (Vauxhall 158S – Hays 421S)	763L (West Brooks 28S – Enchant 447S tap point)	-4.17%	22.22%	-1.57%	29.58%	-5.33%	-7.88%	27.32%	0%	16.42%	-4.17%	-7.88%	27.32%	-7.88%	67.12%	43.76%
821L (Vauxhall 158S – Hays 421S)	879L (Bowmanton 244S – Rattlesnake 719S)	-1.61%	31.42%	-13.55%	13.56%	-6.34%	-1.46%	19.04%	0%	45.49%	-1.61%	-1.46%	19.04%	-1.46%	4.54%	10.15%
763L (Vauxhall 158S – Hull 257S)	879L (Bowmanton 244S – Rattlesnake 719S)	-2.61%	36.76%	-13.93%	20.67%	-7.63%	-3.36%	25.61%	0%	49.44%	-2.61%	-3.36%	25.61%	-3.36%	-3.36%	20.67%
763L (Vauxhall 158S – Hull 257S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
MH138-T71 (Brier Park MHS-7 – Brier Park MHS-7)	MH-15L (Brier Park MHS-7 – MHS-9A)	99.99%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1005L (Travers 554S – Travers 554S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
895S SUFFIELD TRANSFORMER T2 (Suffield 895S- Tilley 498S – Bowmanton 244S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
100L (Suffield 895S – Tilley 498S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
1034L (Bowmanton 244S – Cassils 324S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
935L (Cassils 324S – Milo 356S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
923L (Milo 356S – Newell 2075S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
1035L (Bowmanton 244S – Newell 2075S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
163S AMOCO EMPRESS TRANSFORMER T1 OR T5 (Amoco Empress 163S – Empress 394S, Cypress 562S – Amoco Empress 163S – Empress Liquid Tap 164S, Sandy point 204S – Amoco Empress 163S – Sandhills 341S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
28S WEST BROOKS TRANSFORMER 28ST1A (West Brooks 28S – West Brooks 28S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
28S WEST BROOKS TRANSFORMER 28ST2A (West Brooks 28S – West Brooks 28S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
1036L (Milo 356S – Travers 554S)	763AL-1 (ENCH 447S tap point – 763AAL TAP)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%

Table A7-4: 2022 Summer Peak Post Project Scenario 4 Generators Effectiveness Factors (BC Sink) for Category B (N-1) Condition at 60 MW

Contingency	Plant / Line	Cancarb	CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock / Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
Cells with red text indicated that the unit is offline in the study case	Red cells indicate the unit with the highest effectiveness factor for the specified contingency and thermal violation																
172L (Chin Chute 315S – Taber 83S – Hillridge 139S, Chin Chute 315S – Coaldale 254S)	610L (Fincastle 336S – Taber 83S)	-0.20%	-0.20%	58.17%	9.51%	-26.15%	2.91%	-2.13%	69.04%	0%	45.82%	-0.20%	-2.13%	69.04%	-9.91%	-9.52%	18.90%
674L AND 658L (Bowmanton 244S - Chappice Lake 649S - Cypress 562S)	610L (Fincastle 336S – Taber 83S)	1.16%	1.16%	78.27%	25.37%	-8.43%	11.47%	1.81%	87.49%	0%	67.79%	1.16%	1.81%	87.49%	-1.50%	-1.34%	-5.34%
879L TAP (Burdett 368S - Bowmanton 244S - Rattlesnake 719S)	610L (Fincastle 336S – Taber 83S)	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%
610L (Fincastle 336S – Taber 83S)	879L (Rattlesnake 719S – Burdett 368S)	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%
610L (Fincastle 336S – Taber 83S)	879L (Bowmanton 244S – Rattlesnake 719S)	0%	0%	99.99%	0%	0%	0%	0%	99.99%	0%	99.99%	0%	0%	99.99%	0%	0%	0%
MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	-22.15%	33.9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	-22.15%	33.9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
MH138-T63 (Riverview MH69S-6 - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	17.98%	-27.54%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
MH138-T34 (South Ridge MH69S-3 - MH69S-3A)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	17.98%	-27.54%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH-4L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	MH-8L (Power Plant Switchyard MH69S-1 - Riverview MH69S-6)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2075L (Newell 2075S - Newell 2075S)	610L (Fincastle 336S – Taber 83S)	1.44%	1.44%	69.48%	13.49%	-12.36%	6.13%	0.82%	82.06%	0%	55.17%	1.44%	0.82%	82.06%	-3.45%	-3.23%	-8.38%
MH-20L (MH69S-3A - MH69S-3B)	MH-60L (North East Crescent Heights MH69S - Brier Park MHS-7)	-17.98%	27.52%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1036L (Milo 356S – Travers 554S)	1005L (Milo 356S – Travers 554S)	-12.29%	-12.29%	5.81%	-6.86%	10.09%	-8.23%	-8.70%	8.78%	0%	2.44%	-12.29%	-8.70%	8.78%	-2.61%	-2.92%	4.42%

Table A7-5: 2022 Summer Light Post Project Sensitivity Scenario 8 Generators Effectiveness Factors (BC Sink) for Category A (N-0) Condition at 50 MW

Contingency	Plant / Line	Cancarb & CMH	Burdett & Westfield	Suffield	Taber DG	Tilley	Cutting Lake	Taber Wind	Vauxhall	Rattlesnake	Shamrock / Cypress & Granlea	Brooks	Conrad	Hays	Wheatcrest & Enchant	Hull
Cells with red text indicated that the unit is offline in the study case	Red cells indicate the unit with the highest effectiveness factor for the specified contingency and thermal violation															
CATEGORY A	879L (Bowmanton 244S - Rattlesnake 719S)	-1.44%	30.52%	-13.49%	12.36%	-6.13%	-0.82%	17.93%	5.85%	44.82%	-1.44%	-0.82%	17.93%	3.45%	3.23%	8.38%
CATEGORY A	763L (West Brooks 28S – Enchant 447S tap point)	-3.04%	16.19%	-1.15%	21.56%	-3.89%	-3.60%	19.91%	38.45%	11.97%	-3.04%	-3.60%	19.91%	24.96 %	58.37%	31.89%
CATEGORY A	610L (Fincastle 336S - Taber 83S)	1.44%	69.48%	13.49%	-12.36%	6.13%	0.82%	82.06%	-5.85%	55.17%	1.44%	0.82%	82.06%	-3.45%	-3.23%	-8.38%