APPENDIX A CONNECTION ASSESSMENT

Engineering Connection Assessment

P2300 Enterprise Solar Project Connection

Renewable Energy Systems Canada Inc.

Date: June 20, 2021

Version: V1

Classification: Public

Role	Name	Date	Signature
Prepared	Siavash Zoroofi, Ph.D, P.Eng	Siavash Zoroofi -- P. Eng. - APEGA	Digitally signed by Siavash Zoroofi -- P. Eng. - APEGA Date: 2021.07.28 12:11:18 -06'00'
Reviewed	Maz Mazadi, Ph.D, P.Eng	Aug 4, 2021	Mazadi
Approved	Robert Davidson, P.Eng	Robert Davidson	Digitally signed by Robert Davidson Date: 2021.08.04 14:55:11 -06'00'

PROFESSIONAL ENGINEER ALBERTA
SIAVASH ZOROOFI
ID 213253

PERMIT TO PRACTICE
INDEPENDENT SYSTEM OPERATOR
RM SIGNATURE: Robert Davidson
RM APEGA ID #: 86358
DATE: 2021-08-04
PERMIT NUMBER: P008200
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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.

Contents

Tables

Figures

Attachments

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

Enterprise Solar GP Inc. (Enterprise Solar), on behalf of Enterprise Solar LP, owned by Renewable Energy Systems Canada Inc., (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Enterprise Solar Project (Facility) to the AIES. The Facility includes the proposed Enterprise 1070S substation.

The Market Participant's request includes: a request for a new system access service in the area of Stavely, with a Rate STS, *Supply Transmission Service*, contract capacity of 65 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 3 MW; and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is August 31, 2022.

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 Stavely (Area 49), which is part of the AESO South Planning Region. Stavely area is surrounded by the planning areas of Strathmore/Blackie (Area 45), Brooks (Area 47), High River (Area 46), Vauxhall (Area 52), Lethbridge (Area 54), and Fort Macleod (Area 53).

From a transmission system perspective, AESO planning area of Stavely (Area 49) consists primarily of 138 kV and 240 kV transmission systems.

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 Brooks (Area 47), Fort Macleod (Area 53), Lethbridge (Area 54), and Stavely (Area 49), 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 MP, examined 11 transmission alternatives to meet the MP'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 – In-and-out connection to the existing 240 kV transmission lines 1037L or 1038L

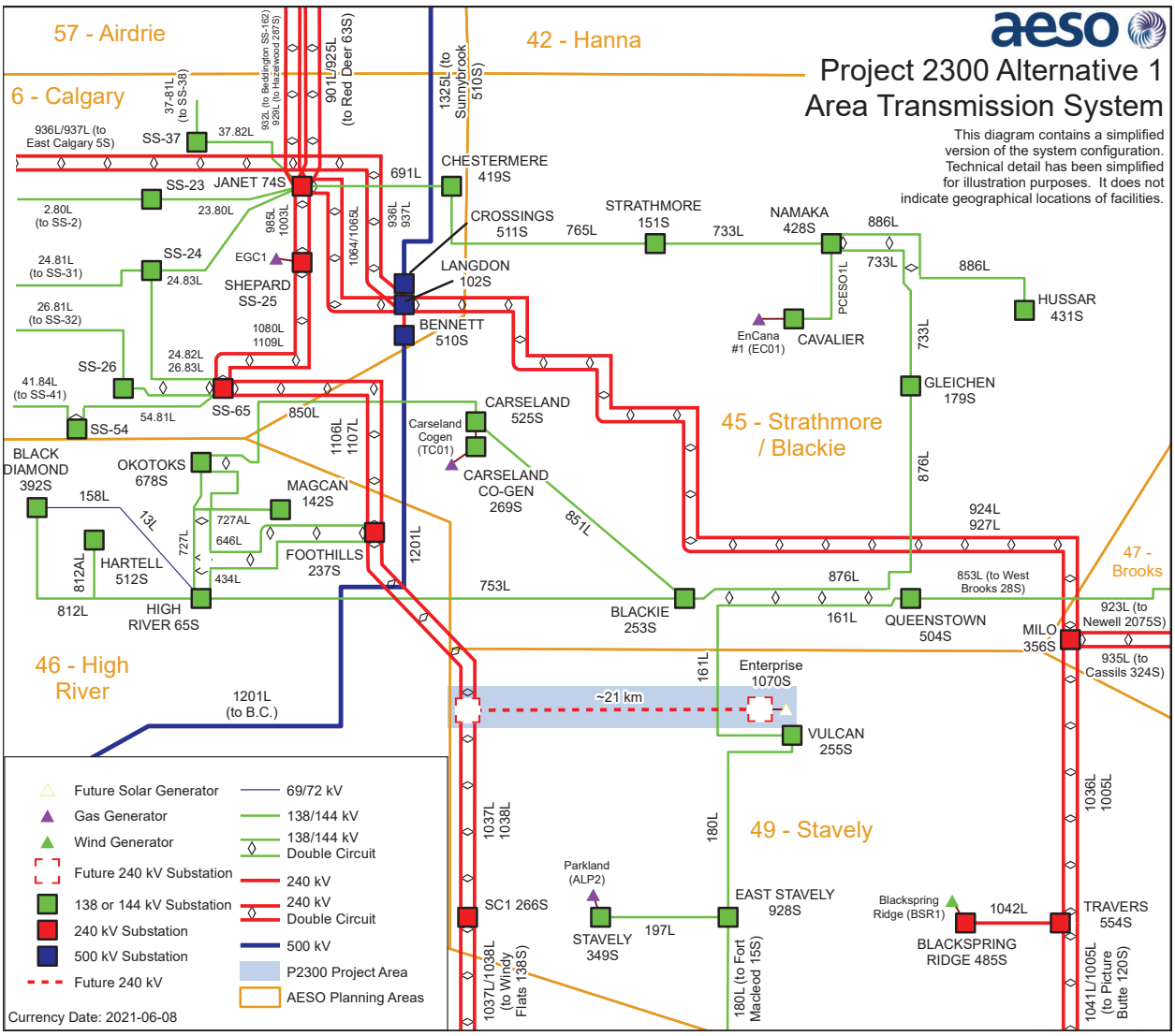
This alternative includes the following developments:

- Add a 240 kV switching station, including three 240 kV circuit breakers;
- Connect the new switching station to one of the existing 240 kV transmission lines 1037L or 1038L (between the existing SC1 266S and Foothills 237S substations) using an in-and-out configuration;
- Add a 240 kV circuit, approximately 21 km[1] in length, to connect the proposed Facility to the switching station; and
- Add or modify associated equipment as required for the above transmission developments.

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

[1] The exact line length to be determined by the Market Participant under the Market Participant Choice process.

Figure 3-1: Connection Alternative 1



Alternative 2 – Radial connection to the existing Foothills 237S substation

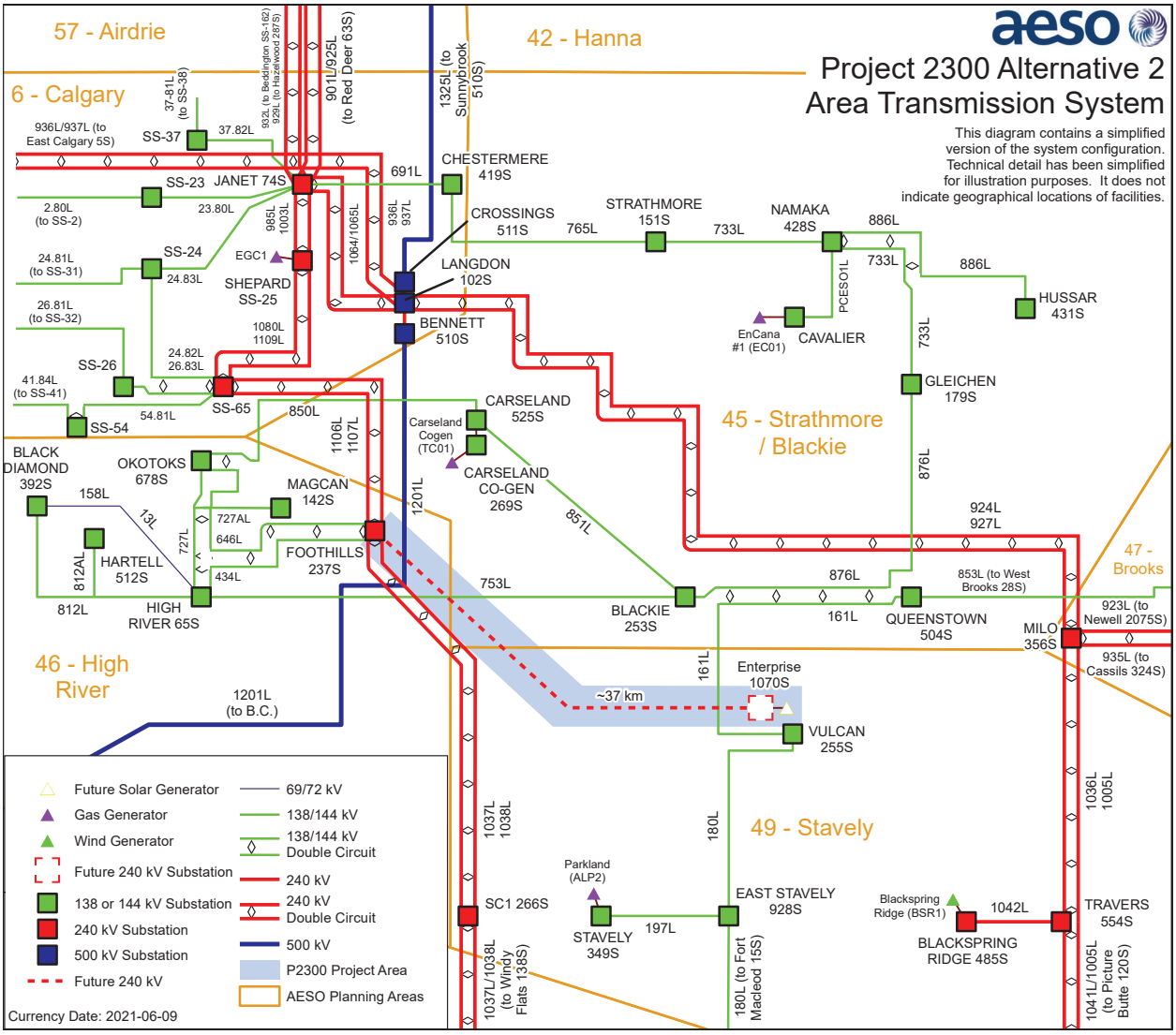
This alternative includes the following developments:

- Modify the existing Foothills 237S substation, including adding one 240 kV circuit breaker;
- Add a 240 kV circuit, approximately 37 km^2 in length to connect the proposed Facility to the Foothills 237S substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

[2] Ibid.

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

Figure 3-2: Connection Alternative 2



Alternative 3 – In-and-out connection to the existing 240 kV transmission line 1036L

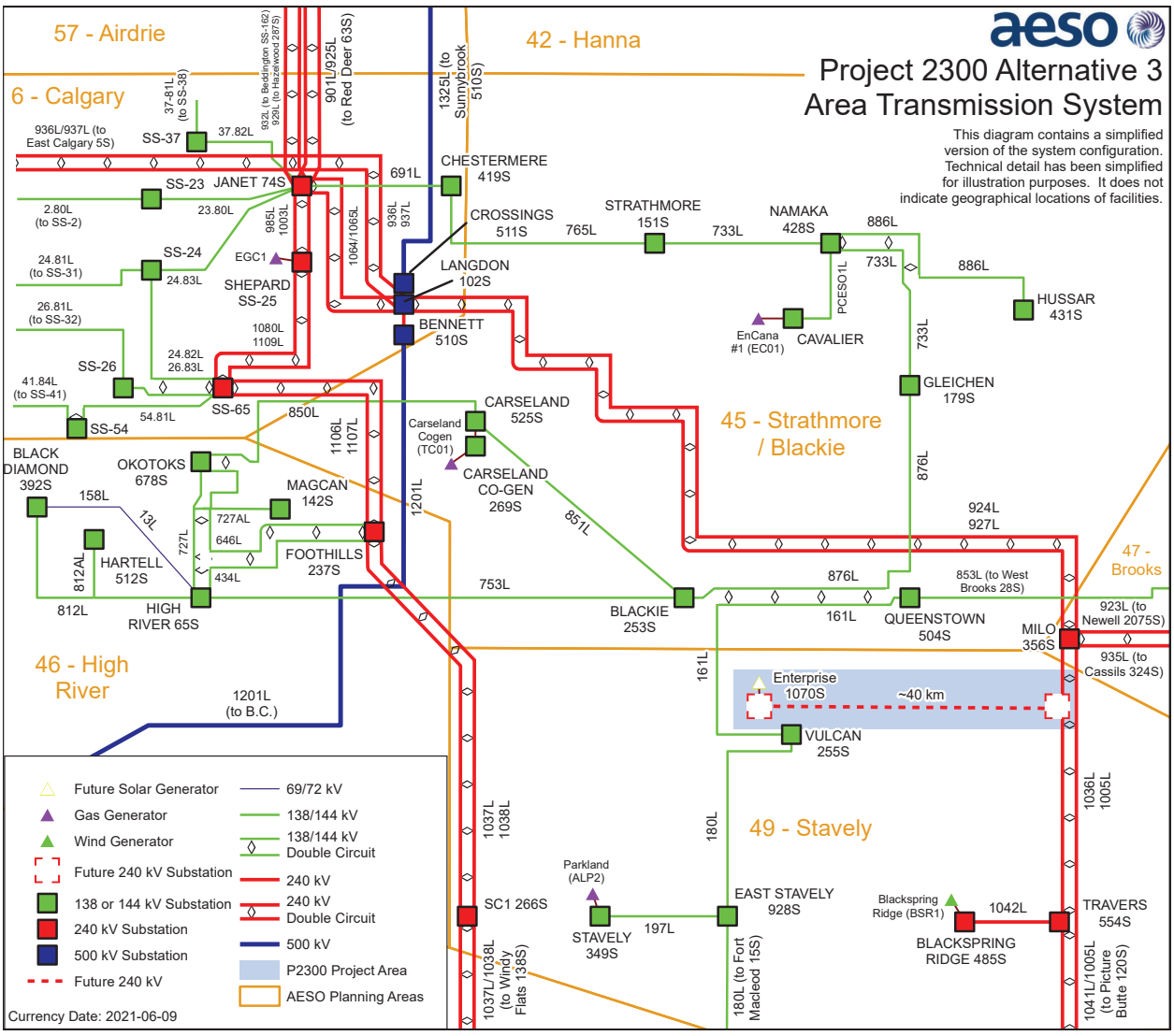
This alternative includes the following developments:

- Add a 240 kV switching station, including three 240 kV circuit breakers;
- Connect the switching station to the existing 240 kV transmission line 1036L (between the Milo 356S and Travers 554S substations) using an in-and-out configuration;

- Add a 240 kV circuit, approximately 40 km[3] in length, to connect the proposed Facility to the switching station; and
- Add or modify associated equipment as required for the above transmission developments.

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

Figure 3-3: Connection Alternative 3



Alternative 4 – In-and-out connection to the existing 240 kV transmission line 1005L

This alternative includes the following developments:

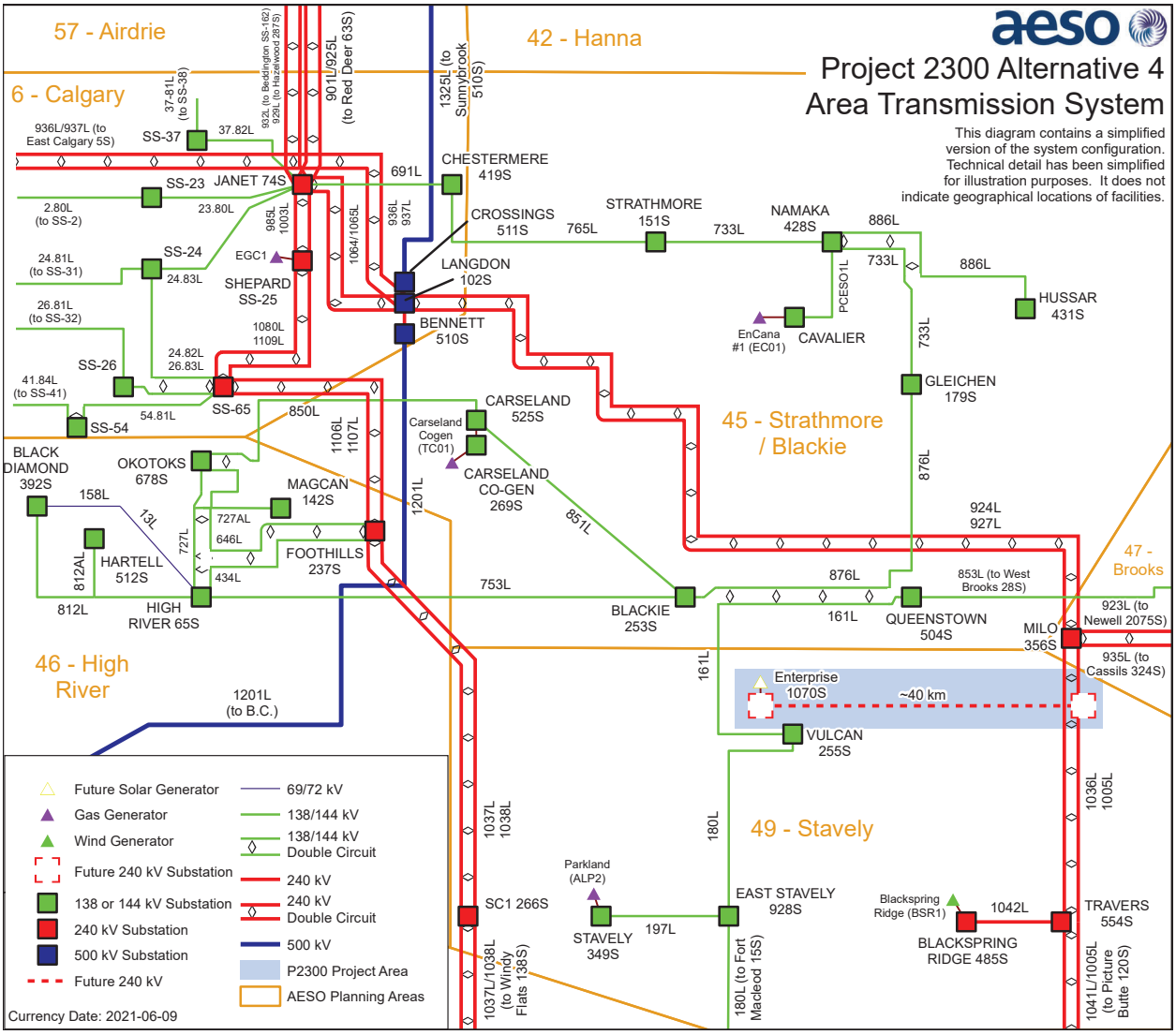
[3] Ibid.

- Add a 240 kV switching station, including three 240 kV circuit breakers;
- Connect the switching station to the existing 240 kV transmission line 1005L (between the Milo 356S and Picture Butte 120S substations) using an in-and-out configuration;
- Add a 240 kV circuit, approximately 40 km[4] in length, to connect the proposed Facility to the switching station; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-4.

[4] Ibid.

Figure 3-4: Connection Alternative 4



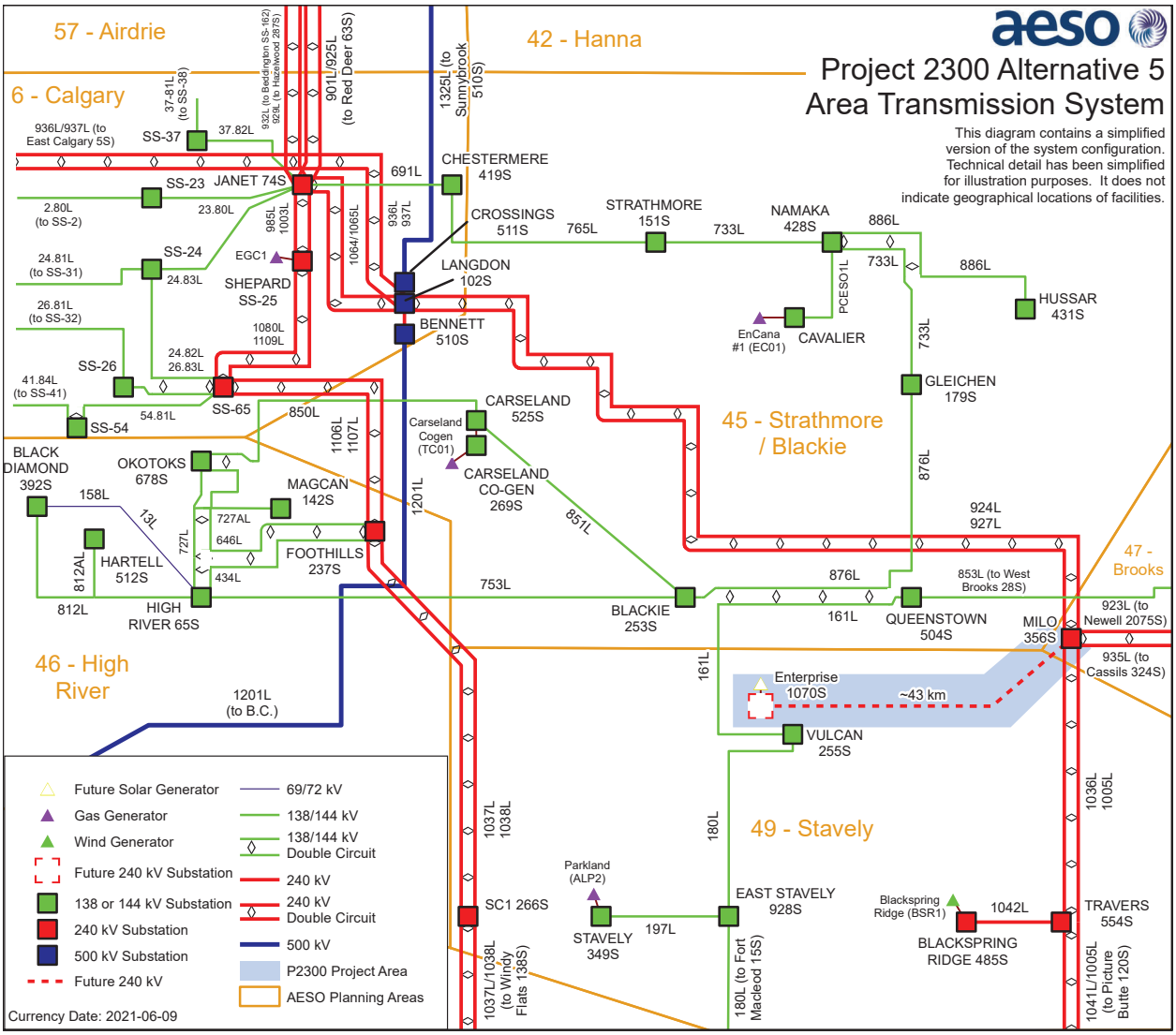
Alternative 5 – Radial connection to the existing Milo 356S substation

This alternative includes the following developments:

- Modify the existing Milo 356S substation, including adding one 240 kV circuit breaker;
- Add a 240 kV circuit, approximately 43 km[5] to connect the proposed Facility to the Milo 356S substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-5.

Figure 3-5: Connection Alternative 5



Alternative 6 – Radial connection to the existing Travers 554S substation

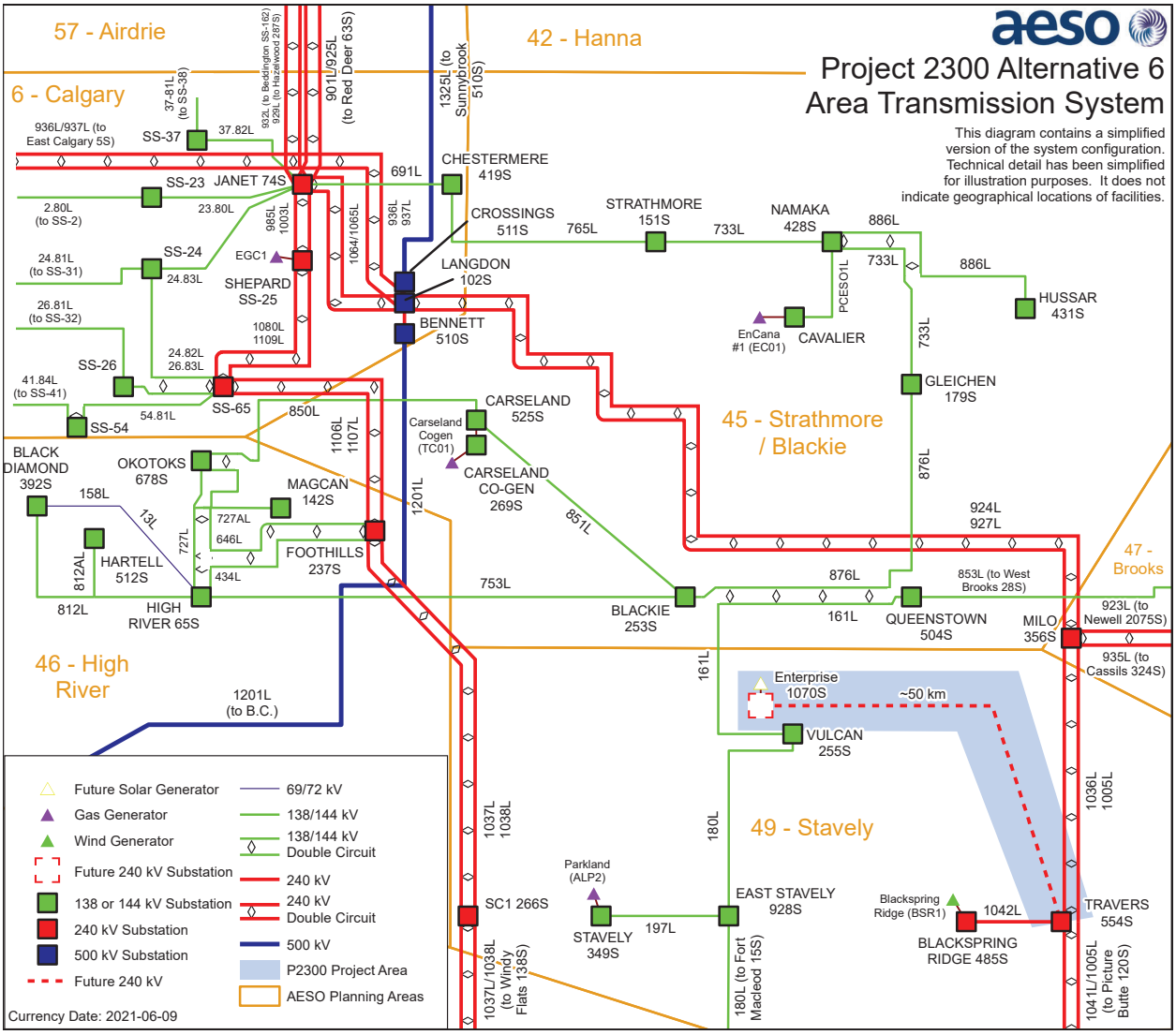
This alternative includes the following developments:

- Modify the existing Travers 554S substation, including adding one 240 kV circuit breaker;
- Add a 240 kV circuit, approximately 50 km[6] in length, to connect the proposed Facility to the Travers 554S substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

[6] Ibid.

The proposed connection configuration is shown in Figure 3-6.

Figure 3-6: Connection Alternative 6



Alternative 7 – T-tap connection to the existing 138 kV transmission line 161L

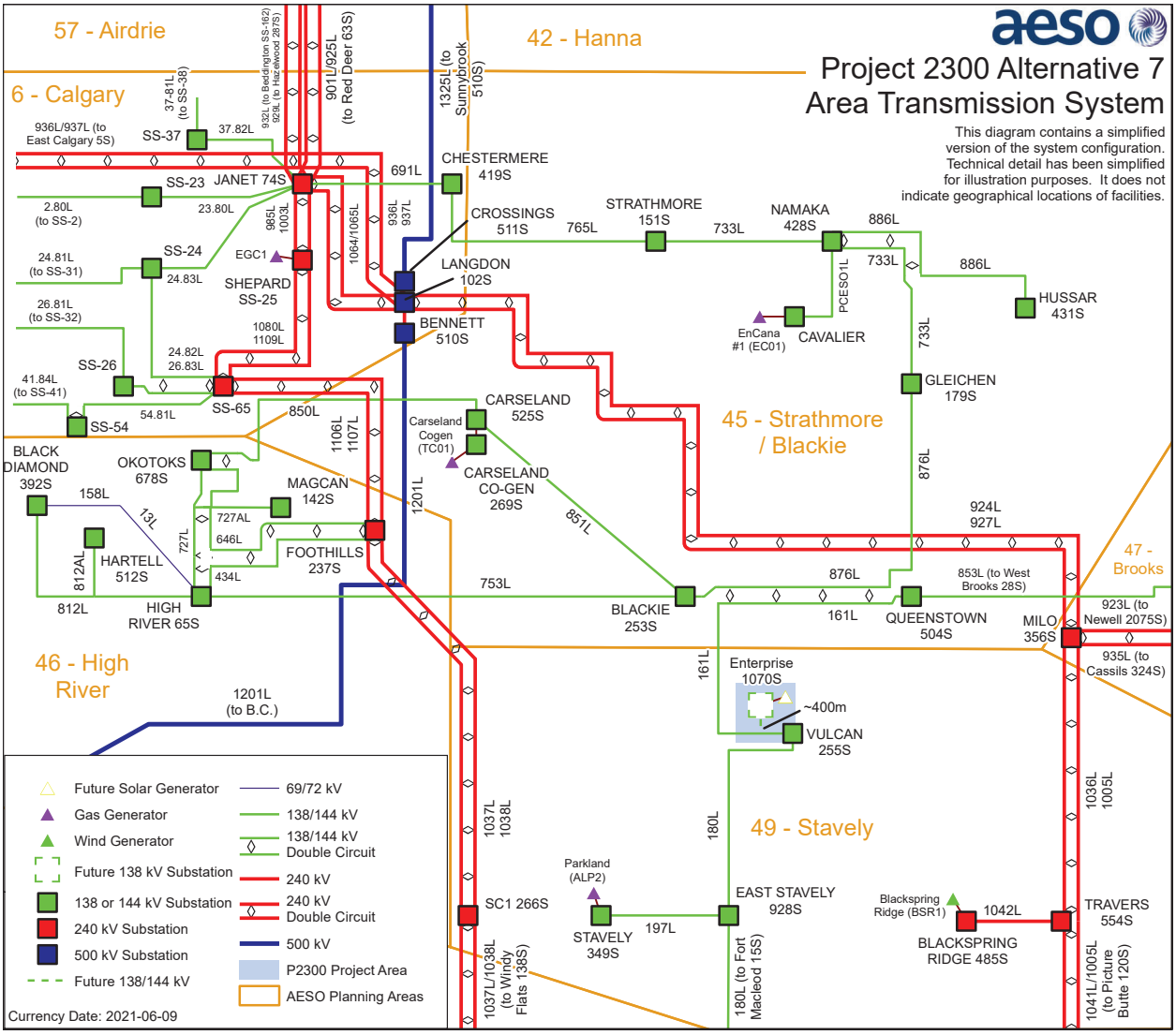
This alternative includes the following developments:

- Add a 138 kV transmission circuit, approximately 400 meters[7] in length, to connect the proposed Facility to the existing 138 kV transmission line 161L (between the existing Vulcan 255S and the Queenstown 504S substations) using a T-tap configuration; and
- Add or modify associated equipment as required for the above transmission developments.

[7] Ibid.

The proposed connection configuration is shown in Figure 3-7.

Figure 3-7: Connection Alternative 7



Alternative 8 – T-tap connection to the existing 138 kV transmission line 180L

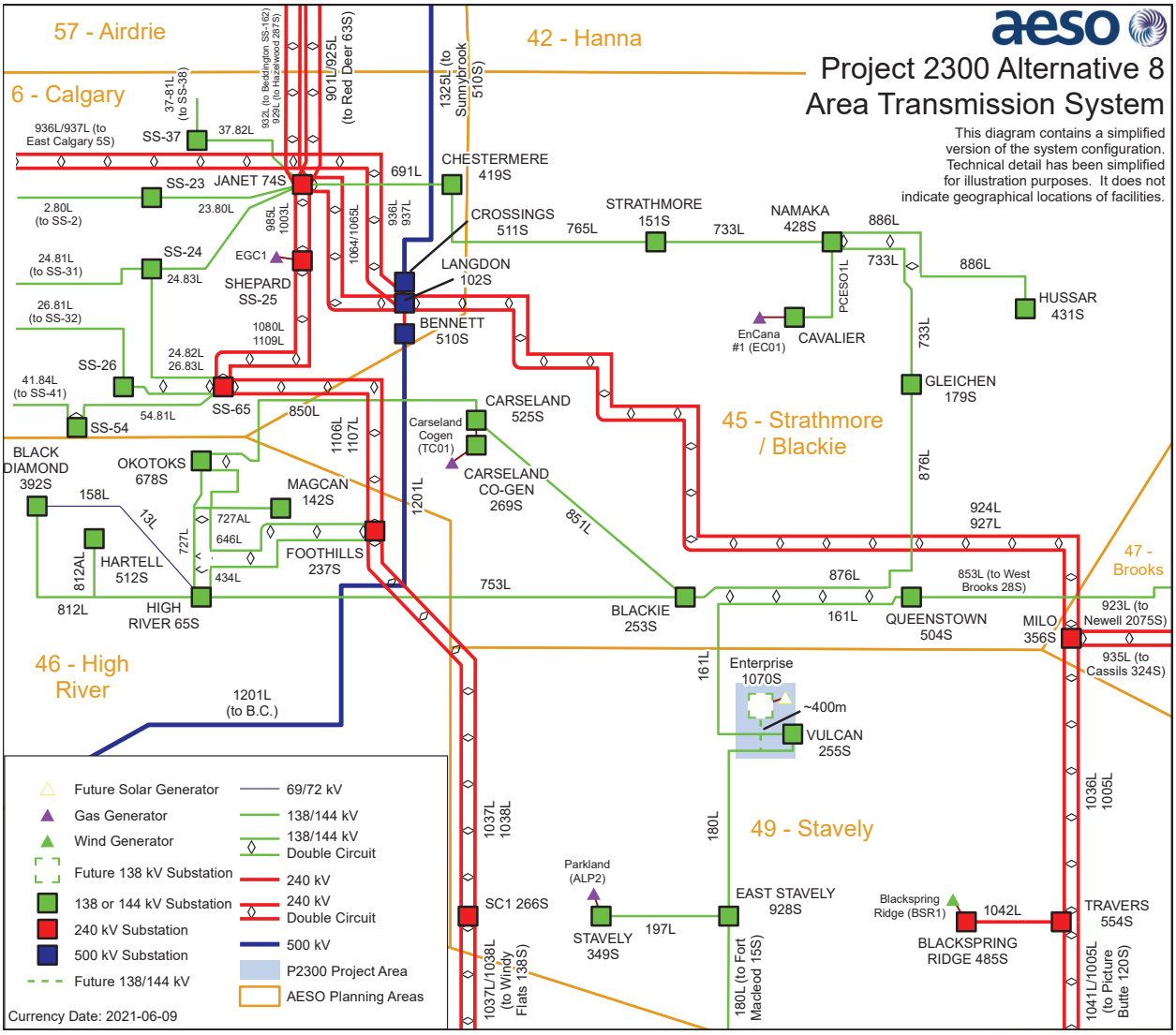
This alternative includes the following developments:

- Add a 138 kV transmission circuit, approximately 400 meters[8] in length, to connect the proposed Facility to the existing 138 kV transmission line 180L (between the existing Vulcan 255S and the East Stavely 928S substations) 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 3-8.

[8] Ibid.

Figure 3-8: Connection Alternative 8



Alternative 9 – Radial connection to the existing Vulcan 255S substation

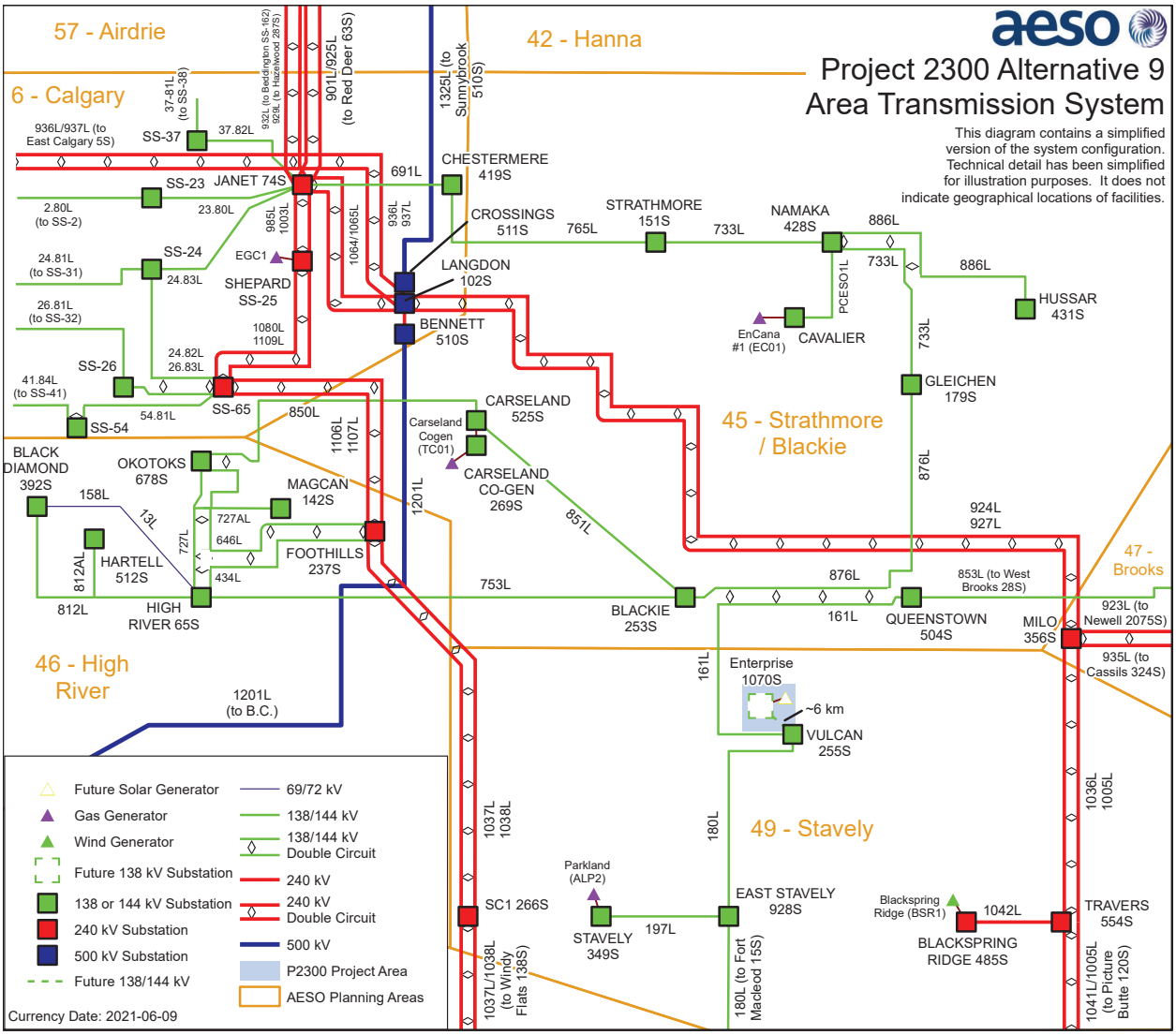
This alternative includes the following developments:

- Modify the existing Vulcan 255S substation, including adding one 138 kV circuit breaker;
- Add a 138 kV circuit, approximately 6 km[9] in length, to connect the proposed Facility to the Vulcan 255S substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-9.

[9] Ibid.

Figure 3-9: Connection Alternative 9



Alternative 10 – Radial connection to the existing Blackie 253S substation

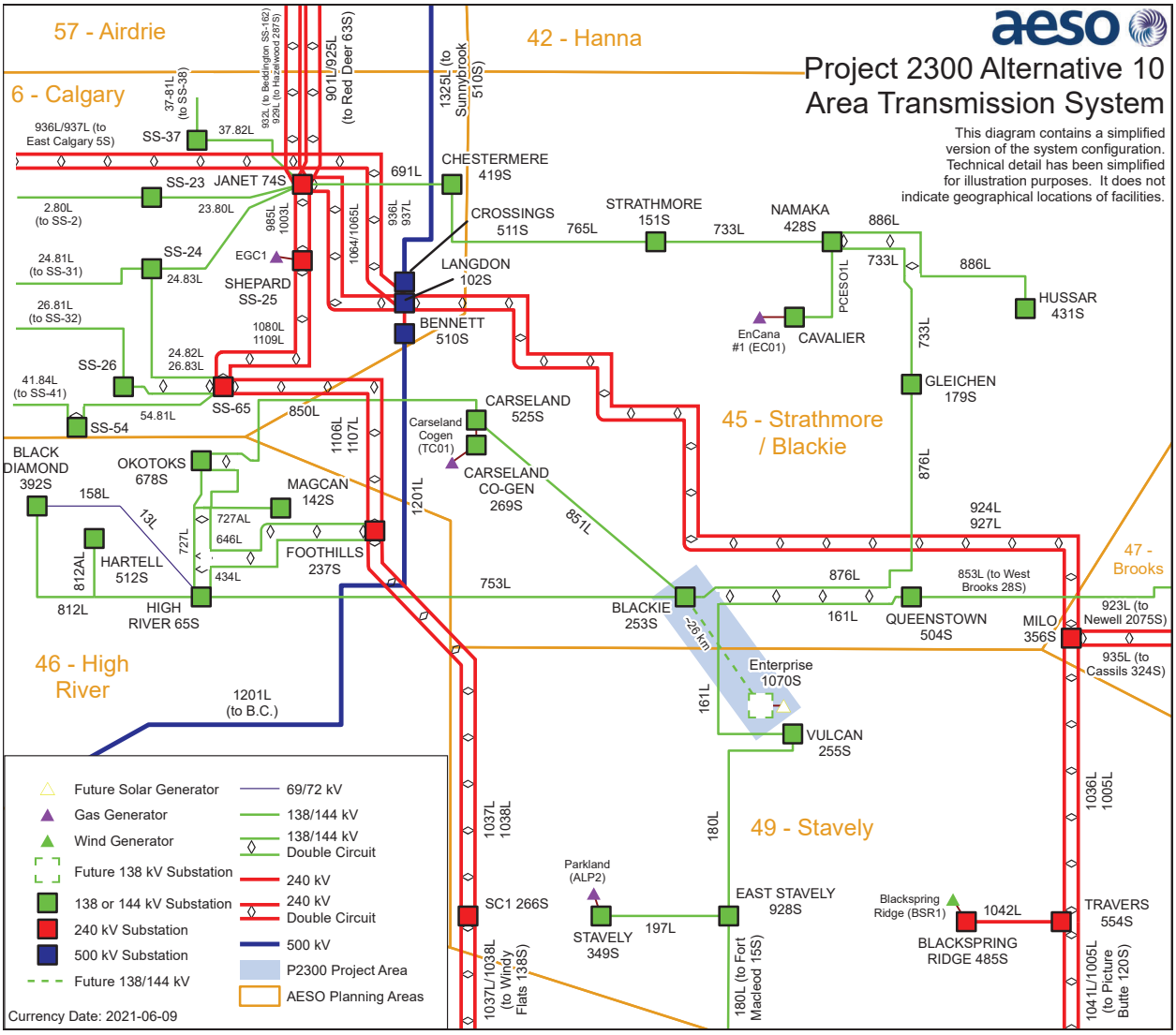
This alternative includes the following developments:

- Modify the existing Blackie 253S substation, including adding one 138 kV circuit breaker;
- Add a 138 kV circuit, approximately 26 km[10] in length, to connect the proposed Facility to the Blackie 253S substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

[10] Ibid.

The proposed connection configuration is shown in Figure 3-10.

Figure 3-10: Connection Alternative 10



Alternative 11 – Radial connection to the existing Queenstown 504S substation

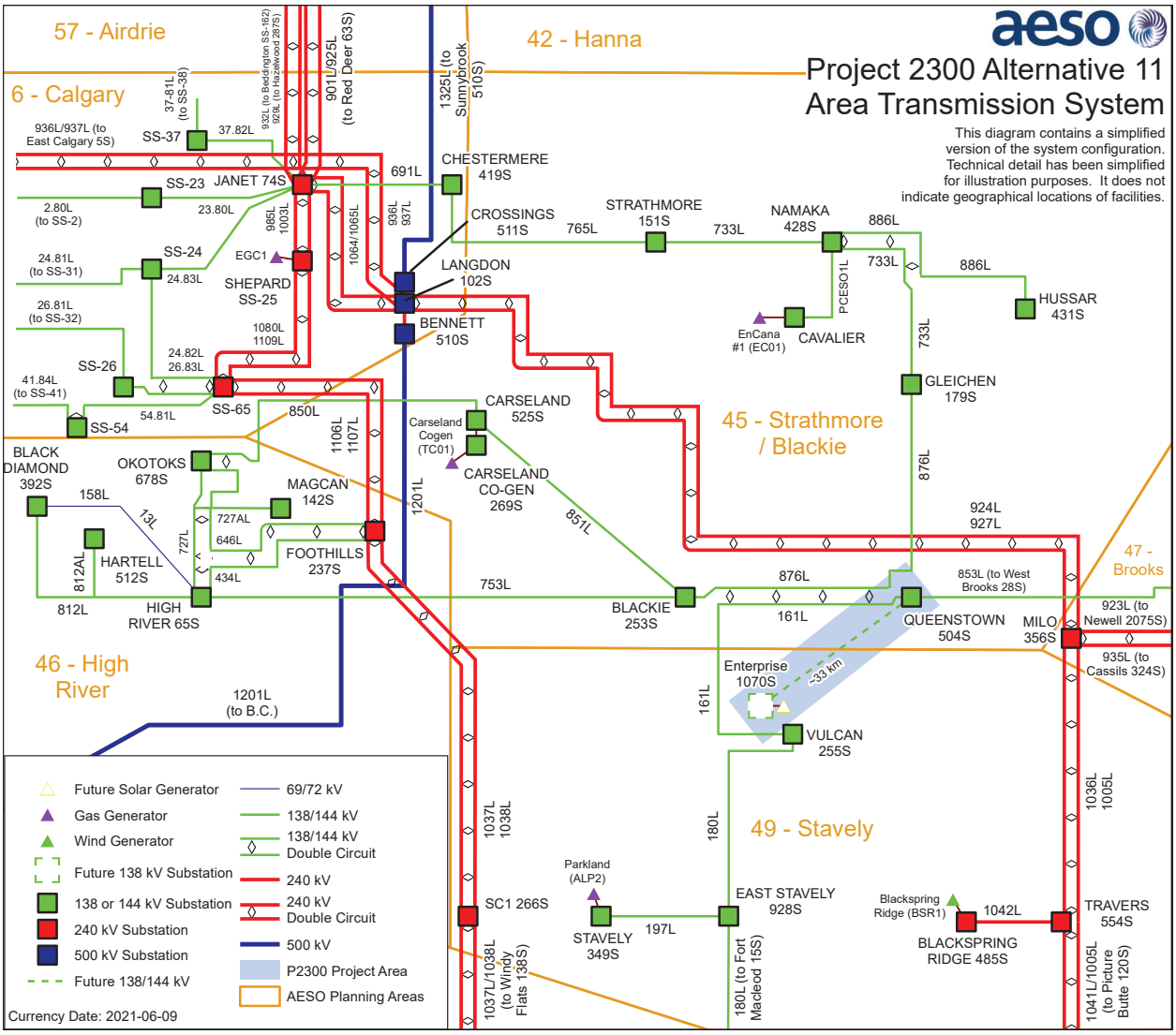
This alternative includes the following developments:

- Modify the existing Queenstown 504S substation, including adding one 138 kV circuit breaker;
- Add a 138 kV circuit, approximately 33 km[11] in length, to connect the proposed Facility to the Queenstown 504S substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

[11] Ibid.

The proposed connection configuration is shown in Figure 3-11.

Figure 3-11: Connection Alternative 11



3.3 Connection Alternatives Selected for Further Study

Alternative 7 is considered technically feasible and was selected for further study.

3.4 Connection Alternatives Not Selected for Further Study

Alternatives 1, 2, 3, 4, 5, 6, 9, 10, and 11 would involve increased transmission development and hence, increased cost, compared to Alternative 7 and Alternative 8. Therefore, these Alternatives were not selected for further study. Compared to Alternative 7, Alternative 8 requires crossing a 138 kV transmission line, which results in greater design complexity and increased overall transmission development and cost; therefore, Alternative 8 was 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

At the time of study, the scheduled ISD for the Project is August 31, 2022. Therefore, studies were performed using scenarios for 2022 Summer Peak and 2022 Summer Light.

Sensitivity scenarios (Scenario 6 - 7) that included Fortis Vulcan DER Solar (AESO project 2335) were also studied.

Table 4-1 lists the study scenarios. Post-Project scenarios reflect the requested Rate STS contract capacity of 65MW.

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 Peak (SP)	High Solar (HS)	2022 SP HS Pre-Project	0	0
2	2022 Summer Light (SL)	HS	2022 SL HS Pre-Project	0	0
Post-Project					
3	2022 SP	HS	2022 SP HS Post-Project	1	65
4	2022 SL	HS	2022 SL HS Post-Project	1	65
5	2029 SP	HS	2029 SP HS Post-Project	1	65
Pre-Project Sensitivity- Fortis Vulcan 255S DER Solar					
6	2022 SP	HS	2022 SP HS Pre-Project P2335 Sensitivity	0	0
Post-Project Sensitivity- Fortis Vulcan 255S DER Solar					
7	2022 SP	HS	2022 SP HS Post-Project P2335 Sensitivity	1	65

The AESO Planning Region load forecasts used for the connection studies were based on the *AESO 2019 Long Term Outlook* (2019 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.[12]

Power flow studies were performed for 2022 SP, and 2022 SL pre-Project scenarios, 2022 SP pre-Project sensitivity scenario,2022 SP and 2022 SL post-Project scenarios, and for 2022 SP post-Project sensitivity scenario.

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 2022 SP and 2022 SL post-Project scenarios, and 2022 SP post-Project sensitivity scenario.

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 SP pre-Project scenario, 2022 SP pre-Project sensitivity scenario, and for 2022 SP and 2029 SP post-Project scenarios, and 2022 SP post-Project sensitivity scenario.

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.

4.3.1 Post-Mitigation Studies

Power flow 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.

[12] 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.

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 SP	Thermal - above emergency rating	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	Materially increased violation	Planned RAS178	Modify Planned RAS178
2022 SP	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	463L (Fort MacLeod 15S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178
2022 SP	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	172L (North Lethbridge 370S to Chinook 181S)	New violation	Planned RAS178	Modify Planned RAS178
2022 SP	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	463L (Chinook 181S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	853L (Queenstown 504S to West Brooks 28S)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Planned RAS178	Modify Planned RAS178
2022 SP	None	Thermal - below emergency rating	EATL	180L (Fort MacLeod 15S to 180AL Tap)	New violation	None	Real Time Operational Practices
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	255ST1 (Vulcan 255S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP	None	Thermal - above emergency rating	725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	New violation	None	Modify Planned RAS178
2022 SP	None	Thermal - above emergency rating	725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	New violation	None	Modify Planned RAS178
2022 SP	None	Thermal - below emergency rating	725L (Bowron 674S to Coalbanks 111S)	463L (Chinook 181S to 463AL Tap)	New violation	None	Modify Planned RAS178
2022 SP	None	Thermal - below emergency rating	725L (Fort MacLeod 15S to Bowron 674S)	172L (North Lethbridge 370S to Chinook 181S)	New violation	None	Real Time Operational Practices
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	1037L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	1038L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	396ST1 (Pincher Creek 396S Transformer T1)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	Marginally reduced violation	Planned RAS174	Modify Planned RAS174
2022 SP	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	161L (Vulcan 255S to 161AL Tap)	Marginally increased violation	Planned RAS174	Modify Planned RAS174
2022 SP	Thermal - below emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	Materially increased violation	Planned RAS174	Modify Planned RAS174
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	180L (East Stavely 928S to 180AL Tap)	Marginally reduced violation	Planned RAS174	Modify Planned RAS174
2022 SP	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	853L (Queenstown 504S to 853AL Tap)	Materially increased violation	Planned RAS174	Modify Planned RAS174

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 SP	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	161L (Queenstown 504S to 161AL Tap)	Materially increased violation	Planned RAS174	Modify Planned RAS174
2022 SP	Thermal - below emergency rating	Thermal - below emergency rating	799ST1 (Coleman 799S Transformer T1)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP	None	Thermal - above emergency rating	463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	New violation	None	Modify Existing RAS169
2022 SP	None	Thermal - below emergency rating	172L (Coaldale 254S to Taber 83S)	1005L (Milo 356S to P2009 Tap)	New violation	None	Real Time Operational Practices
2022 SP	None	Thermal - above emergency rating	674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178
2022 SP	Thermal - above emergency rating	Thermal - above emergency rating	674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	Materially increased violation	Planned RAS178	Modify Planned RAS178
2022 SP	None	Thermal - above emergency rating	674ST1 (Bowron 674S Transformer T1)	463L (Chinook 181S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178
2022 SL	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	New violation	None	Modify Planned RAS178
2022 SL	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	172L (North Lethbridge 370S to Chinook 181S)	New violation	None	Modify Planned RAS178
2022 SL	None	Thermal - below emergency rating	725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	New violation	None	Real Time Operational Practices
2022 SL	None	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	New violation	None	Modify Planned RAS174
2022 SL	None	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	853L (Queenstown 504S to 853AL Tap)	New violation	None	Modify Planned RAS174
2022 SL	None	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	161L (Queenstown 504S to 161AL Tap)	New violation	None	Modify Planned RAS174
2022 SL	None	Thermal - below emergency rating	674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	New violation	Planned RAS178	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	Materially increased violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	463L (Fort MacLeod 15S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	172L (North Lethbridge 370S to Chinook 181S)	Materially increased violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	None	Thermal - above emergency rating	853L (Queenstown 504S to West Brooks 28S)	463L (Chinook 181S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	853L (Queenstown 504S to West Brooks 28S)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	None	Thermal - below emergency rating	EATL	180L (Fort MacLeod 15S to 180AL Tap)	New violation	None	Real Time Operational Practices

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 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	255ST1 (Vulcan 255S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	Marginally reduced violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP-Sensitivity	None	Thermal - above emergency rating	725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	New violation	Real Time Operating Practices	Modify Planned RAS178
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - above emergency rating	725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	Materially increased violation	Real Time Operating Practices	Modify Planned RAS178
2022 SP-Sensitivity	None	Thermal - above emergency rating	725L (Bowron 674S to Coalbanks 111S)	463L (Chinook 181S to 463AL Tap)	New violation	Real Time Operating Practices	Modify Planned RAS178
2022 SP-Sensitivity	None	Thermal - below emergency rating	725L (Fort MacLeod 15S to Bowron 674S)	172L (North Lethbridge 370S to Chinook 181S)	New violation	None	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	1037L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	1038L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	396ST1 (Pincher Creek 396S Transformer T1)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - below emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	Marginally reduced violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	255ST1 (Vulcan 255S Transformer T1)	Materially reduced violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	161L (Vulcan 255S to 161AL Tap)	Marginally reduced violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	Materially increased violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	180L (East Stavely 928S to 180AL Tap)	Marginally reduced violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	853L (Queenstown 504S to 853AL Tap)	Materially increased violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	15ST1 (Fort MacLeod 15S Transformer T1)	161L (Queenstown 504S to 161AL Tap)	Materially increased violation	Planned RAS174	Modify Planned RAS174
2022 SP-Sensitivity	None	Thermal - below emergency rating	240ST1 (McBride Lake 244S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	New violation	None	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - below emergency rating	799ST1 (Coleman 799S Transformer T1)	1005L (Milo 356S to P2009 Tap)	Marginally increased violation	Real Time Operating Practices	Real Time Operational Practices
2022 SP-Sensitivity	None	Thermal - above emergency rating	463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	New violation	None	Modify Existing RAS169
2022 SP-Sensitivity	None	Thermal - below emergency rating	172L (Coaldale 254S to Taber 83S)	1005L (Milo 356S to P2009 Tap)	New violation	None	Real Time Operational Practices

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 SP-Sensitivity	None	Thermal - below emergency rating	370ST1 (North Lethbridge 370S Transformer T1)	725L (Bowron 674S to 725BL Tap)	New violation	None	Real Time Operational Practices
2022 SP-Sensitivity	Thermal - below emergency rating	Thermal - above emergency rating	674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	Materially increased violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	Thermal - above emergency rating	Thermal - above emergency rating	674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	Materially increased violation	Planned RAS178	Modify Planned RAS178
2022 SP-Sensitivity	None	Thermal - above emergency rating	674ST1 (Bowron 674S Transformer T1)	463L (Chinook 181S to 463AL Tap)	New violation	Planned RAS178	Modify Planned RAS178

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%).
- RAS174 is a planned RAS proposed for AESO projects P1831, and P1870
- RAS 178 is a planned RAS proposed for AESO projects P1831, P1870, P1851, and Claresholm solar facility
- RAS169 is an existing RAS (see Section 1.2.2 of Attachment A1).
- In this table, “Modify” refers to adding the Project to the logic of the respective RAS

5.2 Pre-Project Study Results

Results for pre-project and pre-project sensitivity scenarios were similar, as described below.

5.2.1 Category A Conditions

No Reliability Criteria violations were observed under the Category A conditions (i.e., all elements in service) for any of the pre-Project scenarios. 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).

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

5.3 Post-Project Study Results

Results for post-project and post-project sensitivity scenarios were similar, as described below.

5.3.1 Category A Conditions

No Reliability Criteria violations were observed under Category A conditions for any pre-Project scenarios.

The probability of Category A thermal criteria violations materializing is highly dependent upon the production profile of the Facility and other generations facilities in the area. The connection assessment uses credible worst case conditions to assess the impact of the Facility connection on the Alberta interconnected electric system. While Category A thermal criteria violations were not observed under these credible worst case load and generation forecast conditions, certain facilities were observed to be approaching thermal loading limits suggesting that thermal criteria violations could arise 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.

5.3.2 Category B Conditions

Post-Project power flow studies identified a number of thermal criteria violations under Category B conditions.

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 base and sensitivity scenarios.

The same mitigation measures will be applied for both main and sensitivity scenarios.

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 with planned RAS 174 and RAS 178.

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.

Some of the remaining thermal criteria violations can be mitigated by modification of existing RAS169 by including the Project in the RAS logic.

The remaining thermal criteria violations can be mitigated by modification of planned RAS174 and RAS178 by including the Project in the RAS logic.

5.4.3 Post-Project Mitigation Study Results

For both main and sensitivity scenarios, most of the thermal criteria violations observed under Category B conditions can be alleviated by planned RAS 174, Planned RAS 178, and existing RAS 169. After RAS 174 action, real-time operational procedures would be required to fully alleviate the thermal criteria violations observed on 138 kV transmission line 180L (East Stavely 928S to 180AL Tap) under certain Category B conditions.

6 Project Dependencies

The Project does not require the completion of any other AESO plans to expand or enhance the transmission system prior to connection.

7 Conclusions and Recommendations

Based on the study results, Alternative 7 is technically viable. The connection assessment identified 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. While Category A thermal criteria violations were not observed under these credible worst-case load and generation forecast conditions, certain facilities were observed to be approaching thermal loading limits suggesting that thermal criteria violations could arise. The probability of Category A thermal criteria violations materializing is highly dependent upon the production profile of the Facility and other generations 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*.

The identified system performance issues can be mitigated through the use of planned RAS 174, planned RAS 178, existing RAS 169, and real-time operational practices, alone or in combination, as appropriate. With implementation of these mitigation measures, 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 7 as the preferred alternative to respond to the Market Participant’s request for system access service. Alternative 7 involves adding one 138 kV circuit to connect the Facility to the existing 138 kV transmission line 161L using a T-tap configuration. The conductor used for the new 138 kV circuit should have a minimum thermal rating similar to the existing 138 kV transmission line 161L.

Attachment A:
Engineering Connection Assessment Results

Engineering Connection Assessment: Study Results

P2300 Enterprise Solar project Connection

Renewable Energy Systems Canada Inc.

Date: April 20, 2021
Version: V1D1
Classification: Public

Role	Name	Date	Signature
Prepared	Yani Jazayeri, P. Eng.	April 20, 2021	
Reviewed	James Howland, P. Eng.	2021-04-20	
Approved	Yani Jazayeri, P. Eng.	April 20, 2021	

April 20, 2021

APEGA Permit to Practice: P14024

Contents

Tables

Attachments

1 Introduction

This report presents the results of the engineering studies that were completed by Hardline Engineering Ltd. (the Studies Consultant) to assess the impact of the Project (as defined in Attachment A1: AESO Engineering Connection Assessment Scope) on the performance of the Alberta interconnected electric system (AIES). The studies were performed in accordance with Attachment A1: AESO 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 Peak High Solar Pre-Project

Category A Conditions

No Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

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

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

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow[b] (MVA)	% Loading[c]
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	139.3	116.1
	1005L (Milo 356S to P2009 Tap)	481	588	485.3	100.9
255ST1 (Vulcan 255S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	129.1	107.6
	1005L (Milo 356S to P2009 Tap)	481	588	484.4	100.7
1037L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	518.0	107.7
1038L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	518.5	107.8
396ST1 (Pincher Creek 396S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	481.5	100.1

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow[b] (MVA)	% Loading[c]
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	118	130	130.6	110.7
	161L (Vulcan 255S to 161AL Tap)	117	129	139.6	119.3
	853L (West Brooks 28S to 853AL Tap)	121	133	128.5	106.2
	180L (East Stavely 928S to 180AL Tap)	120	132	124.2	103.5
	853L (Queenstown 504S to 853AL Tap)	121	133	138.2	114.2
	161L (Queenstown 504S to 161AL Tap)	117	129	139.6	119.3
799ST1 (Coleman 799S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	484.8	100.8
674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	85	94	95.6	112.5

Notes:

[b] Power flow (MVA) is current expressed as MVA (i.e., $S = \sqrt{3} \times V_{base} \times I_{actual}$)

[c] Reported as a percentage of the power flow (in MVA, i.e., $S = \sqrt{3} \times V_{base} \times I_{actual}$) 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 Light High Solar Pre-Project

Category A Conditions

No Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under Category A conditions.

Category B Conditions

No Reliability 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.

2.1.3 Scenario 6: 2022 Summer Peak High Solar Pre-Project P2335 Sensitivity

Category A Conditions

No Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under Category A conditions.

Category B Conditions

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 6

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow[b] (MVA)	% Loading[c]
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	150.5	125.4
	172L (North Lethbridge 370S to Chinook 181S)	85	94	86.8	102.1
	1005L (Milo 356S to P2009 Tap)	481	588	487.7	101.4
255ST1 (Vulcan 255S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	129.1	107.6
	1005L (Milo 356S to P2009 Tap)	481	588	484.4	100.7
725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	85	94	87.7	103.2
1037L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	519.5	108.0
1038L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	519.5	108.0
396ST1 (Pincher Creek 396S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	482.4	100.3

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow[b] (MVA)	% Loading[c]
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	118	130	130.5	110.6
	161L (Vulcan 255S to 161AL Tap)	117	129	151.3	129.3
	853L (West Brooks 28S to 853AL Tap)	121	133	140.2	115.9
	180L (East Stavely 928S to 180AL Tap)	120	132	123.6	103.0
	853L (Queenstown 504S to 853AL Tap)	121	133	150.0	124.0
	161L (Queenstown 504S to 161AL Tap)	117	129	151.3	129.3
799ST1 (Coleman 799S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	485.8	101.0
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	108.0	100.9
	172L (North Lethbridge 370S to Chinook 181S)	85	94	99.6	117.2

Notes:

[b] Power flow (MVA) is current expressed as MVA (i.e., $S = \sqrt{3} \times V_{base} \times I_{actual}$)

[c] Reported as a percentage of the power flow (in MVA, i.e., $S = \sqrt{3} \times V_{base} \times I_{actual}$) 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.

3 Post-Project Study Results

This section describes the results of the post-Project power flow studies and transient stability studies.

As described in Section 2 of Attachment A1, the post-Project studies were performed using Alternative 7.

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 Peak High Solar Post-Project Alternative 7

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-1.

Table 3-1: Thermal Criteria Violations under Category B Conditions for Scenario 3

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	
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	139.3	116.1	199.7	166.4	50.3
	463L (Fort MacLeod 15S to 463AL Tap)	107	118	90.1	84.2	123.6	115.5	31.3
	172L (North Lethbridge 370S to Chinook 181S)	85	94	81.6	96.0	114.2	134.3	38.3
	463L (Chinook 181S to 463AL Tap)	107	118	88.4	82.6	121.2	113.3	30.7
	1005L (Milo 356S to P2009 Tap)	481	588	485.3	100.9	495.4	103.0	2.1
EATL	180L (Fort MacLeod 15S to 180AL Tap)	120	132	94.9	79.1	126.6	105.5	26.4

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	
255ST1 (Vulcan 255S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	129.1	107.6	129.1	107.6	0.0
725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	90.8	84.9	118.9	111.1	26.2
	172L (North Lethbridge 370S to Chinook 181S)	85	94	84.1	99.0	111.0	130.6	31.6
	463L (Chinook 181S to 463AL Tap)	107	118	89.7	83.9	117.5	109.8	26.0
	172L (North Lethbridge 370S to Chinook 181S)	85	94	60.5	71.2	87.6	103.1	31.9
1037L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	518.0	107.7	522.8	108.7	1.0
1038L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	518.5	107.8	523.3	108.8	1.0
396ST1 (Pincher Creek 396S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	481.5	100.1	485.3	100.9	0.8
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	118	130	130.6	110.7	130.4	110.5	-0.2
	161L (Vulcan 255S to 161AL Tap)	117	129	139.6	119.3	139.9	119.6	0.3
	853L (West Brooks 28S to 853AL Tap)	121	133	128.5	106.2	188.2	155.5	49.3
	180L (East Stavely 928S to 180AL Tap)	120	132	124.2	103.5	123.5	102.9	-0.6
	853L (Queenstown 504S to 853AL Tap)	121	133	138.2	114.2	197.6	163.3	49.1
	161L (Queenstown 504S to 161AL Tap)	117	129	139.6	119.3	198.4	169.6	50.3

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	
799ST1 (Coleman 799S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	484.8	100.8	488.7	101.6	0.8
463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	118	130	102.1	86.5	130.0	110.2	23.7
172L (Coaldale 254S to Taber 83S)	1005L (Milo 356S to P2009 Tap)	481	588	477.5	99.3	481.5	100.1	0.8
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	103.6	96.8	132.3	123.6	26.8
	172L (North Lethbridge 370S to Chinook 181S)	85	94	95.6	112.5	123.6	145.4	32.9
	463L (Chinook 181S to 463AL Tap)	107	118	102.4	95.7	130.9	122.3	26.6

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 Light High Solar Post-Project Alternative 7

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

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

Table 3-2: 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	
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	102.6	85.5	161.6	134.7	49.2
	172L (North Lethbridge 370S to Chinook 181S)	85	94	63.4	74.6	95.8	112.7	38.1
725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	85	94	58.0	68.2	87.0	102.4	34.2
15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	121	133	91.2	75.4	149.7	123.7	48.3
	853L (Queenstown 504S to 853AL Tap)	121	133	101.1	83.5	159.4	131.7	48.2
	161L (Queenstown 504S to 161AL Tap)	117	129	102.3	87.4	160.2	136.9	49.5
674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	85	94	62.4	73.4	91.5	107.7	34.3

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.1.3 Scenario 7: 2022 Summer Peak High Solar Post-Project Alternative 7 P2335 Sensitivity

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions.

Category B Conditions

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 7

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	
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	150.5	125.4	209.0	174.2	48.8
	463L (Fort MacLeod 15S to 463AL Tap)	107	118	95.8	89.6	128.4	120.0	30.5
	172L (North Lethbridge 370S to Chinook 181S)	85	94	86.8	102.1	118.7	139.7	37.6
	463L (Chinook 181S to 463AL Tap)	107	118	94.1	87.9	126.0	117.8	29.9
	1005L (Milo 356S to P2009 Tap)	481	588	487.7	101.4	497.4	103.4	2.0
EATL	180L (Fort MacLeod 15S to 180AL Tap)	120	132	100.8	84.0	131.4	109.5	25.5
255ST1 (Vulcan 255S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	129.1	107.6	126.0	105.0	-2.6
725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	94.9	88.7	121.6	113.6	24.9
	172L (North Lethbridge 370S to Chinook 181S)	85	94	87.7	103.2	113.2	133.2	30.0
	463L (Chinook 181S to 463AL Tap)	107	118	93.8	87.7	120.3	112.4	24.7
	172L (North Lethbridge 370S to Chinook 181S)	85	94	64.0	75.3	90.5	106.5	31.2

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	
1037L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	519.5	108.0	524.3	109.0	1.0
1038L (Foothills 237S to Windy Flats 138S)	1005L (Milo 356S to P2009 Tap)	481	588	519.5	108.0	524.3	109.0	1.0
396ST1 (Pincher Creek 396S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	482.4	100.3	486.3	101.1	0.8
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	118	130	130.5	110.6	128.0	108.5	-2.1
	161L (Vulcan 255S to 161AL Tap)	117	129	151.3	129.3	149.2	127.5	-1.8
	853L (West Brooks 28S to 853AL Tap)	121	133	140.2	115.9	200.0	165.3	49.4
	180L (East Stavely 928S to 180AL Tap)	120	132	123.6	103.0	121.3	101.1	-1.9
	853L (Queenstown 504S to 853AL Tap)	121	133	150.0	124.0	209.5	173.1	49.1
	161L (Queenstown 504S to 161AL Tap)	117	129	151.3	129.3	210.1	179.6	50.3
240ST1 (McBride Lake 244S Transformer T1)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	90.7	75.6	121.3	101.1	25.5
799ST1 (Coleman 799S Transformer T1)	1005L (Milo 356S to P2009 Tap)	481	588	485.8	101.0	489.7	101.8	0.8
463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	118	130	106.6	90.3	133.3	113.0	22.7
172L (Coaldale 254S to Taber 83S)	1005L (Milo 356S to P2009 Tap)	481	588	478.5	99.5	482.4	100.3	0.8
370ST1 (North Lethbridge 370S Transformer T1)	725L (Bowron 674S to 725BL Tap)	118	130	94.1	79.8	119.5	101.3	21.6

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	
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	108.0	100.9	135.5	126.6	25.7
	172L (North Lethbridge 370S to Chinook 181S)	85	94	99.6	117.2	126.4	148.7	31.5
	463L (Chinook 181S to 463AL Tap)	107	118	106.8	99.8	134.1	125.3	25.5

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.2 Transient Stability Studies

Transient stability studies were completed for Scenario 3 - 2022 Summer Peak High Solar Post-Project, Scenario 4 - 2022 Summer Light High Solar Post-Project, and Scenario 7 - 2022 Summer Peak High Solar Post-Project P2335 Sensitivity.

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 3-4. 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 3-4: Transient Stability Study Results under Category B Conditions for Scenario 3, Scenario 4, and Scenario 7

Studied Contingency	Fault Description and Location	Results
180L (Fort Macleod 15S – Vulcan 255S)	3-phase fault at Fort Macleod 15S	Stable
	3-phase fault at Vulcan 255S	Stable
463L (Fort Macleod 15S – Chinook 181S)	3-phase fault at Fort Macleod 15S	Stable
	3-phase fault at Chinook 181S	Stable
725L (Fort Macleod 15S – Bowron 674S)	3-phase fault at Fort Macleod 15S	Stable
	3-phase fault at Bowron 674S	Stable
853L (Queenstown 504S – West Brooks 28S)	3-phase fault at Queenstown 504S	Stable
	3-phase fault at West Brooks 28S	Stable
172L (Chinook 181S – North Lethbridge 370S)	3-phase fault at Chinook 181S	Stable
	3-phase fault at North Lethbridge 370S	Stable
1041L (Travers 554S – North Lethbridge 370S)	3-phase fault at Travers 554S	Stable
	3-phase fault at North Lethbridge 370S	Stable
161L (Queenstown 504S – Vulcan 255S)	3-phase fault at Queenstown 504S	Stable
	3-phase fault at Vulcan 255S	Stable

4 Short Circuit Studies

4.1 Pre-Project Results

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

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

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)
North Lethbridge 370S	240	240.9	11.44	0.004350+ j0.022103	10.11	0.005407+ j0.031075
	138	143.4	13.20	0.007856+ j0.034290	11.54	0.007468+ j0.049869
West Brooks 28S	240	250.2	13.77	0.004264+ j0.020243	13.57	0.002733+ j0.021365
	138	141.2	15.03	0.006260+ j0.031707	16.56	0.001792+ j0.023019
East Stavely 928S	138	140.1	3.23	0.051605+ j0.132793	2.89	0.044214+ j0.188426
Queenstown 504S	138	139.2	2.93	0.060419+ j0.149334	1.98	0.122558+ j0.374002
Vulcan 255S	138	138.9	2.70	0.065896+ j0.157804	2.04	0.095580+ j0.322729
Fort Macleod 15S	138	141.2	5.85	0.025528+ j0.073732	4.52	0.031821+ j0.144026

Table 4-2: Pre-Project Short-Circuit Current Levels for Scenario 6

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)
North Lethbridge 370S	240	240.7	11.45	0.004334+ j0.022064	10.11	0.005400+ j0.031045
	138	143.2	13.23	0.007823+ j0.034176	11.55	0.007459+ j0.049778
West Brooks 28S	240	250.2	13.78	0.004255+ j0.020227	13.58	0.002732+ j0.021363
	138	141.2	15.05	0.006243+ j0.031670	16.57	0.001792+ j0.023014
East Stavely 928S	138	141.4	3.29	0.050362+ j0.131628	2.94	0.043180+ j0.186131
Queenstown 504S	138	140.3	2.97	0.059503+ j0.148482	2.01	0.120578+ j0.370612
Vulcan 255S	138	141.2	2.79	0.063180+ j0.155469	2.13	0.088982+ j0.311654
Fort Macleod 15S	138	141.2	5.88	0.025302+ j0.073401	4.53	0.031769+ j0.143769

[1] 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.

4.2 Post-Project Results

4.2.1 Scenario 3: 2022 Summer Peak High Solar Post-Project

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

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

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)
North Lethbridge 370S	240	241.2	11.43	0.004370+ j0.022148	10.11	0.005405+ j0.031055
	138	143.3	13.18	0.007885+ j0.034334	11.53	0.007465+ j0.049852
West Brooks 28S	240	250.0	13.75	0.004274+ j0.020254	13.56	0.002733+ j0.021365
	138	140.9	14.99	0.006278+ j0.031724	16.52	0.001792+ j0.023019
East Stavely 928S	138	141.7	3.25	0.052160+ j0.133371	2.92	0.044219+ j0.188439
Queenstown 504S	138	139.7	2.94	0.060931+ j0.149792	1.99	0.122569+ j0.374025
Vulcan 255S	138	141.6	2.74	0.067140+ j0.158891	2.08	0.095610+ j0.322798
Fort Macleod 15S	138	141.2	5.85	0.025623+ j0.073854	4.52	0.031820+ j0.144019
Enterprise 1070S	138	141.8	2.70	0.068405+ j0.161601	2.01	0.103056+ j0.340655

4.2.2 Scenario 5: 2029 Summer Peak High Solar Post-Project

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

Table 4-4: Post-Project Short-Circuit Current Levels for Scenario 5

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)
North Lethbridge 370S	240	247.0	11.47	0.003813+ j0.021362	10.01	0.004841+ j0.030886
	138	142.8	12.74	0.007020+ j0.033395	11.01	0.006564+ j0.049901
West Brooks 28S	240	255.2	13.86	0.003309+ j0.018378	14.28	0.001864+ j0.016970
	138	142.0	14.57	0.004940+ j0.029455	16.30	0.001233+ j0.020135
East Stavely 928S	138	142.9	2.87	0.057682+ j0.140105	1.98	0.104664+ j0.342849
Queenstown 504S	138	144.5	2.72	0.061365+ j0.150474	1.77	0.133039+ j0.400825
Vulcan 255S	138	145.4	2.49	0.070584+ j0.163759	1.68	0.131452+ j0.413603
Fort Macleod 15S	138	141.5	5.42	0.026048+ j0.075077	3.58	0.048899+ j0.197037
Enterprise 1070S	138	145.9	2.46	0.071572+ j0.165949	1.66	0.136079+ j0.424322

4.2.3 Scenario 7: 2022 Summer Peak High Solar Post-Project P2335 Sensitivity

Post-Project short-circuit current levels for Scenario 7 are provided in Table 4-4.

Table 4-5: Post-Project Short-Circuit Current Levels for Scenario 7

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)
North Lethbridge 370S	240	241.7	11.46	0.004356+ j0.022148	10.13	0.005405+ j0.031065
	138	143.9	13.23	0.007848+ j0.034337	11.57	0.007462+ j0.049885
West Brooks 28S	240	250.2	13.76	0.004264+ j0.020247	13.57	0.002732+ j0.021364
	138	141.0	15.02	0.006258+ j0.031704	16.54	0.001791+ j0.023015
East Stavely 928S	138	145.4	3.35	0.051335+ j0.132917	2.99	0.043842+ j0.189982
Queenstown 504S	138	141.1	2.98	0.060090+ j0.149116	2.02	0.120688+ j0.371306
Vulcan 255S	138	144.6	2.83	0.064662+ j0.157010	2.17	0.089364+ j0.313913
Fort Macleod 15S	138	143.4	5.94	0.025459+ j0.073802	4.57	0.031950+ j0.145026
Enterprise 1070S	138	144.5	2.78	0.066103+ j0.159852	2.09	0.097297+ j0.332463

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
Planned 174[a]	161L (Vulcan 255S - Queenstown 504S)	15ST1 (Fort Macleod 15S Transformer T1)
Planned 178[b]	172L (Chinook 181S - North Lethbridge 270S)	853L (Queenstown 504S – West Brooks 28S)
		674ST1 (Bowron 674S Transformer T1)
		725L (Bowron 674S – Coalbanks 111S)
Real time operational practices	180L (Fort Macleod 15S - Vulcan 255S)[c]	255ST1 (Vulcan 255S Transformer T1)
	1005L (Milo 356S - P2009 Tap)	1037L (Foothills 237S – Windy Flats 138S) 1038L (Foothills 237S – Windy Flats 138S) 396ST1 (Pincher Creek 396S Transformer T1) 799ST1 (Coleman 799S Transformer T1) 172L (Coaldale 254S – Taber 83S)

Notes:

[a] Planned 174 is a RAS proposed for the planned P1831, P1870, and P2335.

[b] Planned 178 is a RAS proposed for the planned P1831, P1851, P1870, and Claresholm Solar.

[c] The thermal loading that exceeds emergency rating on 180L in Pre-project scenario will be managed by the RAS planned for 172L in the Post-Project .

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
Planned 169[a, b]	725L (Bowron 674S - Fort Macleod 15S)	463L (Fort Macleod 15S – Chinook 181S)
Planned 174[b]	161L (Vulcan 255S - Queenstown 504S)	15ST1 (Fort Macleod 15S Transformer T1)
Planned 178[b]	172L (Chinook 181S - North Lethbridge 270S)	853L (Queenstown 504S – West Brooks 28S)
		725L (Bowron 674S – Coalbanks 111S)
		674ST1 (Bowron 674S Transformer T1)

Mitigation Measure	Location of Observed Violation	Contingency
Real time operational practices	180L (Fort Macleod 15S - Vulcan 255S)	255ST1 (Vulcan 255S Transformer T1) EATL (East Alberta Transmission Line) 240ST1 (McBride Lake 240S Transformer T1)
	172L (Chinook 181S - North Lethbridge 270S)	725L (Fort Macleod 15S – Bowron 674S)
	725L (Bowron 674S - Fort Macleod 15S)	370ST1 (North Lethbridge 370S Transformer T1)
	1005L (Milo 356S - P2009 Tap)	1037L (Foothills 237S – Windy Flats 138S) 1038L (Foothills 237S – Windy Flats 138S) 396ST1 (Pincher Creek 396S Transformer T1) 799ST1 (Coleman 799S Transformer T1) 172L (Coaldale 254S – Taber 83S)

Notes:

[a] 169 is an existing RAS (see Section 1.2.2 of Attachment A1). Modifications to 169 are proposed for the planned P1831, P1870, and Claresholm Solar. This modified version of 169 is referred to hereafter as “planned 169”.

[b] “Modify” refers to adding the Project to the logic of the planned 169, 174, and 178.

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 scenarios 3, 4, and 7 using Alternative 7 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 or TFO capital maintenance projects were not studied.

5.3.1 Scenario 3: 2022 Summer Peak High Solar Post-Project Post-RAS

Category B Conditions

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

After RAS actions were complete, real-time operational practices are required to fully alleviate certain thermal criteria violations observed on 138 kV transmission line 180L.

Table 5-3: Post-RAS Power Flow Study Results for Scenario 3

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
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	199.7	166.4	23.9	19.9
	463L (Fort MacLeod 15S to 463AL Tap)	107	118	123.6	115.5	14.8	13.8
	172L (North Lethbridge 370S to Chinook 181S)	85	94	114.2	134.3	48.2	56.8
	463L (Chinook 181S to 463AL Tap)	107	118	121.2	113.3	37.3	34.9
	1005L (Milo 356S to P2009 Tap)	481	588	495.4	103.0	446.7	92.9
725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	118.9	111.1	38.6	36.0
	172L (North Lethbridge 370S to Chinook 181S)	85	94	111.0	130.6	75.8	89.2
	463L (Chinook 181S to 463AL Tap)	107	118	117.5	109.8	64.4	60.2
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	118	130	130.4	110.5	113.5	96.2
	161L (Vulcan 255S to 161AL Tap)	117	129	139.9	119.6	103.8	88.7
	853L (West Brooks 28S to 853AL Tap)	121	133	188.2	155.5	88.0	72.7
	180L (East Stavely 928S to 180AL Tap)	120	132	123.5	102.9	122.7	102.2[a]
	853L (Queenstown 504S to 853AL Tap)	121	133	197.6	163.3	97.2	80.3
	161L (Queenstown 504S to 161AL Tap)	117	129	198.4	169.6	100.6	86.0
463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	118	130	130.0	110.2	20.1	17.0
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	132.3	123.6	23.1	21.6
	172L (North Lethbridge 370S to Chinook 181S)	85	94	123.6	145.4	58.1	68.3
	463L (Chinook 181S to 463AL Tap)	107	118	130.9	122.3	47.0	44.0

Notes:

[a] The thermal overloads on 180L remained after RAS actions were complete, and real-time operational practices will mitigate the overload.

5.3.2 Scenario 4: 2022 Summer Light High Solar Post-Project Post-RAS

Category B Conditions

The thermal criteria 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

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
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	161.6	134.7	23.4	19.5
	172L (North Lethbridge 370S to Chinook 181S)	85	94	95.8	112.7	18.8	22.1
15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	121	133	149.7	123.7	61.6	50.9
	853L (Queenstown 504S to 853AL Tap)	121	133	159.4	131.7	71.0	58.6
	161L (Queenstown 504S to 161AL Tap)	117	129	160.2	136.9	73.4	62.7

5.3.3 Scenario 7: 2022 Summer Peak High Solar Post-Project P2335 Sensitivity Post-RAS

Category B Conditions

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

After RAS actions were complete, real-time operational practices are required to fully alleviate certain thermal criteria violations observed on 138 kV transmission line 180L.

Table 5-5: Post-RAS Power Flow Study Results for Scenario 7

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
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	120	132	209.0	174.2	12.1	10.1
	463L (Fort MacLeod 15S to 463AL Tap)	107	118	128.4	120.0	12.2	11.4
	172L (North Lethbridge 370S to Chinook 181S)	85	94	118.7	139.7	40.3	47.4
	463L (Chinook 181S to 463AL Tap)	107	118	126.0	117.8	29.8	27.8
	1005L (Milo 356S to P2009 Tap)	481	588	497.4	103.4	449.2	93.4
725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	121.6	113.6	30.8	28.8
	172L (North Lethbridge 370S to Chinook 181S)	85	94	113.2	133.2	67.6	79.6
	463L (Chinook 181S to 463AL Tap)	107	118	120.3	112.4	56.3	52.6
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	118	130	128.0	108.5	110.5	93.7
	255ST1 (Vulcan 255S Transformer T1)	28.1	28.1	33.9	120.5	4.0	14.4
	161L (Vulcan 255S to 161AL Tap)	117	129	149.2	127.5	100.8	86.1
	853L (West Brooks 28S to 853AL Tap)	121	133	200.0	165.3	84.7	70.0
	180L (East Stavely 928S to 180AL Tap)	120	132	121.3	101.1	119.7	99.8
	853L (Queenstown 504S to 853AL Tap)	121	133	209.5	173.1	94.6	78.1
	161L (Queenstown 504S to 161AL Tap)	117	129	210.1	179.6	97.7	83.5
463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	118	130	133.3	113.0	14.5	12.3
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	107	118	135.5	126.6	17.4	16.3
	172L (North Lethbridge 370S to Chinook 181S)	85	94	126.4	148.7	50.6	59.5
	463L (Chinook 181S to 463AL Tap)	107	118	134.1	125.3	39.7	37.1

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 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

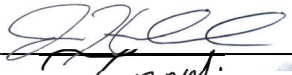
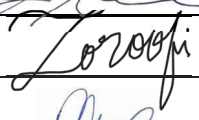
P2300 RESC Enterprise MPC Solar

Renewable Energy Systems Canada Inc.

Date: March 15, 2021

Version: V1

Classification: Public

Company Name	Name and Credentials	Date	Signature
Hardline Engineering Ltd.	James R Howland, P.Eng	2021-03-23	
AESO	Siavash Zoroofi, P. Eng	03/24/2021	
Renewable Energy Systems Canada Inc. (Market Participant)	Rebecca Crump	2021-03-23	

Contents

Tables

Figures

Attachments

1 Introduction

This Study Scope provides an overview of the engineering studies to be completed by Hardline Engineering Ltd. (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

Renewable Energy Systems Canada Inc. (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed RESC Enterprise MPC Solar (Facility) to the AIES.

The Market Participant's request includes: a request for a new system access service in the area of Stavely, with a Rate STS, *Supply Transmission Service*, contract capacity of 65 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 3 MW; and a request for transmission development (collectively, the Project).

The Project in-service date (ISD) used for the purpose of the studies is August 31, 2022.

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	1 MW
	Type	Station service
	Motors (number and size)	Not Applicable
	Power factor	0.9 pf
	Future load expansion plans	No
Generation	Generation type	Solar
	Existing Rate STS, *Supply Transmission Service,* contract capacity	0 MW
	Requested Rate STS	65 MW
	Number and size of generating units	TBD
	Maximum authorized real power (MARP)	65 MW
	Maximum capability (MC)	65 MW
	Reactive power capability	(0.95 pf absorbing)

Project Component		Description
		(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 Stavely (Area 49).

The Study Area for the Project consists of the AESO planning areas of Brooks (Area 47), Fort Macleod (Area 53), Lethbridge (Area 54), and Stavely (Area 49), 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).

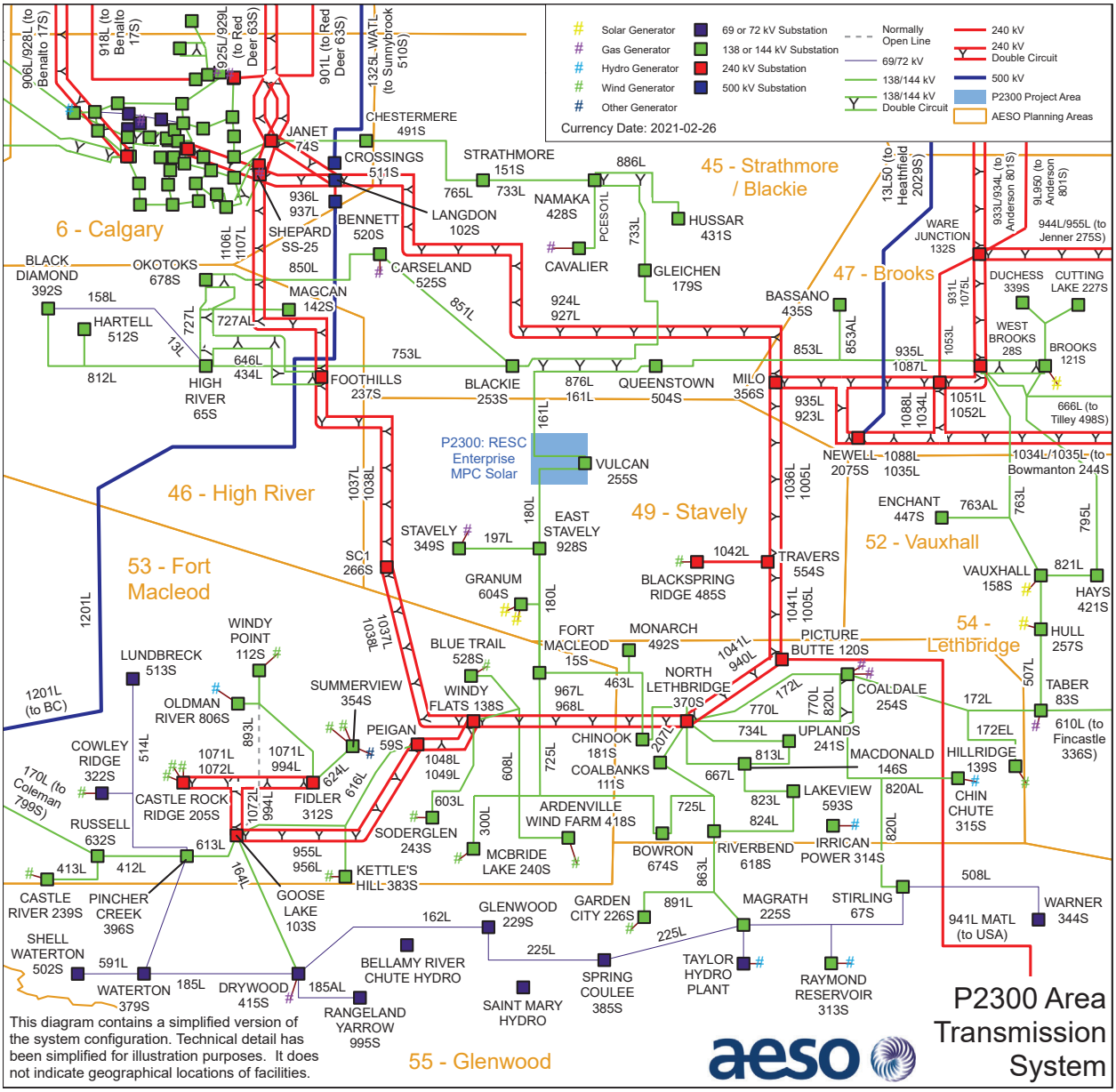
There are a number of constraints in the Study Area that are mitigated by existing remedial action schemes (RASs) and/or other protection schemes.

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

- RAS 36: Garden City 226S WAGF Trip Scheme
- RAS 37: Peigan 59S - 616L Overload Mitigation Scheme
- RAS 40: Coleman 799S - 786L Overload Mitigation Scheme
- RAS 129: Goose Lake 103S 613L Overload Mitigation Scheme
- RAS 136: Direct Transfer Trip to MATL on Loss of 1201L
- RAS 137: MATL Local Detection Scheme
- RAS 141: 498S Voltage Instability Mitigation
- RAS 149: EATL HVDC
- RAS 150: WATL HVDC
- RAS 604: Windy Point/Oldman River Tripping Scheme

- RAS 605: Summerview Tripping 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 7 – Connect the Facility to the existing 138kV transmission line 161L through a T-Tap configuration

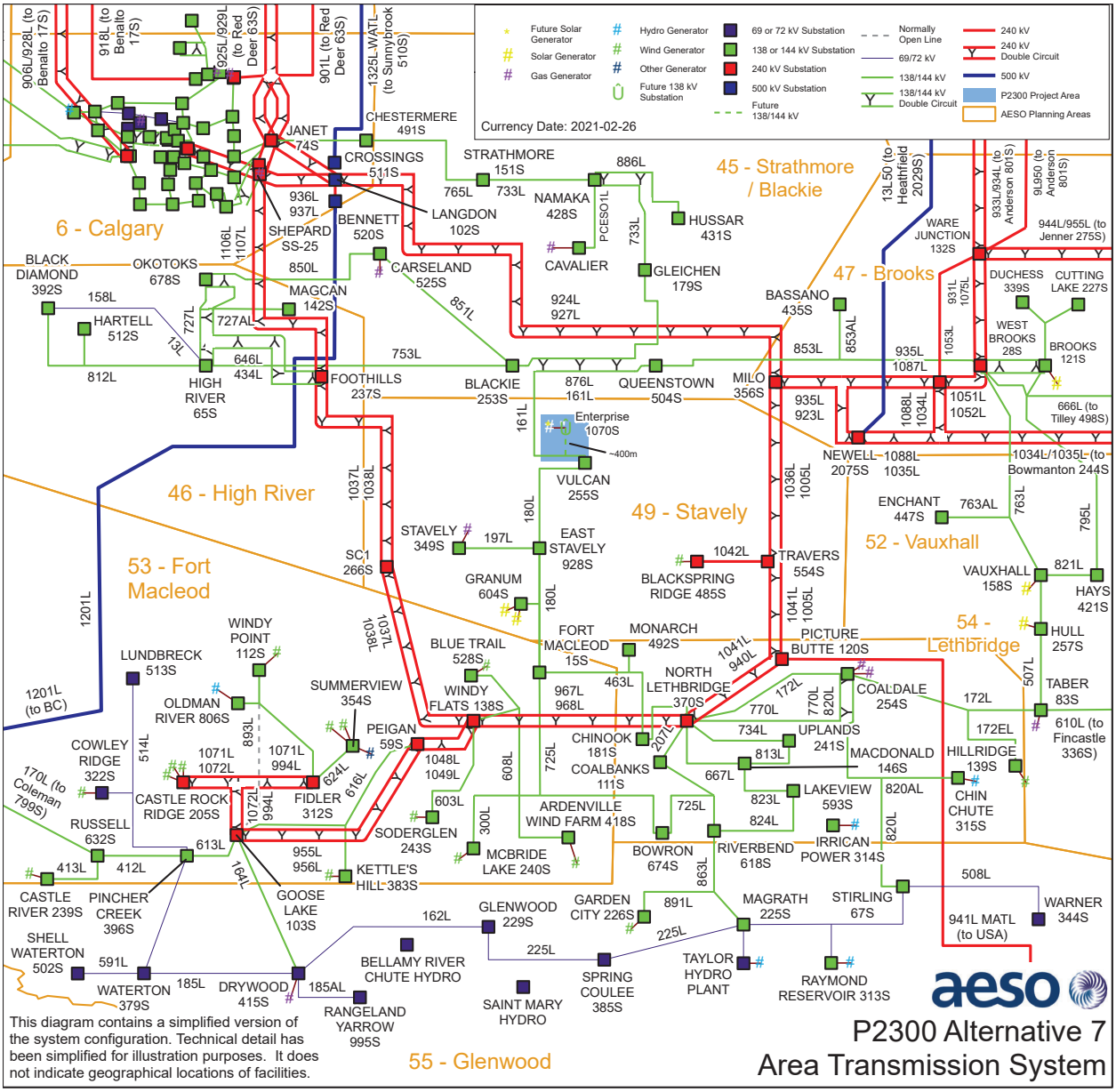
This alternative includes the following developments:

- Add one 138 kV transmission circuit, approximately 400 meters in length[1], to connect the proposed Enterprise 1070S substation to the existing 138 kV transmission line 161L between the existing Vulcan 255S and Queenstown 504S substations using a T-Tap connection configuration; and
- Add or modify associated equipment as required for the above transmission developments

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

[1] The exact line length to be determined by the TFO.

Figure 2-1: Connection Alternative 7



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 vents. 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 502.7 of the ISO rules, *Load Facility Technical 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*;
- Section 502.5 of the ISO rules *Generating Unit Technical Requirements*;
- Section 502.6 of the ISO rules *Generating Unit 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 Peak (SP)	High Solar (HS)	2022 SP HS Pre-Project	0	0
2	2022 Summer Light (SL)	HS	2022 SL HS Pre-Project	0	0
Post-Project					
3	2022 SP	HS	2022 SP HS Post-Project	1	65
4	2022 SL	HS	2022 SL HS Post-Project	1	65
5	2029 SP	HS	2029 SP HS Post-Project	1	65
Pre-Project Sensitivity- Fortis Vulcan 255S DER Solar					
6	2022 SP	HS	2022 SP HS Pre-Project P2335 Sensitivity	0	0
Post-Project Sensitivity- Fortis Vulcan 255S DER Solar					
7	2022 SP	HS	2022 SP HS Post-Project P2335 Sensitivity	1	65

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.

4.2.2 Connection Project Assumptions

Table 4-2 summarizes the connection projects in the Study Area that will be included as part of sensitivity studies in addition to those listed in subsection 4.2.4.

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

AESO Project No.	AESO Project Name	AESO Planning Area No.	Generation (MW)	Load (MW)	Scheduled ISD
P2335	Fortis Vulcan 255S DER Solar	49	13	0	June 2021

Note:

MARP value for this facility is 15 MW.

4.2.3 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 *2019 Long-term Outlook* (2019 LTO)[2] with modifications to incorporate the latest forecast intelligence. For the post-Project studies, when the Study Area loads are modified to align with the regional load forecast, the active power to reactive power ratio in the base case scenarios shall be maintained.

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]	923	1,513

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) ,HighRiver (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.

4.2.4 Generation Assumptions

The generation forecast to be used for the studies is based on the 2019 LTO with modifications to incorporate the latest forecast intelligence. The generation assumptions for the studies will assume high solar dispatch 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.

[2] The [e.g., 2017 LTO] is available on the AESO website.

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
Irrican Hydro (ICP1)	450	7	54	6.9	6.6
Lethbridge Coaldale (ME04)	4690	6	54	0	6
Altagas Parkland (ALP2)	4235	10	49	0	9.9
Oldman River (OMRH)	2230	32	53	31.6	31.7
Chin Chute (CHIN)	407	15	54	9.9	11.3
AltaGas Bantry (ALP1)	4275	7	47	0	6.5

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

Pre-Project dispatch levels for the [existing, under-construction and contracted] 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)	
				2022 SL	2022 SP
Ardenville Wind (ARD1)	4735, 4740	68	53	13.6	40.8
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 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	16.2	48.6
Kettles Hill (KHW1)	2402, 3402	63	53	12.6	37.8
McBride Lake Windfarm (AKE1)	2901, 3901, 4901	73	53	14.6	43.8
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	53	6.0	18.0

Suncor Wintering Hills (SCR4)	60789, 60791, 60793, 60846, 60848, 60850	88	43	17.6	52.8
Old Man River (OWF1)	61543	46	53	9.2	27.6
Blackspring Ridge (BSR1)	61736, 61737	300	49	60.0	180.0
Castle Rock Ridge 2 (CRR2)	567221	30.6	53	6.1	18.4
Enel Riverview Wind Farm (RIV1)	69221	115	53	23.0	69.0
Capital Power Whitla Wind Power Facility (WHT1)	60990	201.6	4	40.3	121.0
Subtotal (Southern Alberta)				**306.2**	**918.7**
Ghost Pine (NEP1)	2621, 2622, 2623, 2624, 2625	82	42	16.4	49.2
Halkirk (HAL1)	66435, 67435	150	42	30.0	90.0
Fortis Bull Creek Phases 1 and 2(Bul1 & BUL2)	550003, 550004	29	37	5.8	17.4
Subtotal (Central Alberta)				**52.2**	**156.6**
Total				**358.4**	**1075.3**

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 Generations (MW)	
				2022 SL	2022 SP
Brooks Solar (BSC1)	553257	15	47	10.5	14.3
Hull DER Solar (HUL1)	552402	24.5	52	17.2	23.3
Vauxhall Solar (VXH1)	554273	22	52	15.4	20.9
Claresholm 1 (CLR1)	60894	58	49	40.6	55.1
Clareshom 2 (CLR2)	61894	75	49	52.5	71.3
Suffield (SUF1)	557270	23	52	16.1	21.9
Burdett(BRD1)	992692	10.5	52	7.4	10.0
Burdett (BUR1)	558269	20	52	14.0	19.0
Westfield Yellow Lake (WEF1)	557277	19	52	13.3	18.1
Subtotal (Southern Alberta)				**186.9**	**253.7**
Innisfail Solar (INF1)	557120	22	39	15.4	20.9
Subtotal (Central Alberta)				**15.4**	**20.9**
Total				**202.3**	**274.6**

Table 4-7 and Table 4-8 list 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 4-7: 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 (MW)	
						2022 SL	2022 SP
P1892	Fortis Buffalo Atlee Cluster 3 WAGF (REP #2)	Sept. 1, 2020	552260	17.25	47	3.5	10.4
P1853	Fortis Buffalo Atlee Cluster 1 WAGF (REP #2)	Sept. 1, 2020	553260	17.25	47	3.5	10.4
P2199	Buffalo Atlee Wind Farm 2 (REP #2)	Sept. 1, 2020	557261	13.8	47	2.8	8.3
P1719	Stirling WAGF Project	21-May-21	61630	113	54	22.6	67.8
P2122	EDF Cypress Wind (REP #2)	Nov. 1, 2021	560003	201.6	4	40.3	121.0
P1533	Joss MPC WAGF (REP #3)	31-May-21	60798, 60799	122.4	47	24.5	73.4
P1698	Joss Jenner WAGF - Phase 2 (REP #3)	31-May-21	61798, 61799	71.4	47	14.3	42.8
P2041	TransAlta Windrise MPC Wind (REP #3)	Dec. 17, 2020	56703	207	53	41.4	124.2
P1812	Suncor Forty Mile Granlea WAGF	Nov. 16, 2020	61994, 62994	200	4	40.0	120.0
P1800	Capital Power Whitla Wind Power Facility	Dec. 1, 2020	61990	97.2	4	19.4	58.3
P2212	RESC Rattlesnake Ridge MPC Wind	30-Jul-21	60873	115.9	4	23.2	69.5
P1718	Wheatland WAGF	30-Sep-22	61632, 60632	120	43	24.0	72.0
Subtotal (Southern Alberta)						**259.4**	**778.1**
P1567	EDPR Sharp Hills Wind Farm (REP #1)	Nov. 15, 2020	60831, 60832	248.4	42	49.7	149.0
Subtotal (Central Alberta)						**49.7**	**149.0**
Total Planned						**309.0**	**927.1**
Total Planned, Existing and Under Construction							

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)	
						2022 SL	2022SP
P2009	Greengate Travers MPC Solar	Dec. 1, 2020	560026, 561026, 562026	400	49	280.0	380.0
P1839	Fortis 421S Hays DG PV	Feb. 15, 2021	554401	23	52	16.1	21.9

P1831	Fortis 255S Vulcan Faribault Farms DG PV	24-May-21	4244	22	49	15.4	20.9
P1850	Fortis Coaldale 254S DER Solar 3	24-May-21	554691	22	54	15.4	20.9
P1851	Fortis Monarch 492S DER Solar	24-May-21	2005	23.6	54	16.5	22.4
P1862	Fortis Spring Coulee 385S Solar DG	Oct. 15, 2021	553246, 554246	29.5	55	20.7	28.0
P1870	Fortis Stavely 349S DER Solar	24-May-21	2004	16.5	49	11.6	15.7
P1918	FortisAlberta Conrad DER Solar 1	Aug. 15, 2021	554291	23.4	52	16.4	22.2
P1959	FortisAlberta Conrad DER Solar 2	Aug. 15, 2021	553291	22.5	52	15.8	21.4
P2029	FortisAlberta Strathmore 151S DER Solar 1	Aug. 15, 2021	557259	18	45	12.6	17.1
P2030	FortisAlberta Strathmore 151S DER Solar 2	Aug. 15, 2021	558259	22.5	45	15.8	21.4
P2341	Travers Solar Phase 2	1-Apr-22	560026, 561026, 562026	65	49	45.5	61.8
Subtotal (Southern Alberta)						**481.6**	**653.6**
Subtotal (Central Alberta)							
Total Planned							
Total Planned, Existing and Under Construction							

The post-Project scenario wind and solar generation dispatch levels were identical to the pre-Project scenario dispatch levels shown in Table 4-5, Table 4-6, Table 4-7, and Table 4-8. The Facility was dispatched to 65 MW in all post-Project scenarios.

4.2.5 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 2029 SP 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 (+) (MW) by Intertie		
		AB-BC	AB-SK	MATL
1, 3, 6, 7	2022 SP HS Pre (Post)-Project / 2022 SP HS Pre (Post)-Project P2335 Sensitivity	TBD	0	-300
2, 4	2022 SL HS Pre (Post)-Project / 2022 SL HS Pre (Post)-Project P2335 Sensitivity	0	0	0

4.2.6 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 2029 SP 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, 7	2022 SP HS Pre (Post)-Project / 2022 SP HS Pre (Post)-Project P2335 Sensitivity	TBD	TBD
2, 4	2022 SL HS Pre (Post)-Project / 2022 SL HS Pre (Post)-Project P2335 Sensitivity	TBD	TBD

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

4.2.7 Transmission Facility Ratings

The legal owners of transmission facilities (TFOs) 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 Rating (MVA)	
			Normal	Emergency
820L	Stirling 67S - 820L Tap - Coaldale 254S	138	120	132
820AL	Chin Chute 315S - 820L Tap	138	120	132
1041L	North Lethbridge 370S - Travers 554S	240	481	553
940L	North Lethbridge 370S - Picture Butte 120S	240	481	577

Line ID	Line Description	Voltage Class (kV)	Summer Rating (MVA)	
			Normal	Emergency
1036L	Travers 554S - Milo 356S	240	481	577
1005L	Picture Butte 120S - Milo 356S	240	481	577
863L	Magrath 225S - Riverbend 618S	138	120	132
725AL	Riverbend 618S- 725L	138	120	132
725L	Bowron 674S- 725AL tap	138	122	134
725L	725AL tap - Coalbanks 111S	138	116	128
207L	Coalbanks 111S - North Lethbridge 370S	138	120	132
734L	Uplands 241S - North Lethbridge 370S	138	167	184
172L	North Lethbridge 370S - Coaldale 254S	138	119	131
172L	Chinook 181S - North Lethbridge 370S	138	85	94
172L	Coaldale 254S - Taber 83S	138	119	131
180L	East Stavely 928S-Vulcan 255S	138	118	130
180L	East Stavely 928S-Fort Macleod 15S	138	120	132
161L	Vulcan 255S - Queenstown 504S	138	117	129
463L	Fort MacLeod 15S-Chinook L181S	138	107	118
823L	Macdonald 146S t-Lakeview 593S	138	142	142
824L	Lakeview 593S - Riverbend 618S	138	142	142
667L	Macdonald 146S - North Lethbridge 370S	138	175	175
853L	Queenstown 504S-Westbrooks 28S	138	121	133

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)
North Lethbridge 370S	T3	240/138	193.6
	T5	240/138	200
	T6	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		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
Hillridge 139S	138	1 x 1.8 MVAr	1.8	-	-
Windy Flats 138S	240	-	-	2x75 MVAr	150

4.2.8 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
180L (Vulcan 255S – Fort Macleod 15S)	Vulcan 255S	9	60
180L (Vulcan 255S – Fort Macleod 15S)	Fort Macleod 15S	9	60
463L (Fort MacLeod 15S-Chinook 181S)	Chinook L181S	9	60
463L (Fort MacLeod 15S-Chinook 181S)	Fort Macleod 15S	9	60
725L (Bowron 674S - Fort Macleod 15S)	Bowron 674S	9	60
725L (Bowron 674S - Fort Macleod 15S)	Fort Macleod 15S	9	60
853L (Queenstown 504S-Westbrooks 28S)	Queenstown 504S	9	60
853L (Queenstown 504S-Westbrooks 28S)	Westbrooks 28S	9	60
172L (Chinook 181S – North Lethbridge 370S)	Chinook 181S	9	30
172L (Chinook 181S – North Lethbridge 370S)	North Lethbridge 370S	9	30
1041L (North Lethbridge 370S - Travers 554S)	North Lethbridge 370S	5	6
1041L (North Lethbridge 370S - Travers 554S)	Travers 554S	5	6
161L (Vulcan 255S – Queenstown 504S)	Vulcan 255S	9	60
161L (Vulcan 255S – Queenstown 504S)	Queenstown 504S	9	60

4.2.9 Project Dynamic Data

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

4.2.10 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		Motor Starting		Short Circuit
		Category		Category		Category		Category		Category A
		A	B	A	B	A	B	A	B	
Pre-Project										
1	2022 SP HS Pre-Project	X	X							X
2	2022 SL HS Pre-Project	X	X							
Post-Project										
3	2022 SP HS Post-Project	X	X			X	X			X
4	2022 SL HS Post-Project	X	X			X	X			
5	2029 SP HS Post-Project									X
Pre-Project Sensitivity- Fortis Vulcan 255S DER Solar										
6	2022 SP HS Pre-Project P2335 Sensitivity	X	X							X
Post-Project Sensitivity- Fortis Vulcan 255S DER Solar										
7	2022 SP HS Post-Project P2335 Sensitivity	X	X			X	X			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 neighboring 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 AESO planning area of Wabamun (Area 40) will be used as the reference for the studies.

Response plots for angle, active and reactive power output, and terminal voltage for the proposed generation facility and generators listed below will be provided:

- Sheerness#3 Power Plant
- Altagas Parkland
- Lethbridge Coaldale

The transient response voltages shall be monitored at the following key 240 kV and 138 kV buses:

- Lethbridge 370S substation 240 kV bus and 138kV bus
- West Brooks 28S substation 240kV bus and 138kV bus
- Queenstown 504S substation 138kV bus
- Vulcan 255S substation 138kV bus
- East Stavely 928S substation 138kV bus
- Fort Macleod 15S substation 138kV bus

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.

Summer peak scenarios will be used for the short-circuit studies.

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

- North Lethbridge 370S substation
- West Brooks 28S substation
- East Stavley 928S substation
- Queenstown 504S substation
- Vulcan 256S substation
- Fort Macleod 15S substation
- Enterprise 1070S (including in post-Project studies only)

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[3] 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 B conditions.

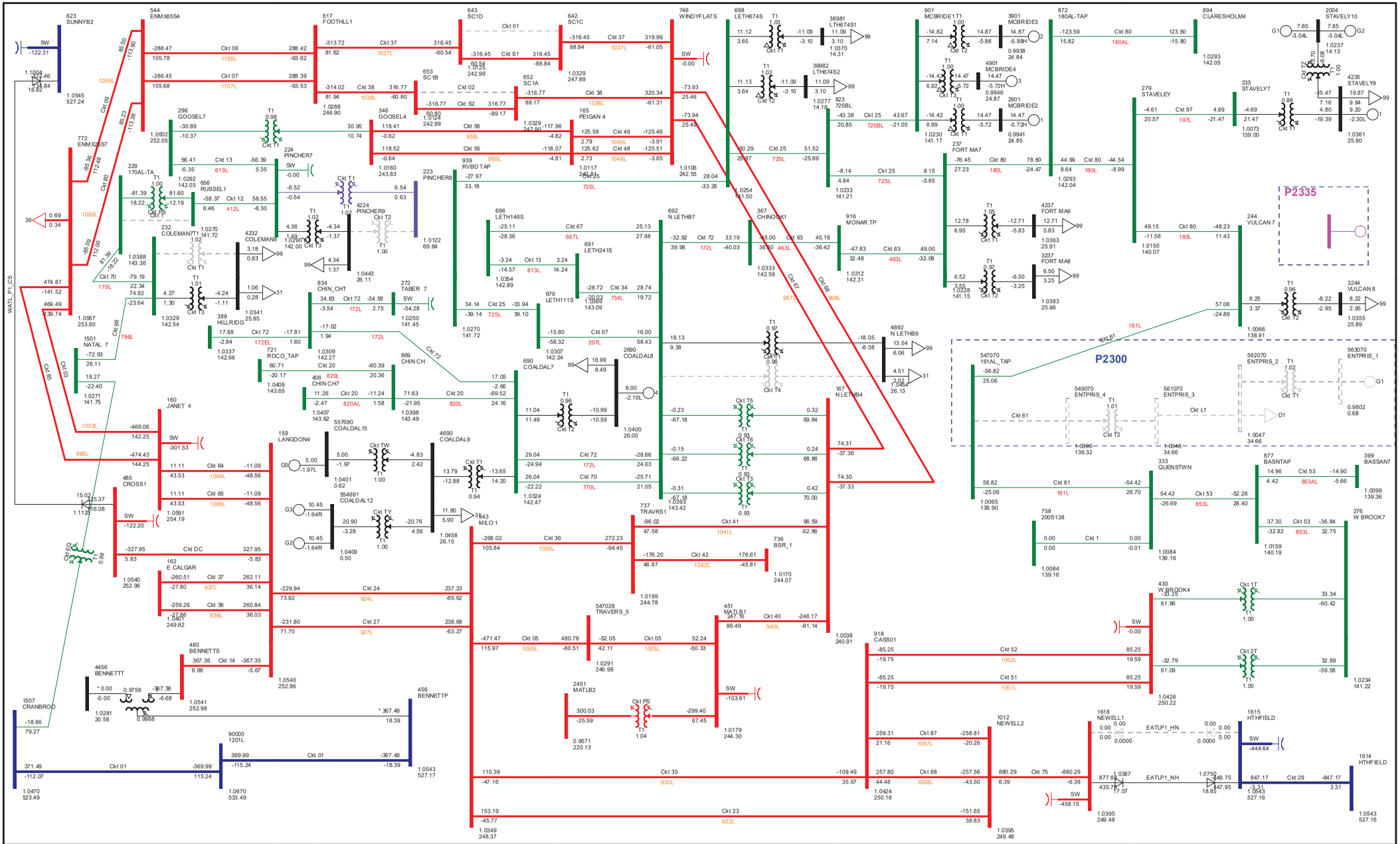
[3] Constraint effective factor studies are performed to determine the generator- and load- constraint effective factors. Constraint effective factors are used to estimate the ability of generators and loads to manage transmission constraints. A generator's or load's constraint effective factor is defined 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 (2019 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

Attachment A2
Pre-Project Power Flow Diagrams



P2300 RESC Enterprise MPC Solar

BC Import:-305.06 MW Sask Import:0.00 MW MATL Import:-300.03 MW

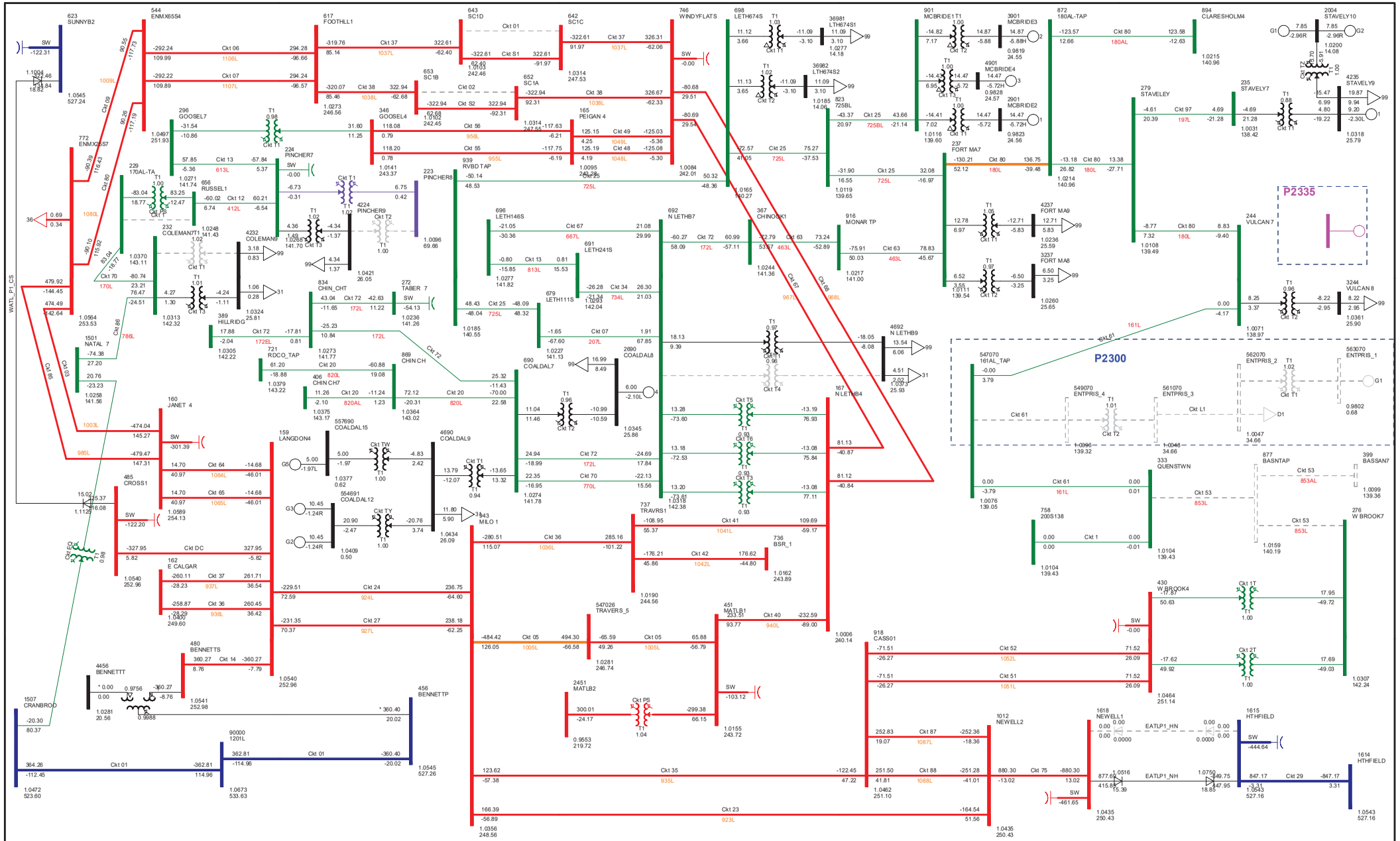
MH Export: 22.21 MW

FIGURE A2-1-1-N-0: NORMAL OPERATION

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Base kV
1.100 kV 0.900 kV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-296.38 MW Sask Import:0.00 MW MATL Import:-300.01 MW

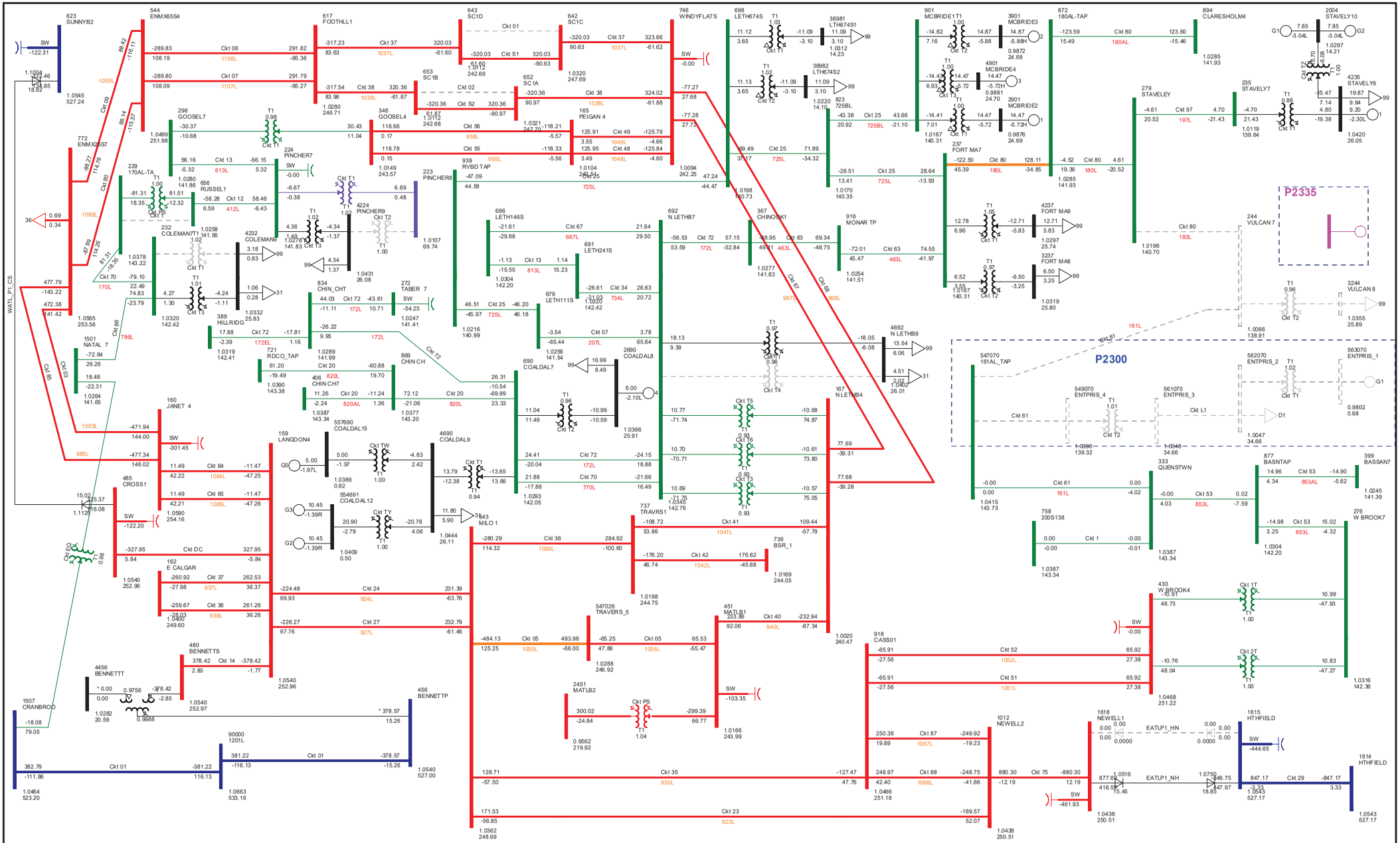
MH Export: 22.21 MW

FIGURE A2-1-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100(V) 0.900(U)
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-316.88 MW Sask Import:0.00 MW MATL Import:-300.02 MW

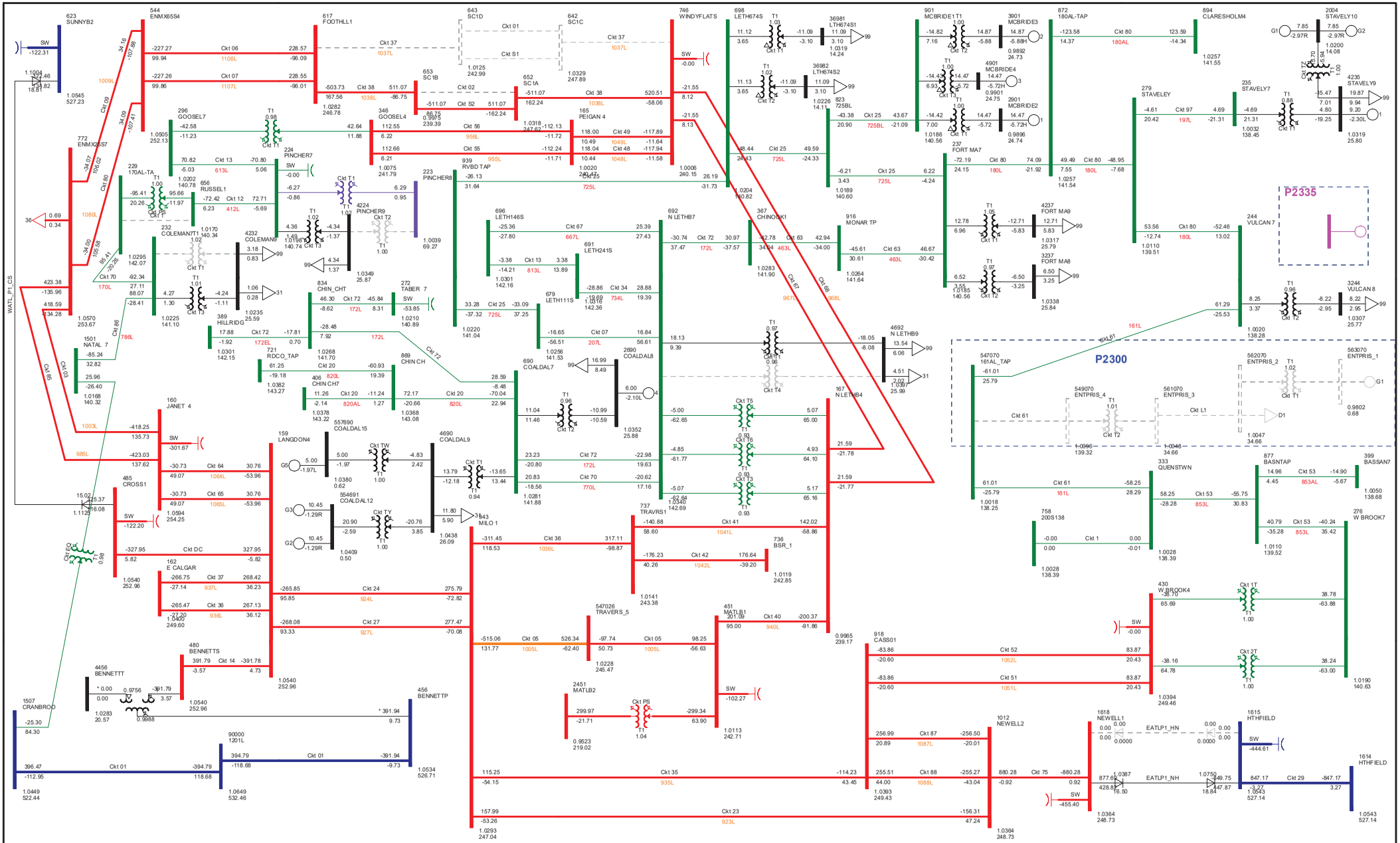
MH Export: 22.21 MW

FIGURE A2-1-3 N-1: 255ST1 (VULCAN 255S TRANSFORMER T1)

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-321.57 MW Sask Import:0.00 MW MATL Import:-299.97 MW

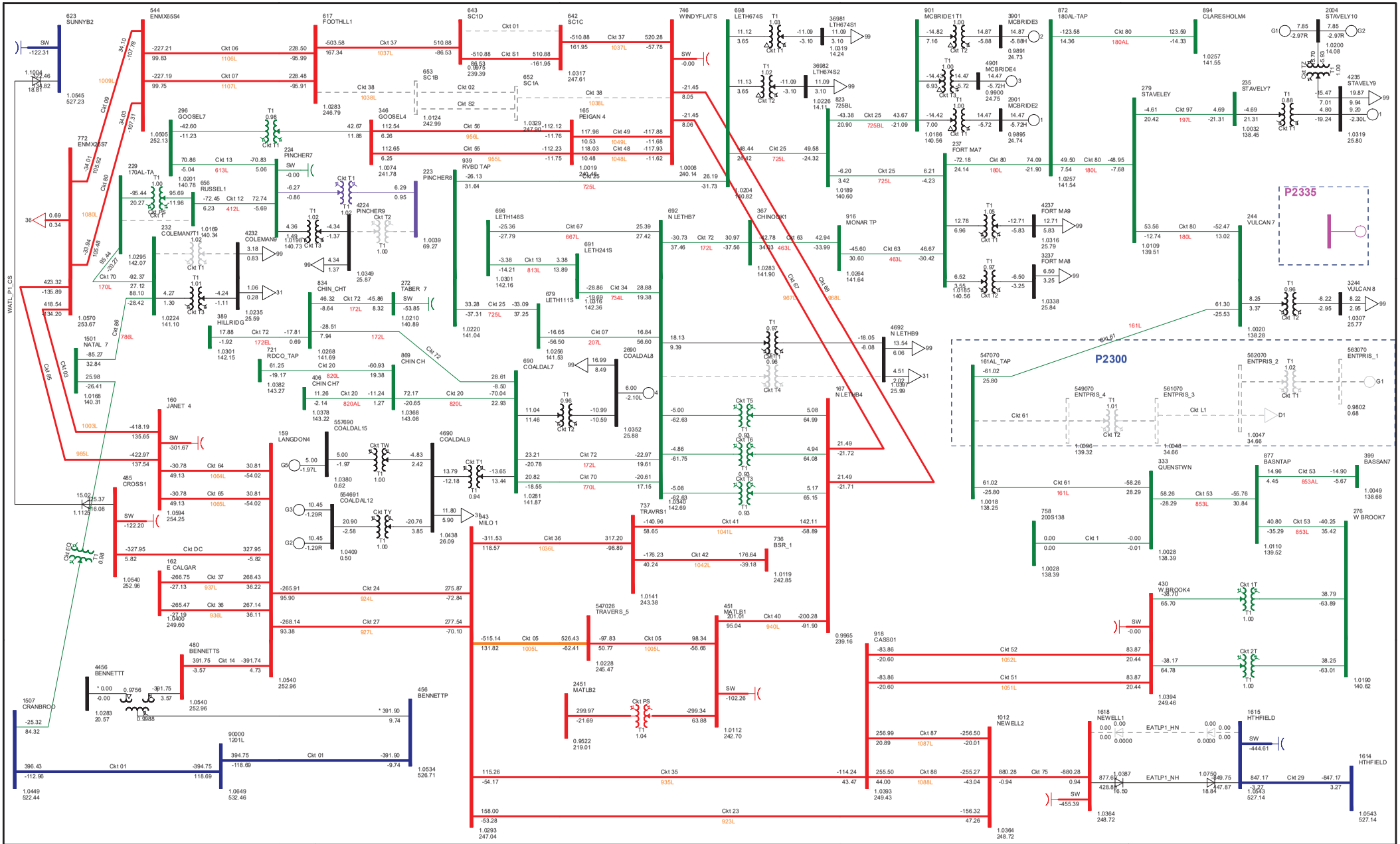
MH Export: 22.21 MW

FIGURE A2-1-4 N-1: 1037L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-321.51 MW Sask Import:0.00 MW MATL Import:-299.97 MW

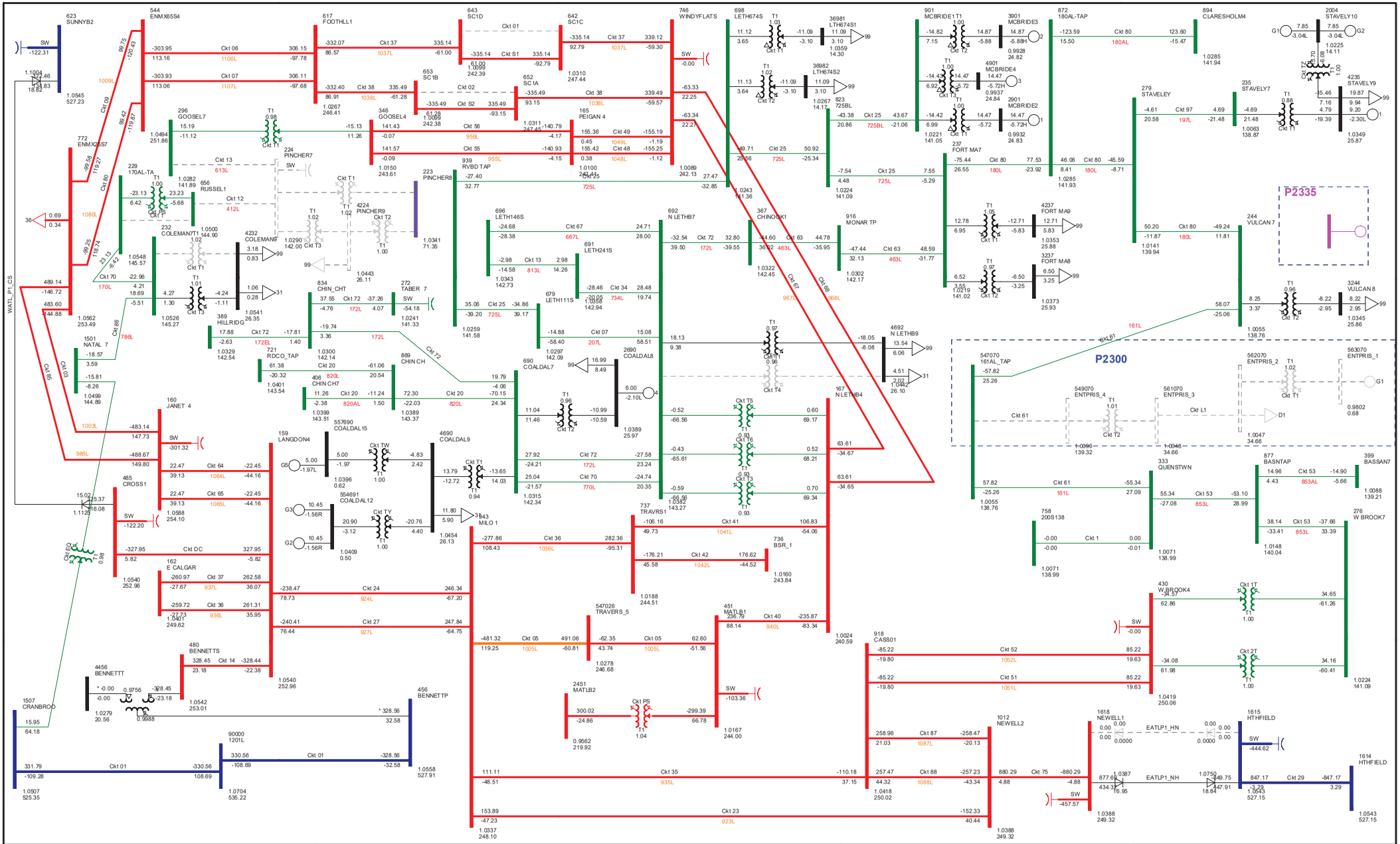
MH Export: 22.21 MW

FIGURE A2-1-5 N-1: 1038L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-303.89 MW Sask Import:0.00 MW MATL Import:-300.02 MW

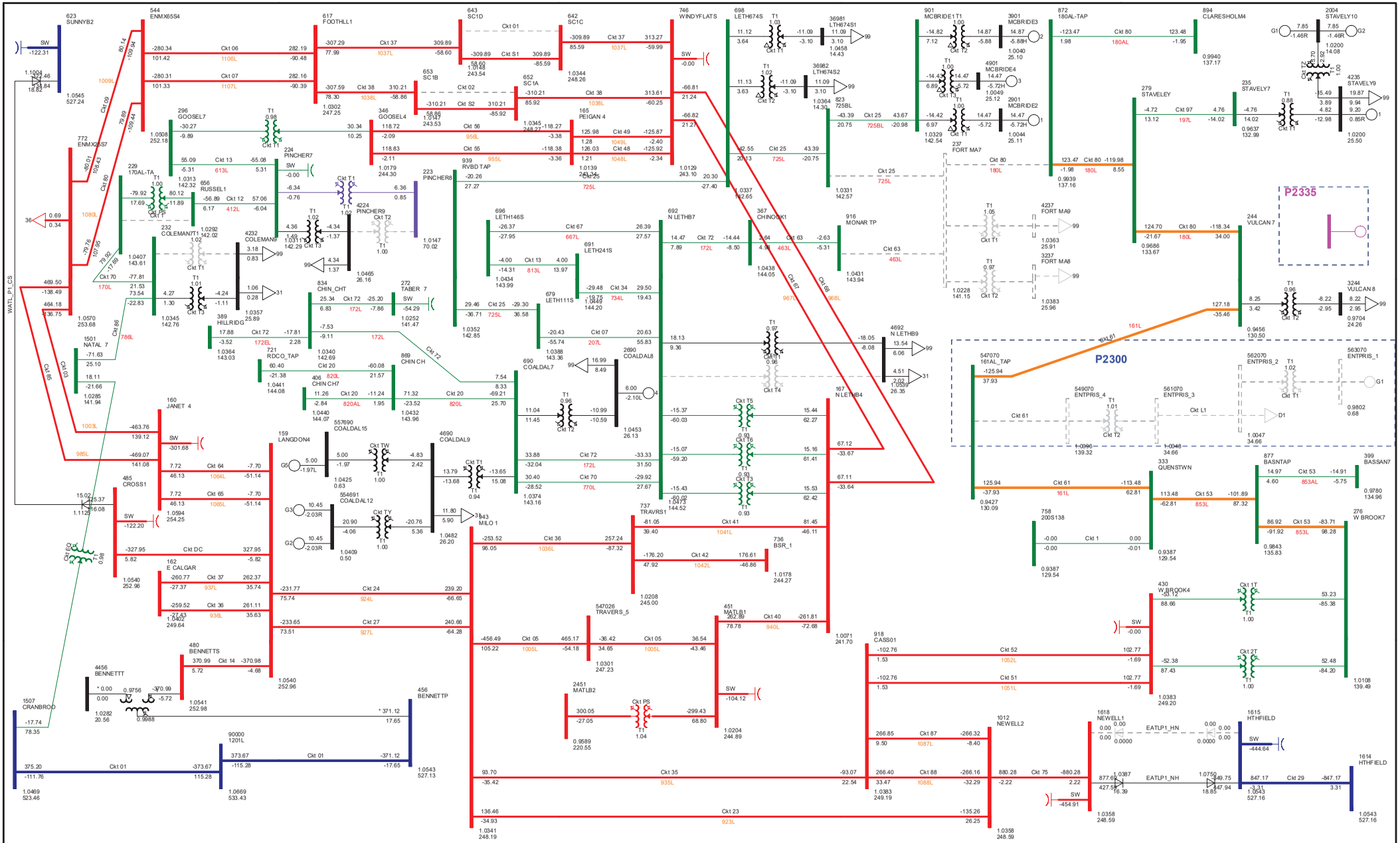
MH Export: 22.21 MW

FIGURE A2-1-6 N-1: 396ST1 (PINCHER CREEK 396S TRANSFORMER T1)

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-309.95 MW Sask Import:-0.00 MW MATL Import:-300.05 MW

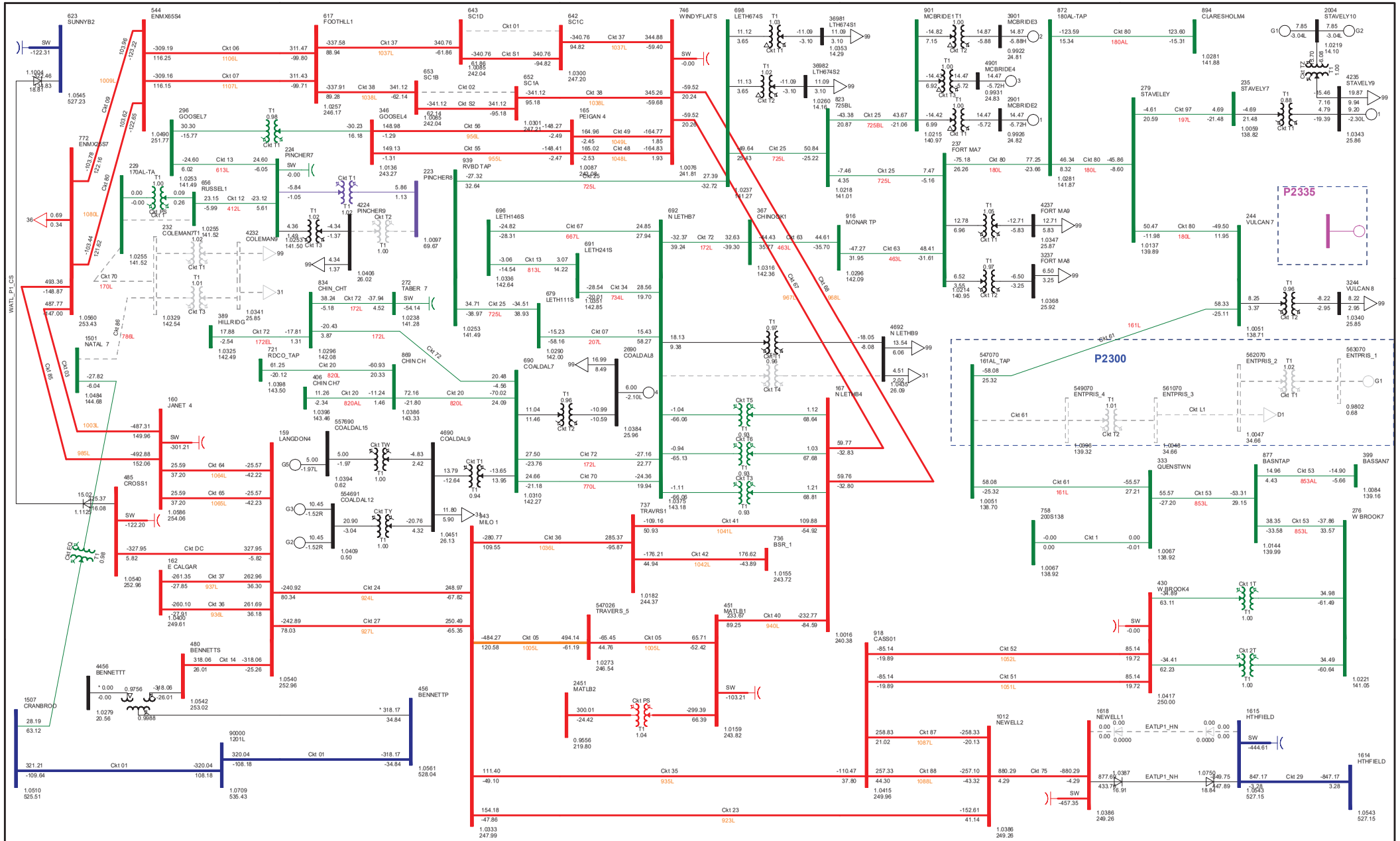
MH Export: 22.21 MW

FIGURE A2-1-7 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.992UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-305.71 MW Sask Import:-0.00 MW MATL Import:-300.01 MW

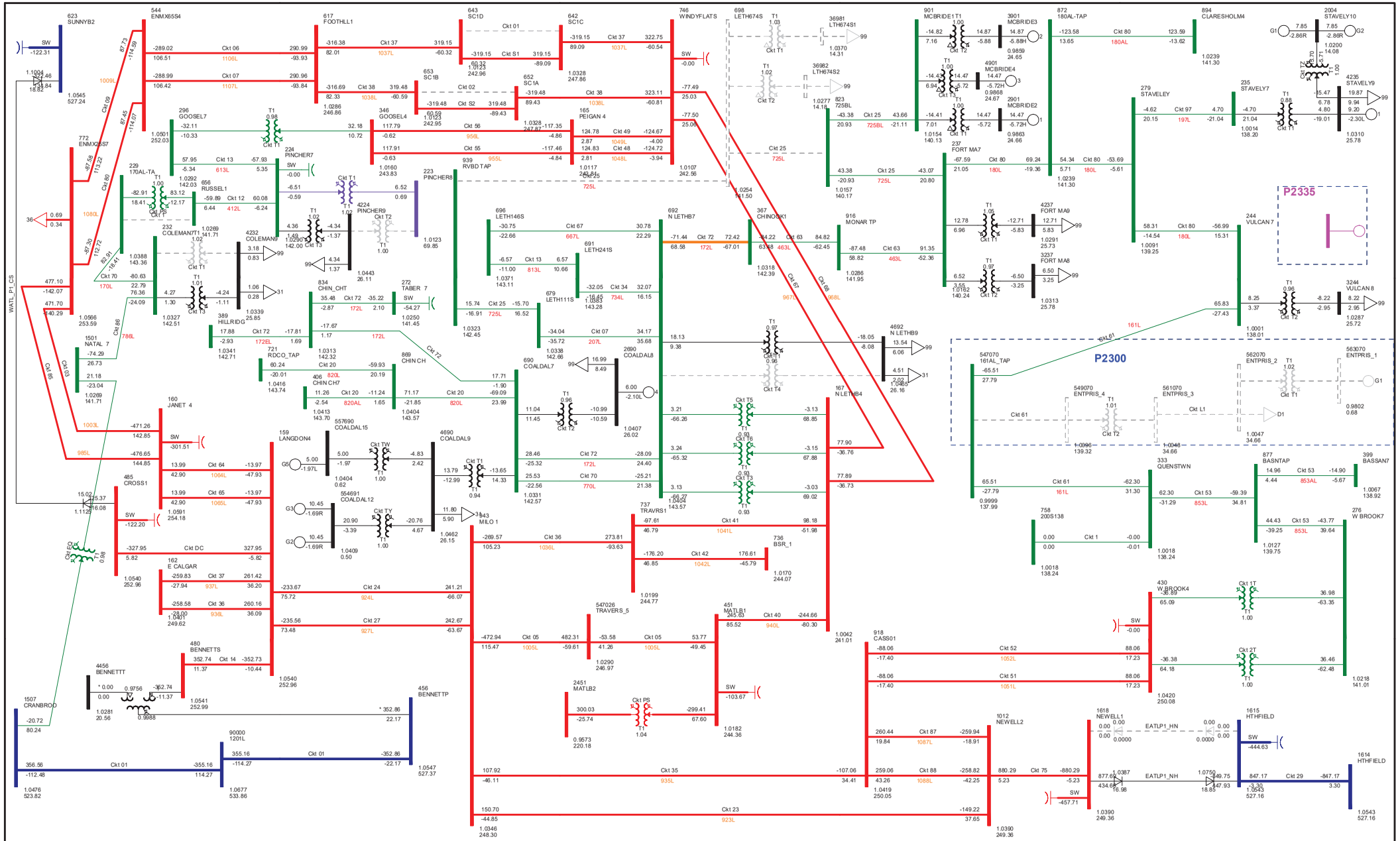
MH Export: 22.21 MW

FIGURE A2-1-8 N-1: 799ST1 (COLEMAN 799S TRANSFORMER T1)

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900LN
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-288.47 MW Sask Import:0.00 MW MATL Import:-300.03 MW

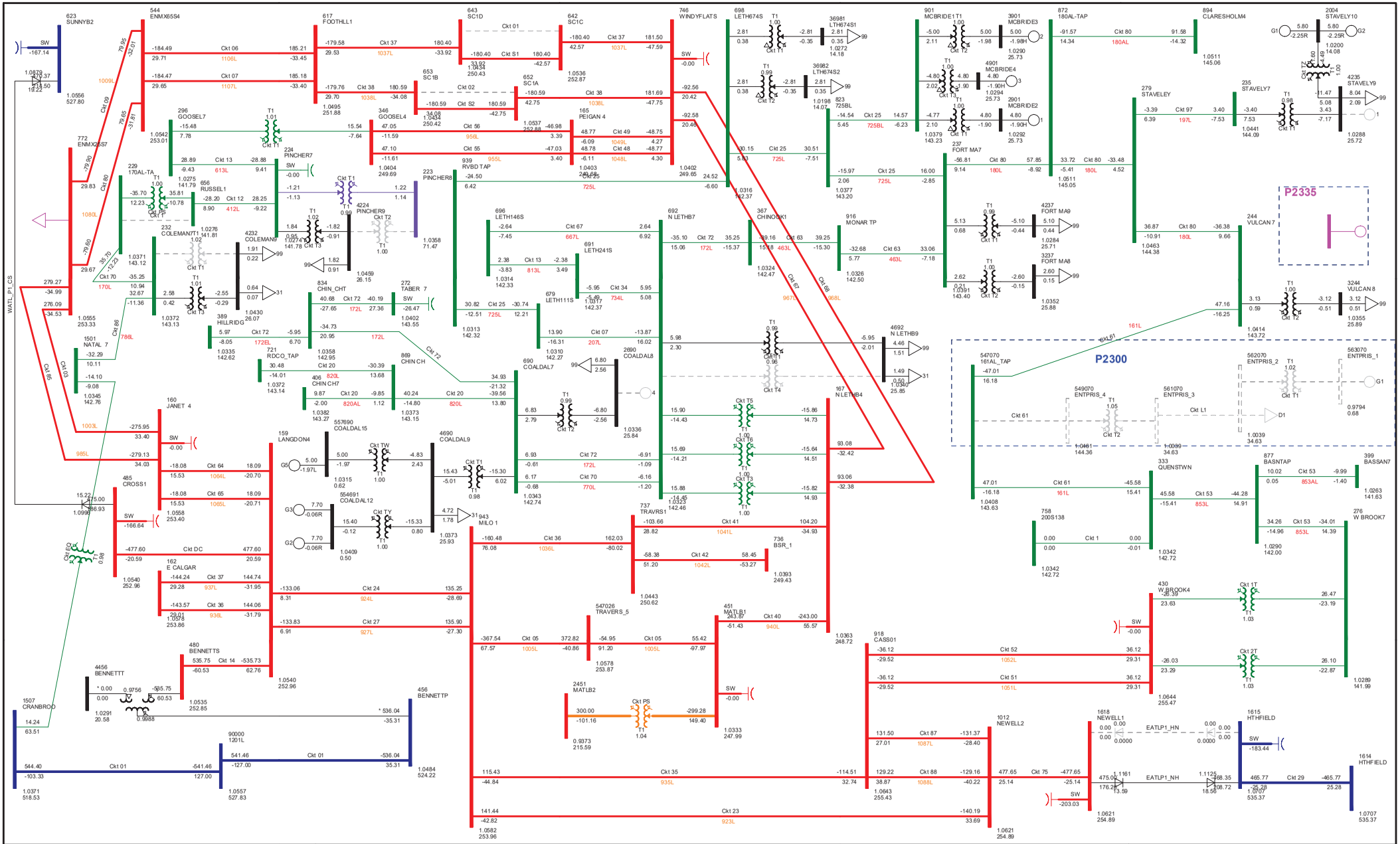
MH Export: 22.21 MW

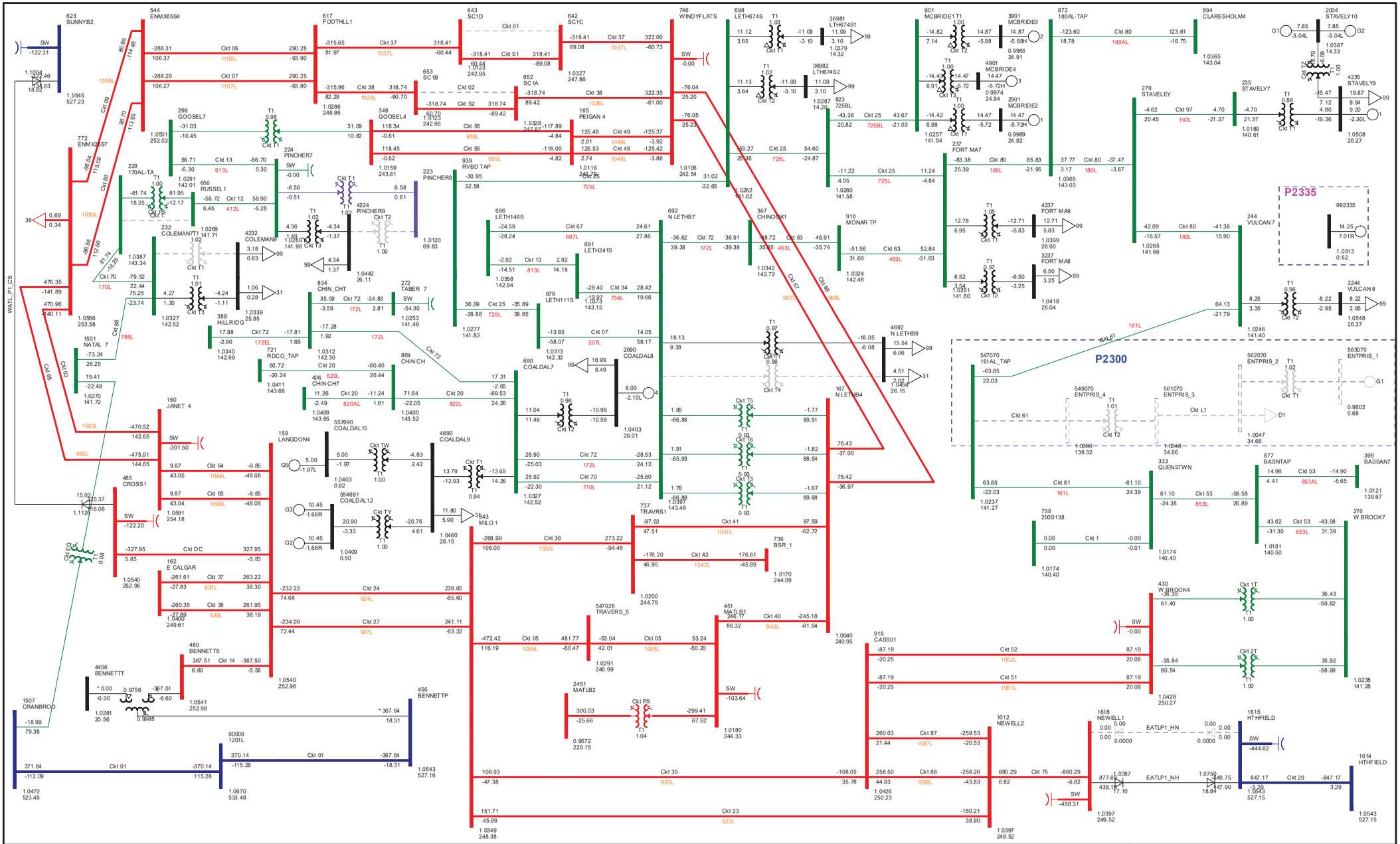
FIGURE A2-1-9 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER PEAK (PRE-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


P2335
P2300
WATL_P1_CS
623 SUNNYB2
544 ENMX65S4
617 FOOTHLL1
643 SC1D
642 SC1C
746 WINDYFLATS
698 LETH674S
901 MCBRIDE1
3901 MCBRIDE3
872 180AL-TAP
894 CLARESHOLM4
2004 STAVELY10
772 ENMX25S7
296 GOOSEL7
346 GOOSEL4
653 SC1B
652 SC1A
165 PEIGAN 4
823 725BL
4901 MCBRIDE4
2901 MCBRIDE2
279 STAVELEY
235 STAVELY7
4235 STAVELY9
229 170AL-TA
656 RUSSEL1
224 PINCHER7
223 PINCHER8
939 RVBD TAP
696 LETH146S
691 LETH241S
679 LETH111S
692 N LETHB7
367 CHINOOK1
916 MONAR TP
237 FORT MA7
4237 FORT MA9
3237 FORT MA8
244 VULCAN7
3244 VULCAN 8
1501 NATAL 7
160 JANET 4
389 HILLRIDG
721 RDCO_TAP
834 CHIN_CHT
272 TABER 7
869 CHIN CH
406 CHIN CH7
690 COALDAL7
2690 COALDAL8
4692 N LETHB9
167 N LETHB4
547070 161AL_TAP
549070 ENTPRIS_4
561070 ENTPRIS_3
562070 ENTPRIS_2
563070 ENTPRIS_1
877 BASNTAP
399 BASSAN7
333 QUENSTWN
758 200S138
276 W BROOK7
430 W BROOK4
159 LANGDON4
557690 COALDAL15
554691 COALDAL12
4690 COALDAL9
943 MILO 1
737 TRAVRS1
736 BSR_1
547026 TRAVERS_5
451 MATL_B1
2451 MATLB2
485 CROSS1
162 E CALGAR
480 BENNETTS
4456 BENNETTT
456 BENNETTP
1507 CRANBROO
90000 1201L
918 CASS01
1012 NEWELL2
1618 NEWELL1
1615 HTHFIELD
1614 HTHFIELD
EATLP1_HN
EATLP1_NH
P2300 RESC Enterprise MPC Solar
BC Import:-509.00 MW Sask Import:0.00 MW MATL Import:-300.00 MW
MH Export: 16.33 MW
FIGURE A2-2-1-N-0: NORMAL OPERATION
2023 SUMMER LIGHT (PRE-CONNECTION)
PRINTED ON APRIL 2021
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-305.04 MW Sask Import:0.00 MW MATL Import:-300.03 MW

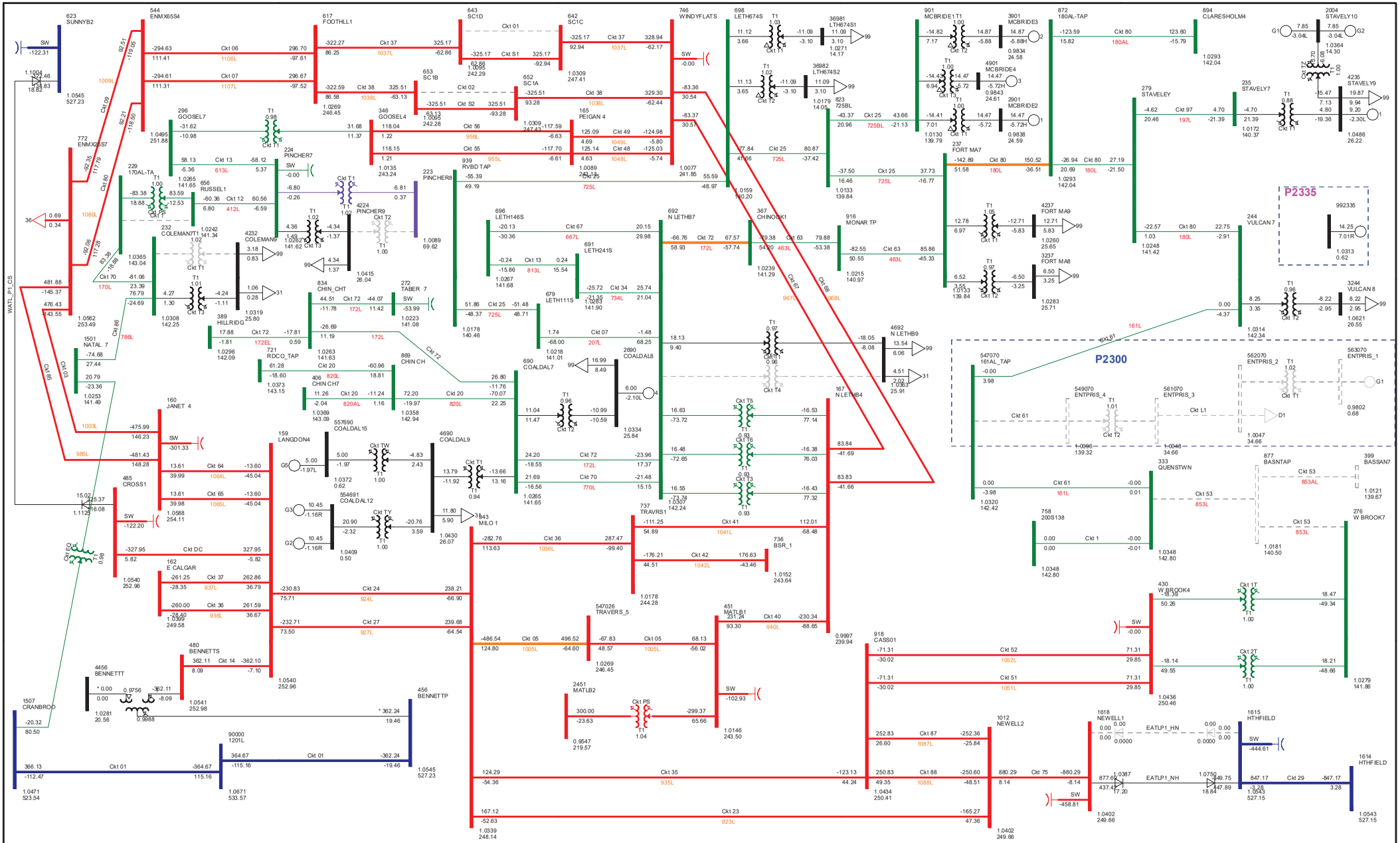
MH Export: 22.21 MW

FIGURE A2-3-1-N-0: NORMAL OPERATION

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100 0.900 UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-298.16 MW Sask Import:-0.00 MW MATL Import:-300.00 MW

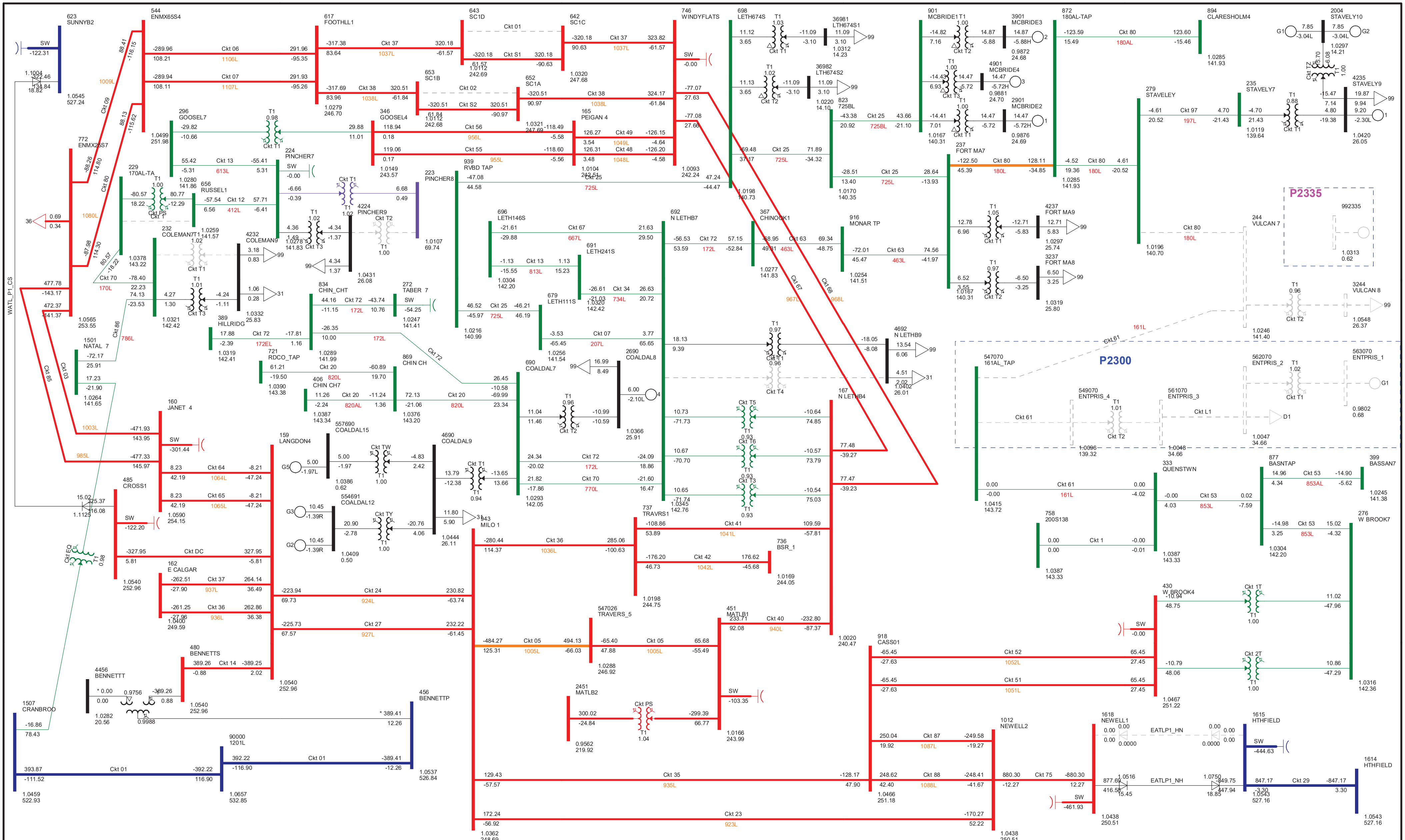
MH Export: 22.21 MW

FIGURE A2-3-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

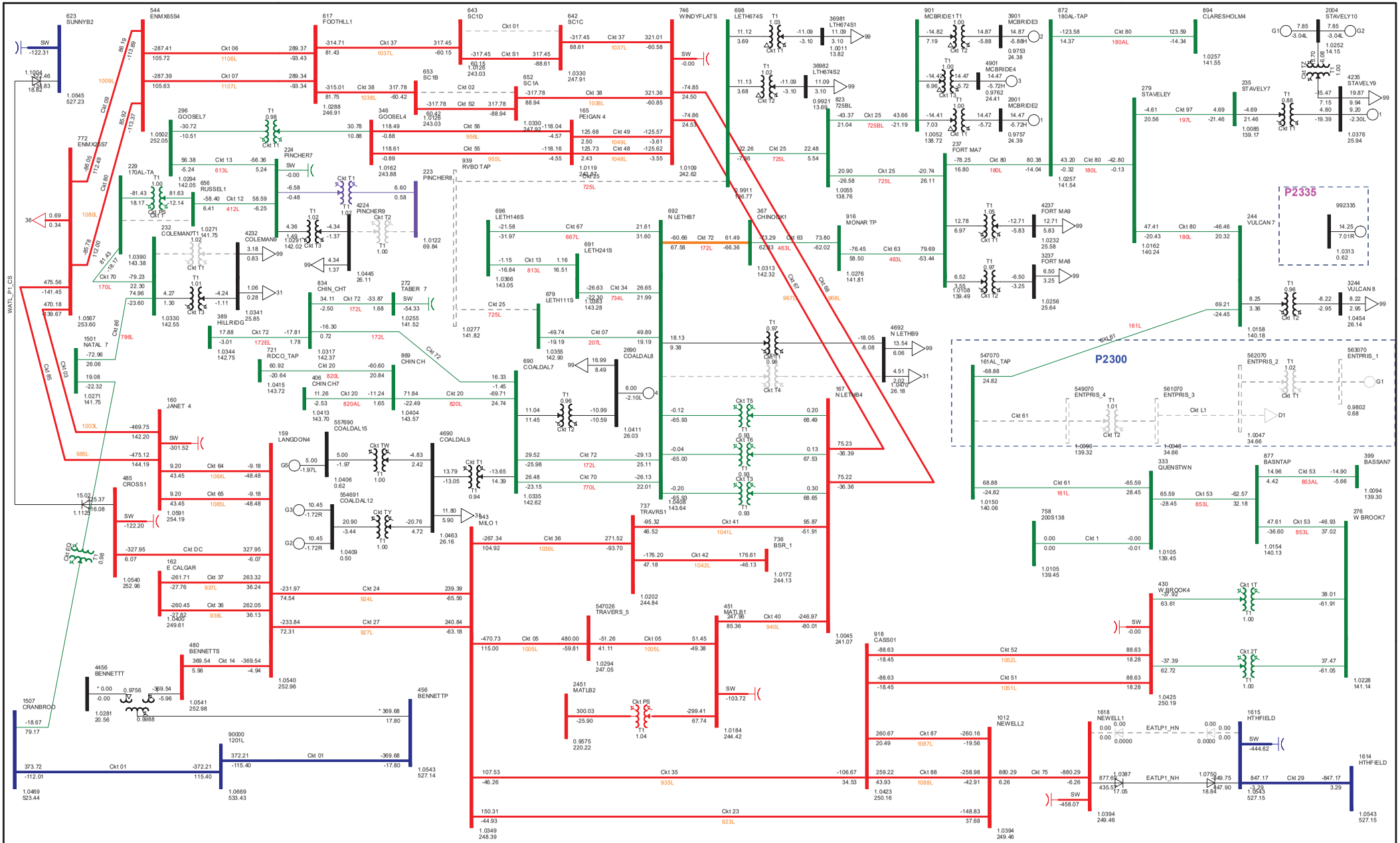
BC Import:-328.98 MW Sask Import:-0.00 MW MATL Import:-300.02 MW

MH Export: 22.21 MW

FIGURE A2-3-3 N-1: 255ST1 (VULCAN 255S TRANSFORMER T1)

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-307.42 MW Sask Import:-0.00 MW MATL Import:-300.03 MW

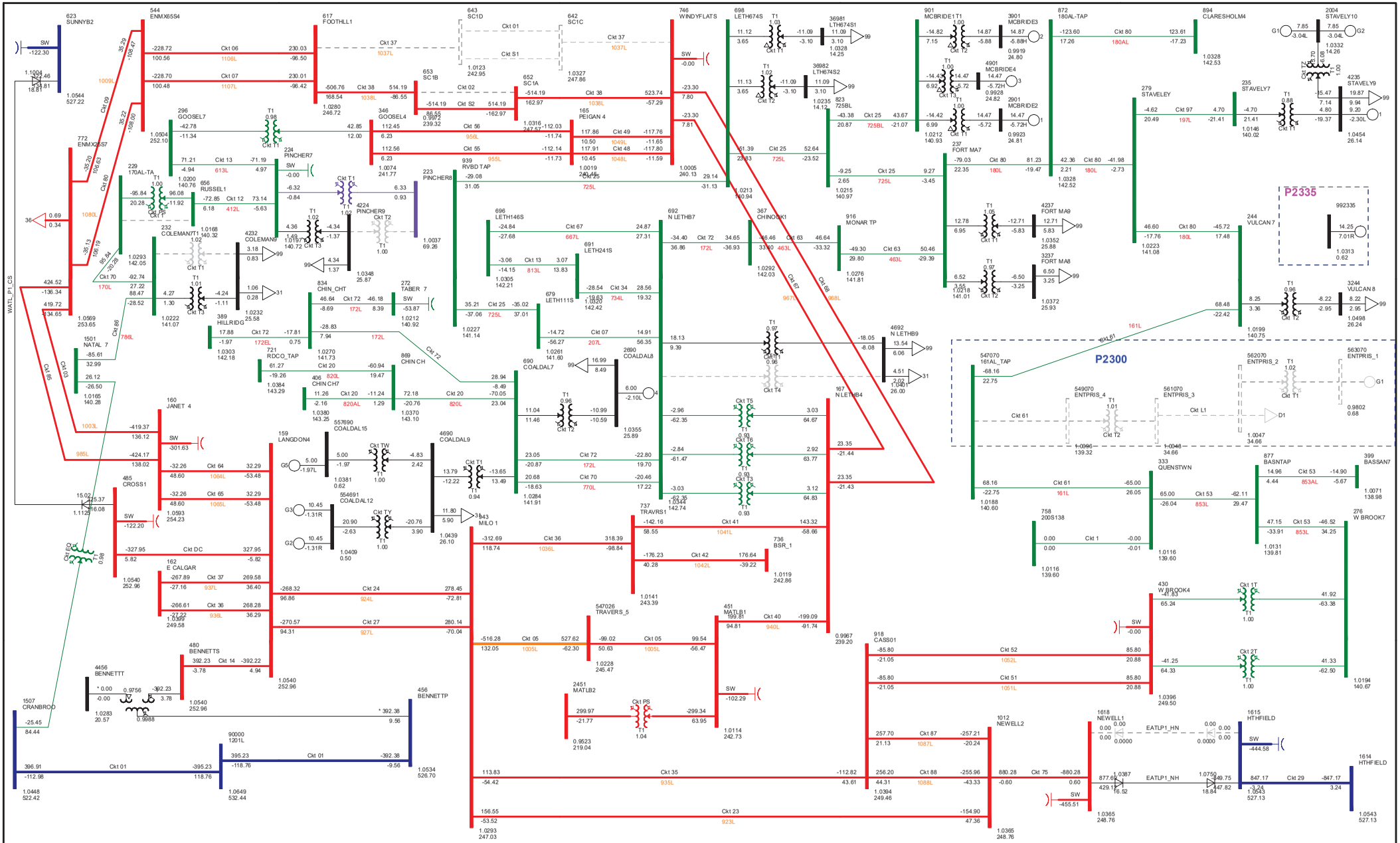
MH Export: 22.21 MW

FIGURE A2-3-4 N-1: 725L (BOWRON 674S TO COALBANKS 111S) AFTER RAS#178

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-321.80 MW Sask Import:0.00 MW MATL Import:-299.97 MW

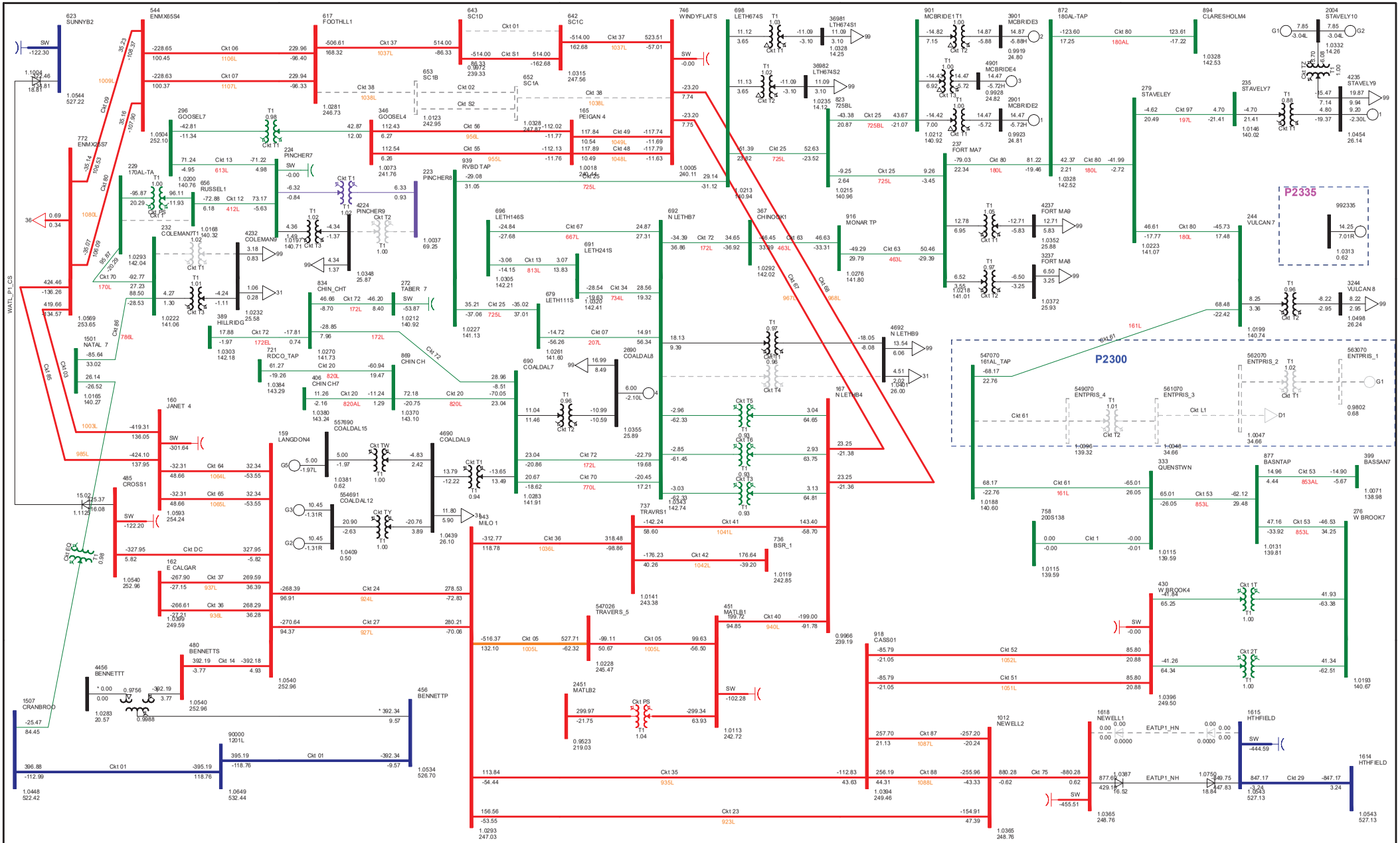
MH Export: 22.21 MW

FIGURE A2-3-5 N-1: 1037L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.992UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-321.74 MW Sask Import:-0.00 MW MATL Import:-299.97 MW

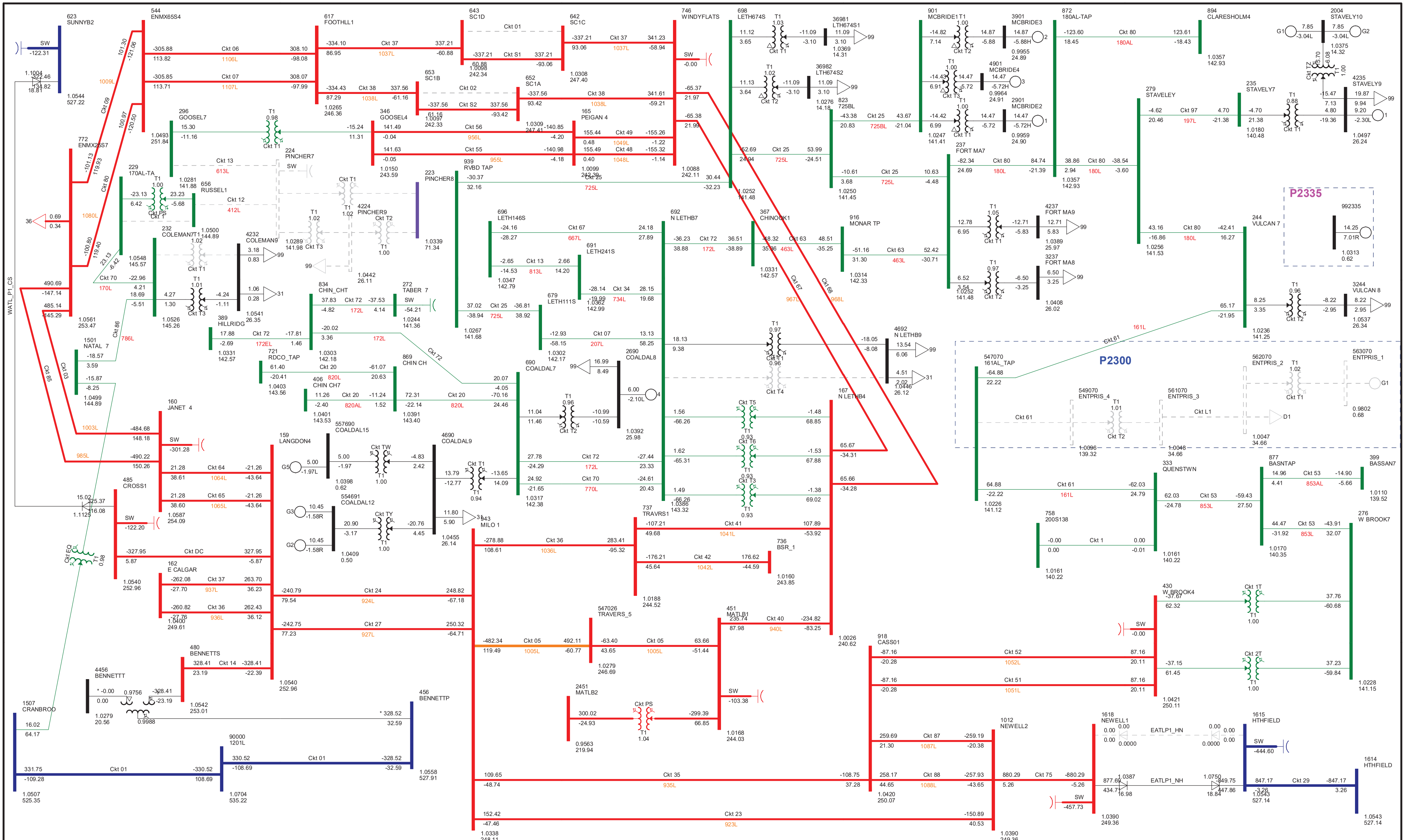
MH Export: 22.21 MW

FIGURE A2-3-6 N-1: 1038L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

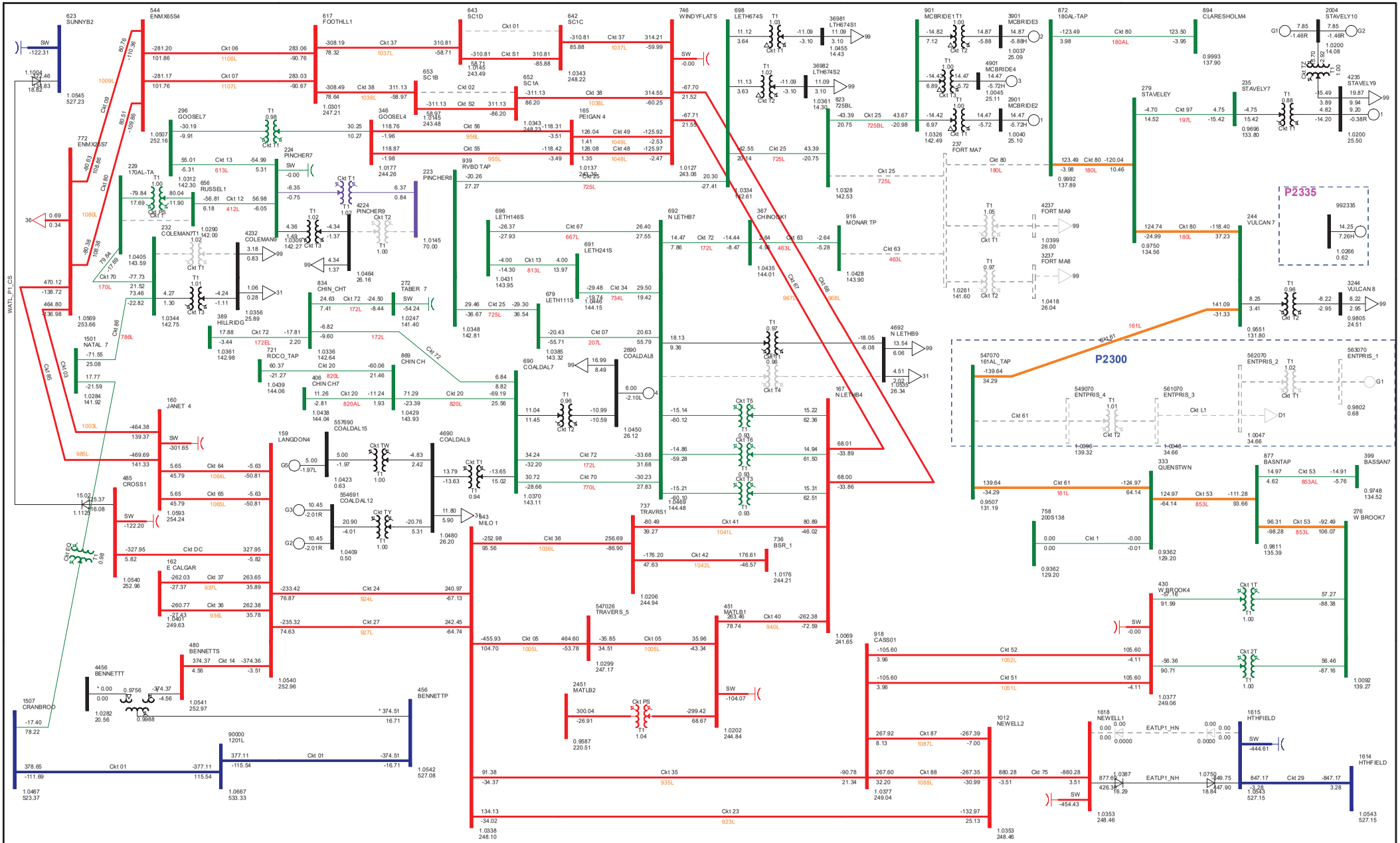
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-303.91 MW Sask Import:-0.00 MW MATL Import:-300.02 MW
MH Export: 22.21 MW

FIGURE A2-3-7 N-1: 396ST1 (PINCHER CREEK 396S TRANSFORMER T1)
2023 SUMMER PEAK (PRE-CONNECTION) - P2335
PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-313.67 MW Sask Import:-0.00 MW MATL Import:-300.04 MW

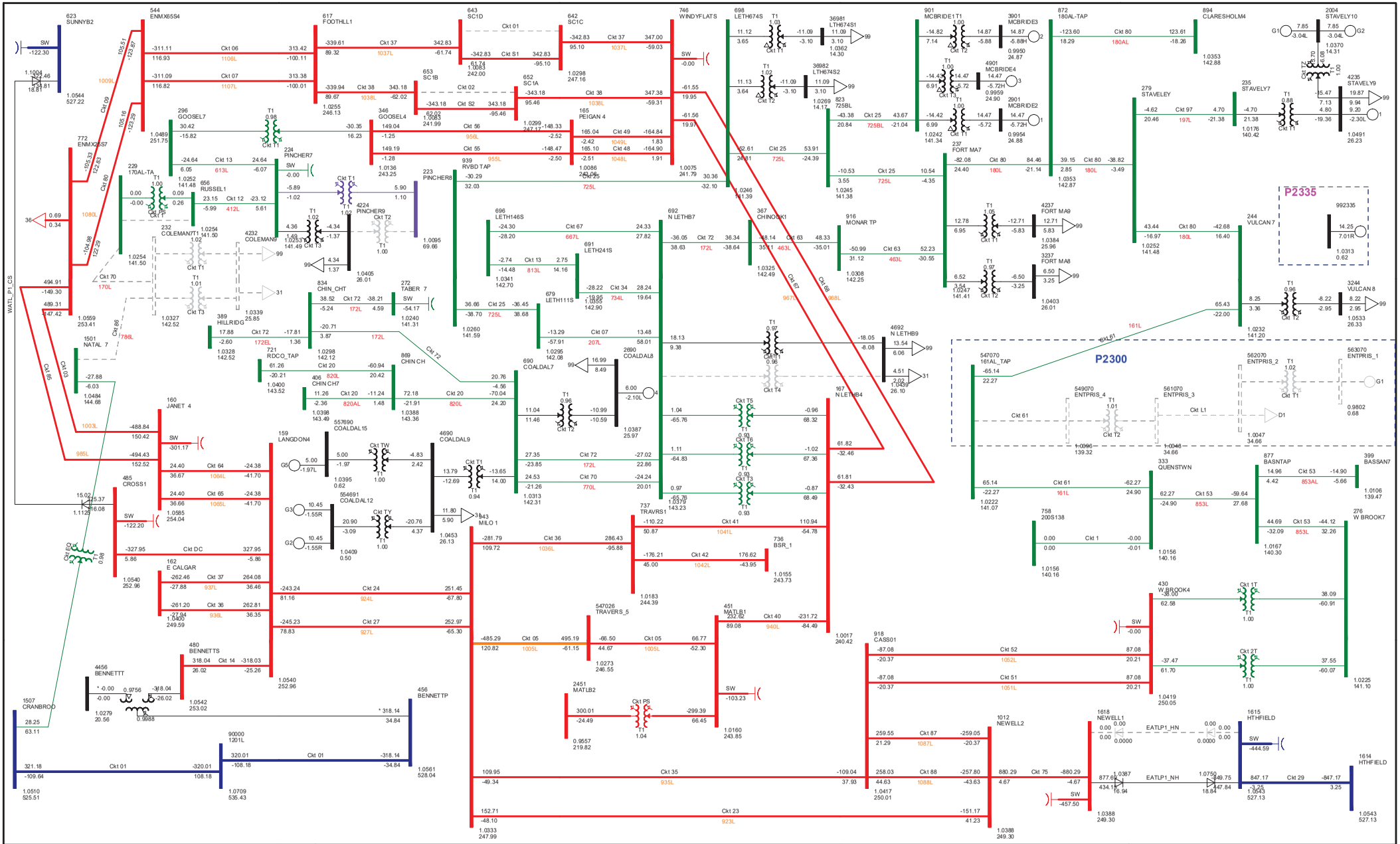
MH Export: 22.21 MW

FIGURE A2-3-8 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-305.74 MW Sask Import:0.00 MW MATL Import:-300.01 MW

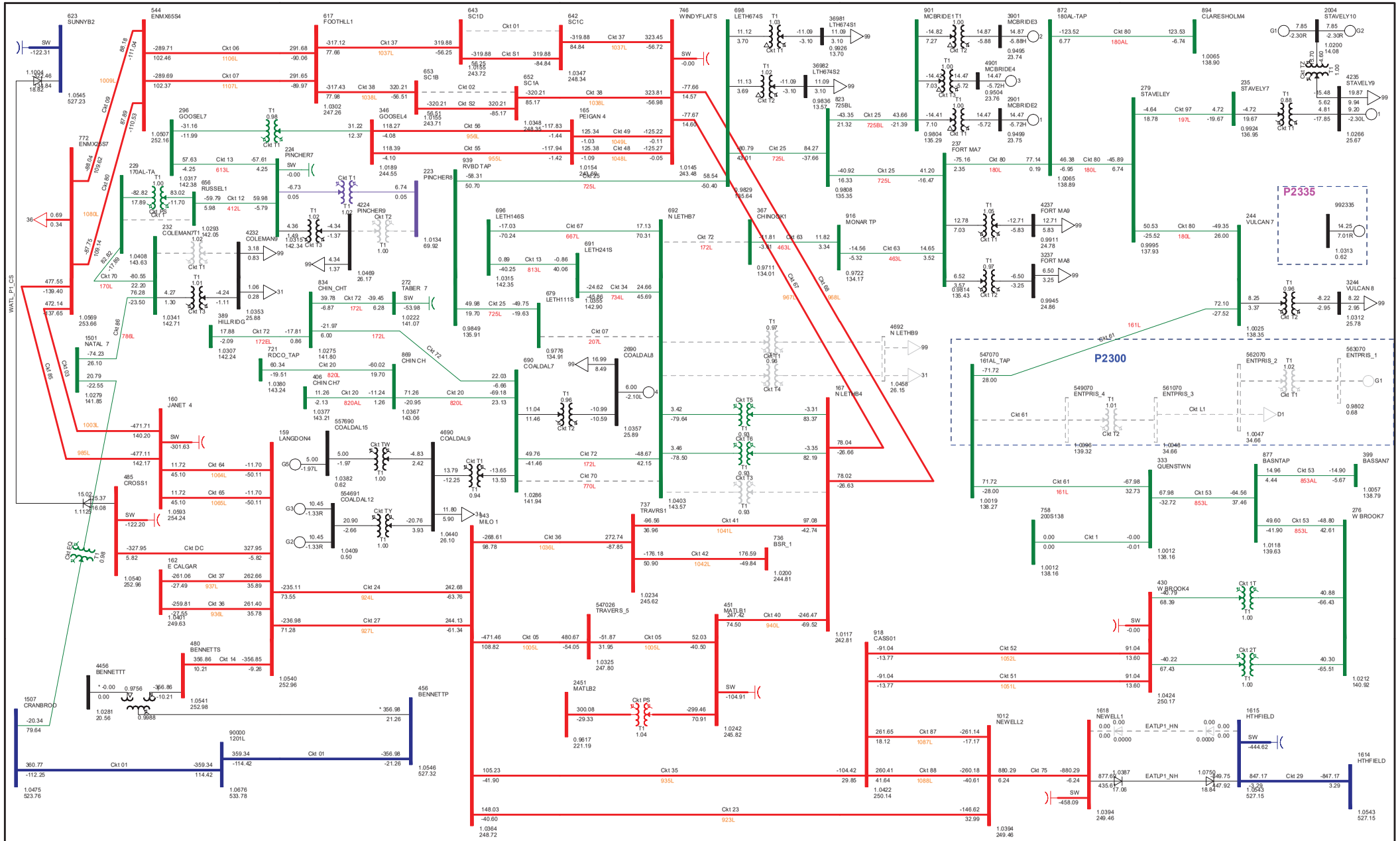
MH Export: 22.21 MW

FIGURE A2-3-9 N-1: 799ST1 (COLEMAN 799S TRANSFORMER T1)

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100UV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-292.99 MW Sask Import:-0.00 MW MATL Import:-300.08 MW

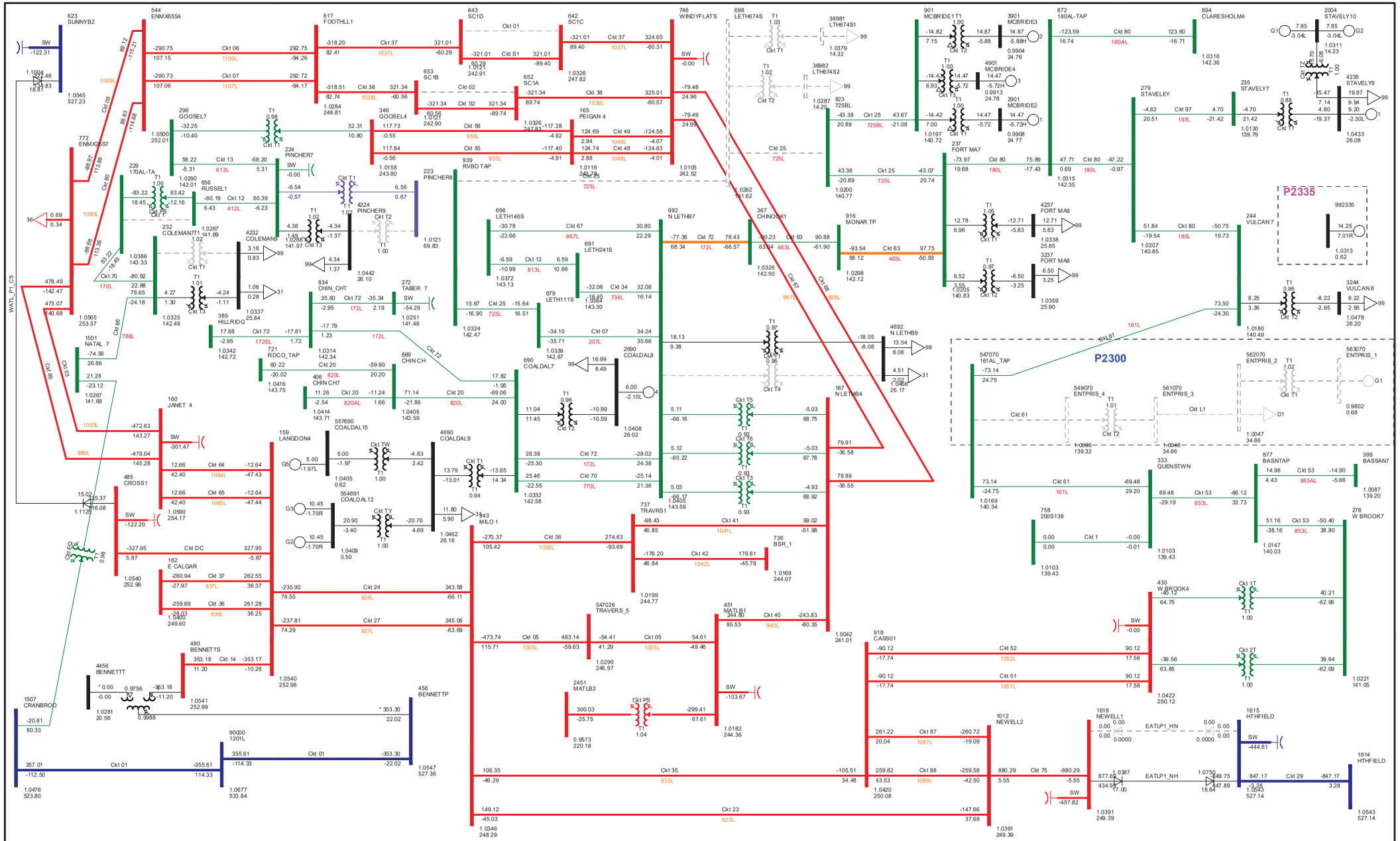
MH Export: 22.21 MW

FIGURE A2-3-10 N-1: 370ST1 (NORTH LETHBRIDGE 370S TRANSFORMER T1)

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-288.79 MW Sask Import:-0.00 MW MATL Import:-300.03 MW

MH Export: 22.21 MW

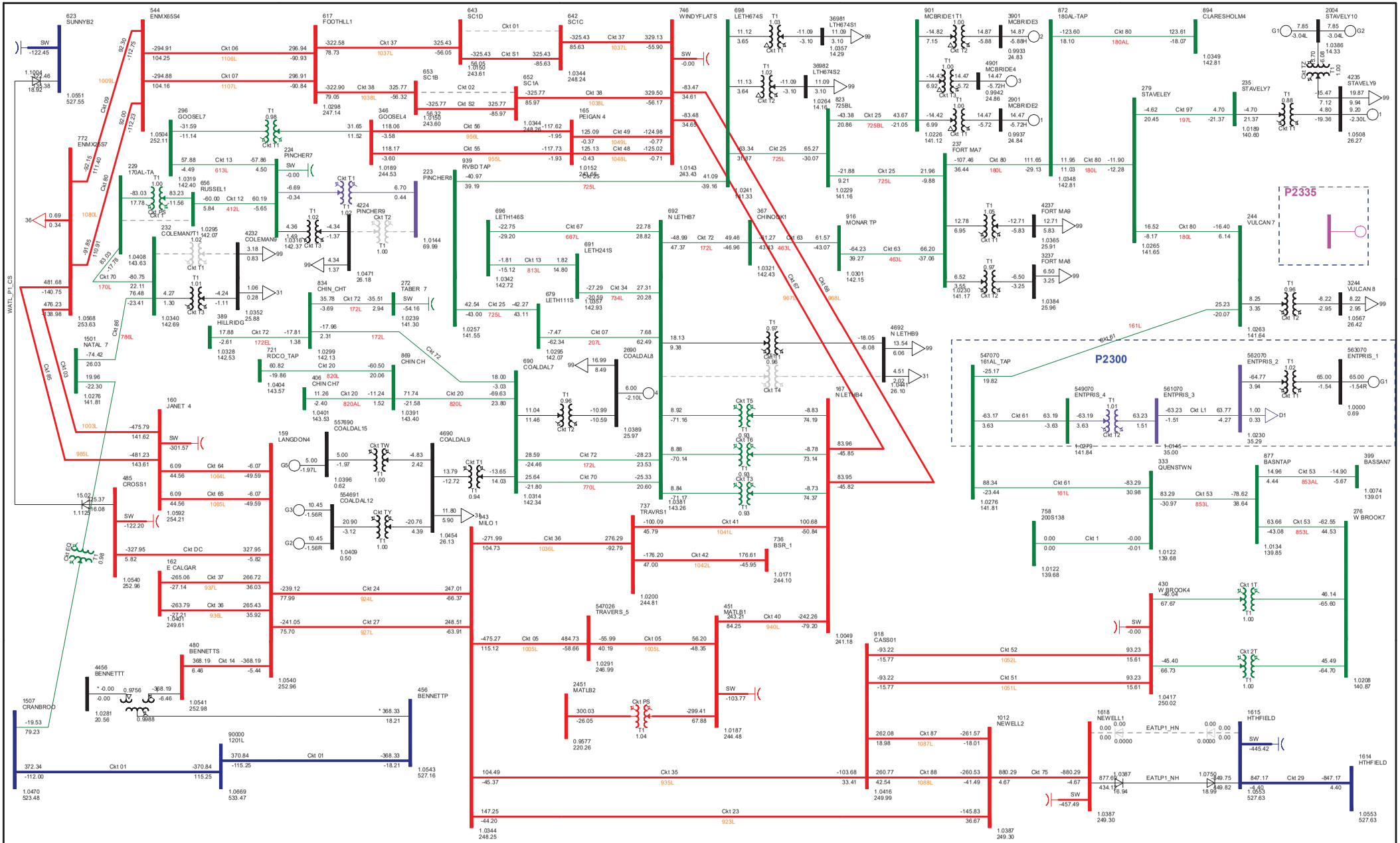
FIGURE A2-3-11 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER PEAK (PRE-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A3
Post-Project Power Flow Diagrams



P2300 RESC Enterprise MPC Solar

BC Import:-305.10 MW Sask Import:-0.00 MW MATL Import:-300.03 MW

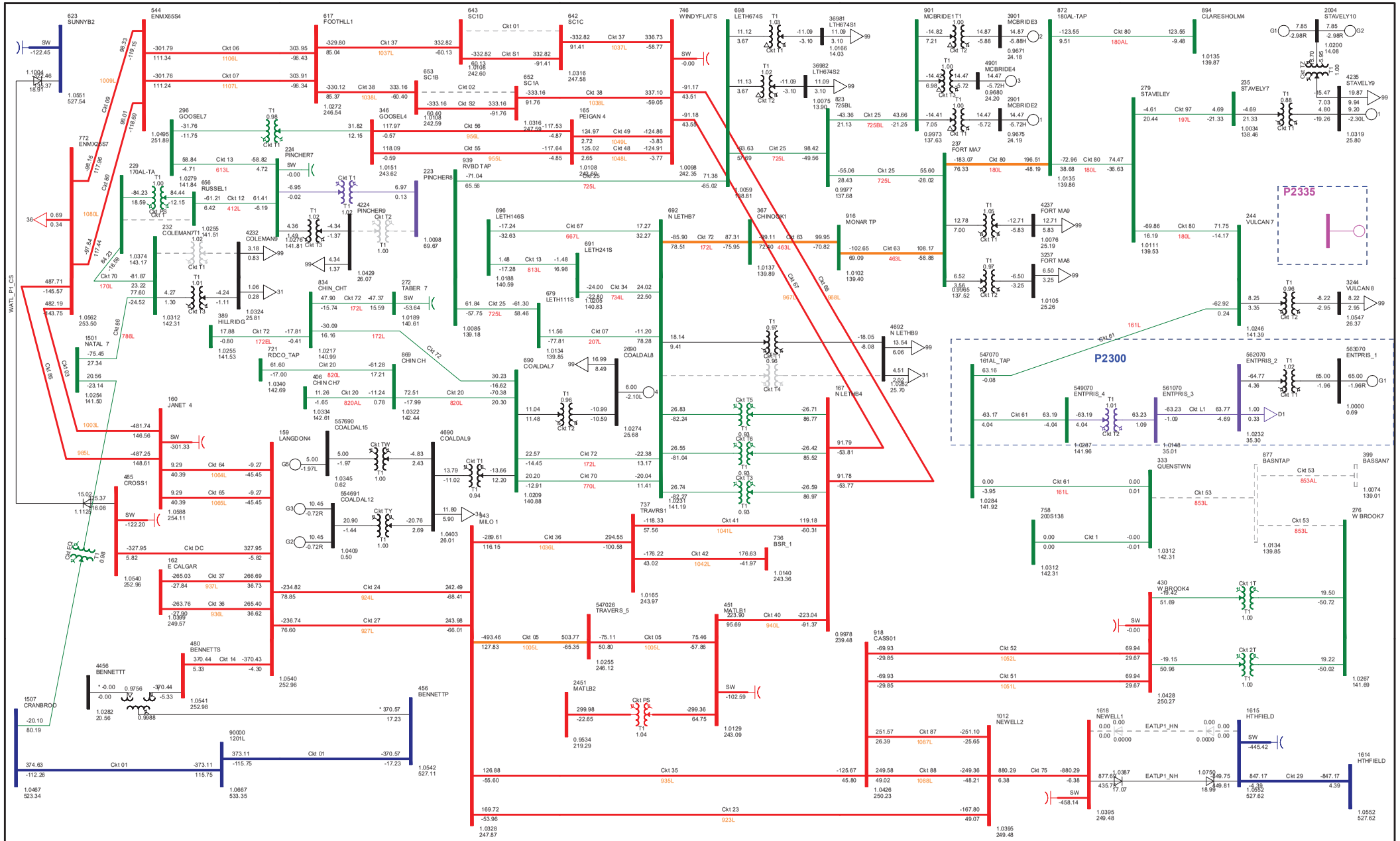
MH Export: 22.21 MW

FIGURE A3-1-1-N-0: NORMAL OPERATION

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100 0.900 p.u.
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-306.62 MW Sask Import:0.00 MW MATL Import:-299.98 MW

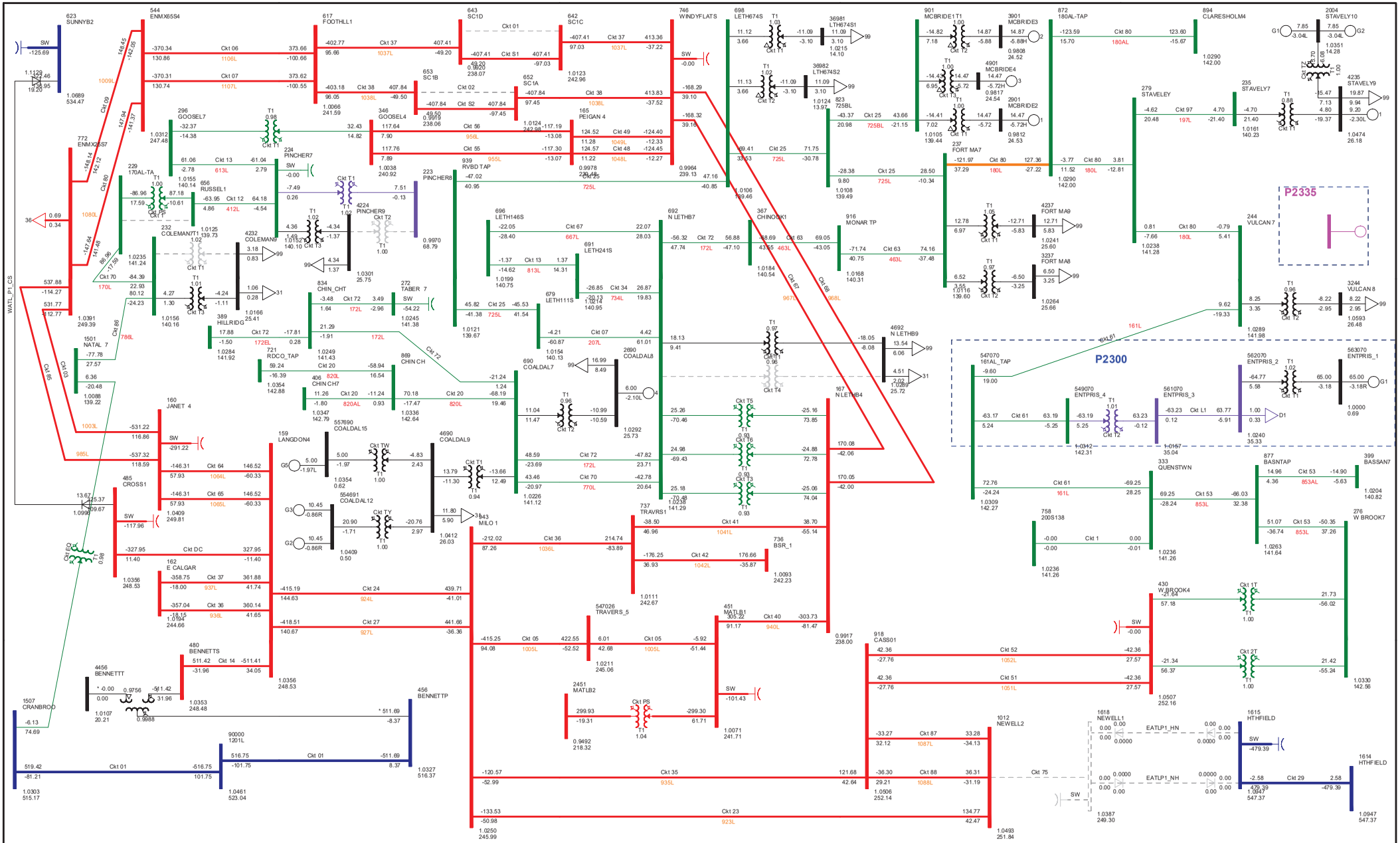
MH Export: 22.21 MW

FIGURE A3-1-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Base kV
1.100kV 0.950UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-460.41 MW Sask Import:0.00 MW MATL Import:-299.93 MW

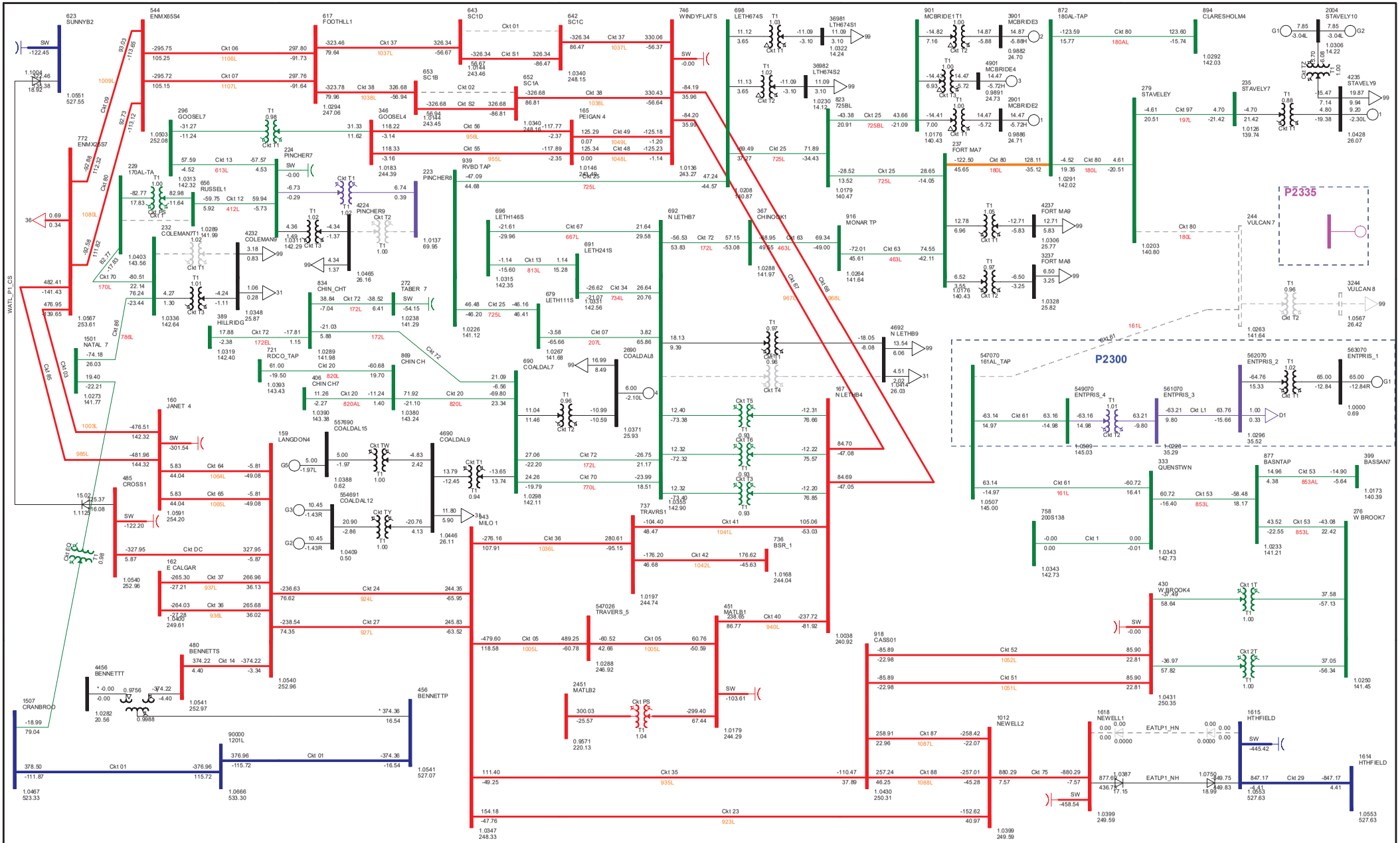
MH Export: 22.22 MW

FIGURE A3-1-3 N-1: EATL

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Base kV
1.100 kV 0.900 kV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-311.68 MW Sask Import:0.00 MW MATL Import:-300.03 MW

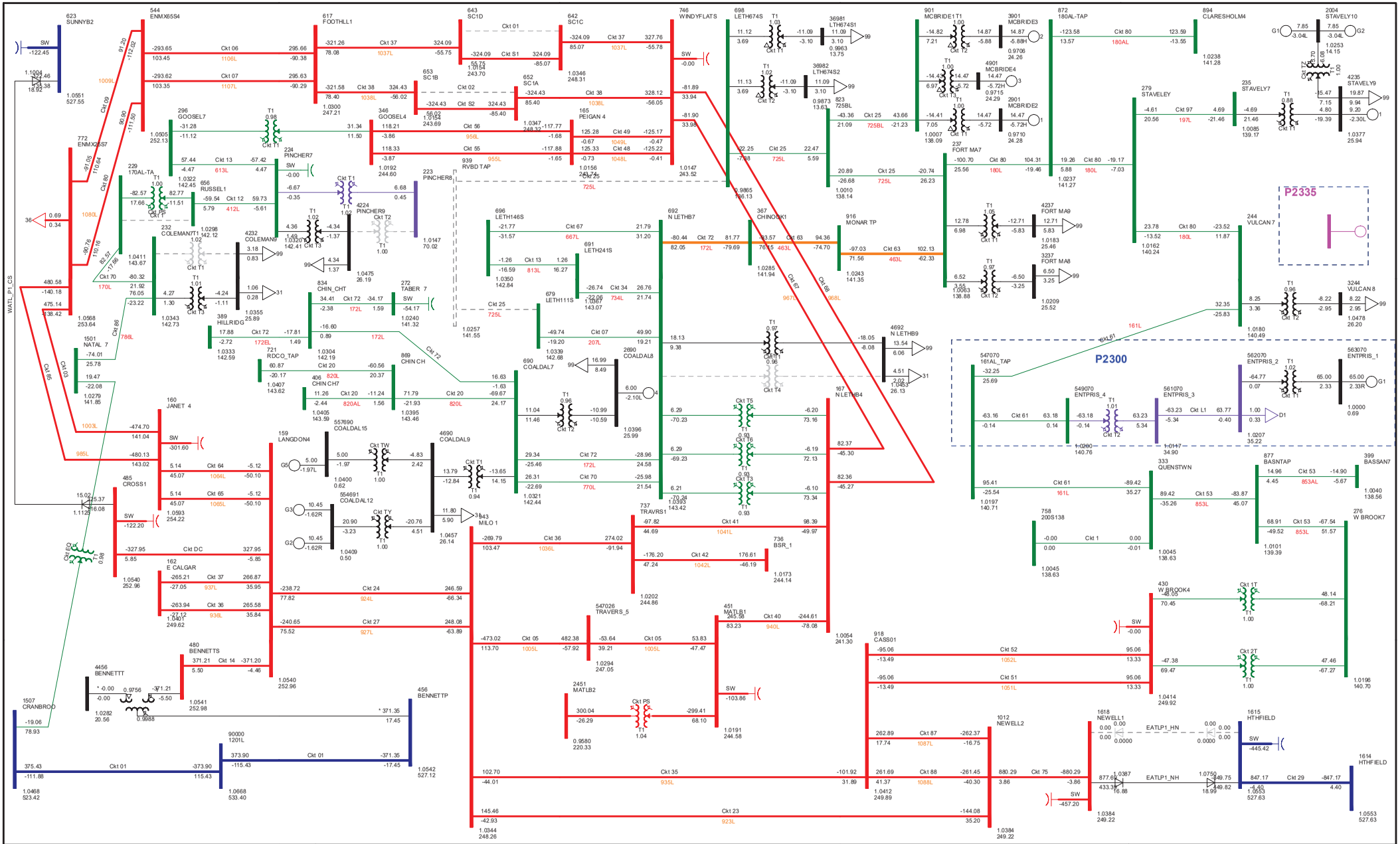
MH Export: 22.21 MW

FIGURE A3-1-4 N-1: 255ST1 (VULCAN 255S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-308.63 MW Sask Import:-0.00 MW MATL Import:-300.04 MW

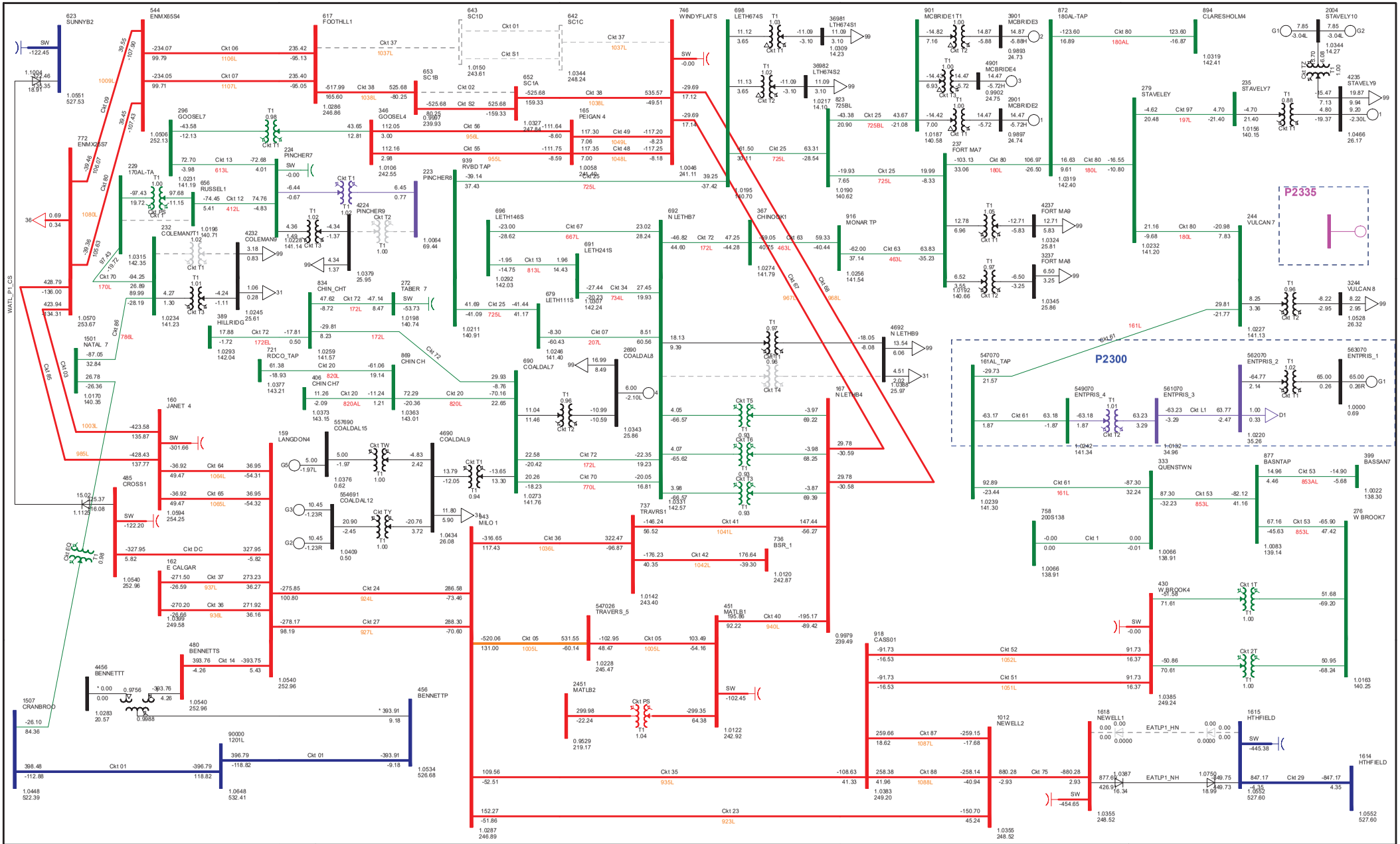
MH Export: 22.21 MW

FIGURE A3-1-5 N-1: 725L (BOWRON 674S TO COALBANKS 111S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100 kV 0.900 kV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-322.55 MW Sask Import:0.00 MW MATL Import:-299.98 MW

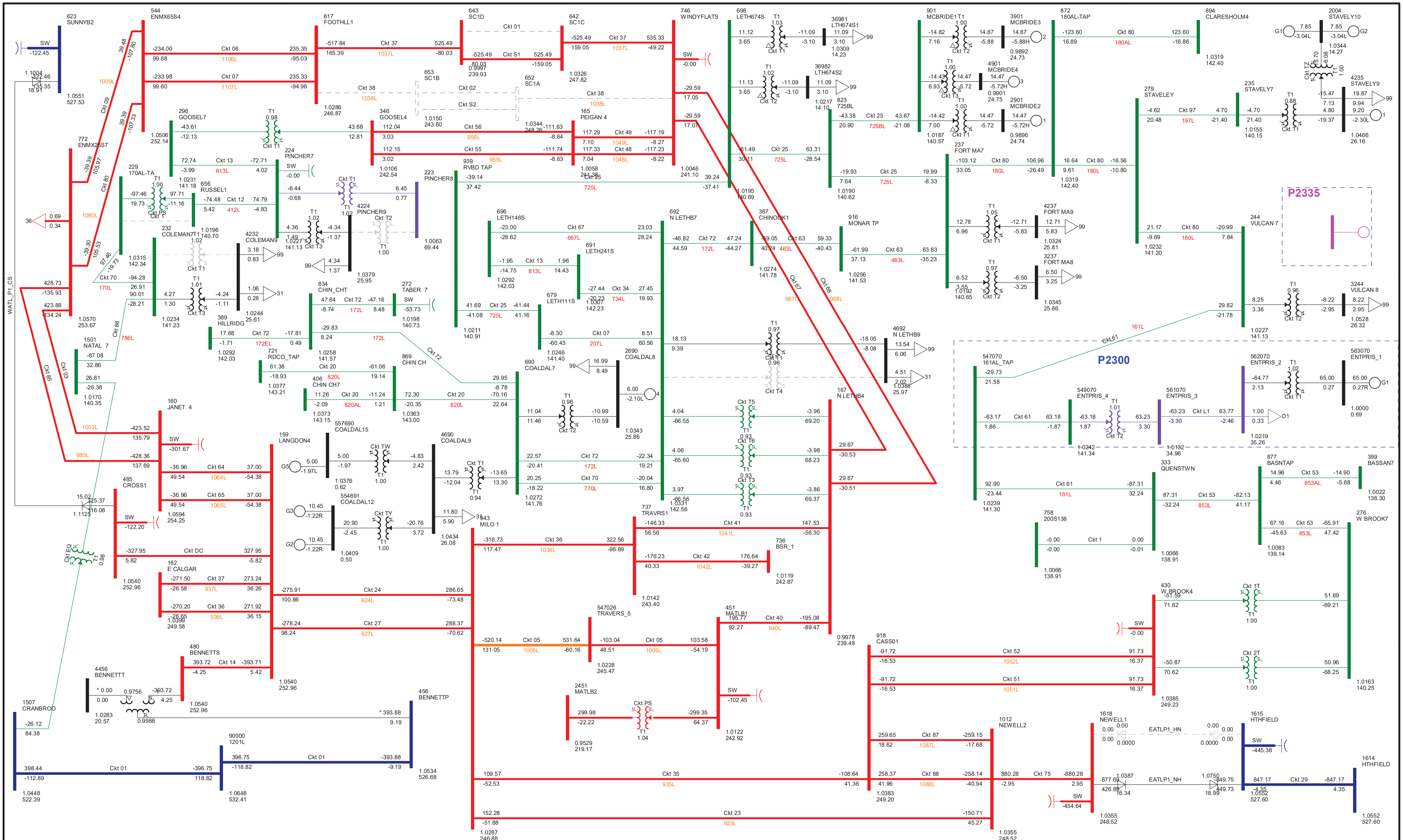
MH Export: 22.21 MW

FIGURE A3-1-6 N-1: 1037L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

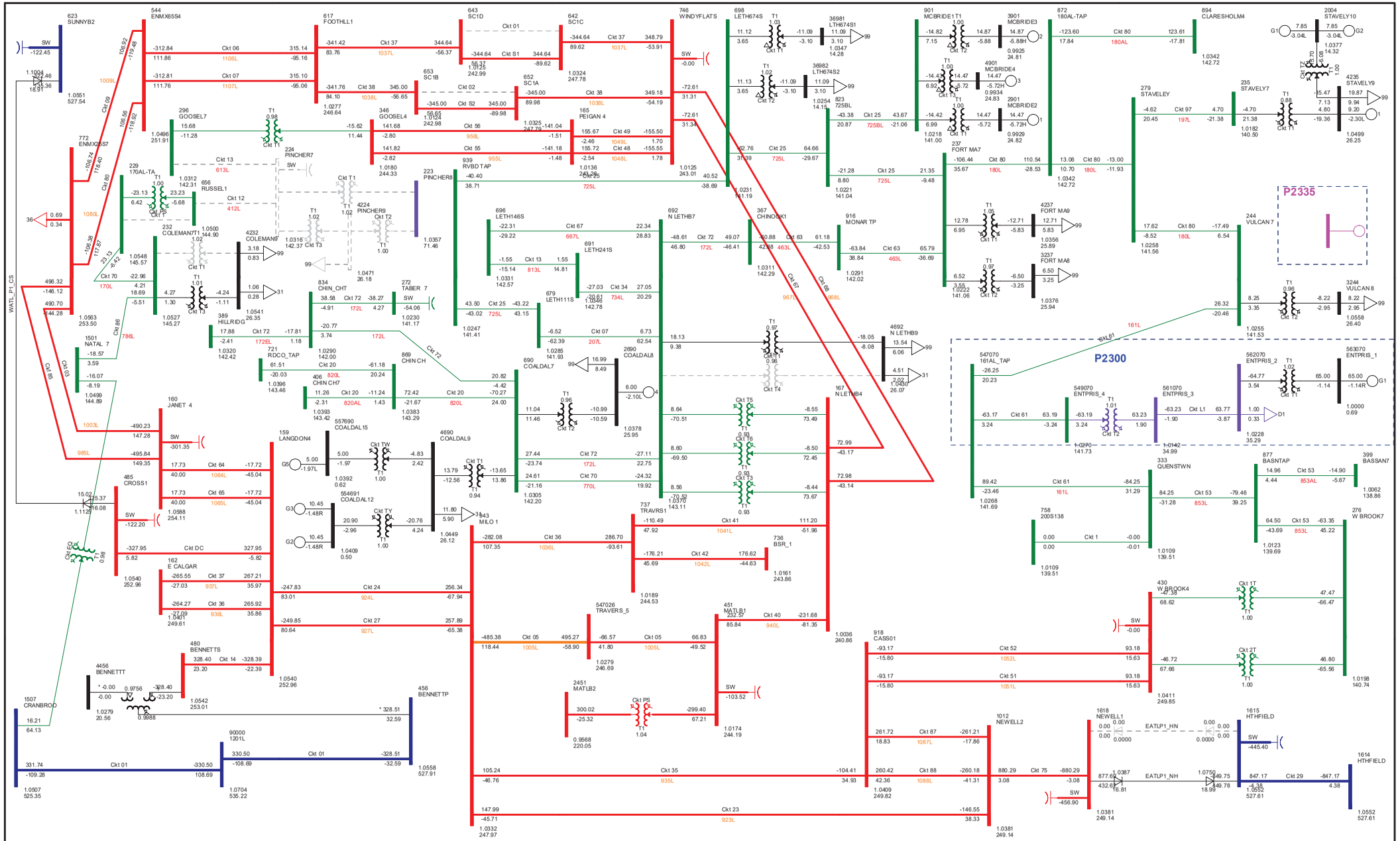
BC Import:-322.48 MW Sask Import:-0.00 MW MATL Import:-299.98 MW

MH Export: 22.21 MW

FIGURE A3-1-7 N-1: 1038L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-304.09 MW Sask Import:-0.00 MW MATL Import:-300.02 MW

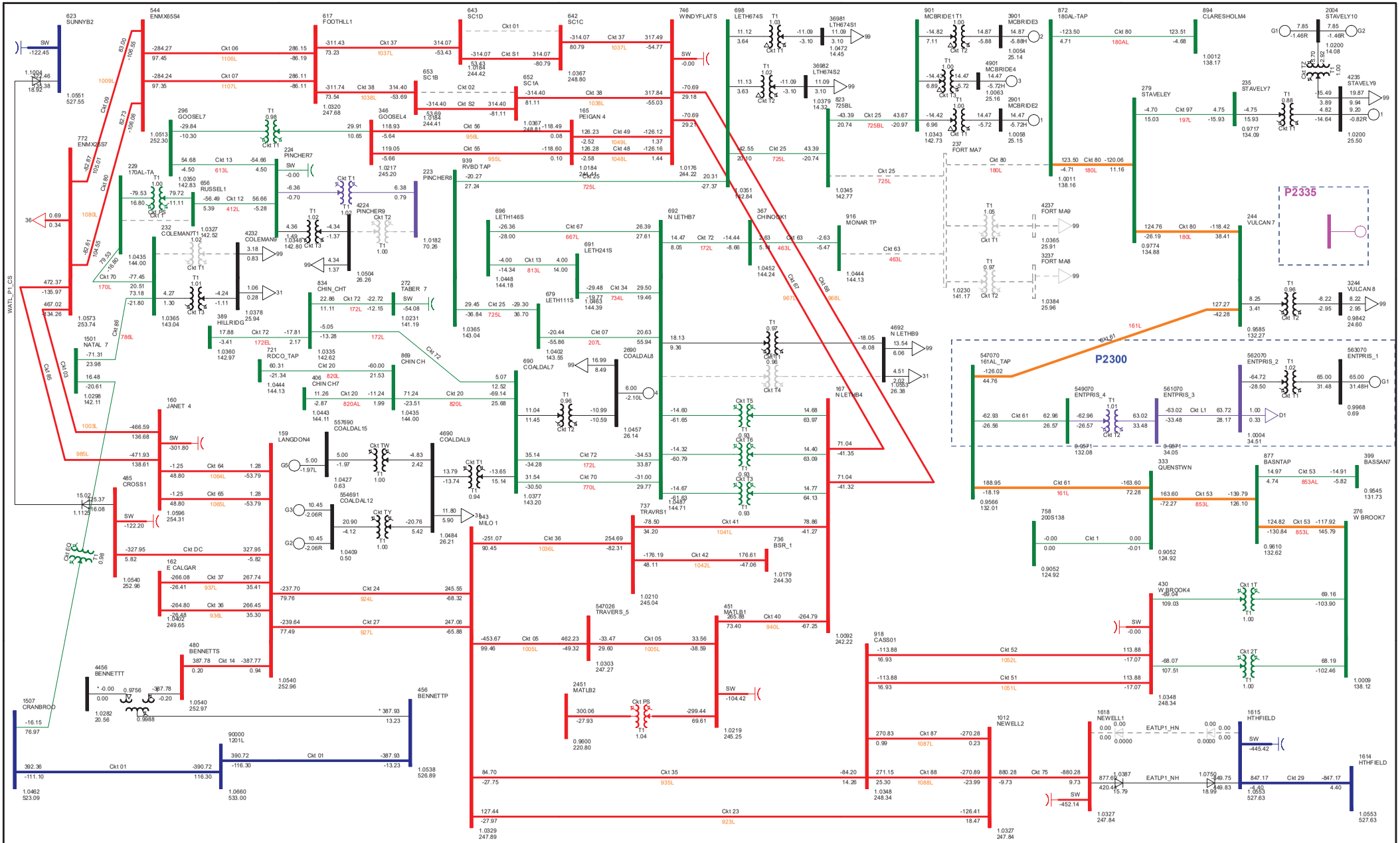
MH Export: 22.21 MW

FIGURE A3-1-8 N-1: 396ST1 (PINCHER CREEK 396S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-328.37 MW Sask Import:-0.00 MW MATL Import:-300.06 MW

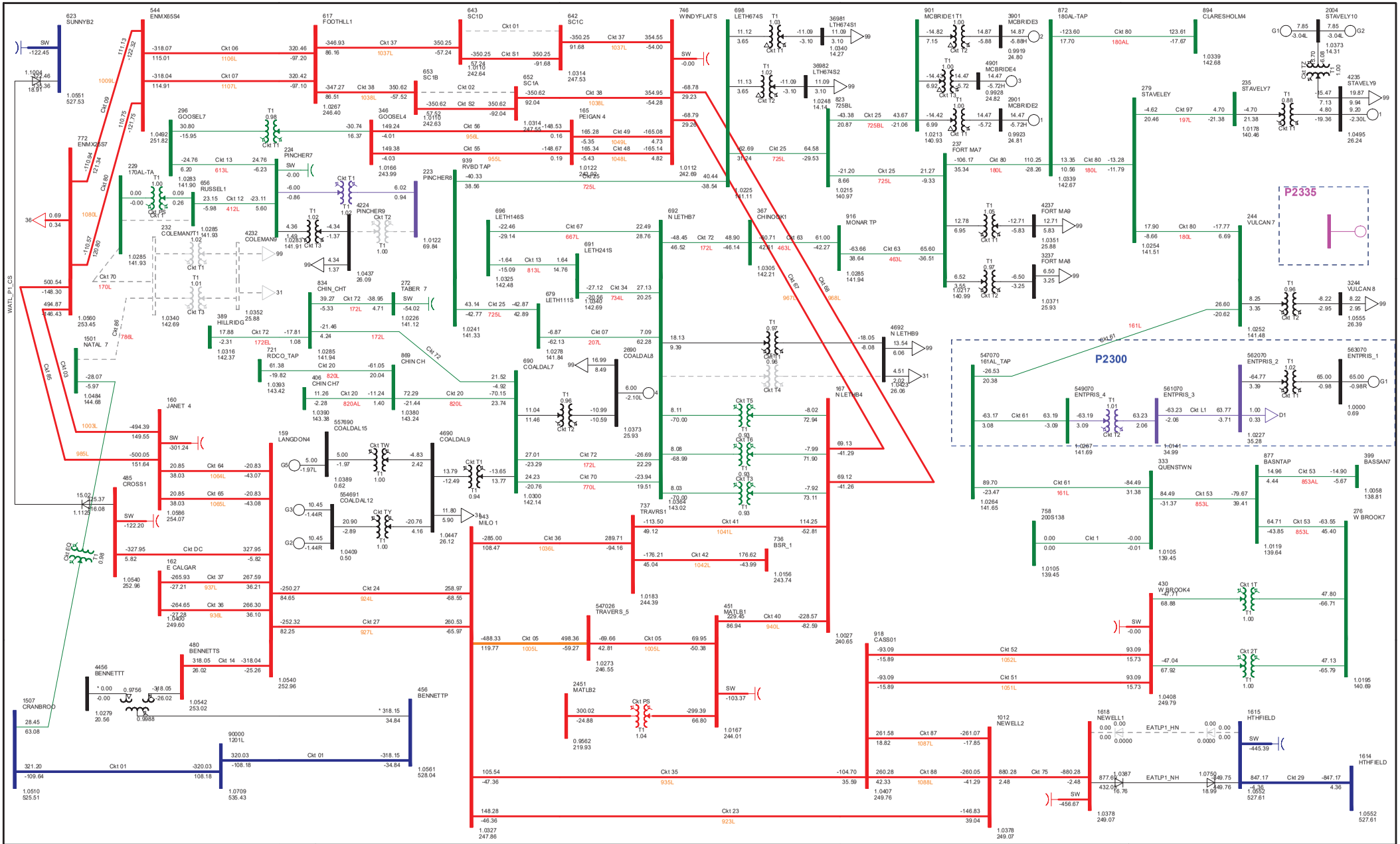
MH Export: 22.20 MW

FIGURE A3-1-9 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100pu 0.900pu
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-305.95 MW Sask Import:-0.00 MW MATL Import:-300.02 MW

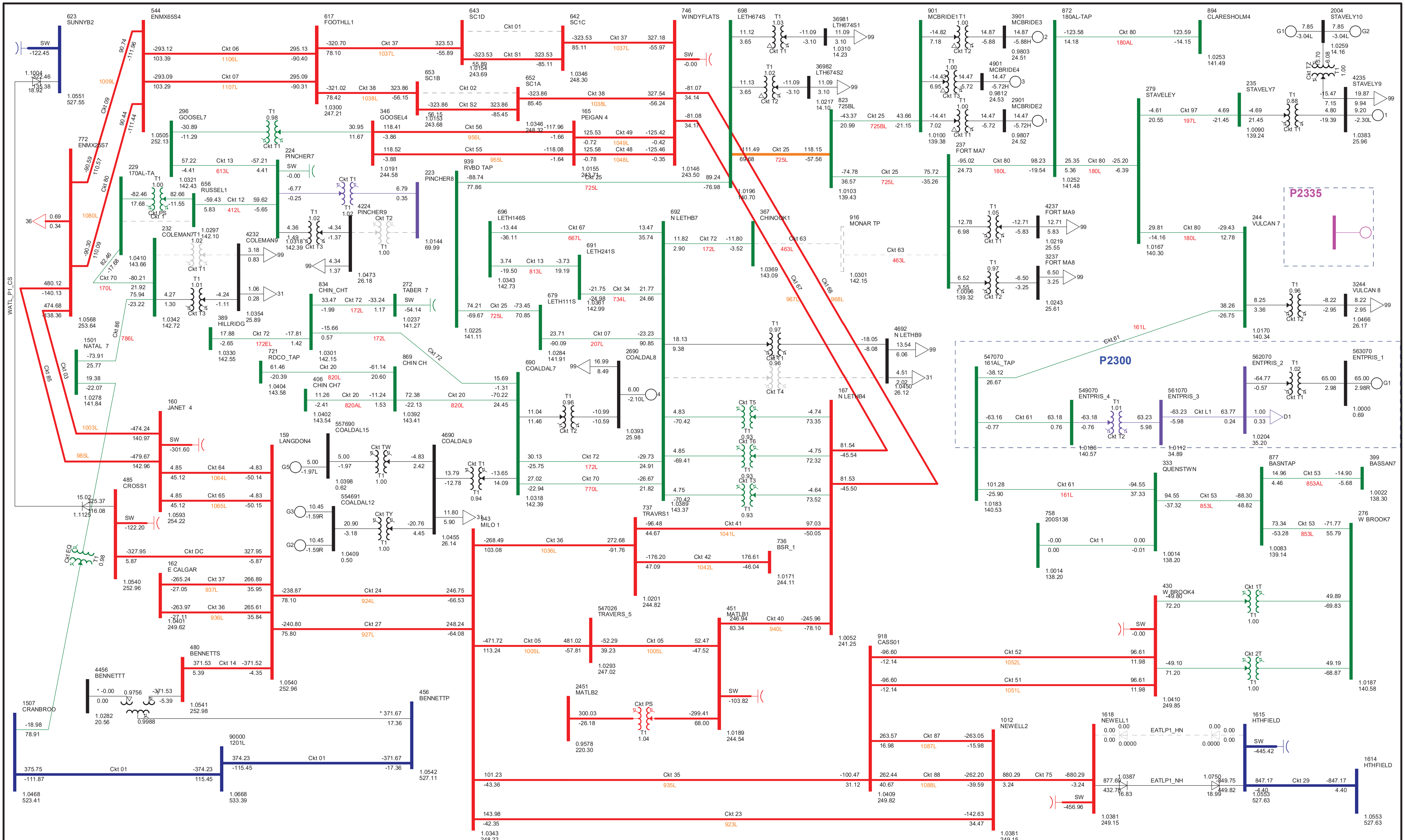
MH Export: 22.21 MW

FIGURE A3-1-10 N-1: 799ST1 (COLEMAN 799S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900LN
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-309.04 MW Sask Import:0.00 MW MATL Import:-300.03 MW

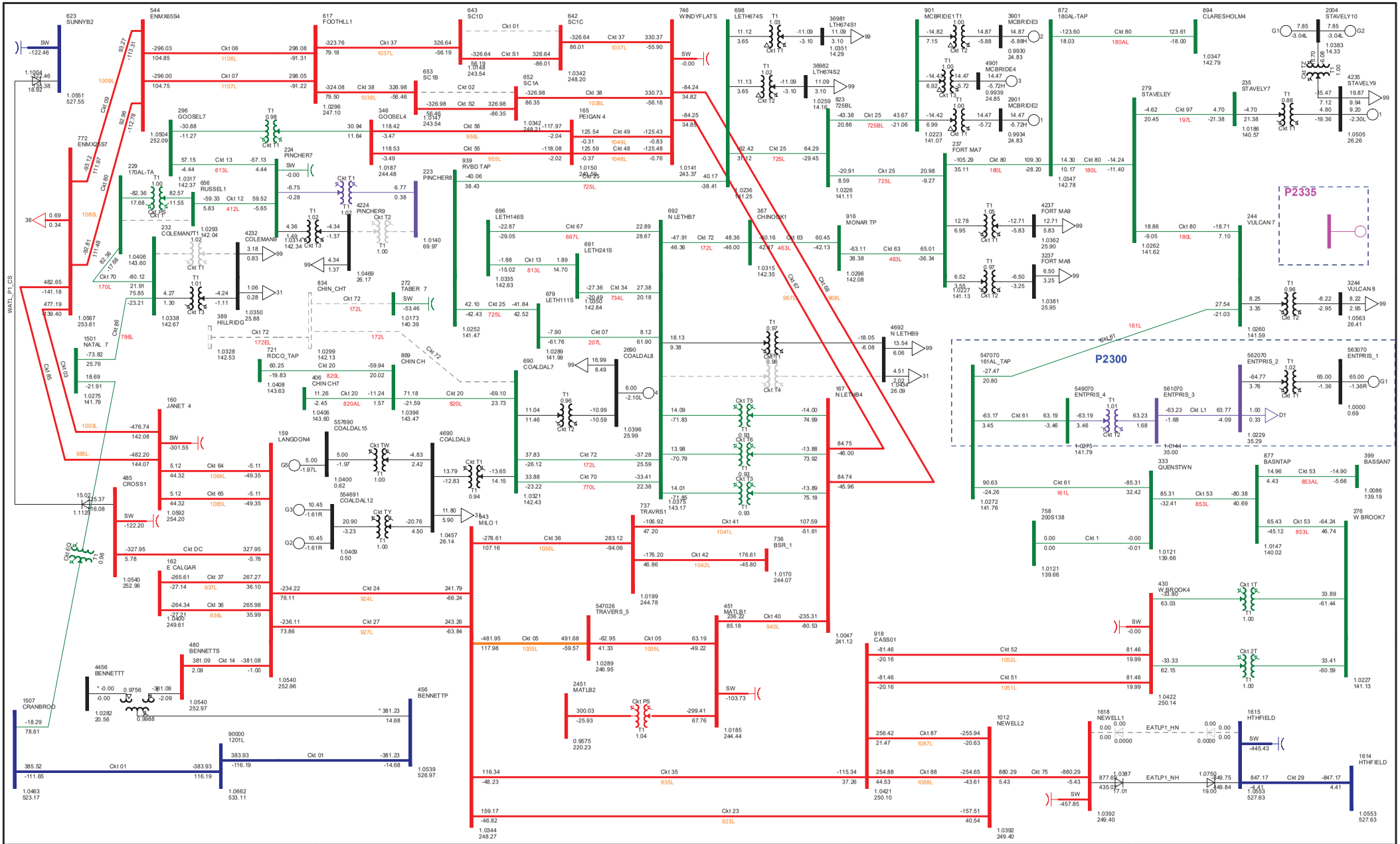
MH Export: 22.21 MW

FIGURE A3-1-11 N-1: 463L (FORT MACLEOD 15S TO CHINOOK 181S) AFTER RAS#169

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-319.27 MW Sask Import:-0.00 MW MATL Import:-300.03 MW

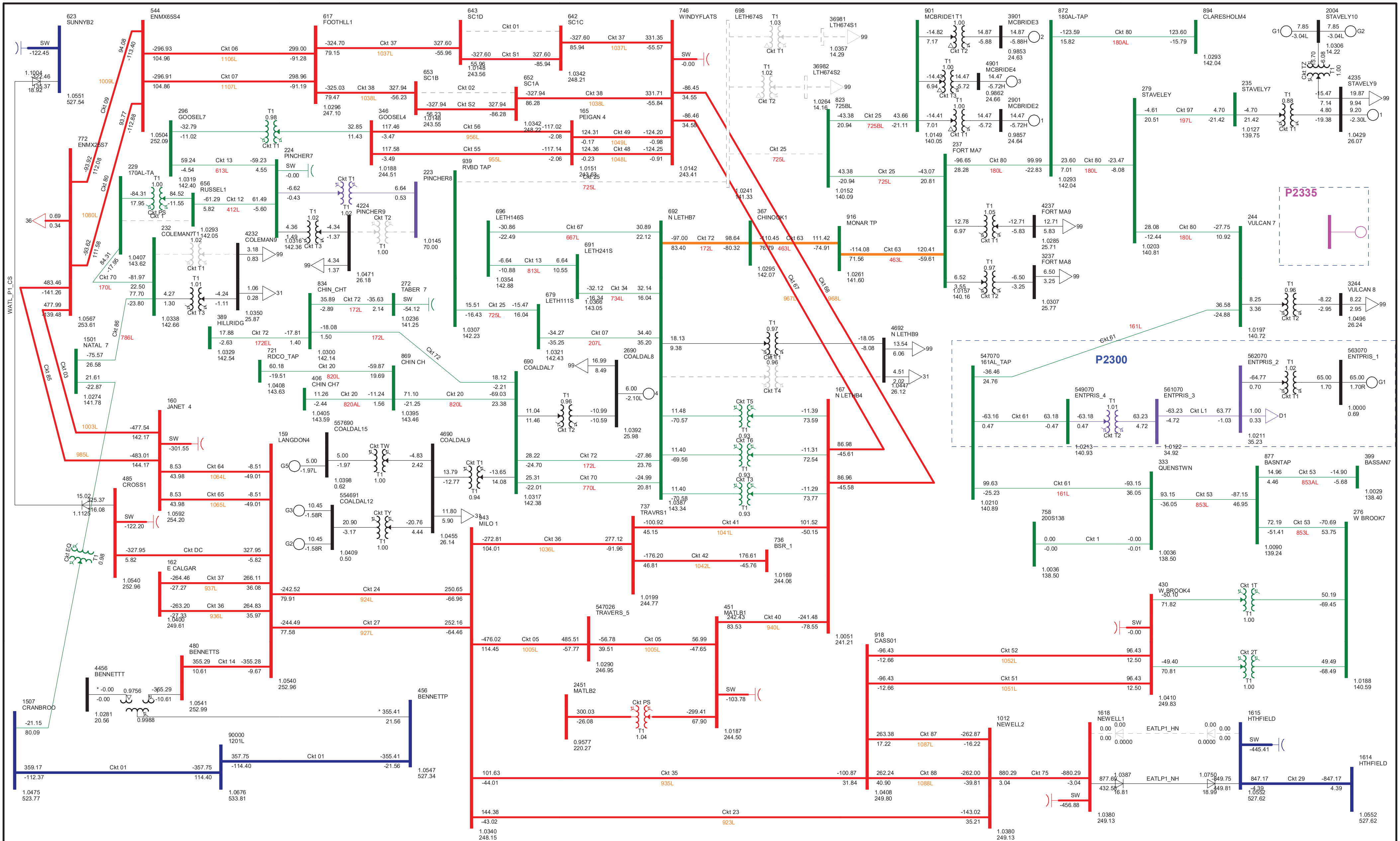
MH Export: 22.21 MW

FIGURE A3-1-12 N-1: 172L (COALDALE 254S TO TABER 83S)

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Base kV
1.100 kV 0.900 kV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

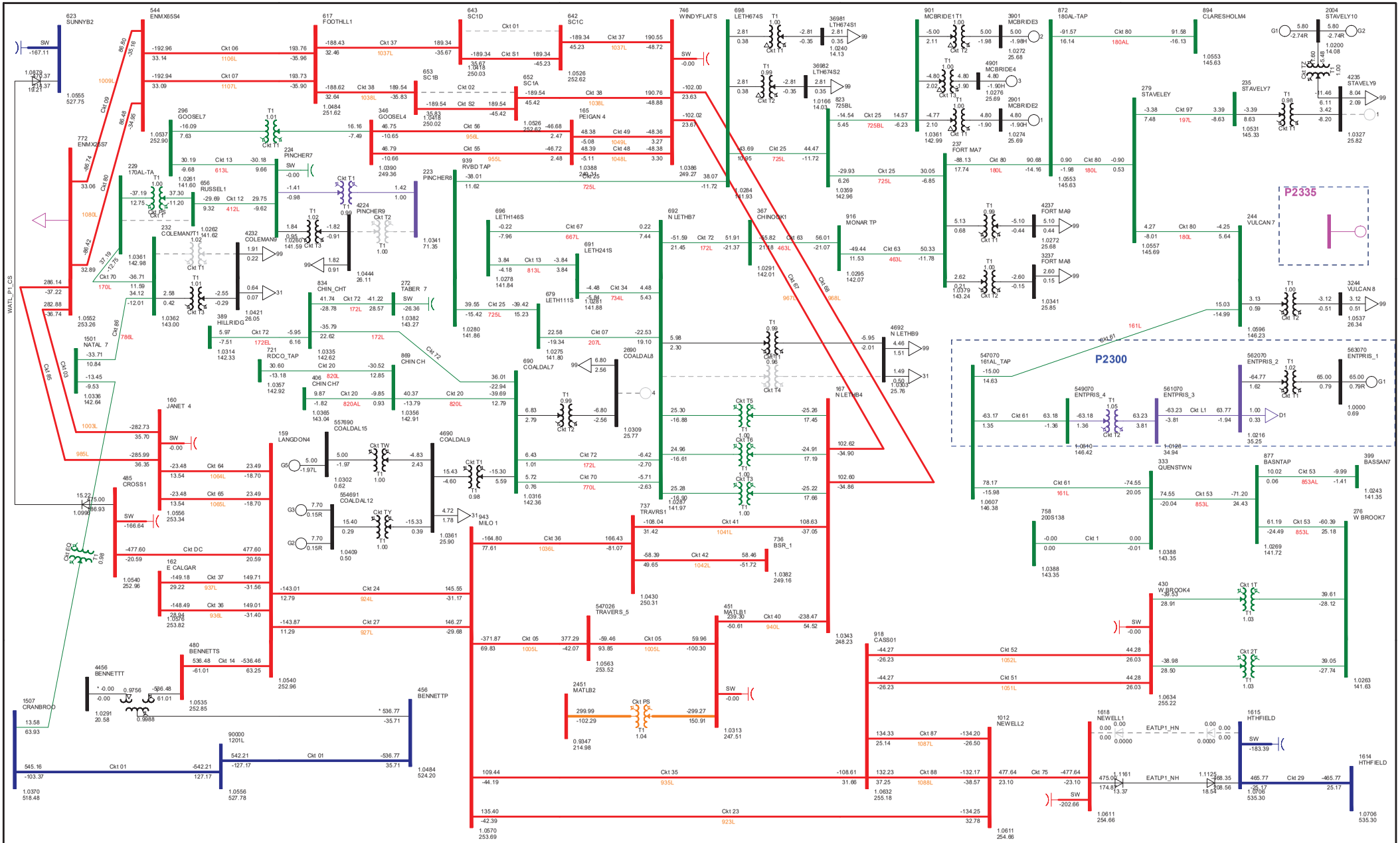
BC Import:-290.49 MW Sask Import:-0.00 MW MATL Import:-300.03 MW

MH Export: 22.21 MW

FIGURE A3-1-13 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-509.01 MW Sask Import:-0.00 MW MATL Import:-299.99 MW

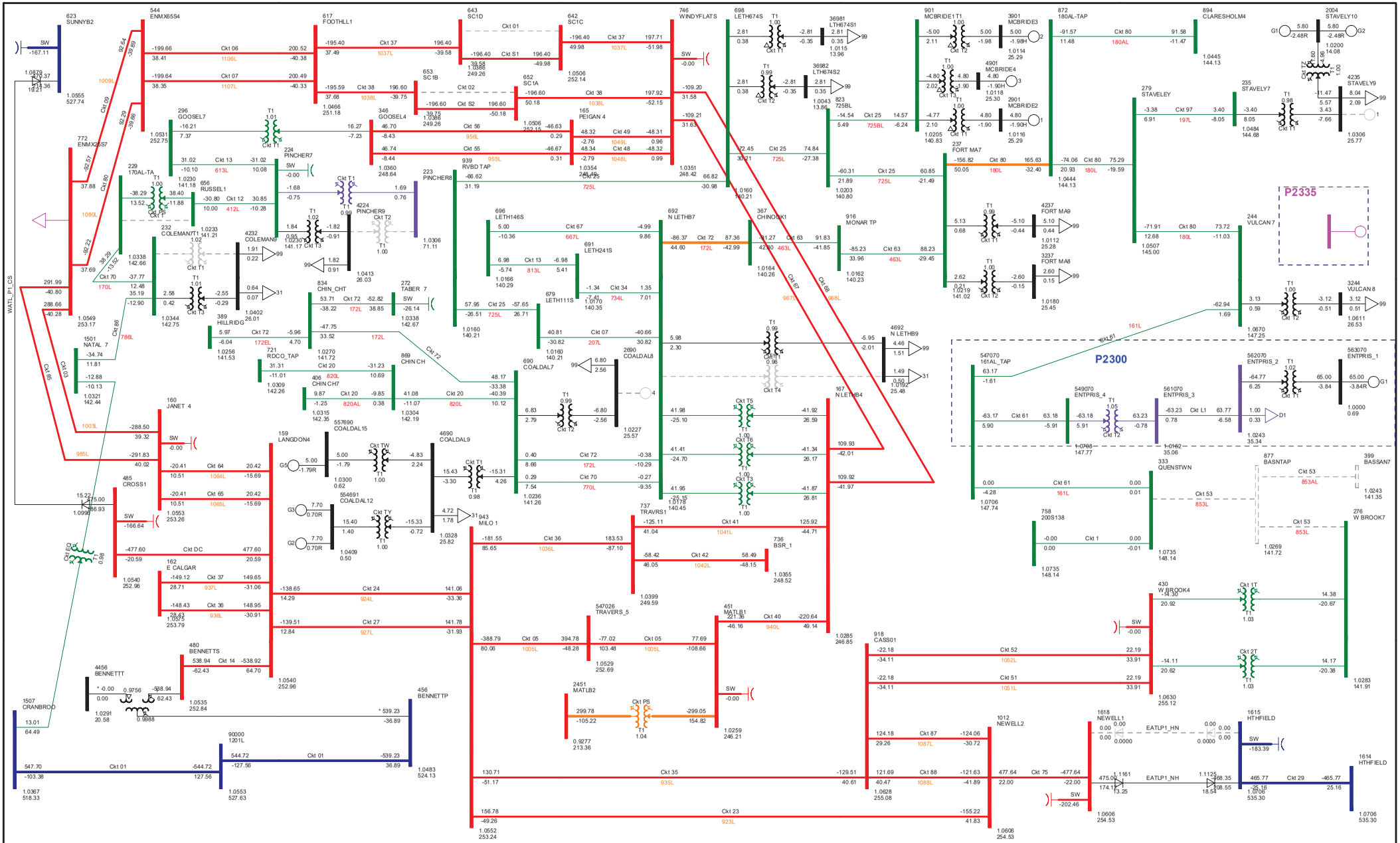
MH Export: 16.33 MW

FIGURE A3-2-1-N-0: NORMAL OPERATION

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-510.83 MW Sask Import:-0.00 MW MATL Import:-299.78 MW

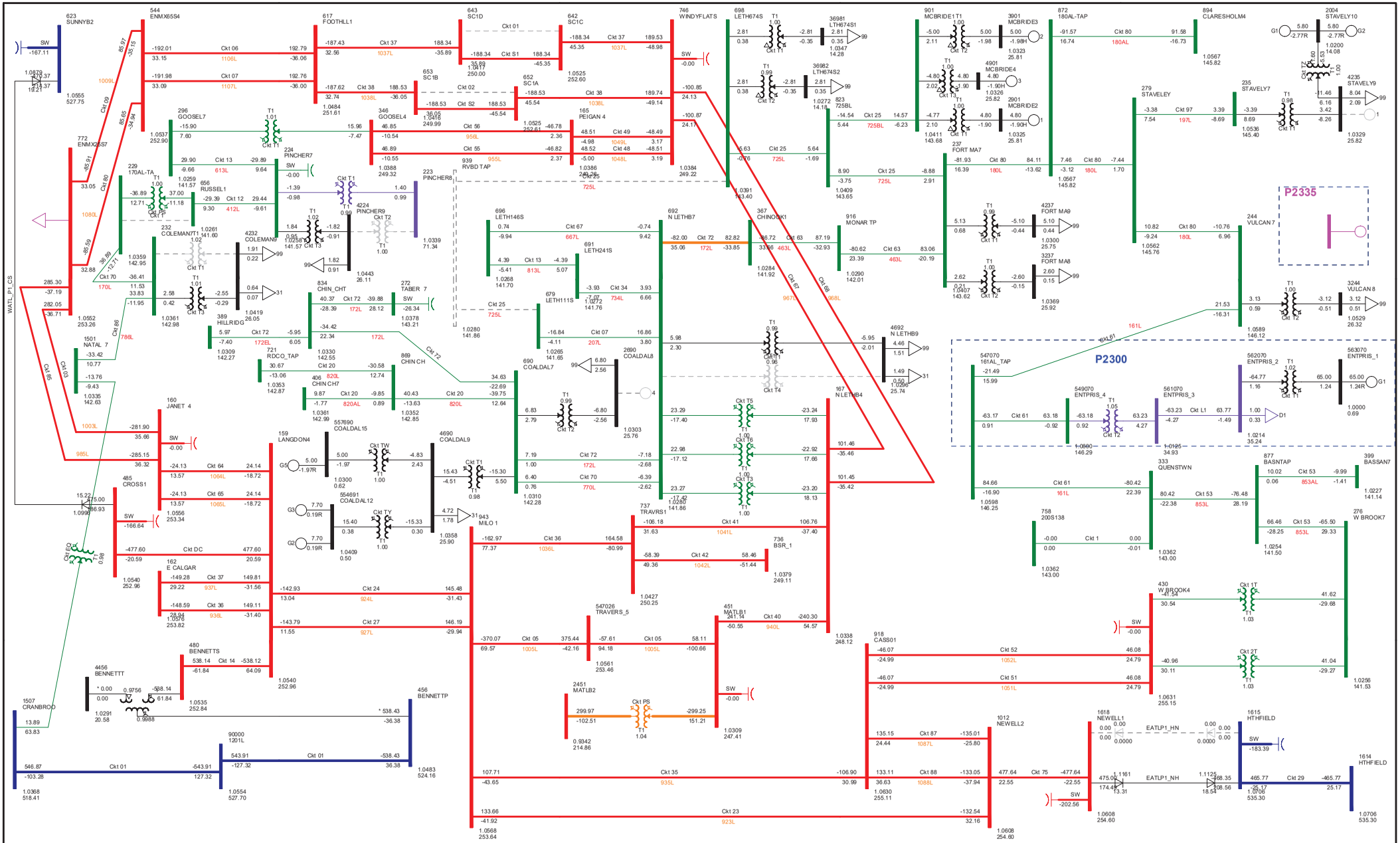
MH Export: 16.33 MW

FIGURE A3-2-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100 0.900 UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-510.98 MW Sask Import:0.00 MW MATL Import:-299.97 MW

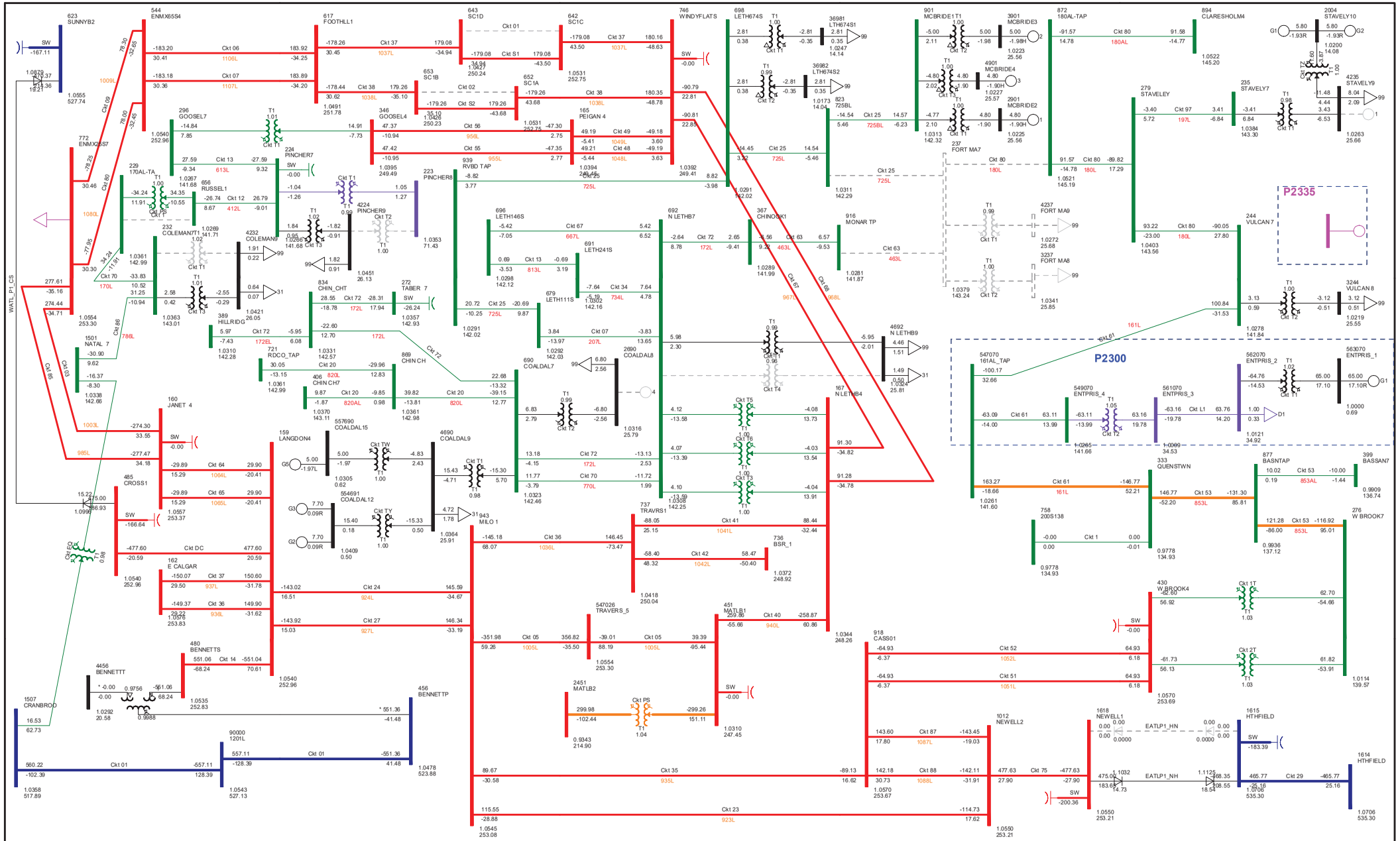
MH Export: 16.33 MW

FIGURE A3-2-3 N-1: 725L (BOWRON 674S TO COALBANKS 111S) AFTER RAS#178

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000<=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-526.58 MW Sask Import:0.00 MW MATL Import:-299.98 MW

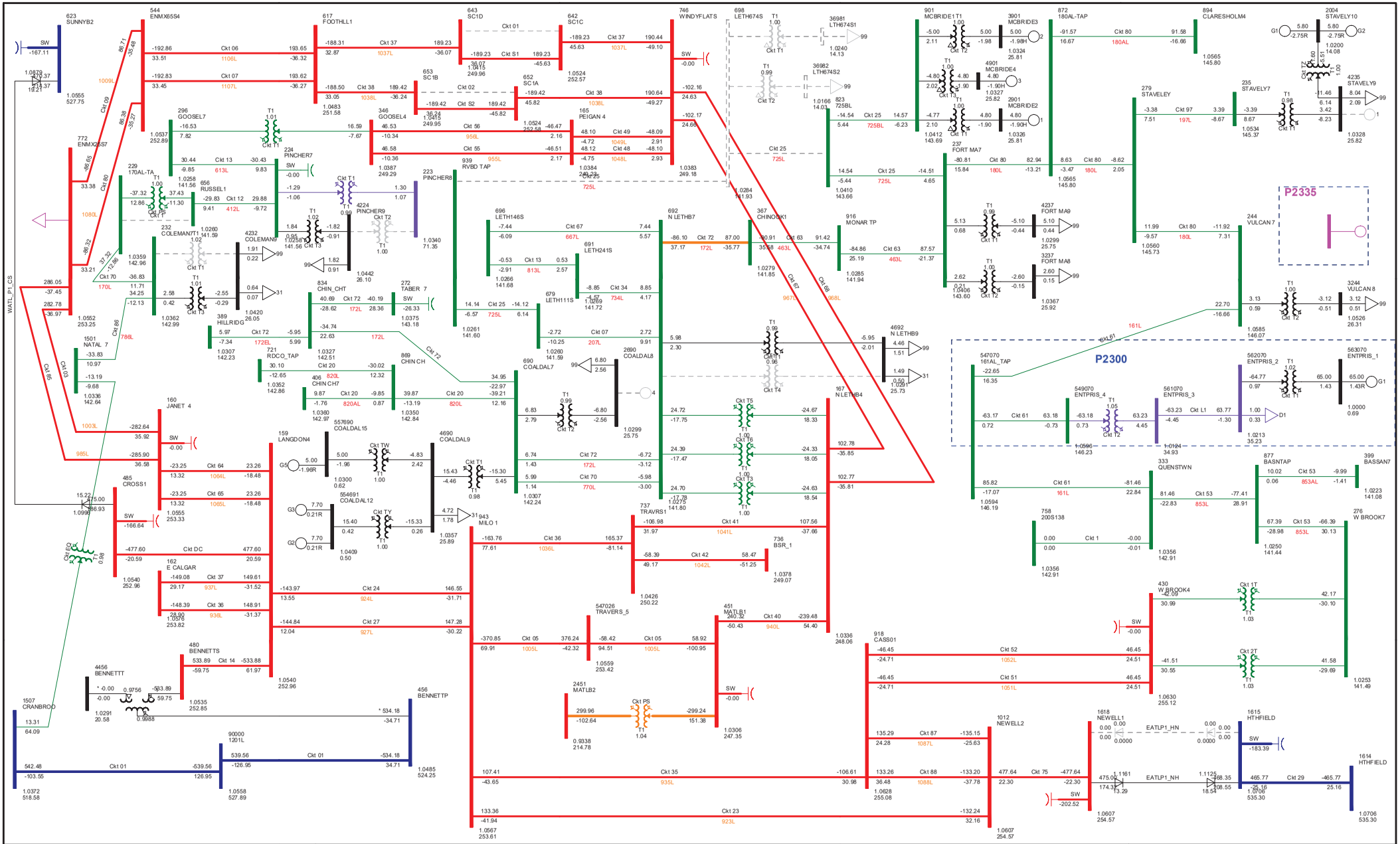
MH Export: 16.32 MW

FIGURE A3-2-4 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-506.15 MW Sask Import:-0.00 MW MATL Import:-299.96 MW

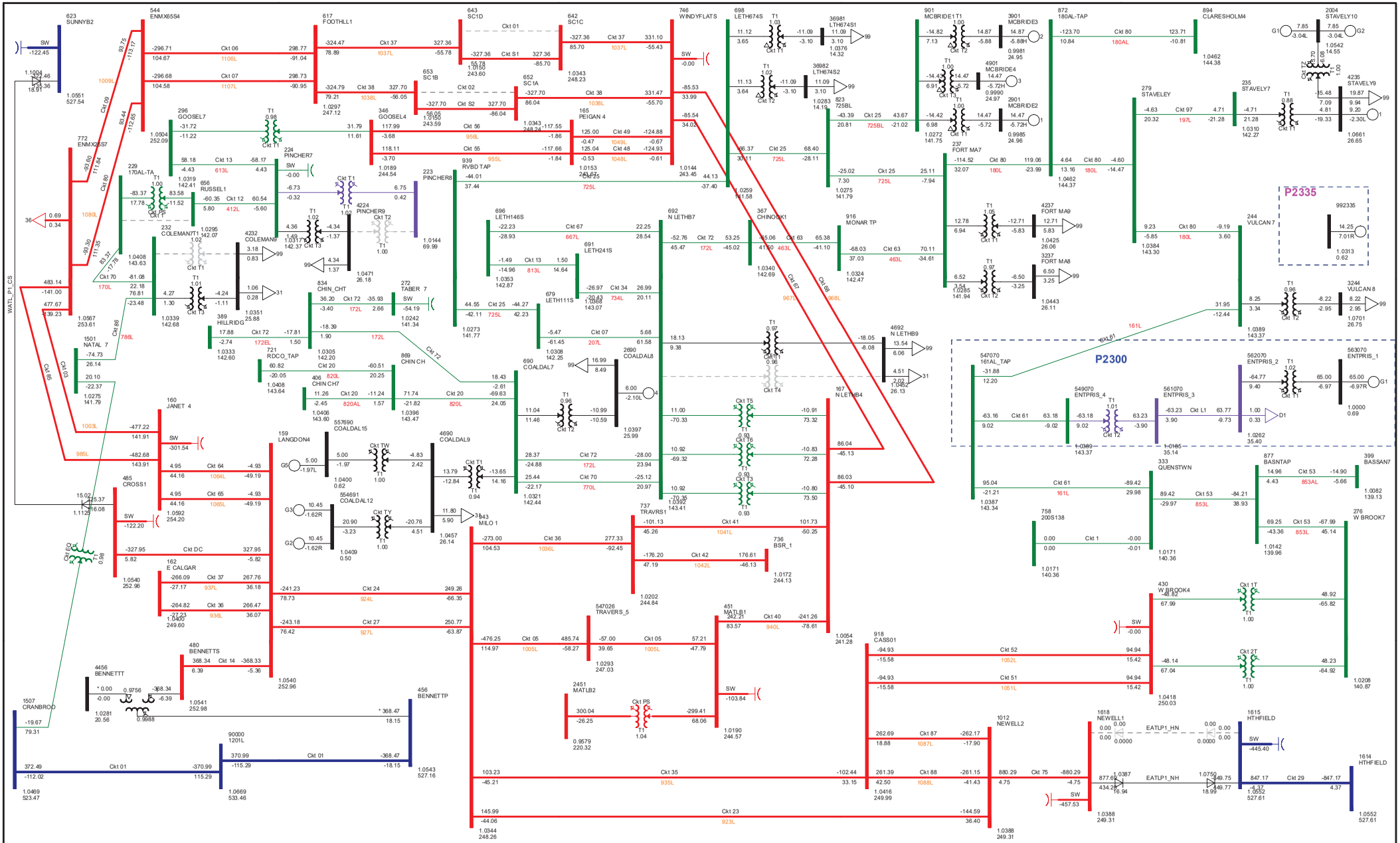
MH Export: 16.33 MW

FIGURE A3-2-5 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900LN
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-305.07 MW Sask Import:0.00 MW MATL Import:-300.04 MW

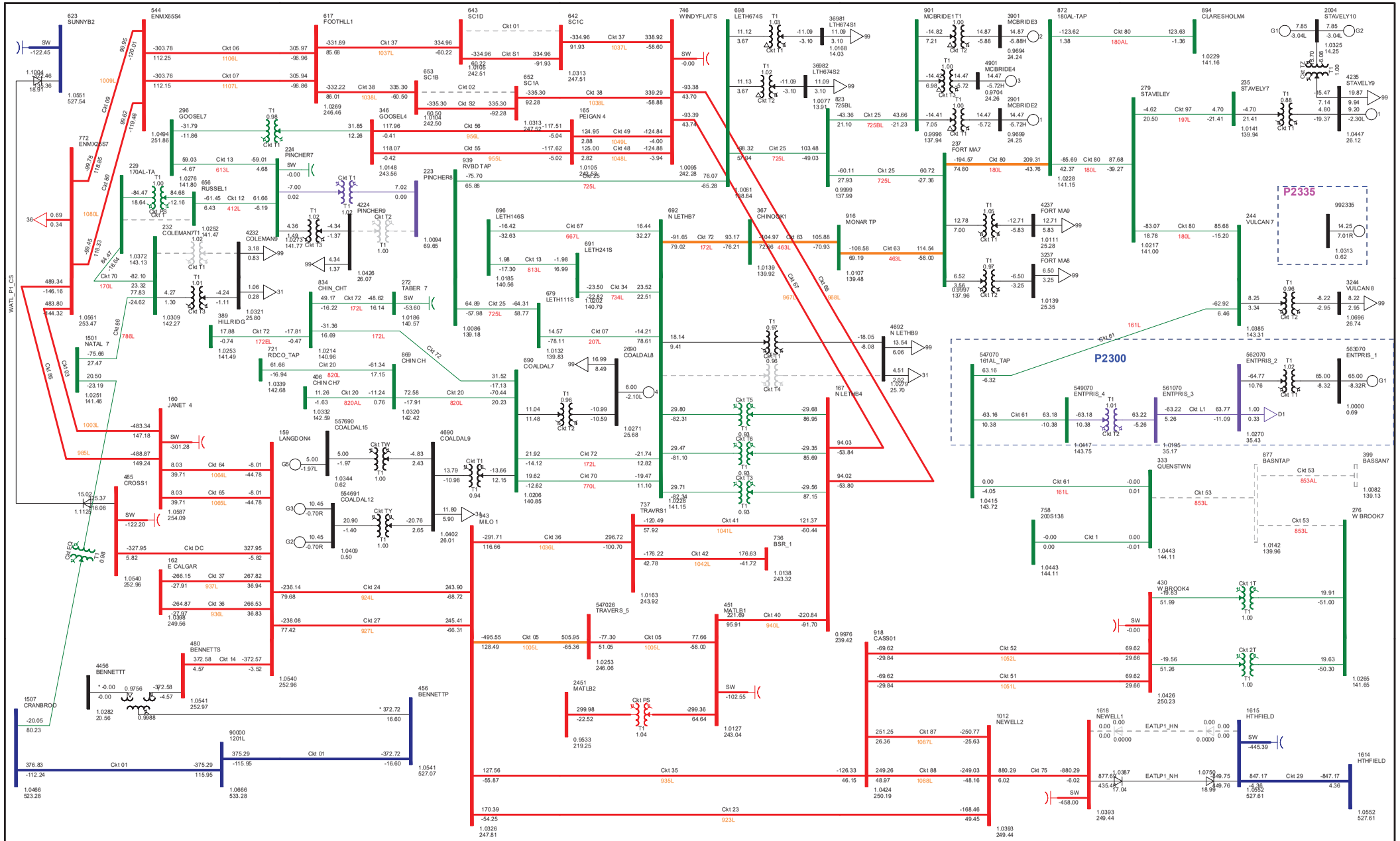
MH Export: 22.21 MW

FIGURE A3-3-1-N-0: NORMAL OPERATION

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-308.79 MW Sask Import:-0.00 MW MATL Import:-299.98 MW

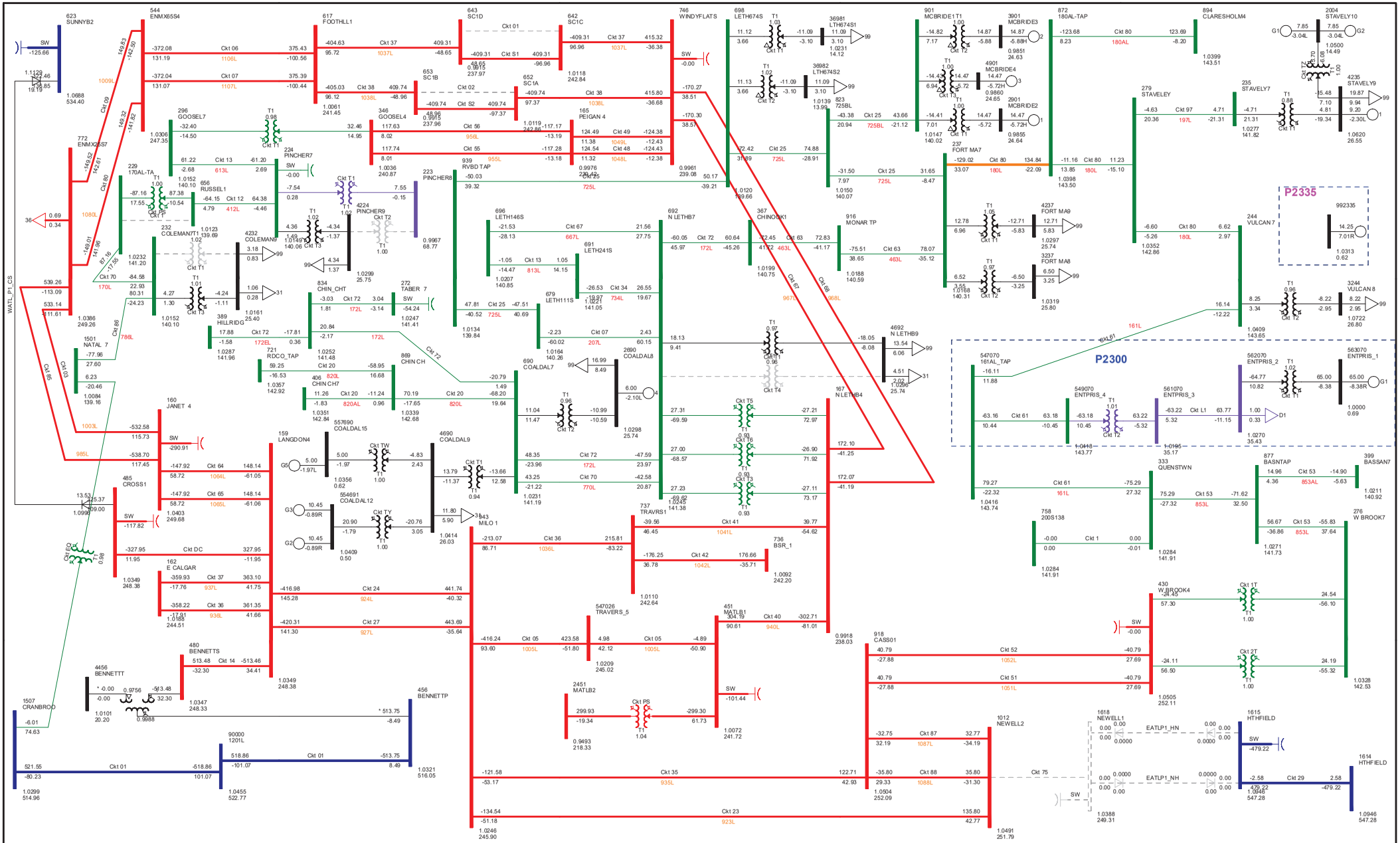
MH Export: 22.21 MW

FIGURE A3-3-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-462.55 MW Sask Import:0.00 MW MATL Import:-299.93 MW

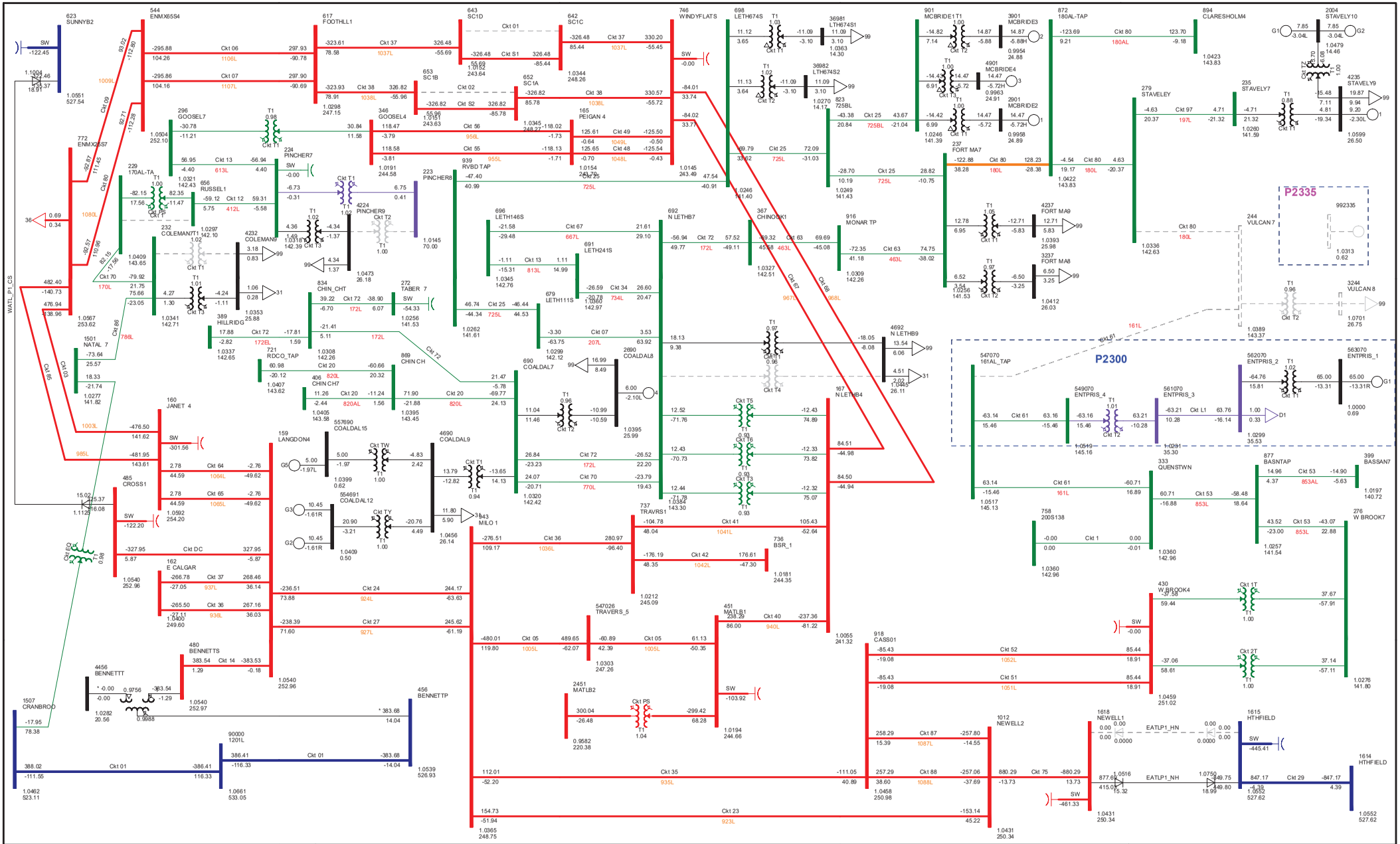
MH Export: 22.22 MW

FIGURE A3-3-3 N-1: EATL

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Base kV
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-322.08 MW Sask Import:0.00 MW MATL Import:-300.04 MW

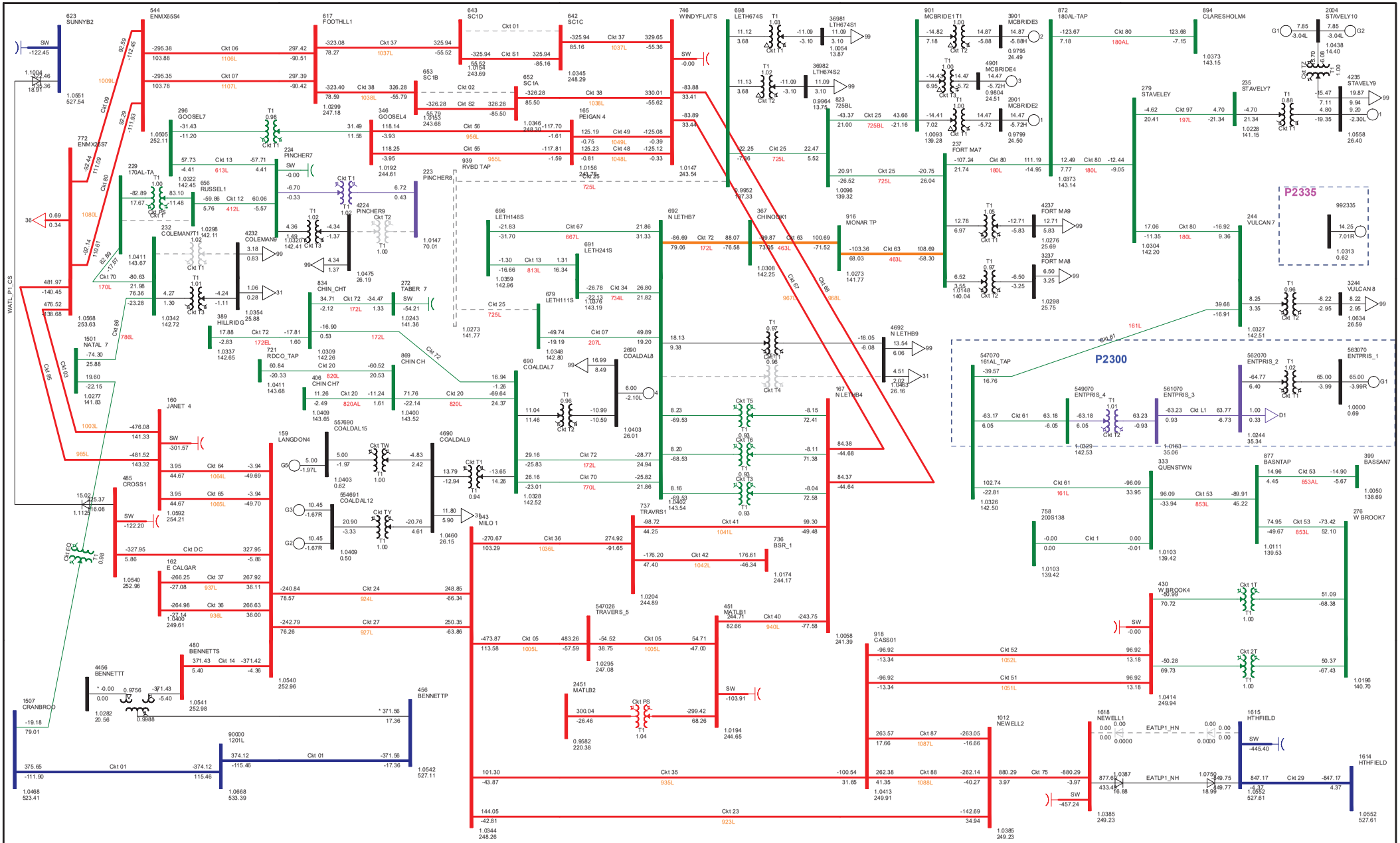
MH Export: 22.21 MW

FIGURE A3-3-4 N-1: 255ST1 (VULCAN 255S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-308.69 MW Sask Import:0.00 MW MATL Import:-300.04 MW

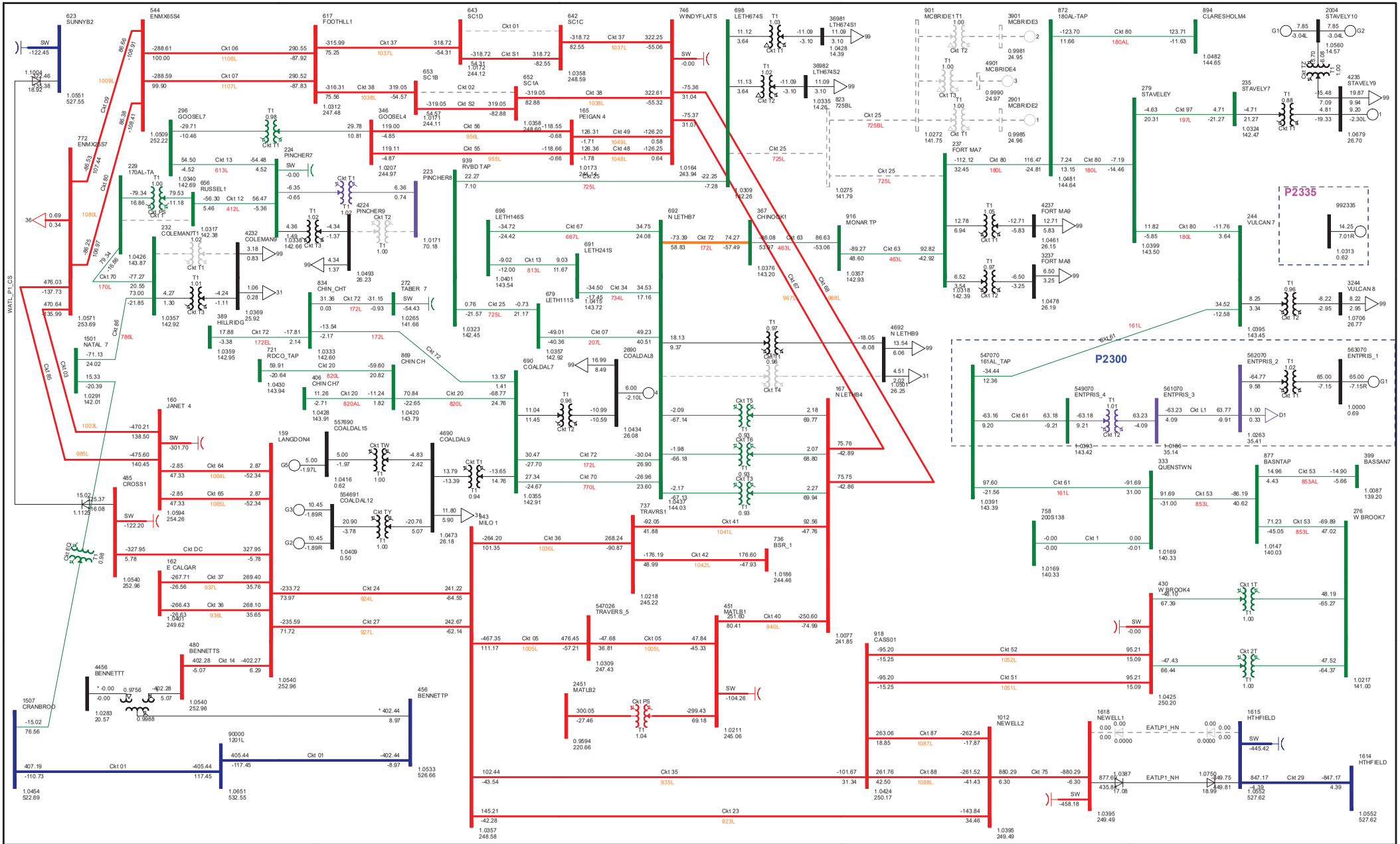
MH Export: 22.21 MW

FIGURE A3-3-5 N-1: 725L (BOWRON 674S TO COALBANKS 111S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-343.96 MW Sask Import:0.00 MW MATL Import:-300.05 MW

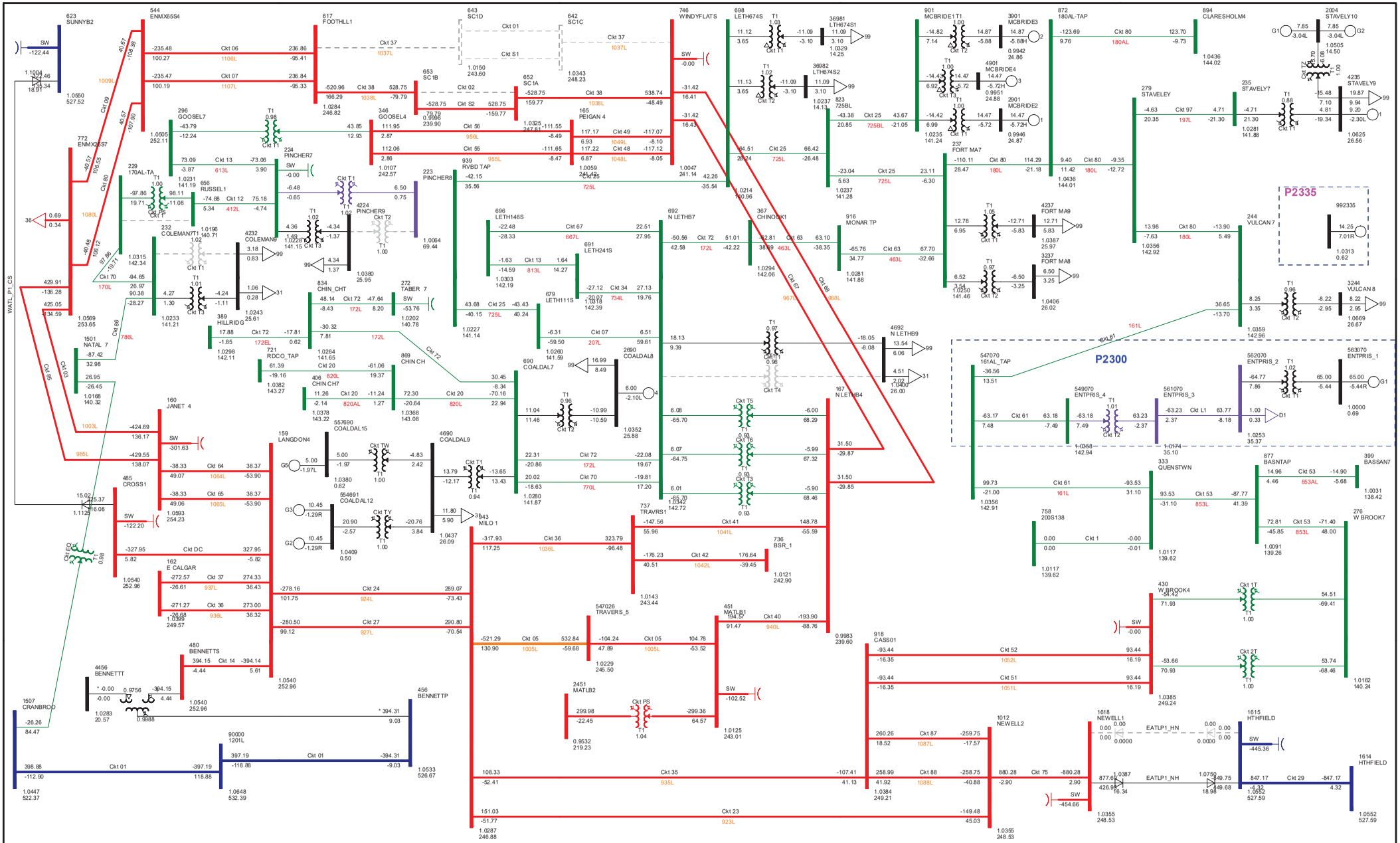
MH Export: 22.21 MW

FIGURE A3-3-6 N-1: 725L (FORT MACLEOD 15S TO BOWRON 674S)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900LN
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-322.73 MW Sask Import:-0.00 MW MATL Import:-299.98 MW

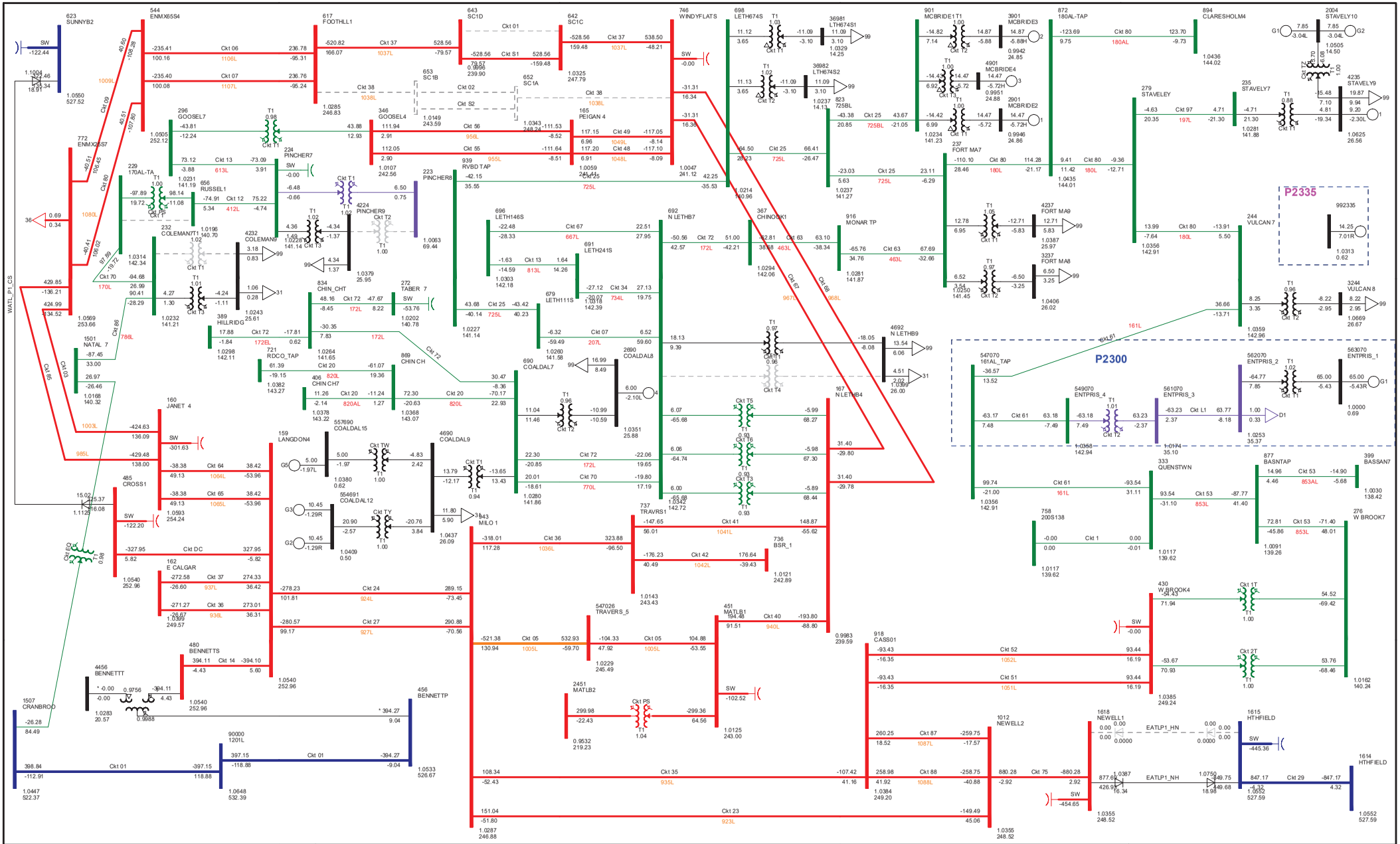
MH Export: 22.21 MW

FIGURE A3-3-7 N-1: 1037L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100 0.900 UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-322.66 MW Sask Import:0.00 MW MATL Import:-299.98 MW

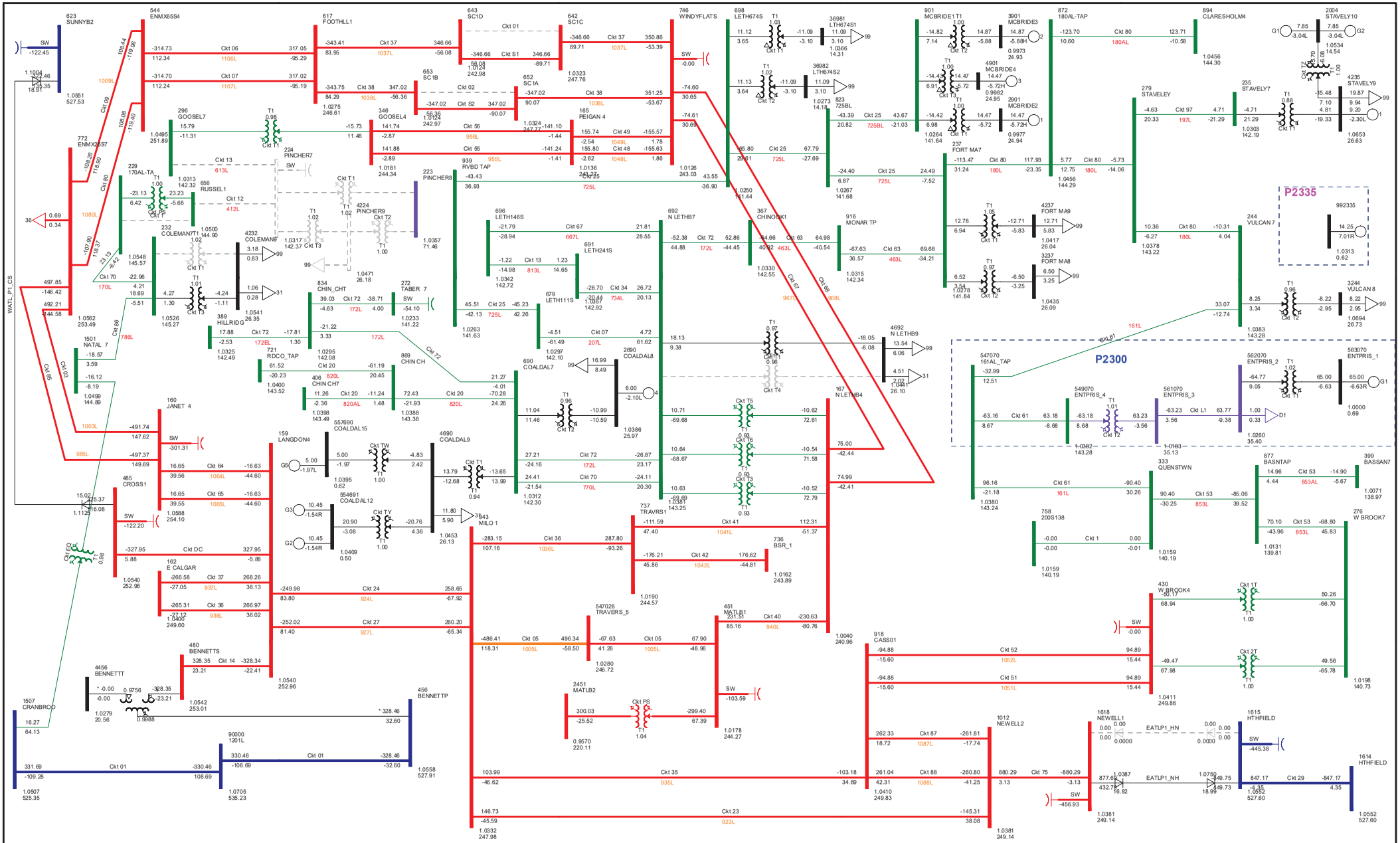
MH Export: 22.21 MW

FIGURE A3-3-8 N-1: 1038L (FOOTHILLS 237S TO WINDY FLATS 138S)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-304.10 MW Sask Import:0.00 MW MATL Import:-300.03 MW

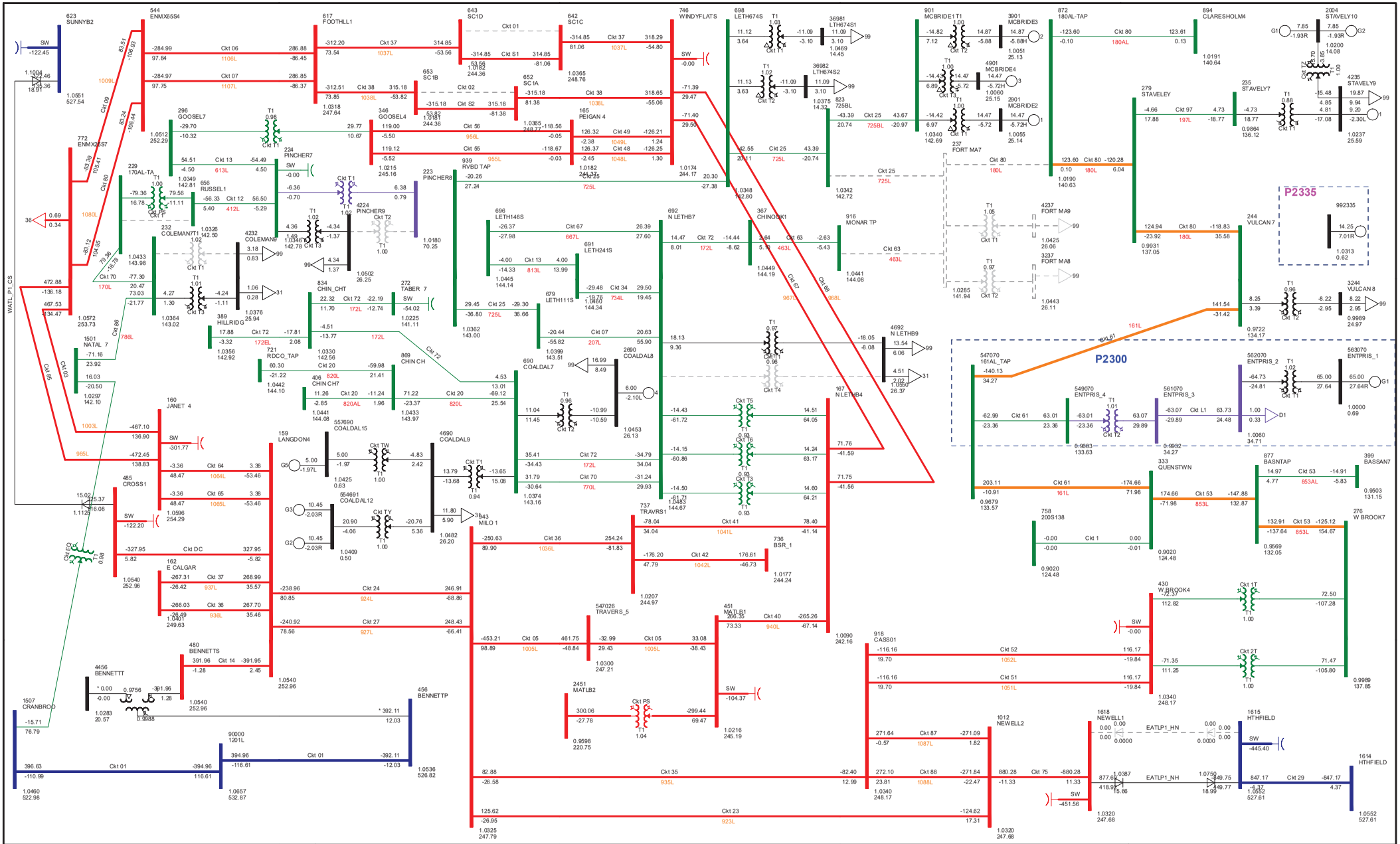
MH Export: 22.21 MW

FIGURE A3-3-9 N-1: 396ST1 (PINCHER CREEK 396S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-332.98 MW Sask Import:0.00 MW MATL Import:-300.06 MW

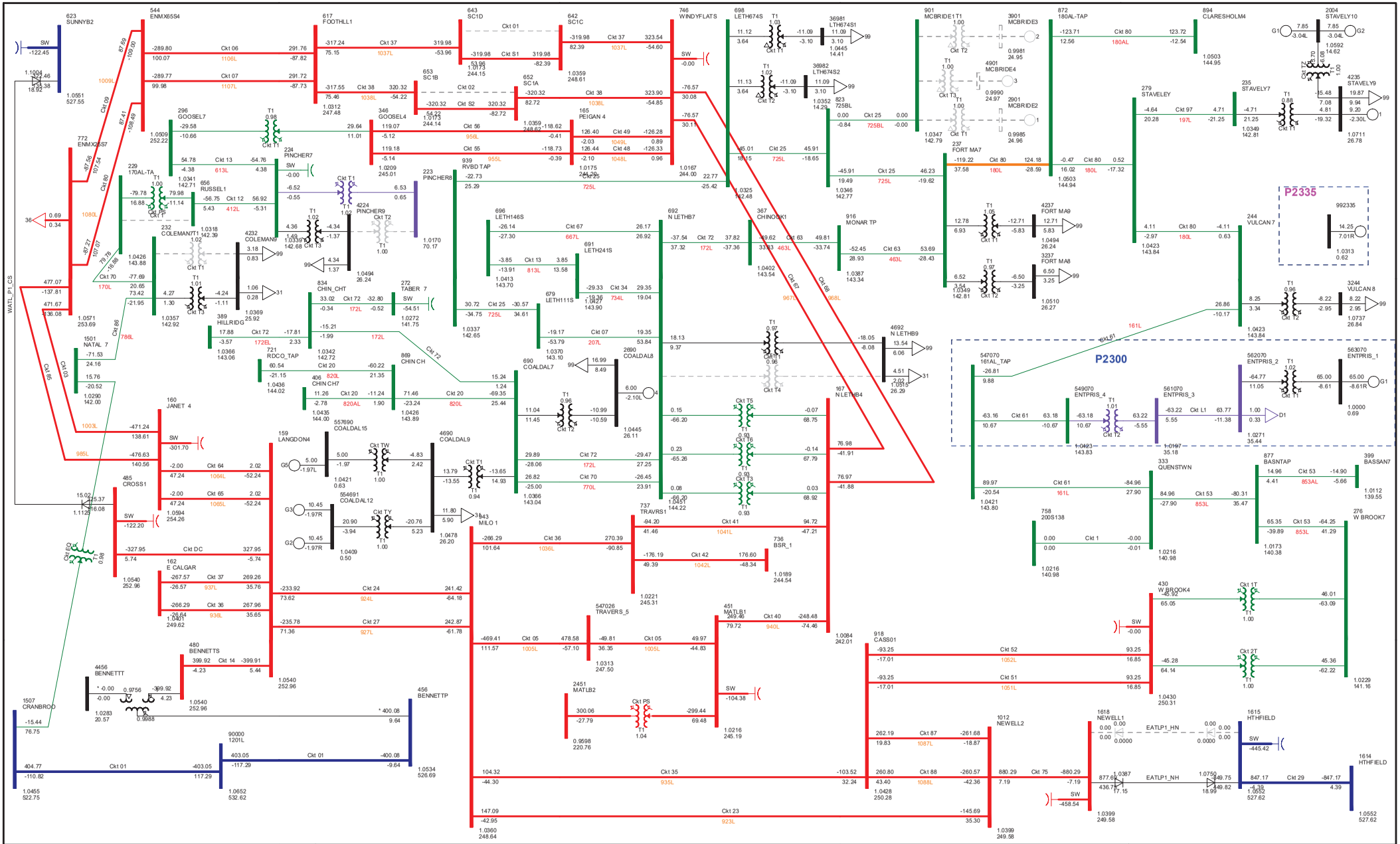
MH Export: 22.20 MW

FIGURE A3-3-10 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-341.15 MW Sask Import:0.00 MW MATL Import:-300.06 MW

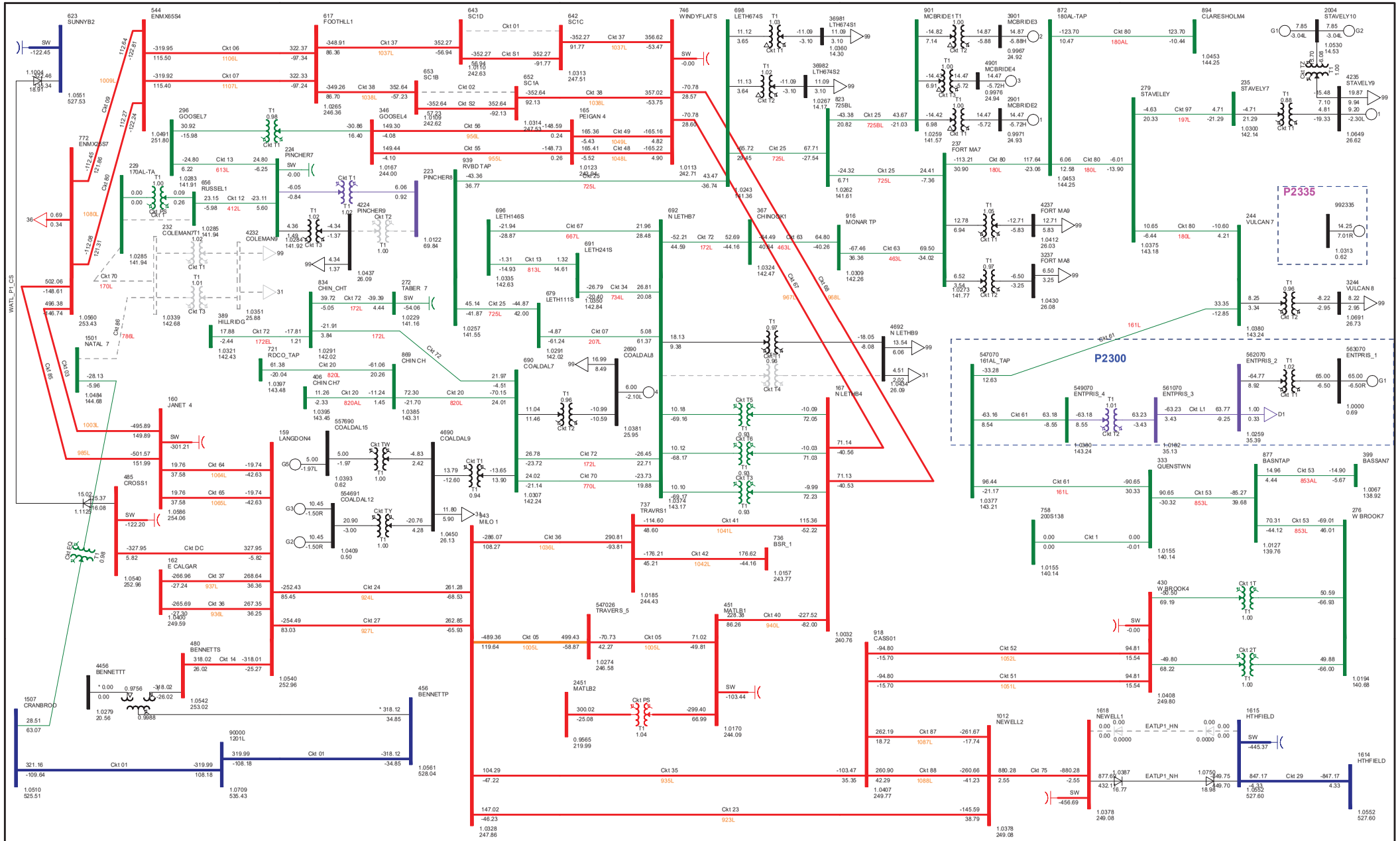
MH Export: 22.21 MW

FIGURE A3-3-11 N-1: 240ST1 (MCBIRDE LAKE 244S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-305.97 MW Sask Import:-0.00 MW MATL Import:-300.02 MW

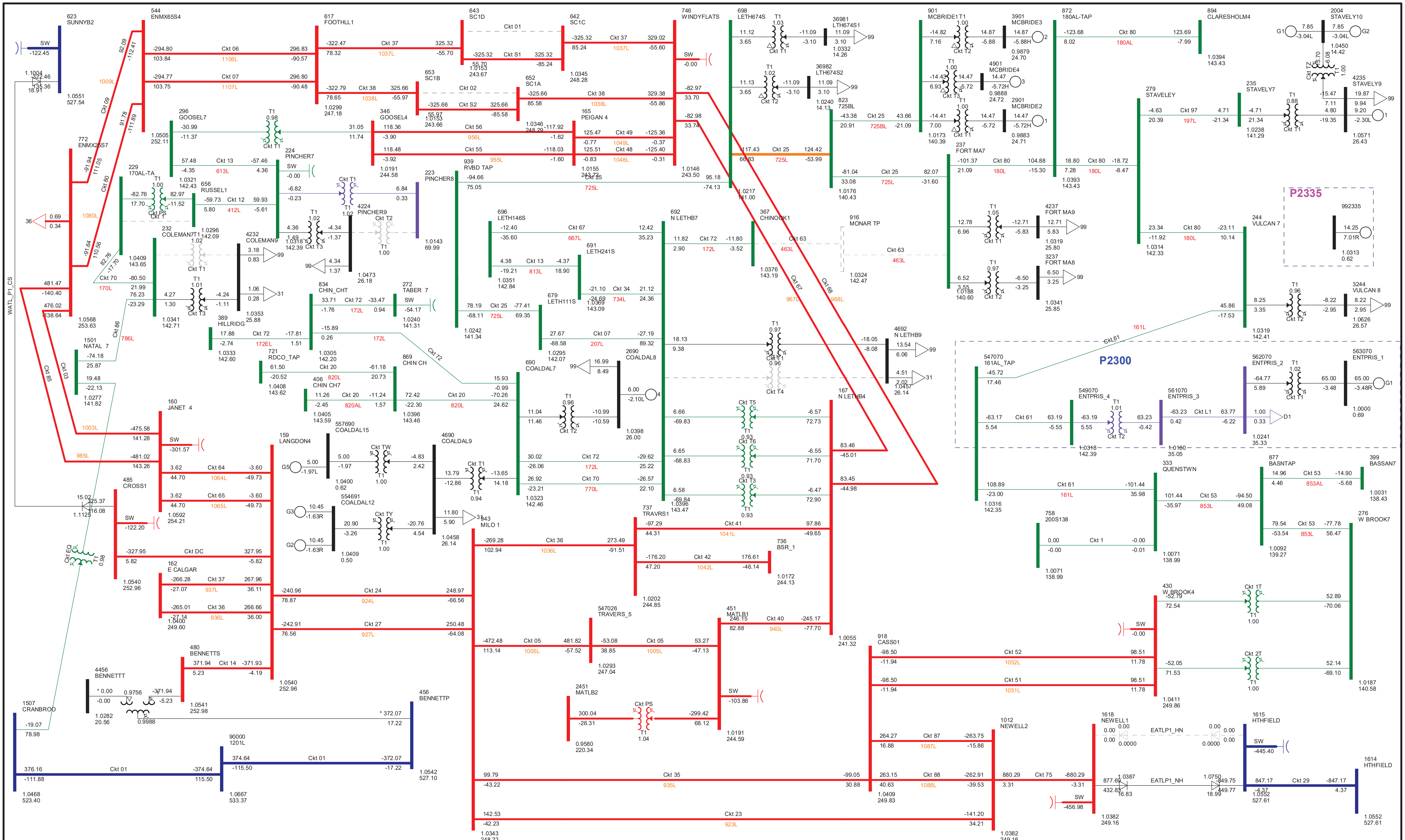
MH Export: 22.21 MW

FIGURE A3-3-12 N-1: 799ST1 (COLEMAN 799S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-309.32 MW Sask Import:0.00 MW MATL Import:-300.04 MW

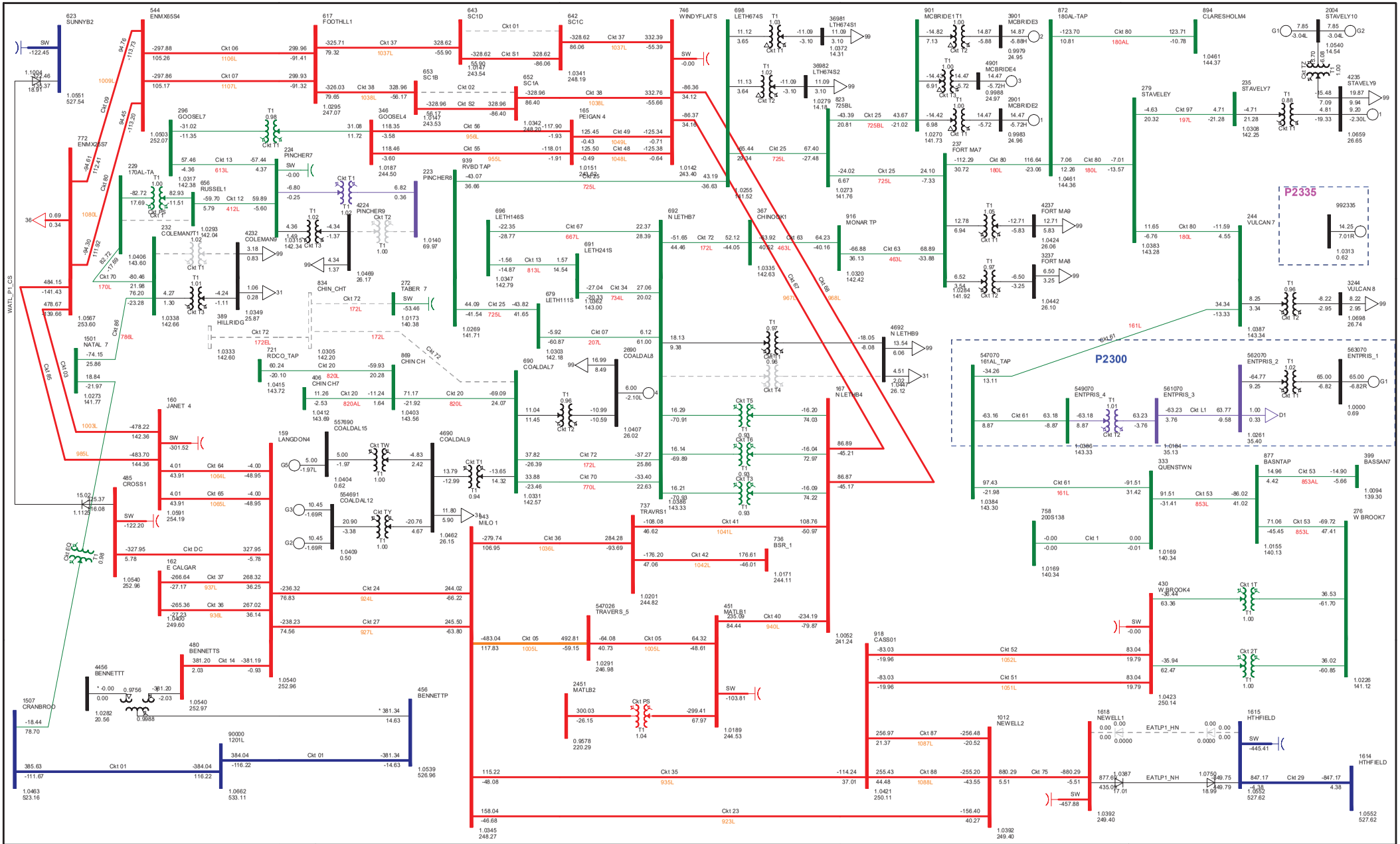
MH Export: 22.21 MW

FIGURE A3-3-13 N-1: 463L (FORT MACLEOD 15S TO CHINOOK 181S) AFTER RAS#169

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-319.19 MW Sask Import:0.00 MW MATL Import:-300.03 MW

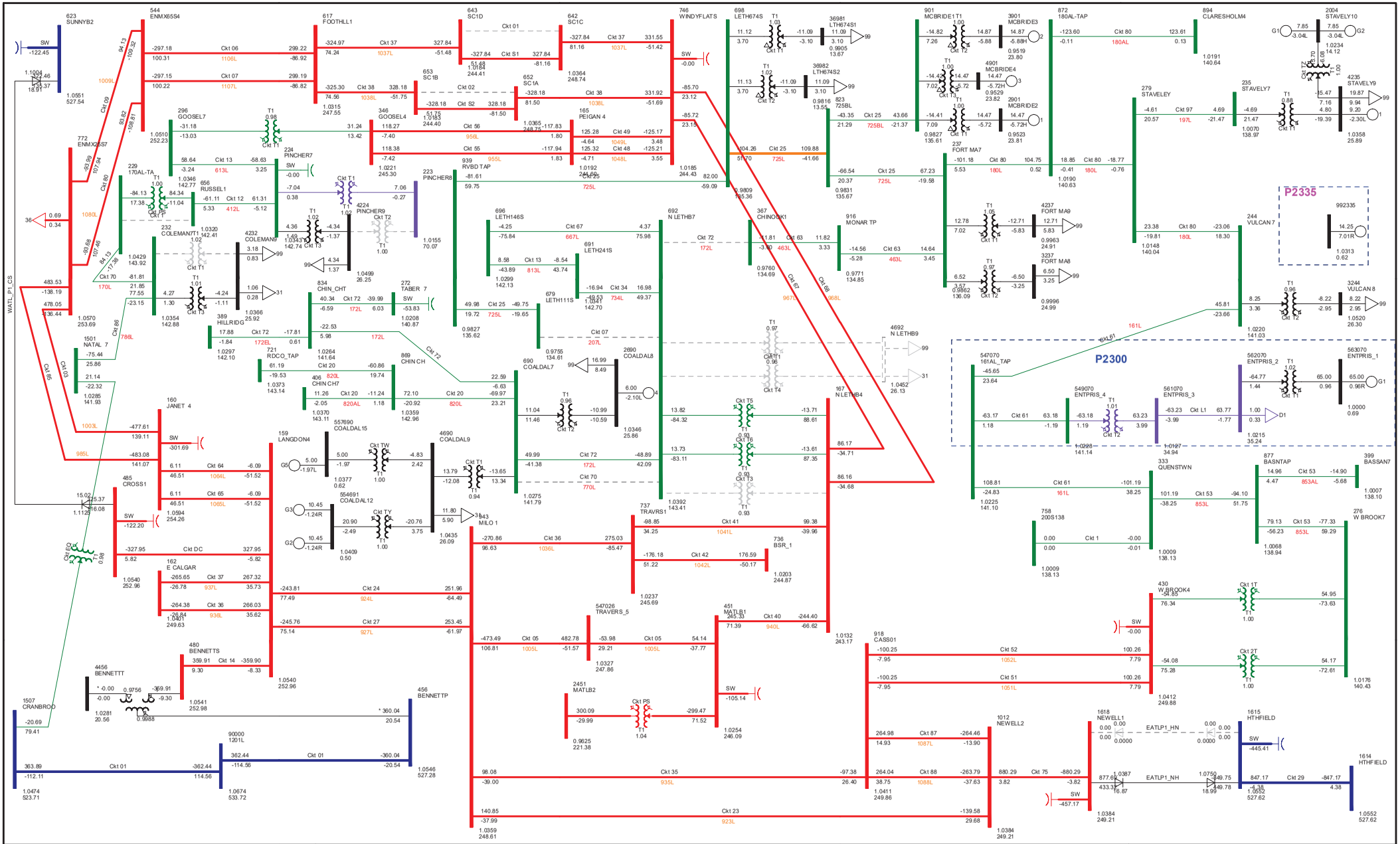
MH Export: 22.21 MW

FIGURE A3-3-14 N-1: 172L (COALDALE 254S TO TABER 83S)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-295.60 MW Sask Import:0.00 MW MATL Import:-300.09 MW

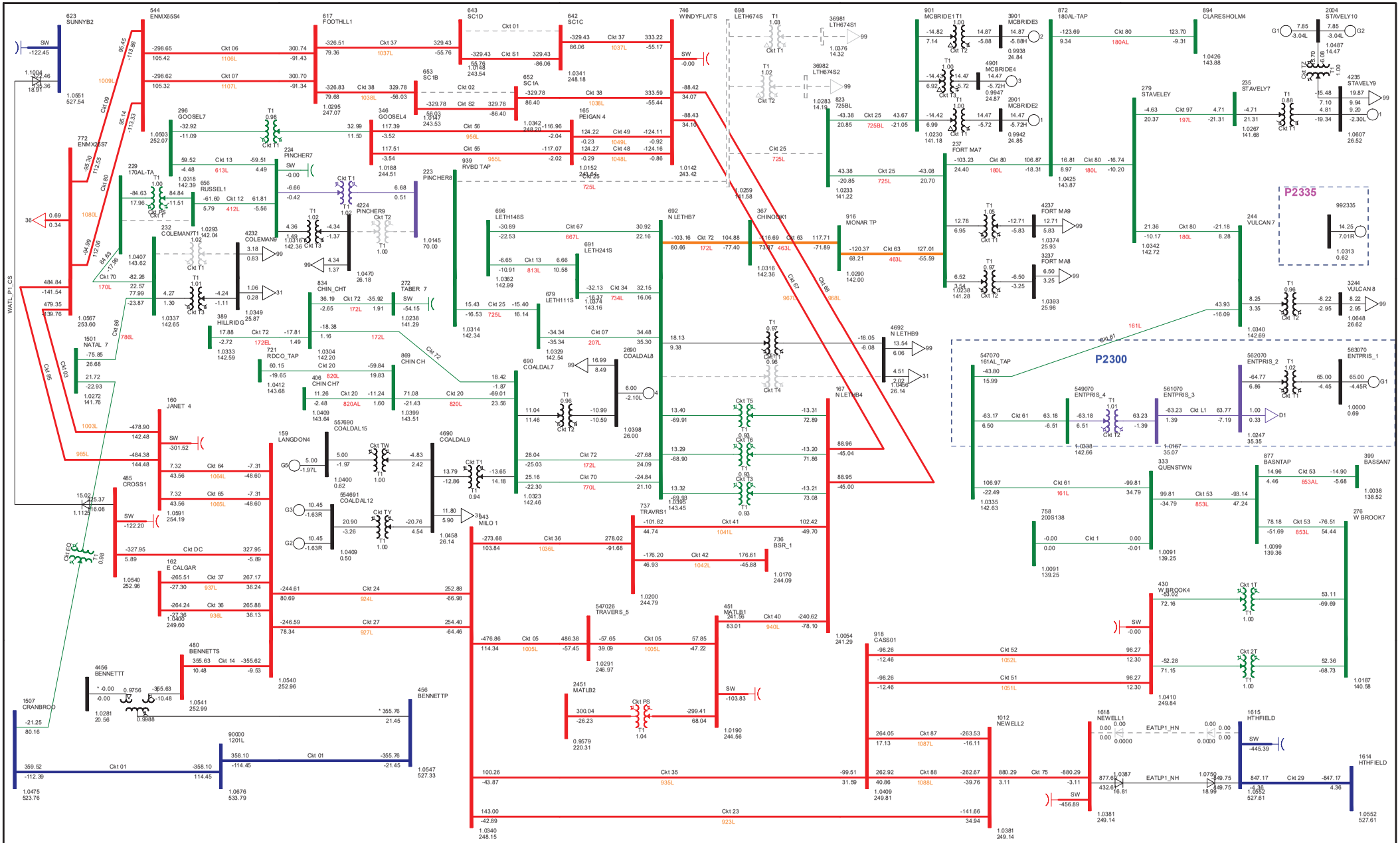
MH Export: 22.21 MW

FIGURE A3-3-15 N-1: 370ST1 (NORTH LETHBRIDGE 370S TRANSFORMER T1)

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-290.70 MW Sask Import:0.00 MW MATL Import:-300.04 MW

MH Export: 22.21 MW

FIGURE A3-3-16 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

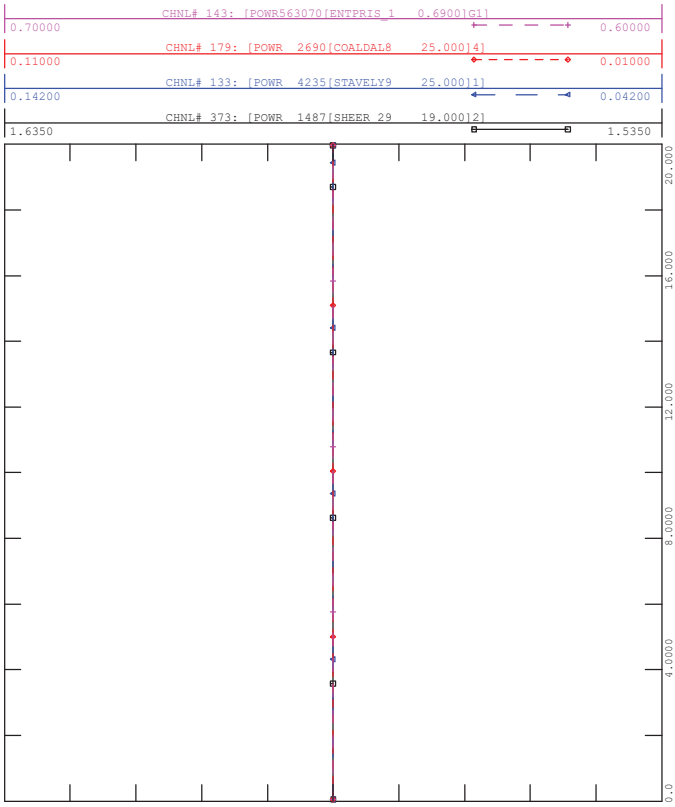
Attachment A4
Post-Project Transient Stability Diagrams

SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_NOFAULT

FILE: scn3_SP_nofault.out

TUE, APR 06 2021 18:57

ACTIVE POWER

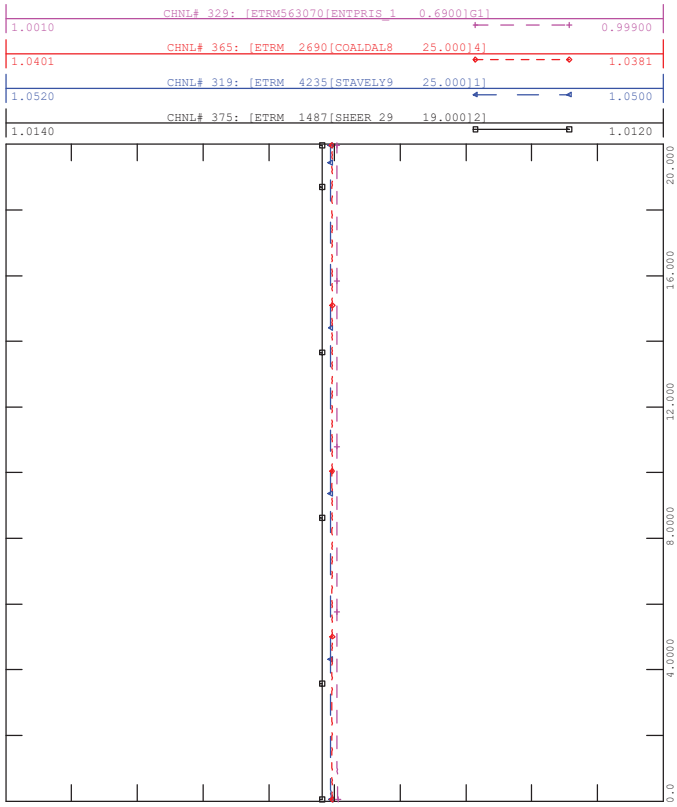


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_NOFAULT

FILE: scn3_SP_nofault.out

TUE, APR 06 2021 18:57

TERMINAL VOLTAGE

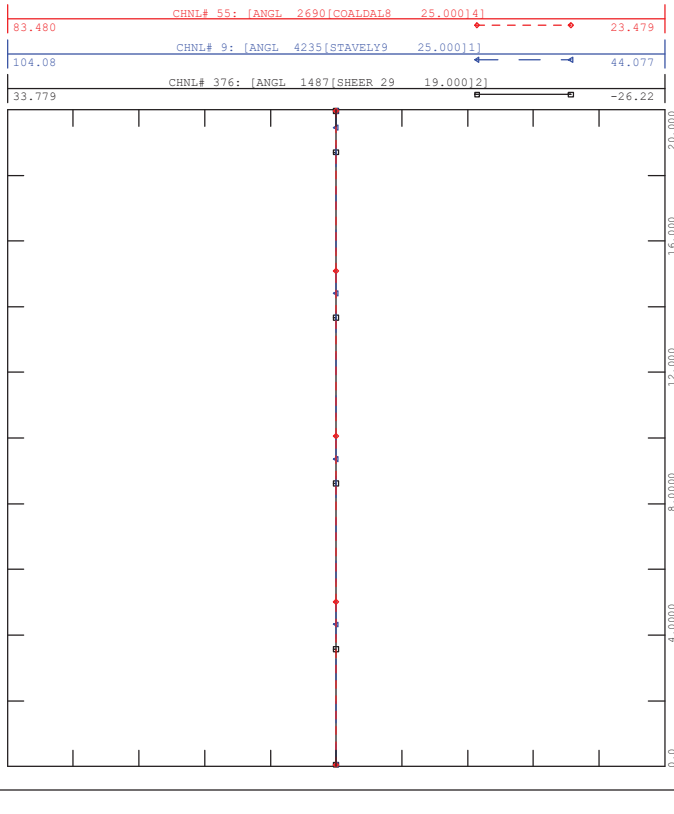


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_NOFAULT

FILE: scn3_SP_nofault.out

TUE, APR 06 2021 18:57

ROTOR ANGLE

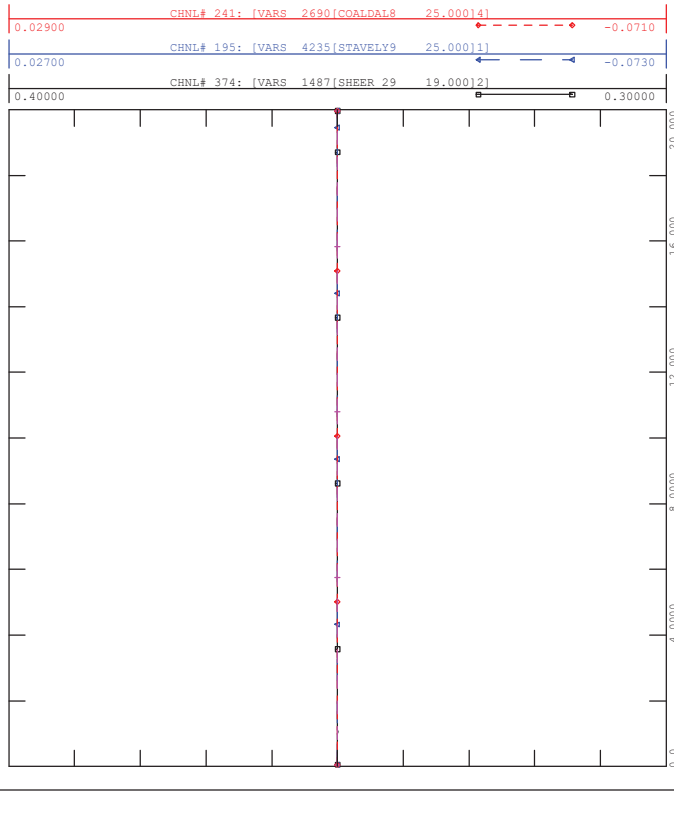


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_NOFAULT

FILE: scn3_SP_nofault.out

TUE, APR 06 2021 18:57

REACTIVE POWER

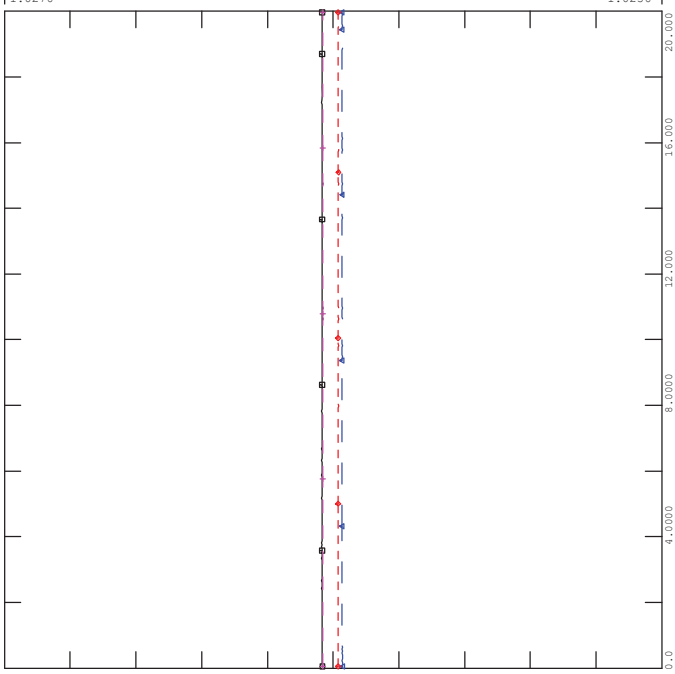


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_NOFAULT

FILE: scn3_SP_nofault.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.0394 1.0374
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.0430 1.0410
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.0134 1.0114
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.0276 1.0256

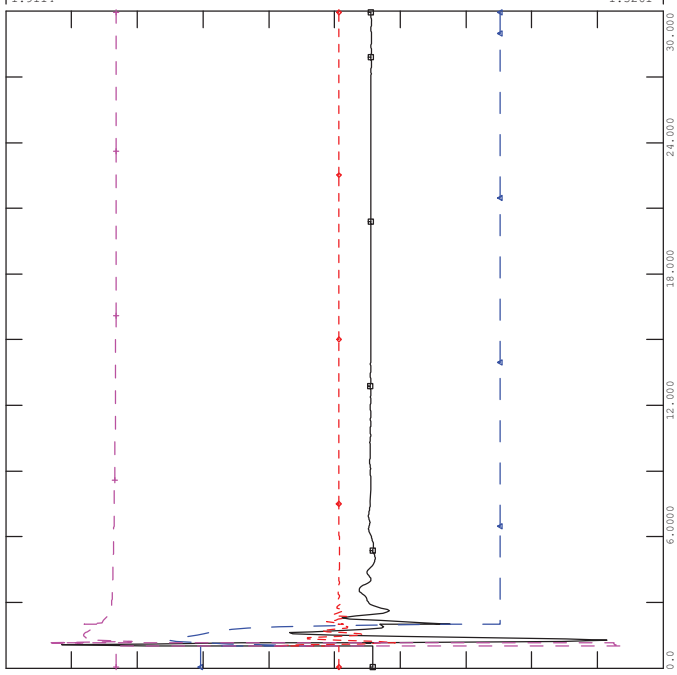


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_01_180L

FILE: scn3_SP_01_180L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.79110 -0.0491
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.12210 -0.0004
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.15180 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
1.9114 1.3261

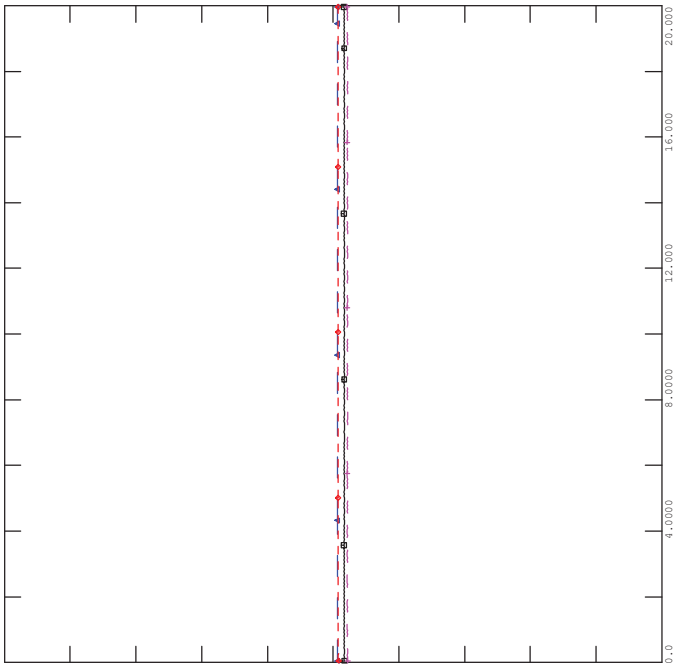


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_NOFAULT

FILE: scn3_SP_nofault.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0221 1.0201
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.0275 1.0255
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0242 1.0222
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.0063 1.0043

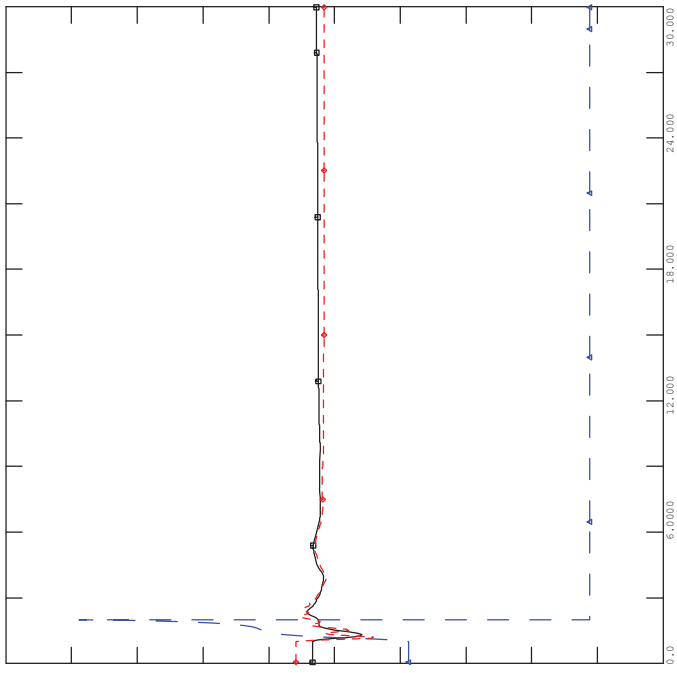


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_01_180L

FILE: scn3_SP_01_180L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

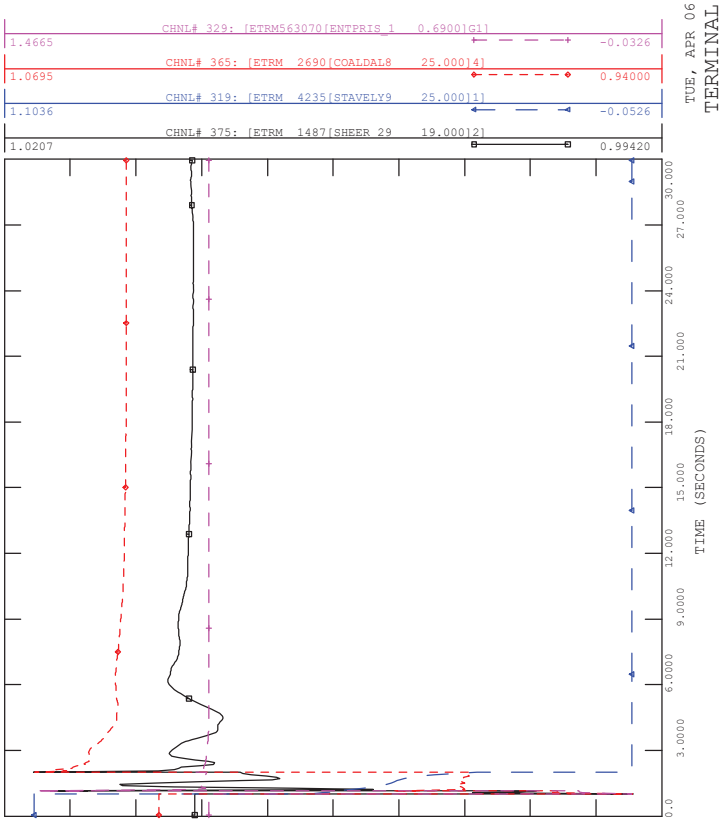
CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
83.480 15.470
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
238.75 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
34.344 -31.13



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_01_180L

FILE: scn3_SP_01_180L.out

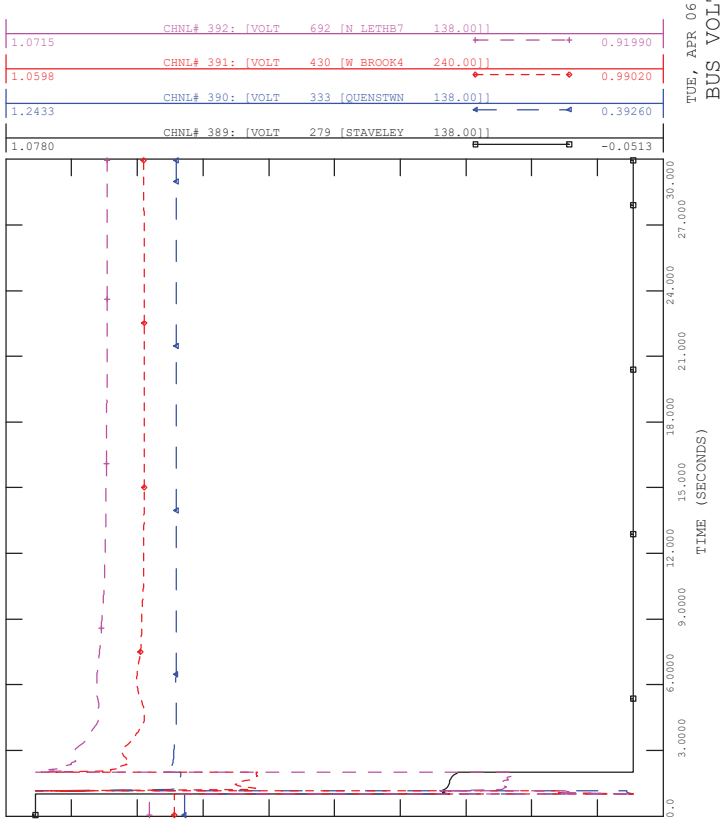
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_01_180L

FILE: scn3_SP_01_180L.out

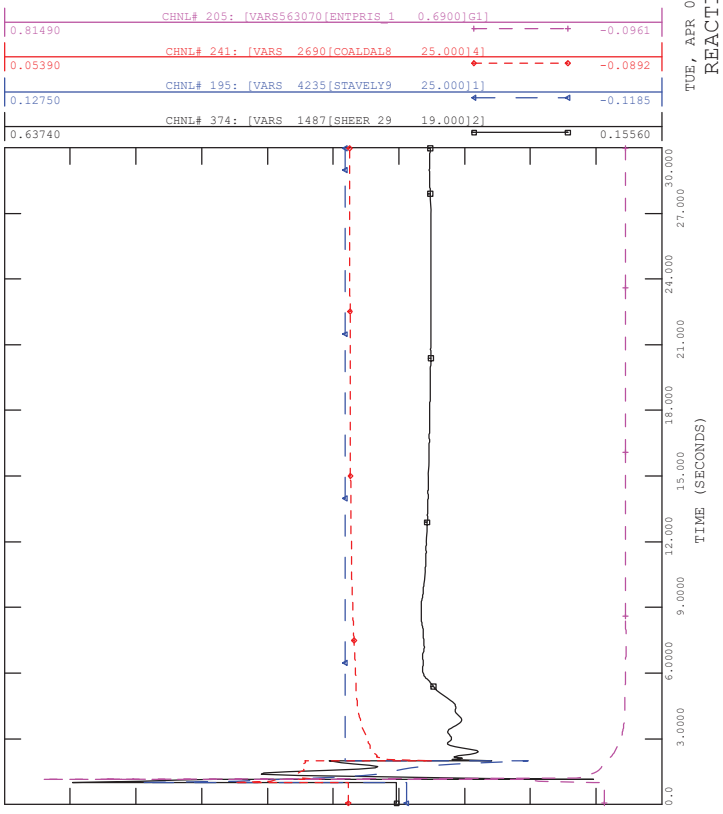
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_01_180L

FILE: scn3_SP_01_180L.out

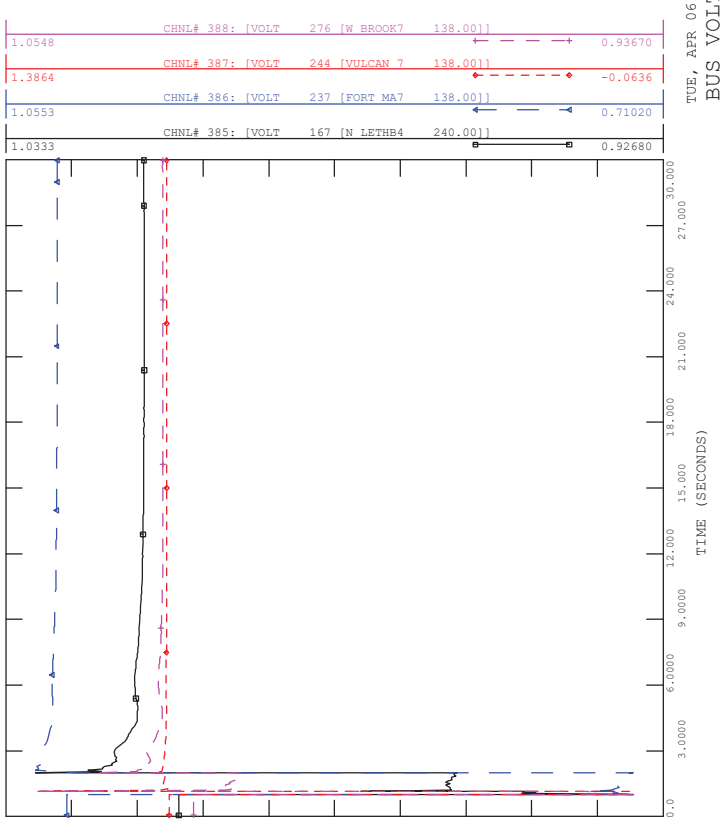
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_01_180L

FILE: scn3_SP_01_180L.out

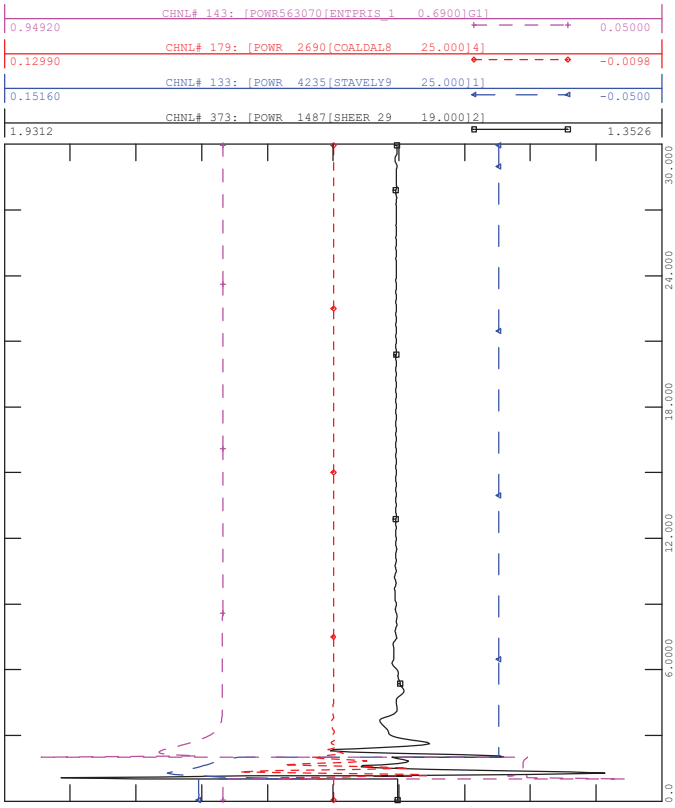
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_02_180L

FILE: scn3_SP_02_180L.out

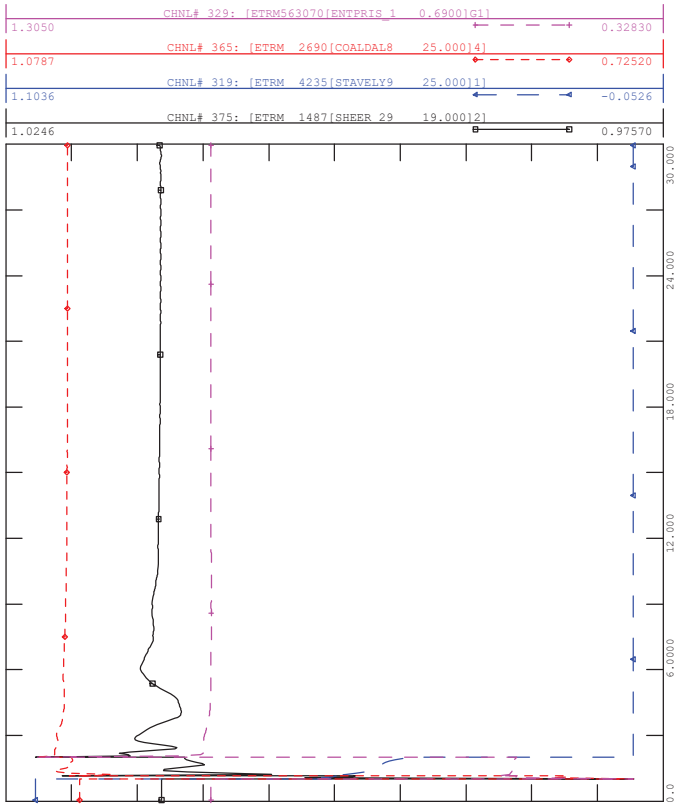
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_02_180L

FILE: scn3_SP_02_180L.out

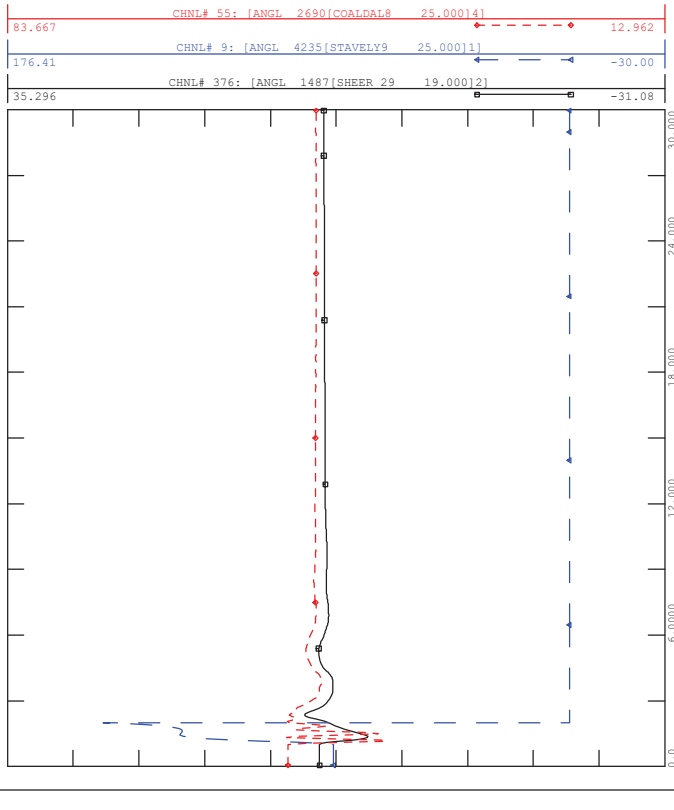
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_02_180L

FILE: scn3_SP_02_180L.out

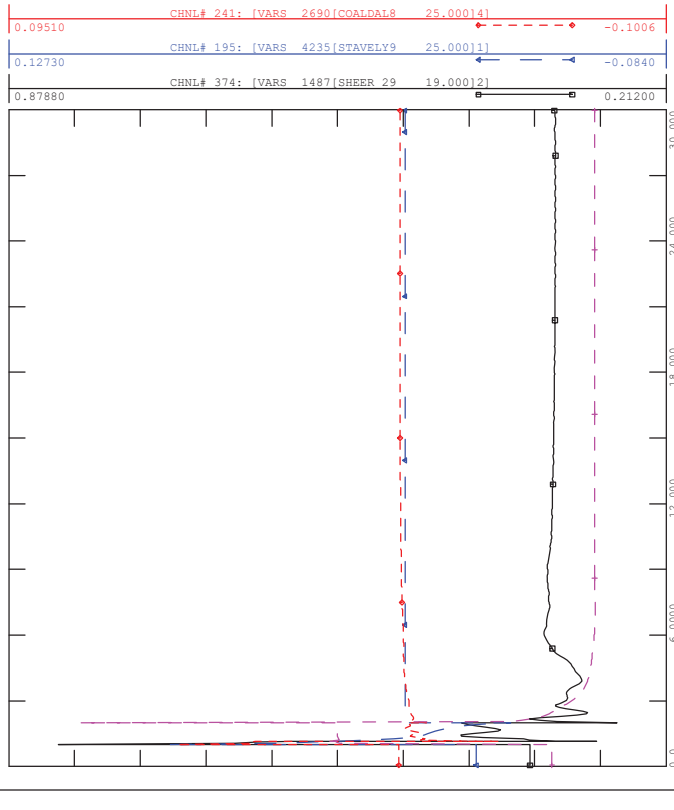
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_02_180L

FILE: scn3_SP_02_180L.out

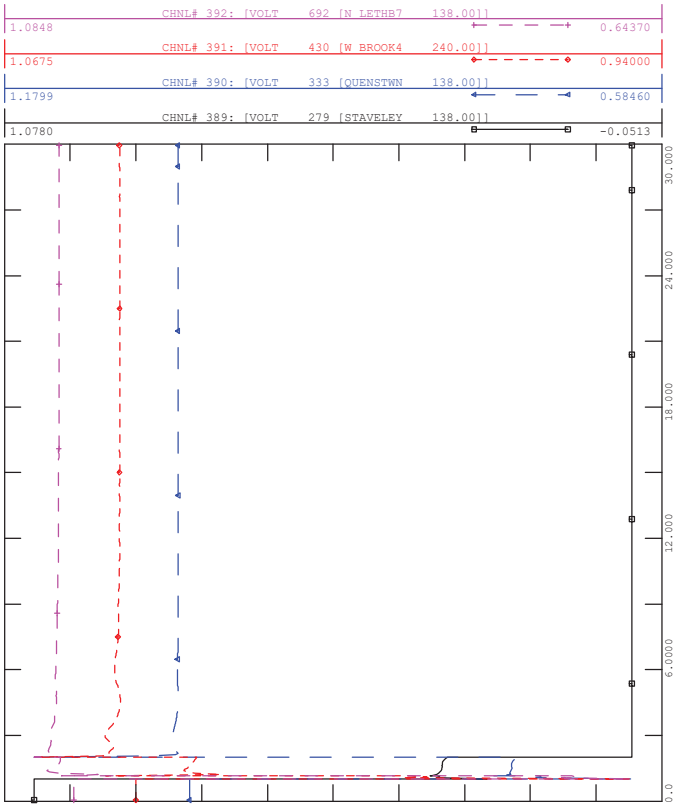
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_02_180L

FILE: scn3_SP_02_180L.out

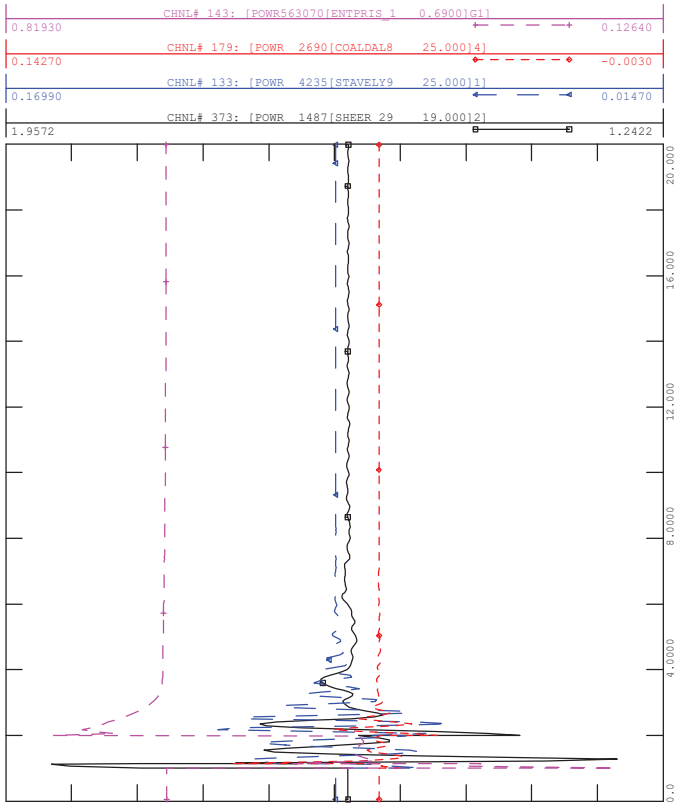
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_03_463L

FILE: scn3_SP_03_463L.out

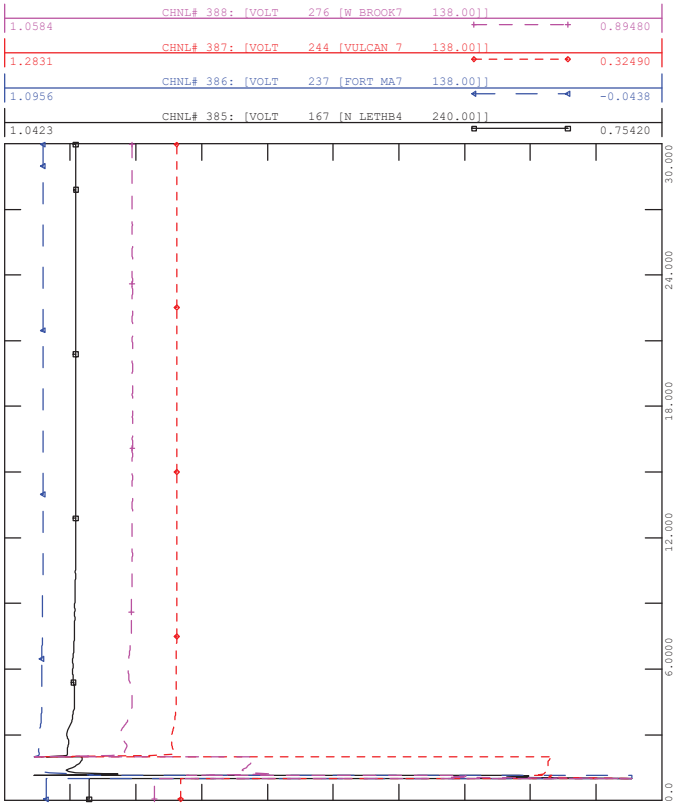
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_02_180L

FILE: scn3_SP_02_180L.out

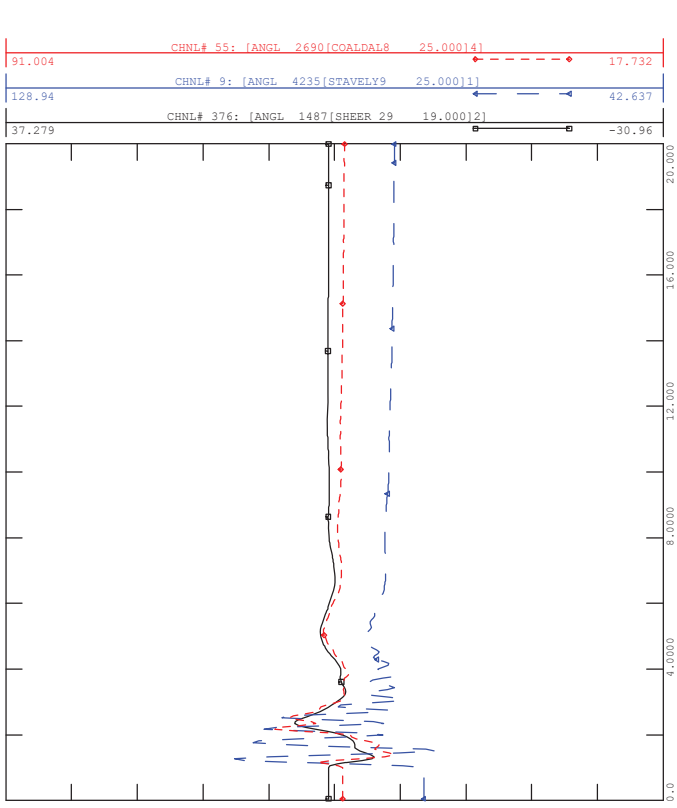
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_03_463L

FILE: scn3_SP_03_463L.out

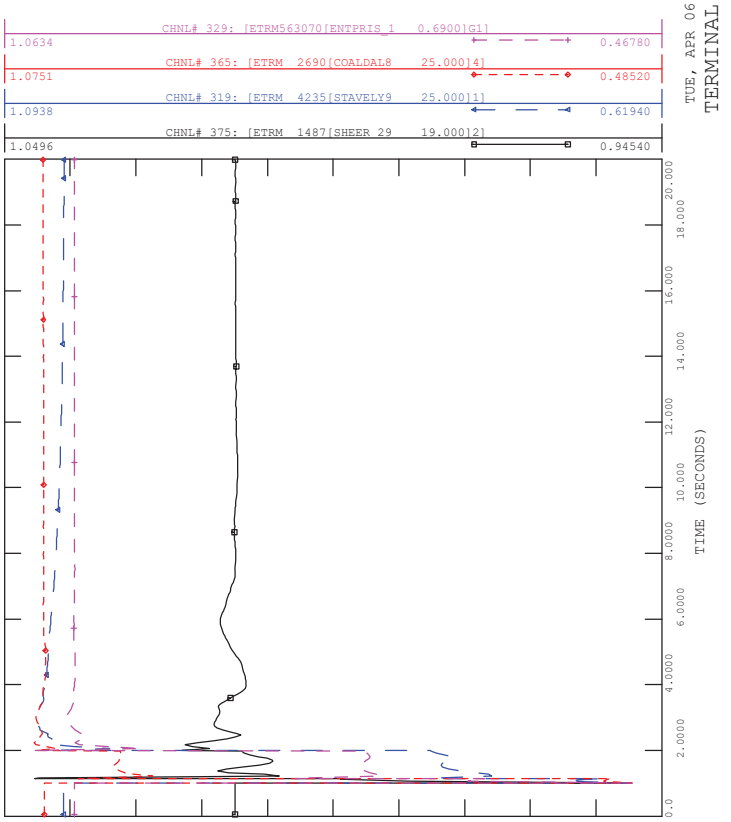
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_03_463L

FILE: scn3_SP_03_463L.out

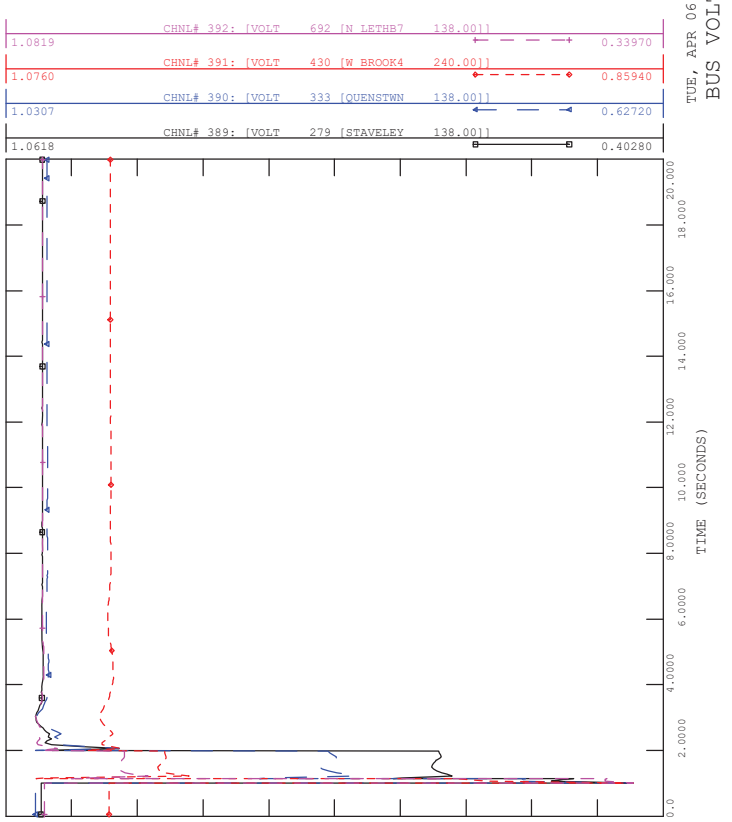
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_03_463L

FILE: scn3_SP_03_463L.out

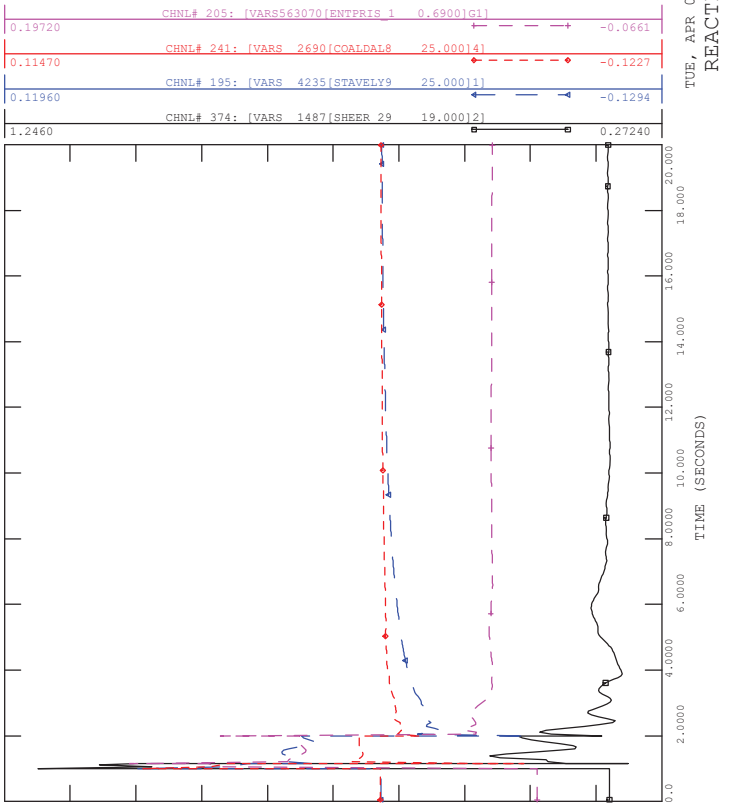
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_03_463L

FILE: scn3_SP_03_463L.out

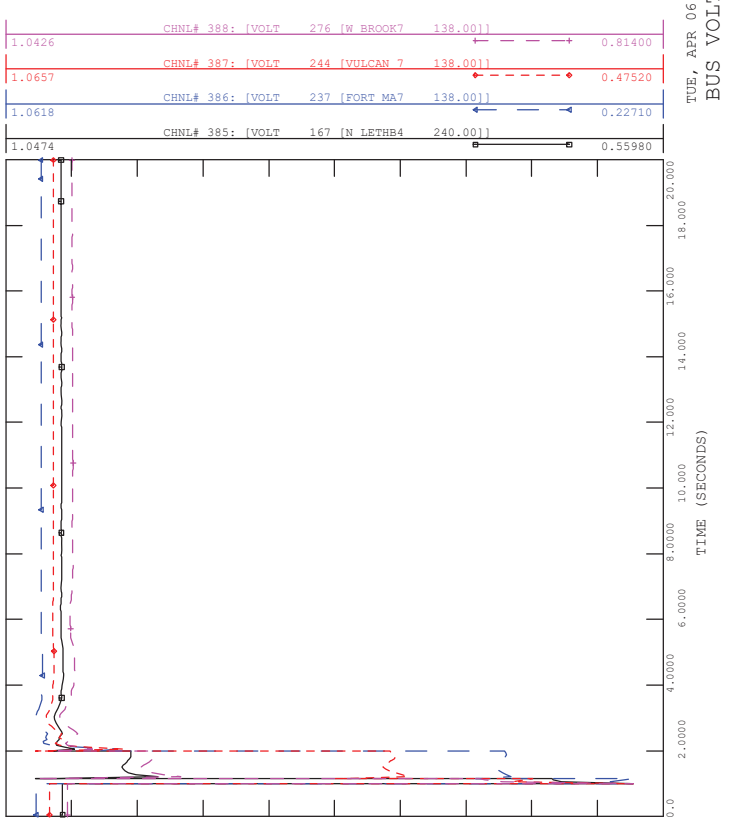
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_03_463L

FILE: scn3_SP_03_463L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

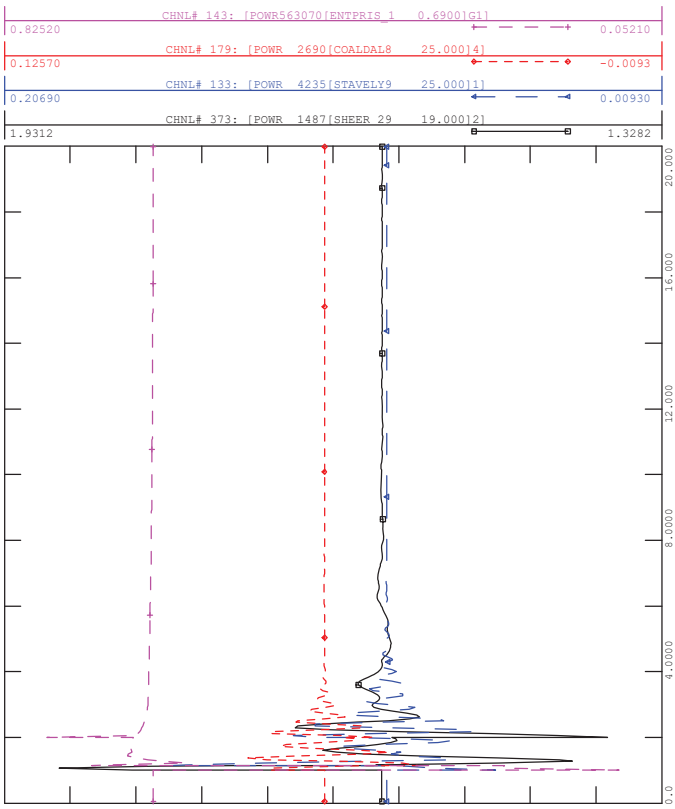


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_04_463L

FILE: scn3_SP_04_463L.out

TUE, APR 06 2021 18:57

ACTIVE POWER

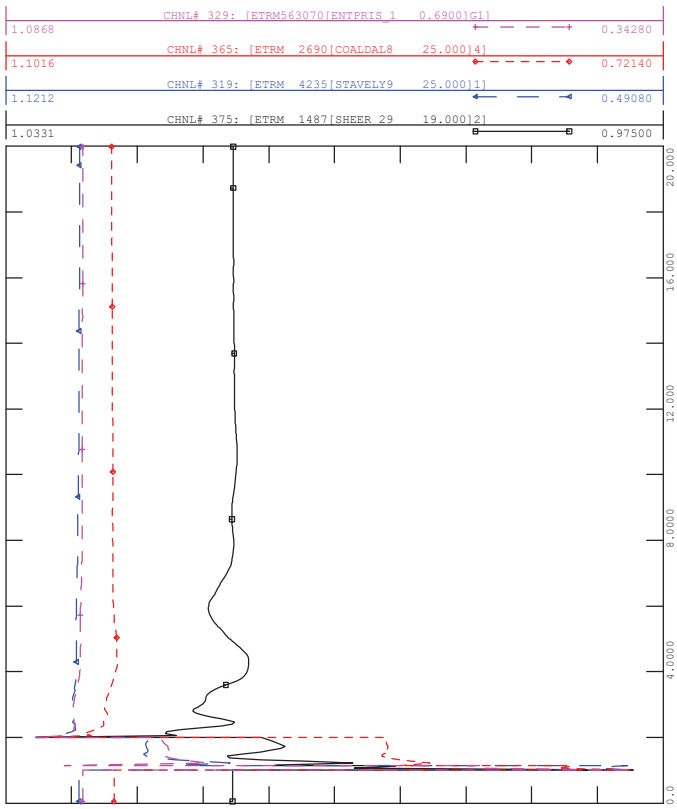


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_04_463L

FILE: scn3_SP_04_463L.out

TUE, APR 06 2021 18:57

TERMINAL VOLTAGE

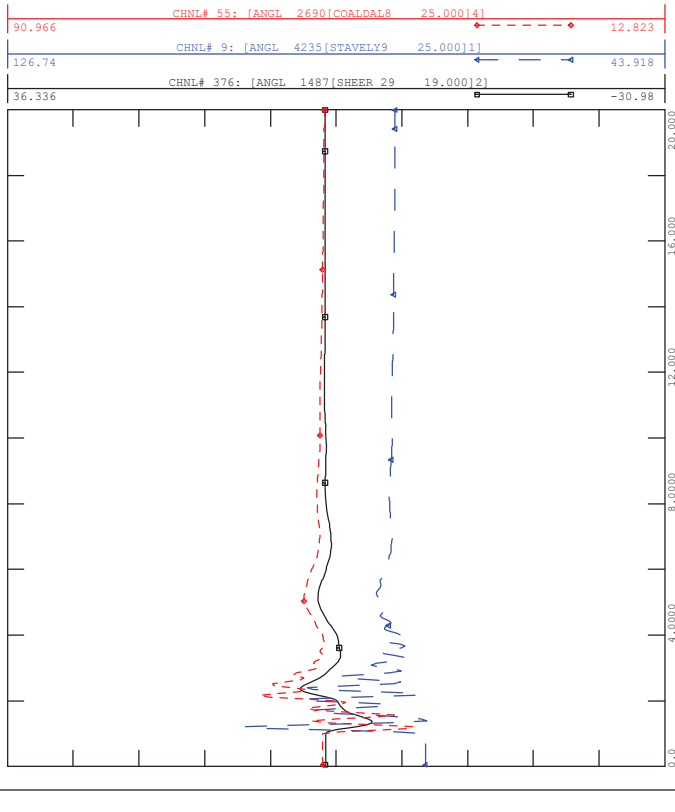


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_04_463L

FILE: scn3_SP_04_463L.out

TUE, APR 06 2021 18:57

ROTOR ANGLE

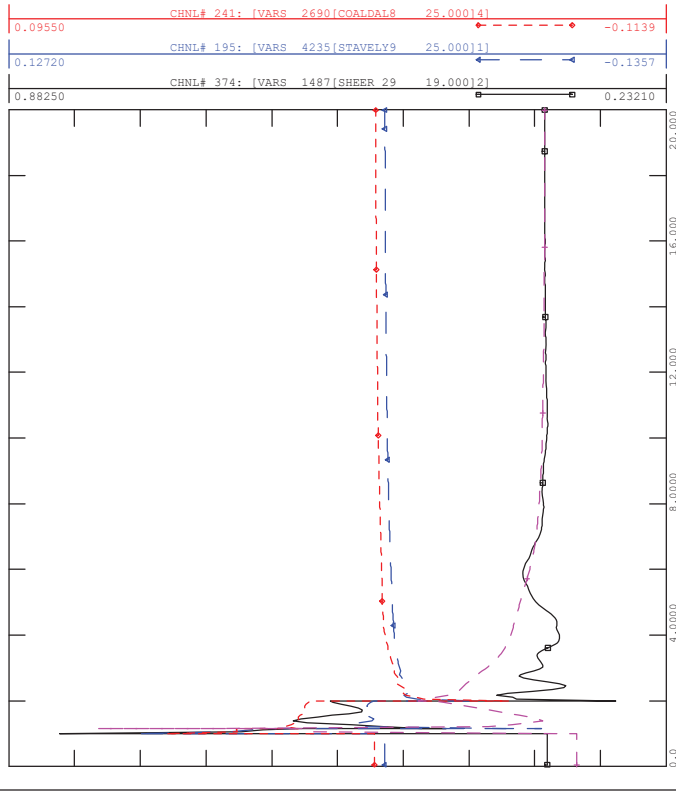


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_04_463L

FILE: scn3_SP_04_463L.out

TUE, APR 06 2021 18:57

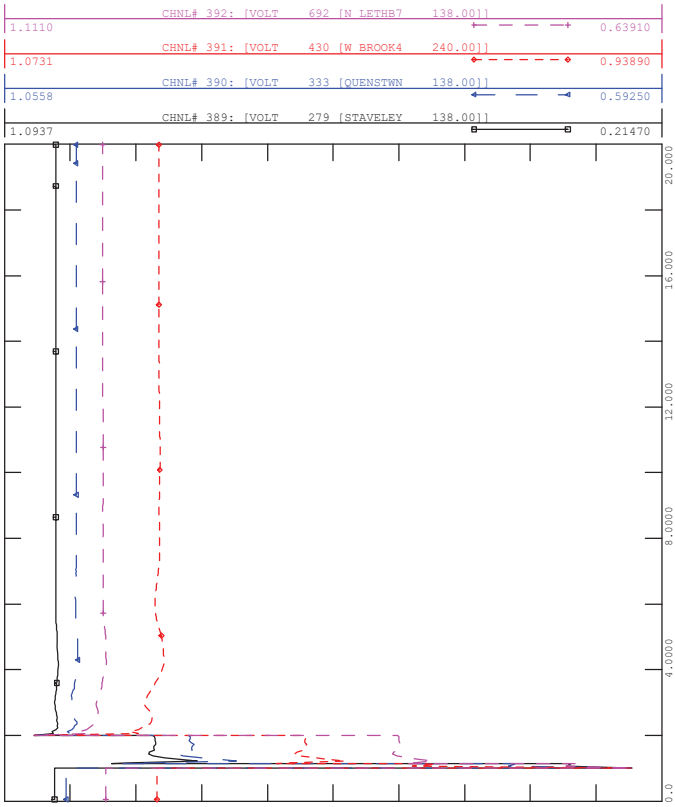
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_04_463L

FILE: scn3_SP_04_463L.out

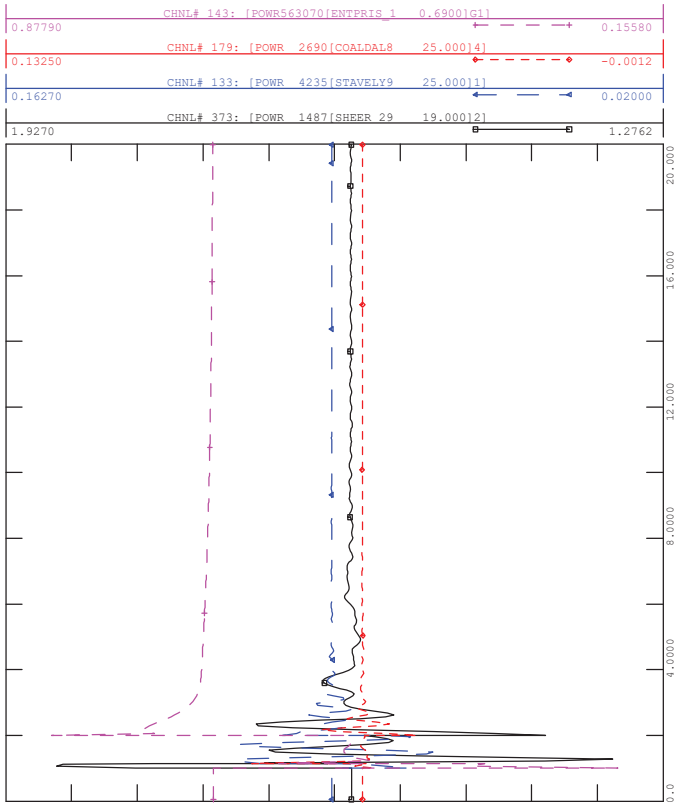
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_05_725L

FILE: scn3_SP_05_725L.out

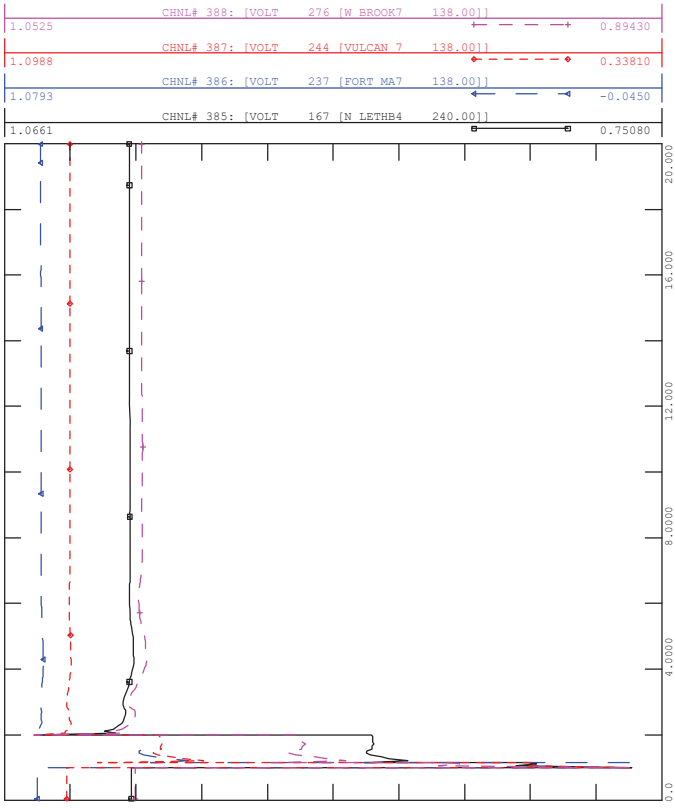
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_04_463L

FILE: scn3_SP_04_463L.out

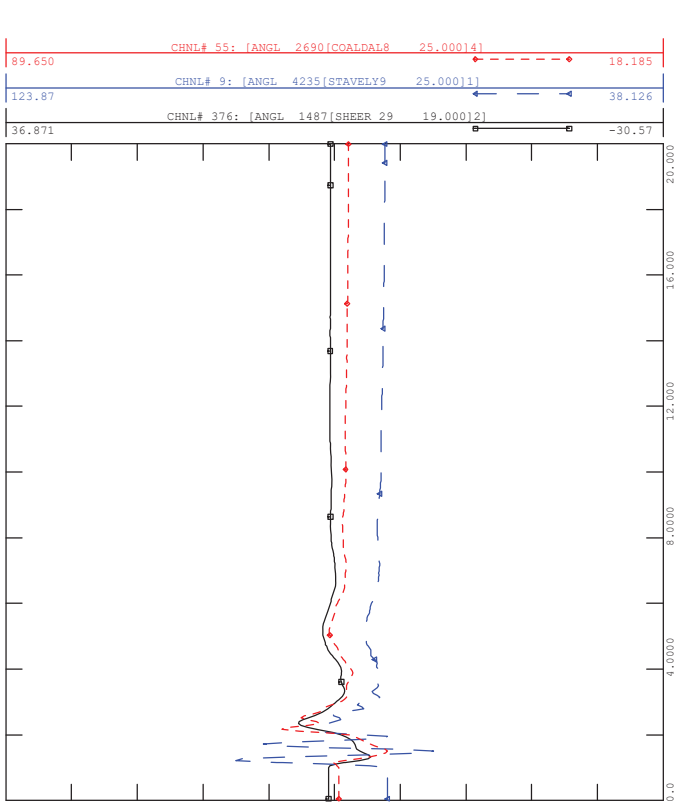
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_05_725L

FILE: scn3_SP_05_725L.out

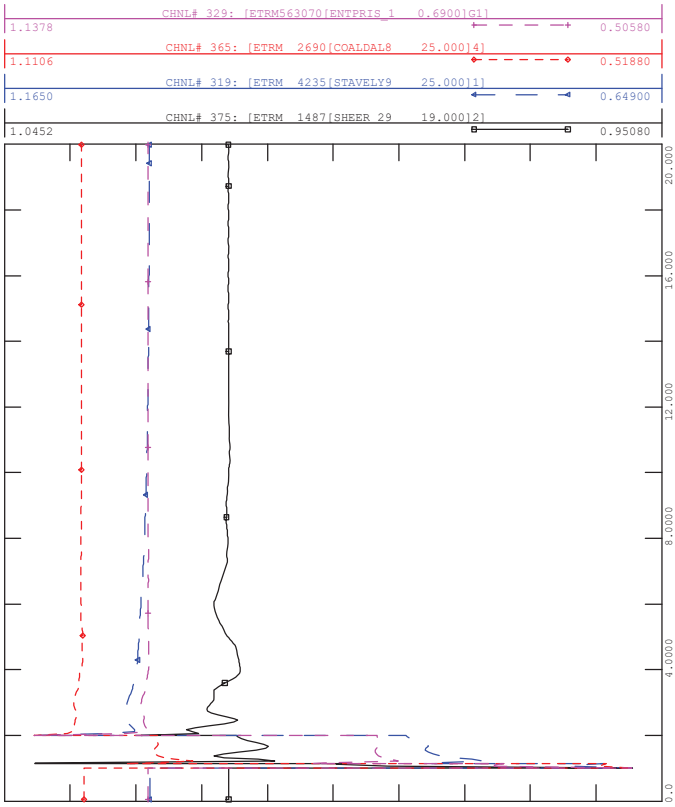
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_05_725L

FILE: scn3_SP_05_725L.out

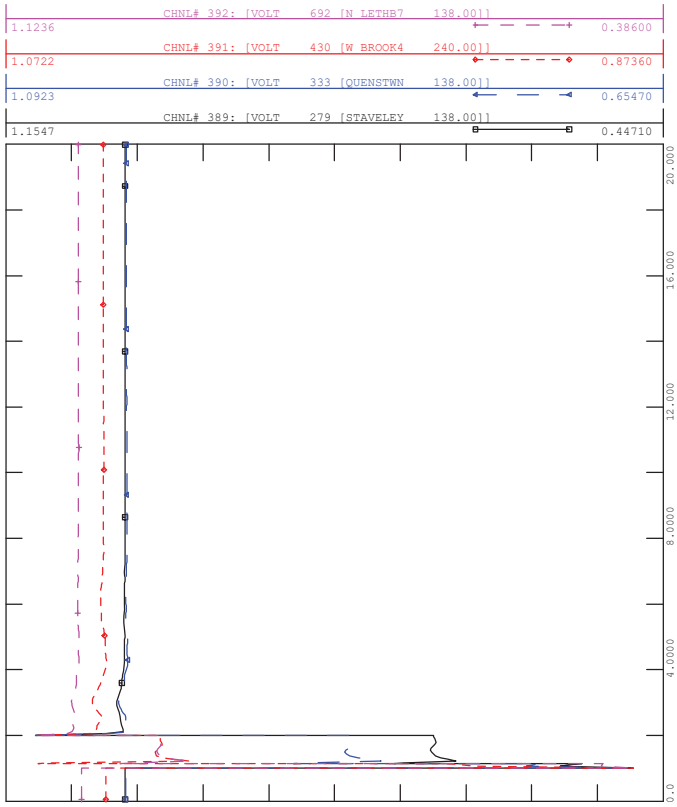
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_05_725L

FILE: scn3_SP_05_725L.out

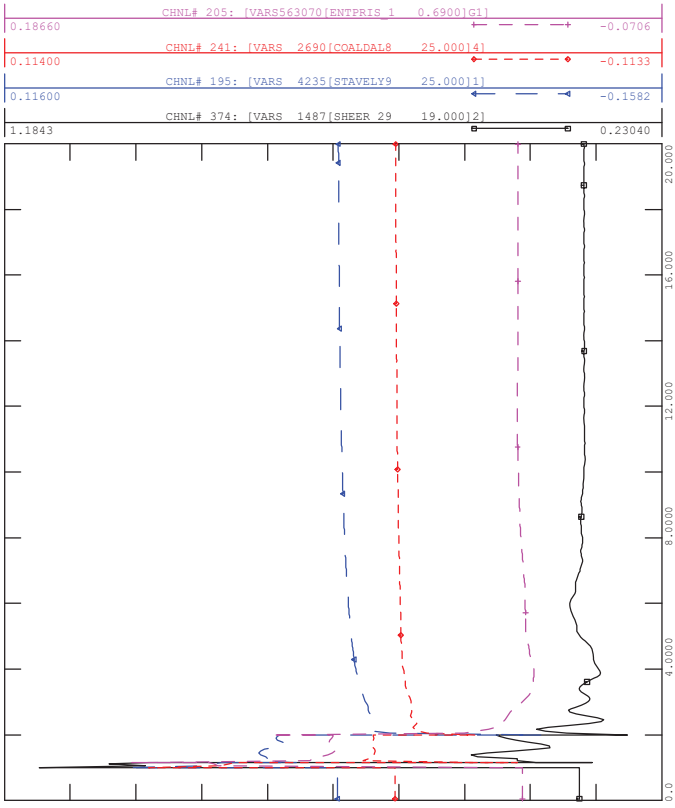
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_05_725L

FILE: scn3_SP_05_725L.out

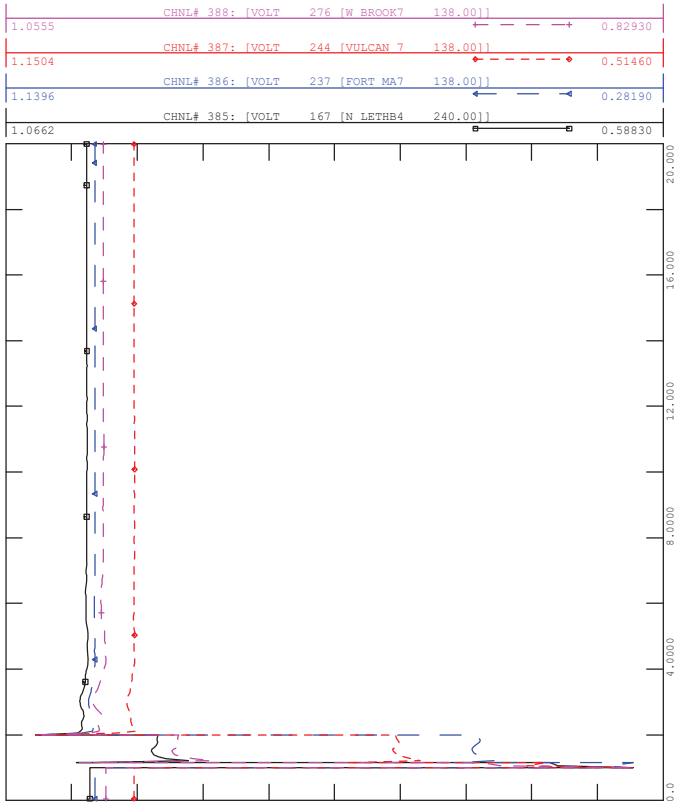
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_05_725L

FILE: scn3_SP_05_725L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

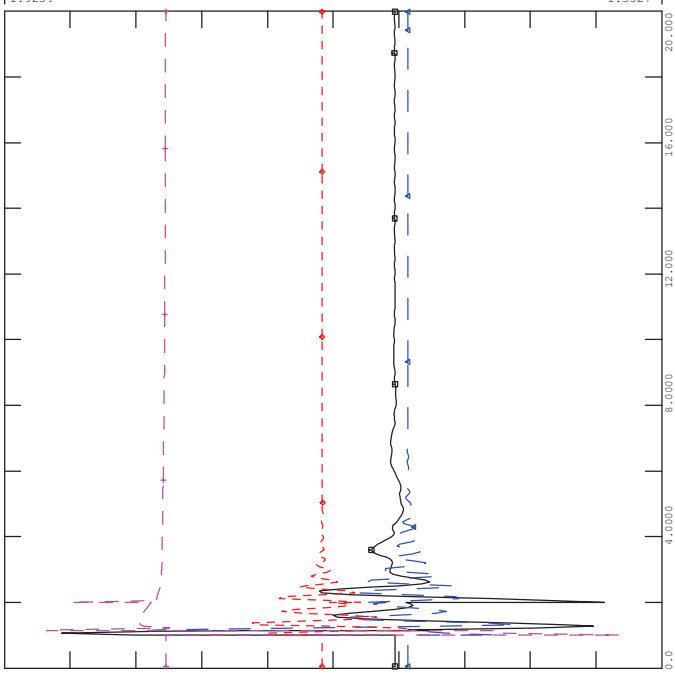


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_06_725L

FILE: scn3_SP_06_725L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.84160 0.06100
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.12400 -0.0085
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.23150 0.00420
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
1.9254 1.3527

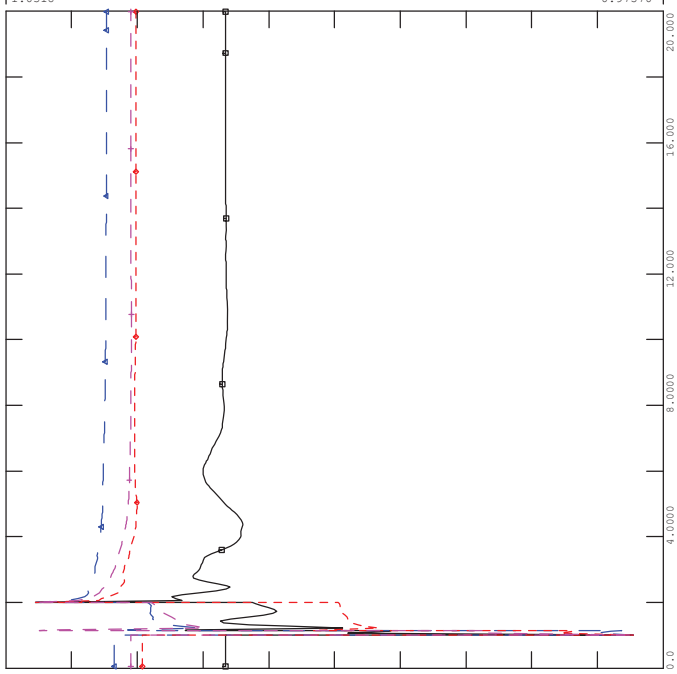


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_06_725L

FILE: scn3_SP_06_725L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 329: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.1514 0.35650
CHNL# 365: [ETRM 2690[COALDAL8 25.000]4]
1.1218 0.72320
CHNL# 319: [ETRM 4235[STAVELY9 25.000]1]
1.1593 0.50340
CHNL# 375: [ETRM 1487[SHEER 29 19.000]2]
1.0318 0.97570

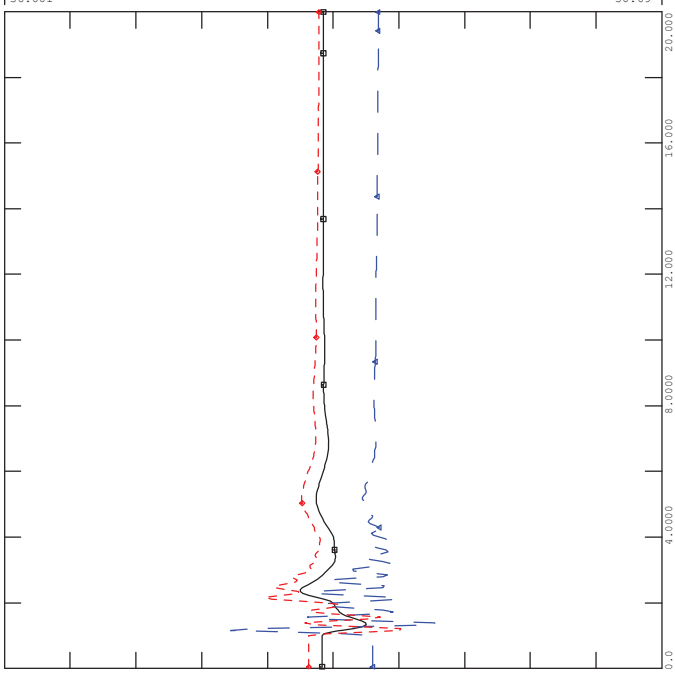


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_06_725L

FILE: scn3_SP_06_725L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
88.502 12.884
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
122.87 35.751
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
36.001 -30.69

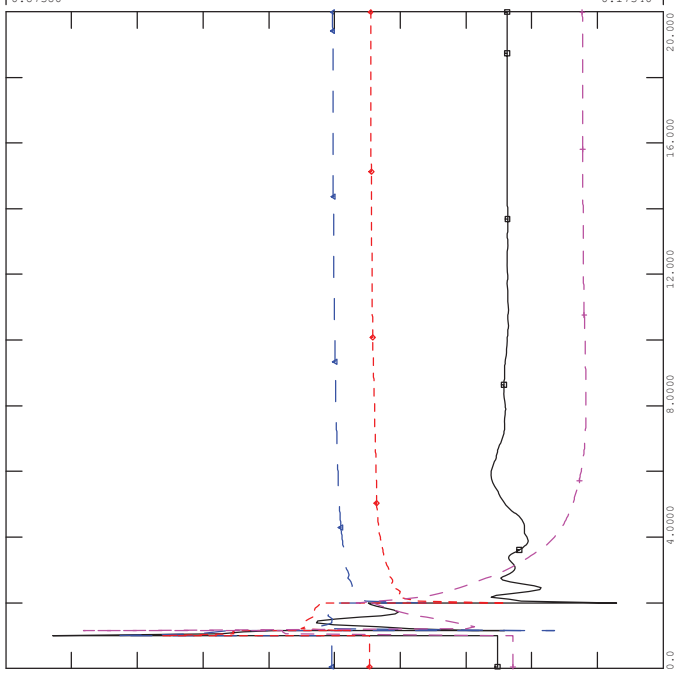


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_06_725L

FILE: scn3_SP_06_725L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

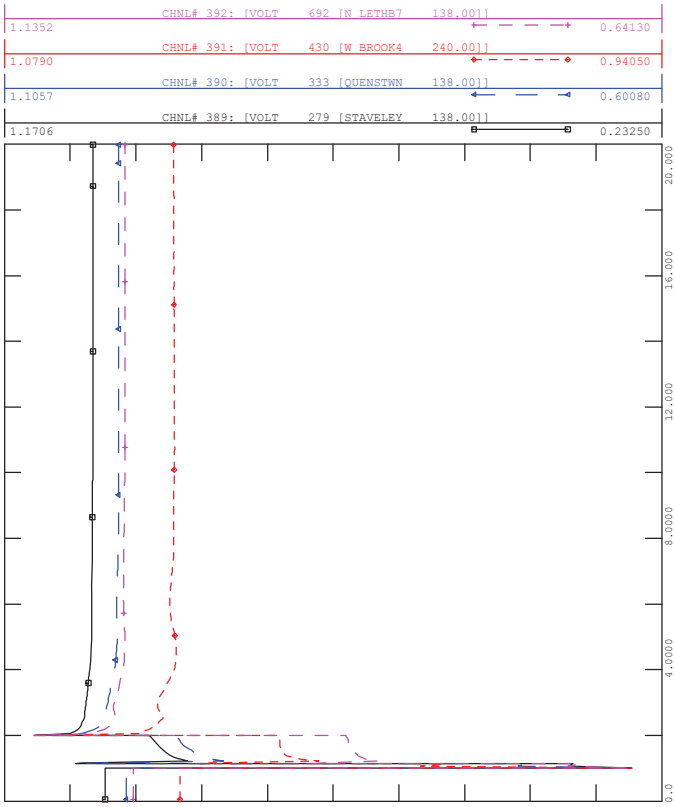
CHNL# 205: [VARS563070[ENTPRIS_1 0.6900]G1]
0.31110 -0.1131
CHNL# 241: [VARS 2690[COALDAL8 25.000]4]
0.09510 -0.1148
CHNL# 195: [VARS 4235[STAVELY9 25.000]1]
0.12670 -0.1750
CHNL# 374: [VARS 1487[SHEER 29 19.000]2]
0.87380 0.17340



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_06_725L

FILE: scn3_SP_06_725L.out

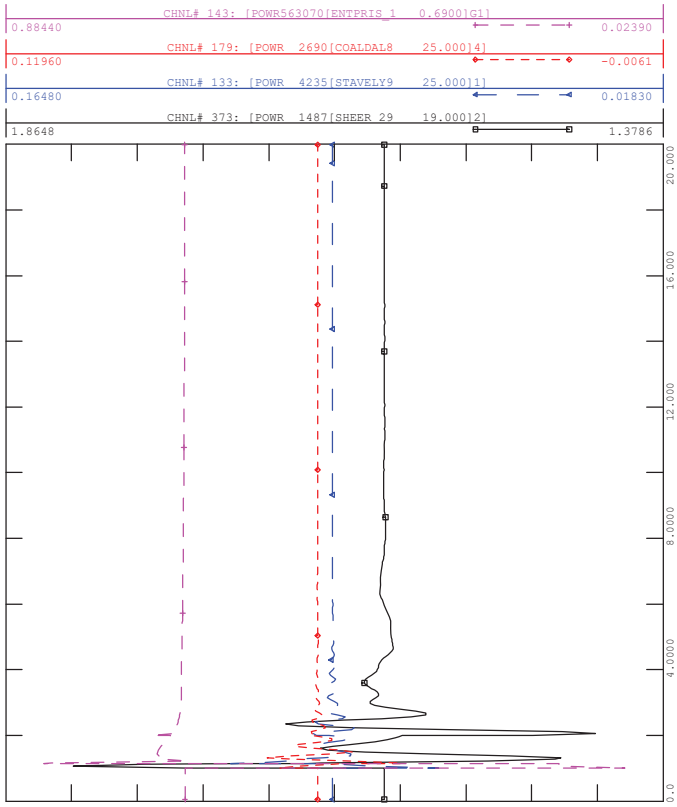
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_07_853L

FILE: scn3_SP_07_853L.out

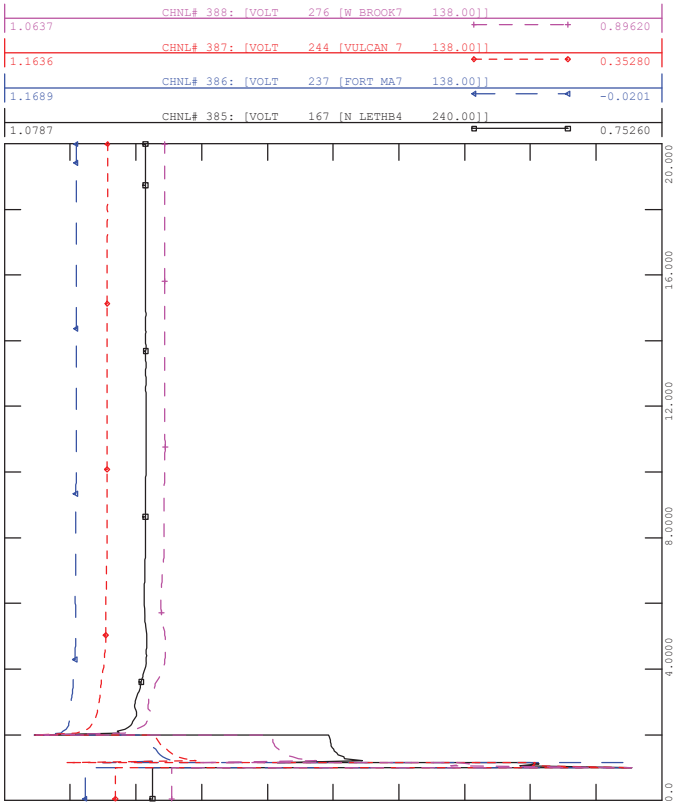
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_06_725L

FILE: scn3_SP_06_725L.out

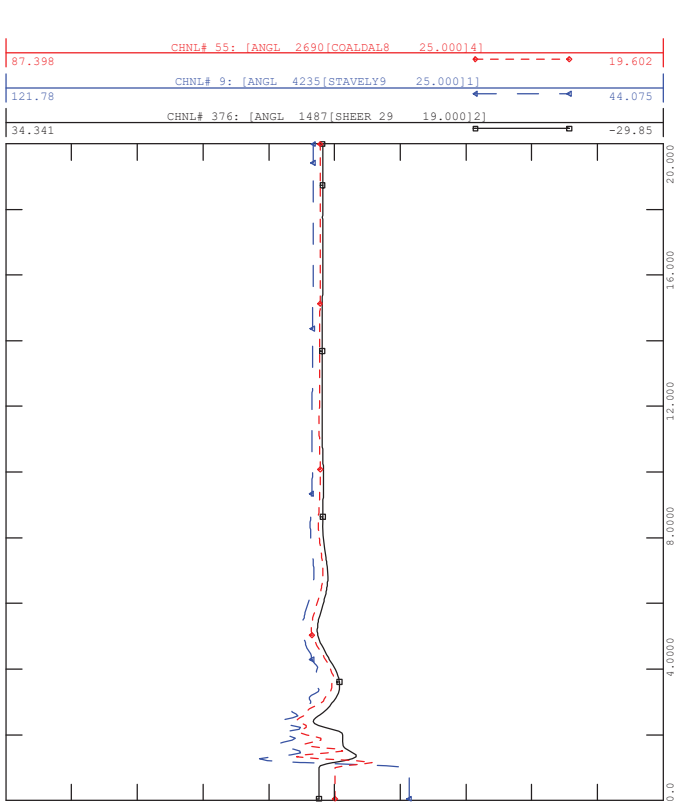
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_07_853L

FILE: scn3_SP_07_853L.out

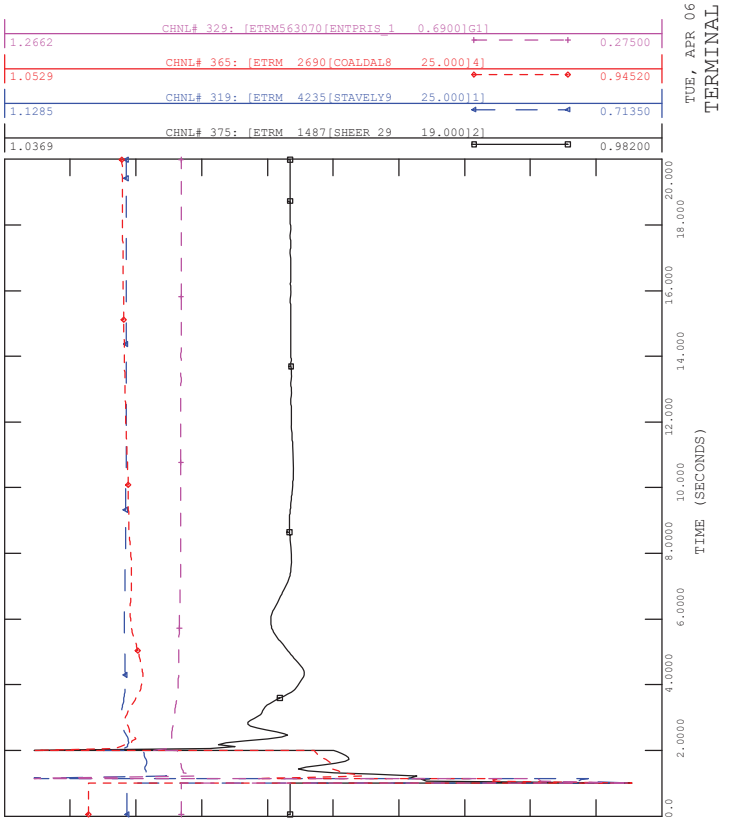
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_07_853L

FILE: scn3_SP_07_853L.out

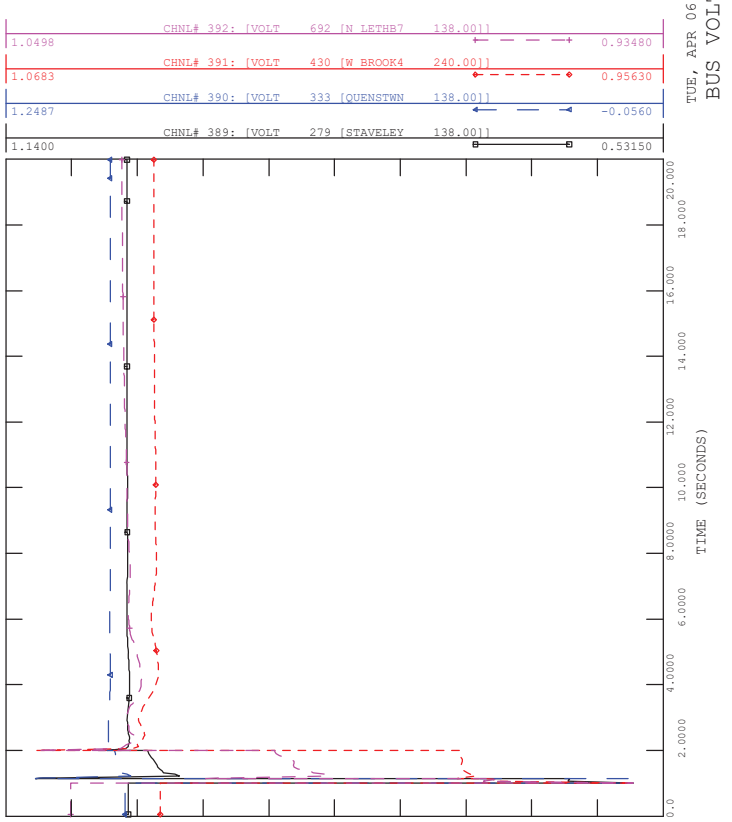
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_07_853L

FILE: scn3_SP_07_853L.out

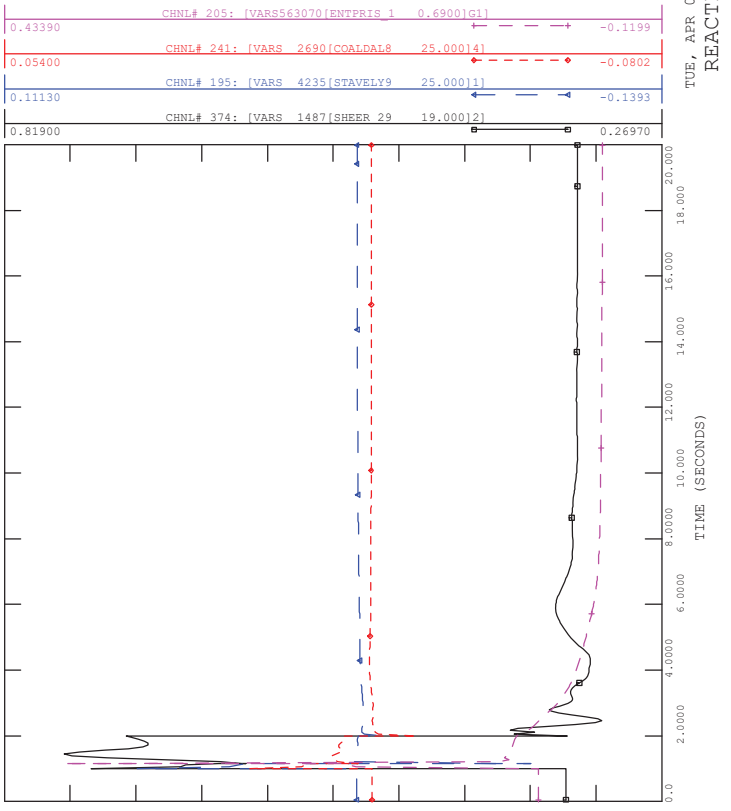
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_07_853L

FILE: scn3_SP_07_853L.out

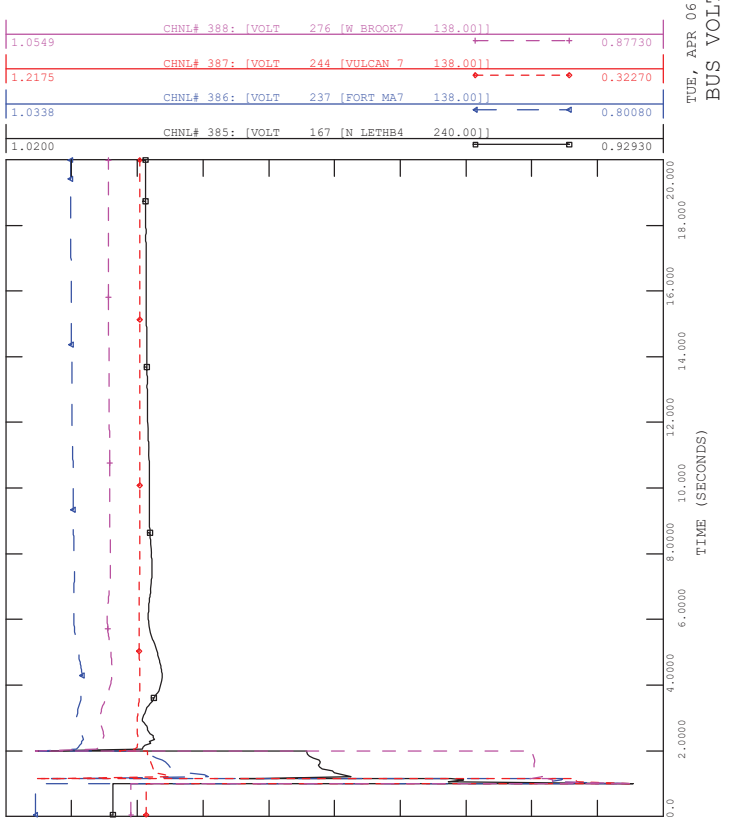
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_07_853L

FILE: scn3_SP_07_853L.out

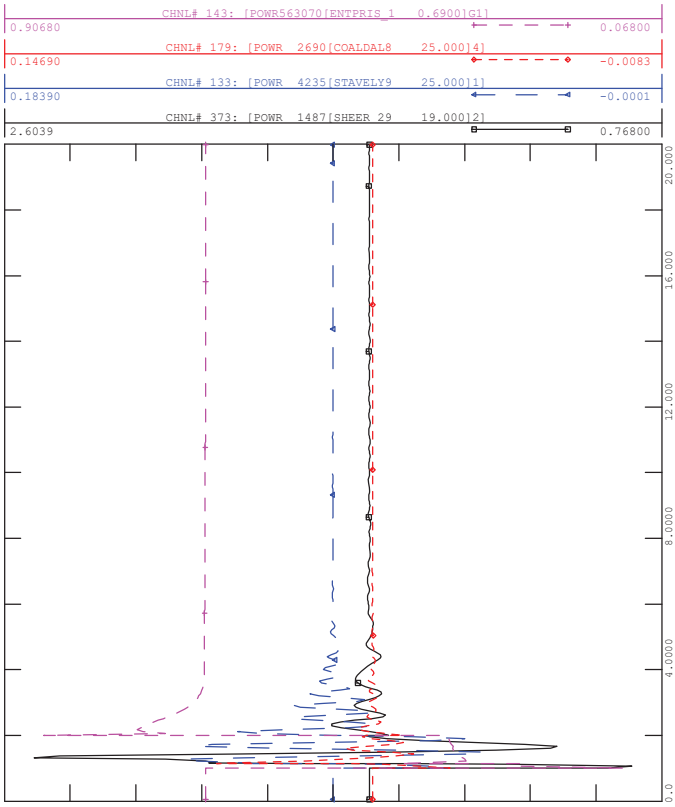
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_08_853L

FILE: scn3_SP_08_853L.out

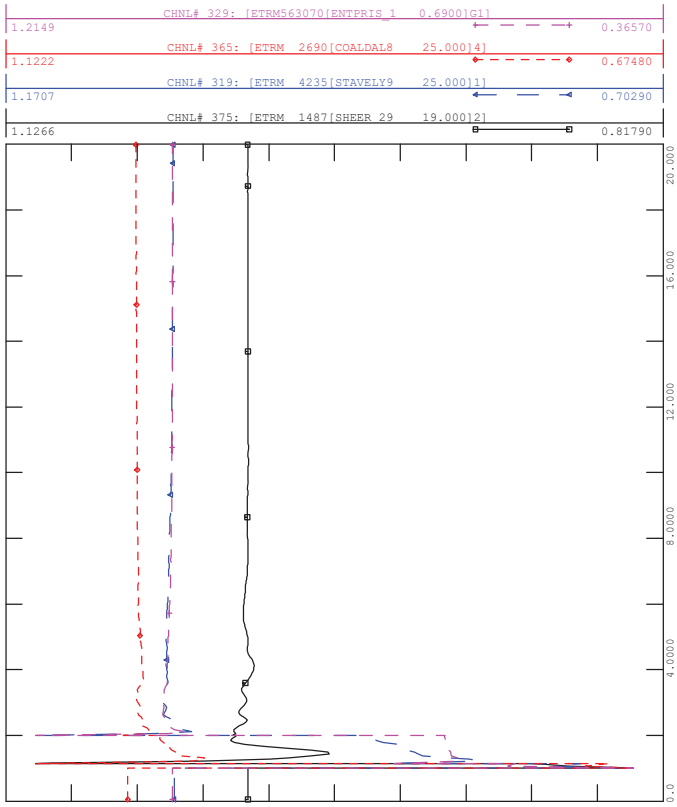
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_08_853L

FILE: scn3_SP_08_853L.out

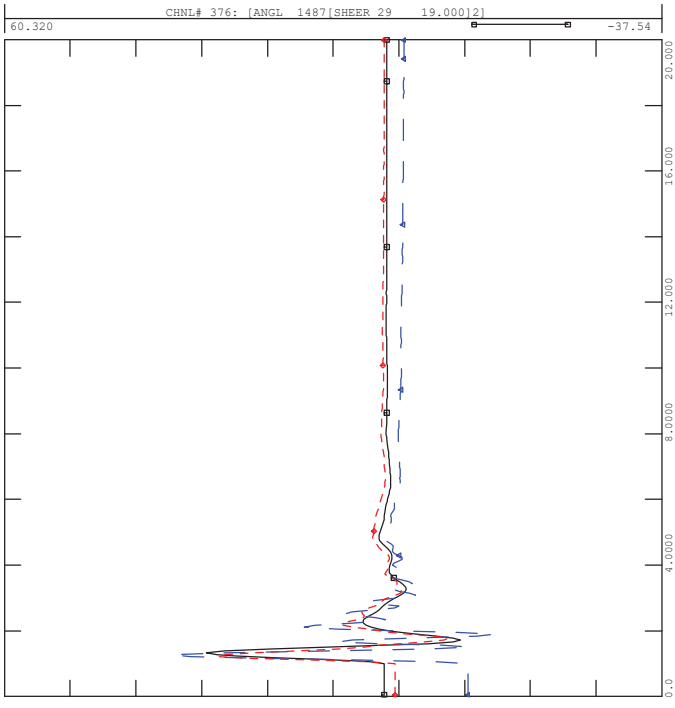
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_08_853L

FILE: scn3_SP_08_853L.out

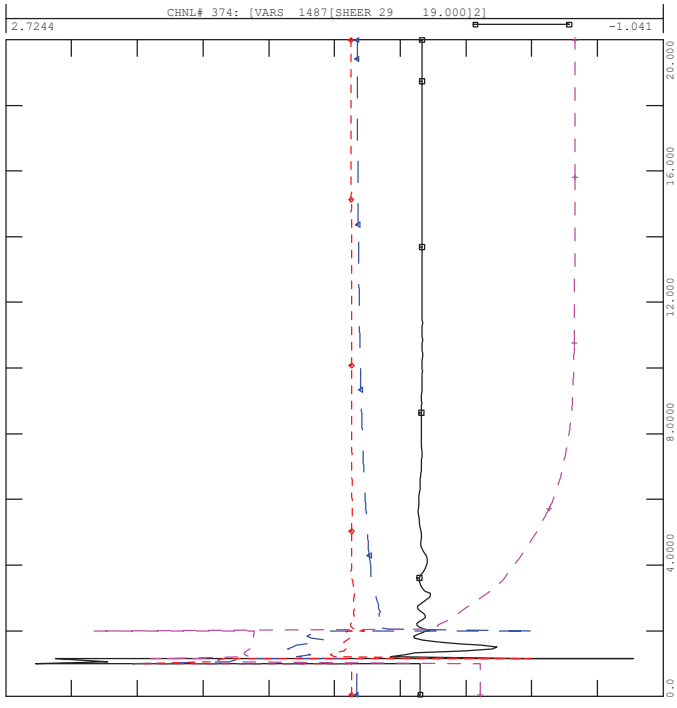
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_08_853L

FILE: scn3_SP_08_853L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

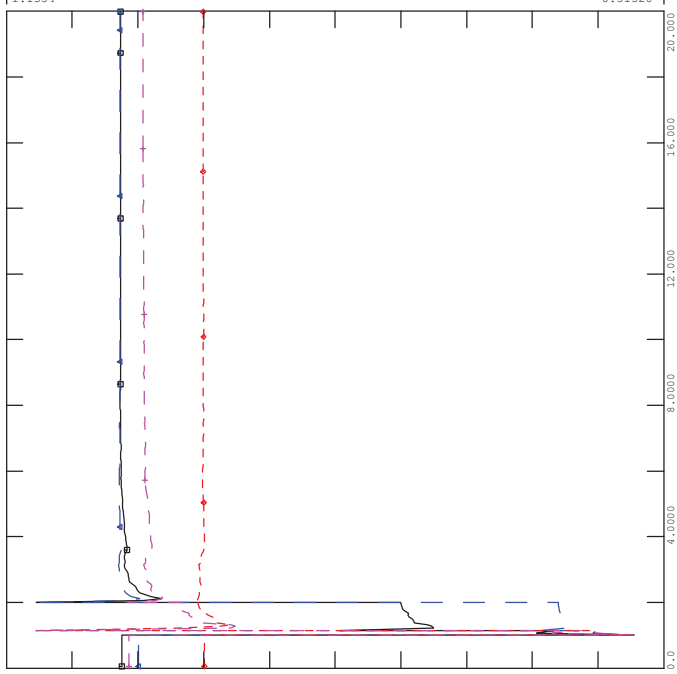


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_08_853L

FILE: scn3_SP_08_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.1180 0.69130
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.2811 0.48620
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.2200 0.18690
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.1354 0.51520

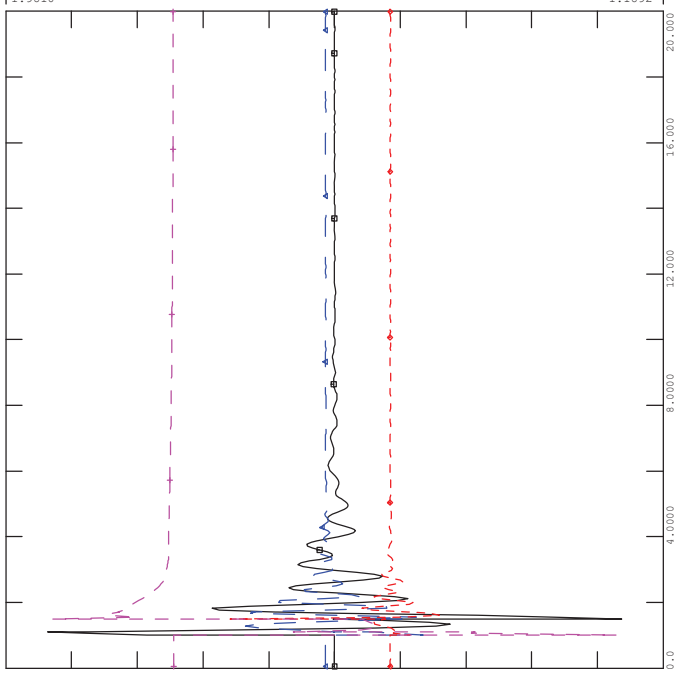


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_09_172L

FILE: scn3_SP_09_172L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.82940 0.12590
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.14580 -0.0009
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.15870 0.02160
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
1.9810 1.1892

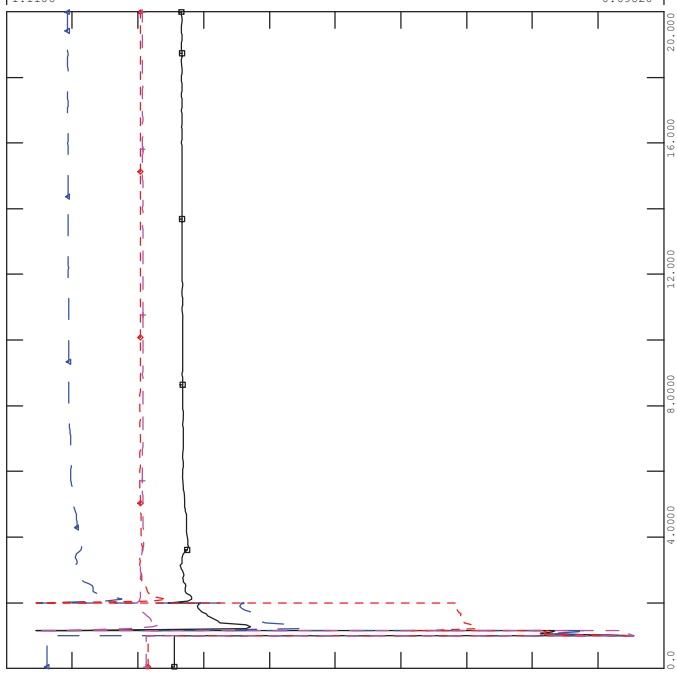


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_08_853L

FILE: scn3_SP_08_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.2759 0.07520
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.1990 0.39730
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0479 0.64870
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.1106 0.69820

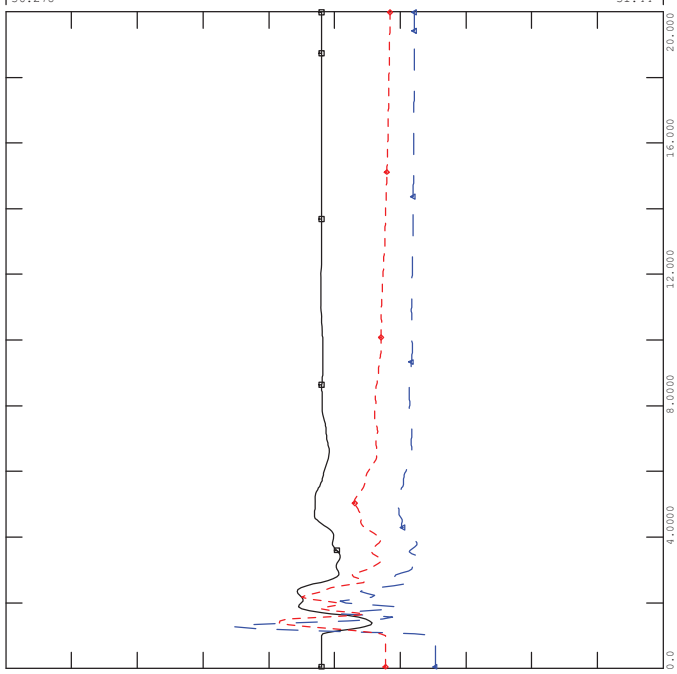


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_09_172L

FILE: scn3_SP_09_172L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

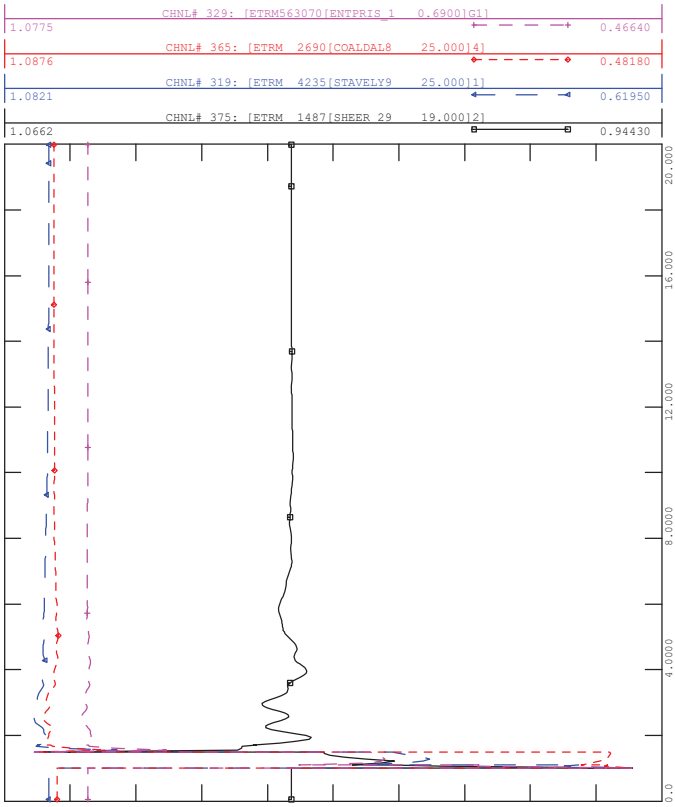
CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
95.174 23.004
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
130.60 44.077
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
36.278 -31.44



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_09_172L

FILE: scn3_SP_09_172L.out

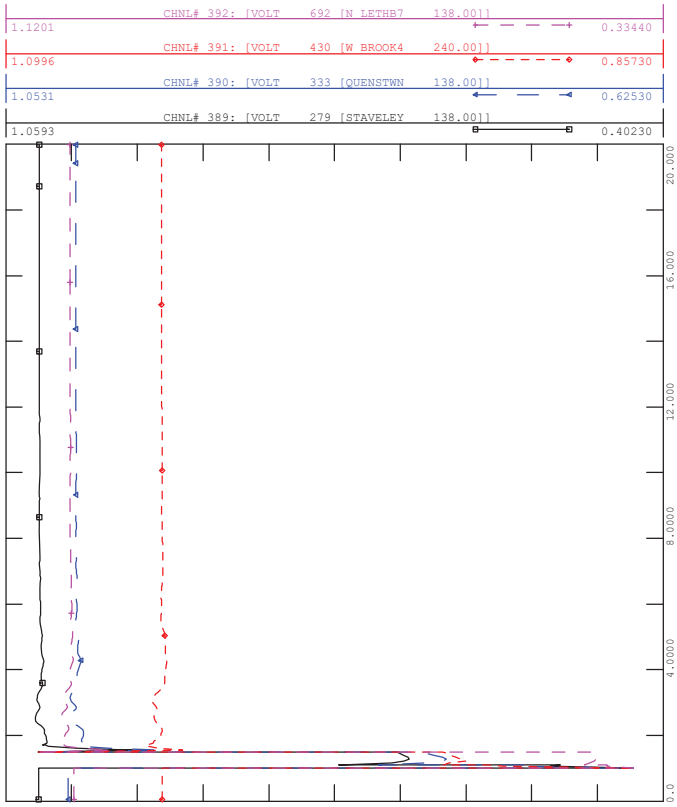
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_09_172L

FILE: scn3_SP_09_172L.out

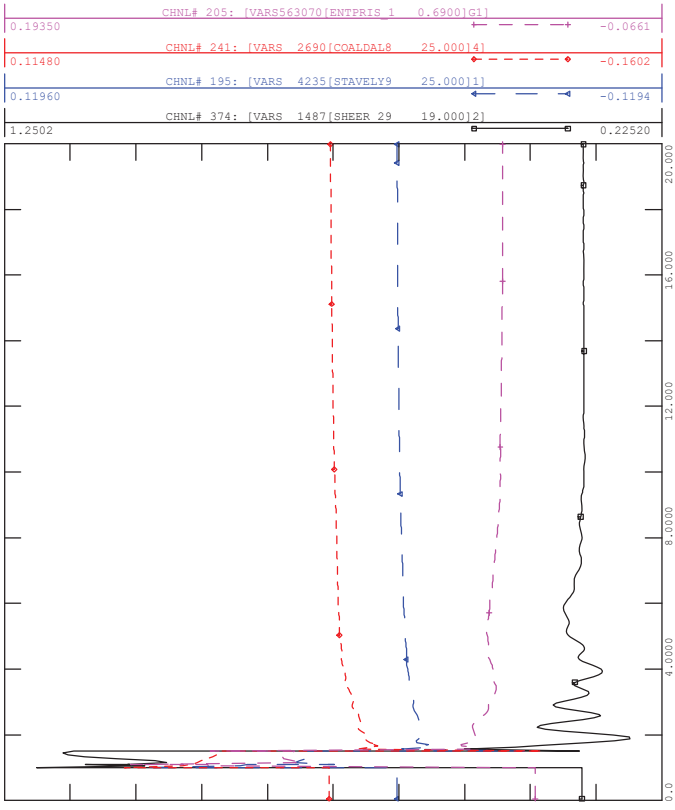
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_09_172L

FILE: scn3_SP_09_172L.out

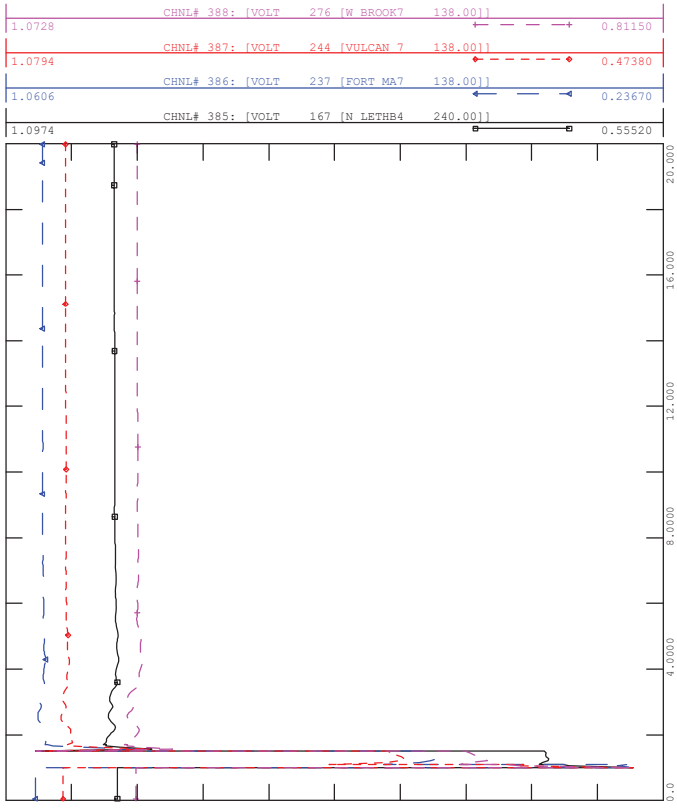
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_09_172L

FILE: scn3_SP_09_172L.out

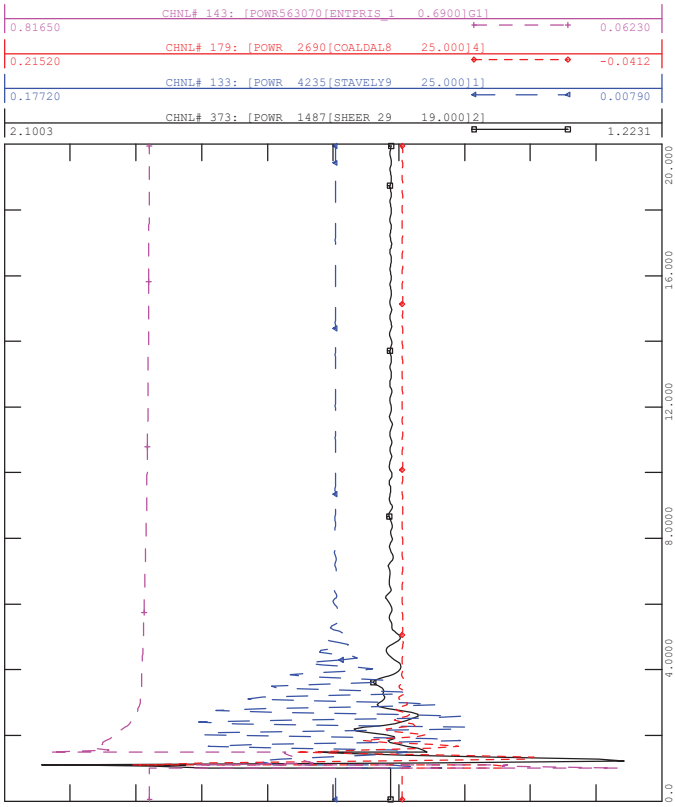
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_10_172L

FILE: scn3_SP_10_172L.out

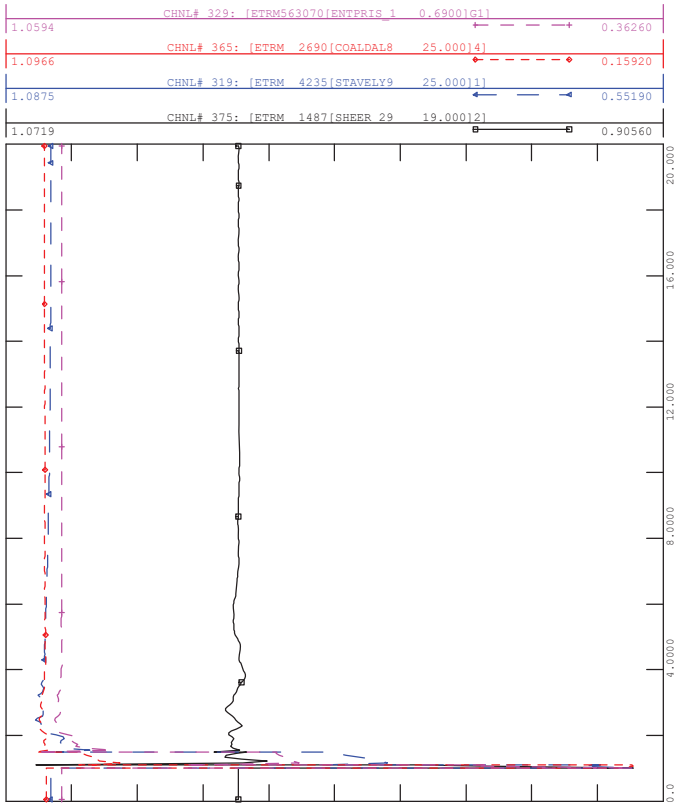
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_10_172L

FILE: scn3_SP_10_172L.out

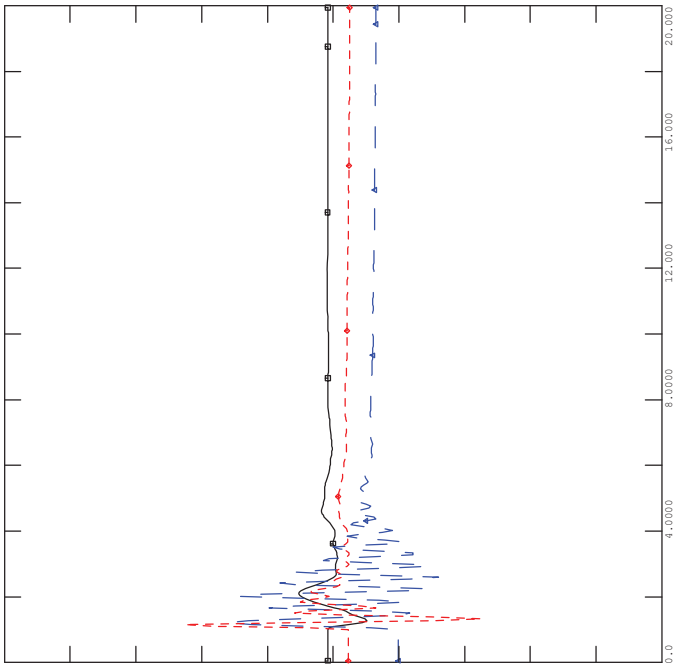
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_10_172L

FILE: scn3_SP_10_172L.out

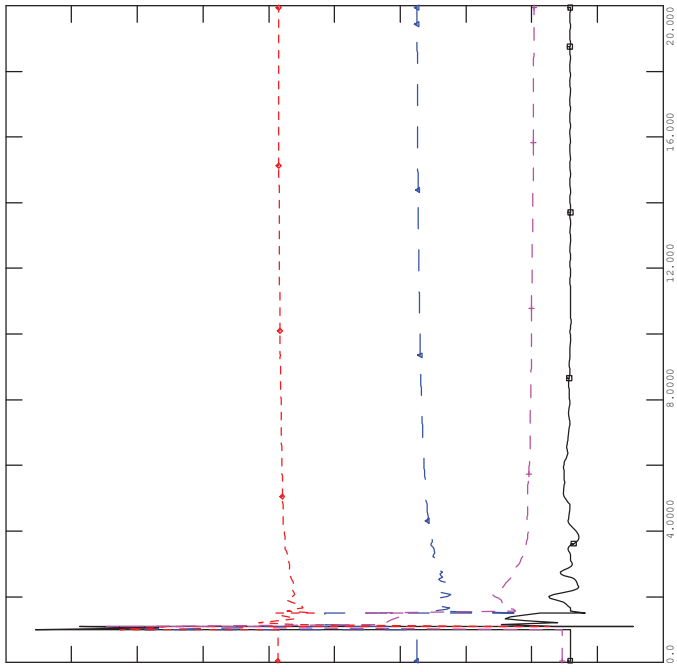
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_10_172L

FILE: scn3_SP_10_172L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

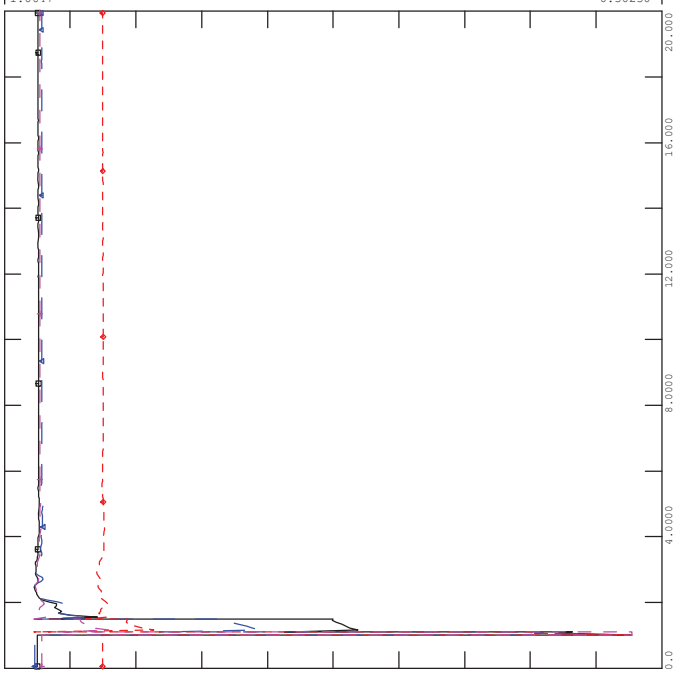


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_10_172L

FILE: scn3_SP_10_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.1042 -0.0460
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.0927 0.75310
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.0363 0.51580
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.0647 0.30230

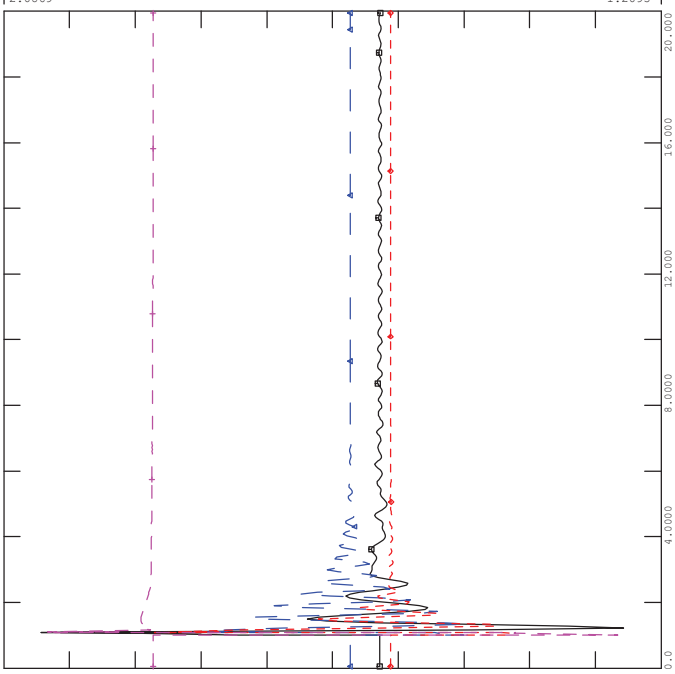


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_11_1041L

FILE: scn3_SP_11_1041L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.82160 0.06670
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.18840 -0.0298
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.18170 0.01150
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
2.0869 1.2095

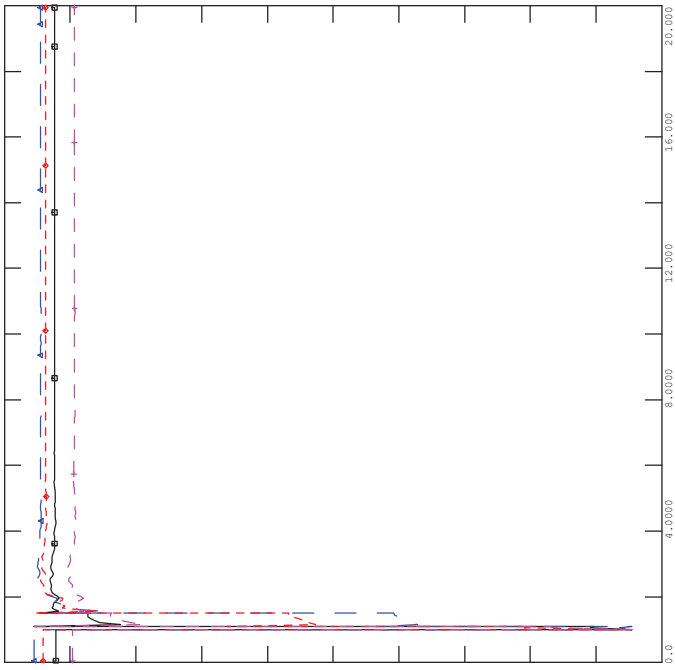


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_10_172L

FILE: scn3_SP_10_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0586 0.69620
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.0675 0.36830
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0655 0.13550
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.0627 0.33140

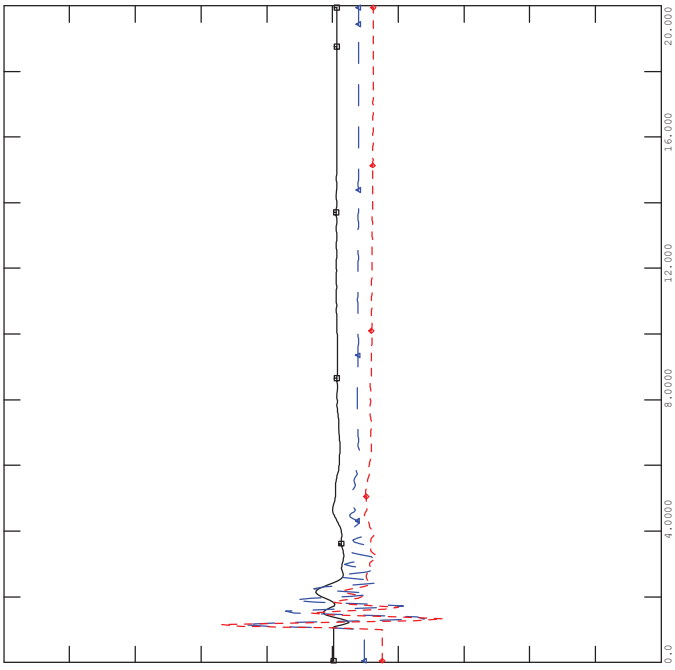


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_11_1041L

FILE: scn3_SP_11_1041L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

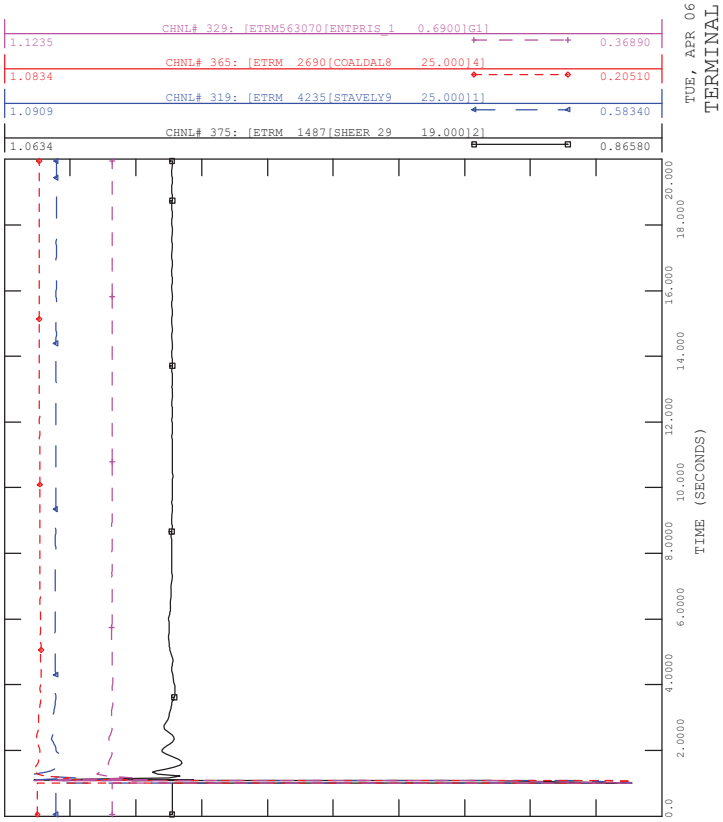
CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
105.55 15.110
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
119.80 36.424
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
35.504 -27.71



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_11_1041L

FILE: scn3_SP_11_1041L.out

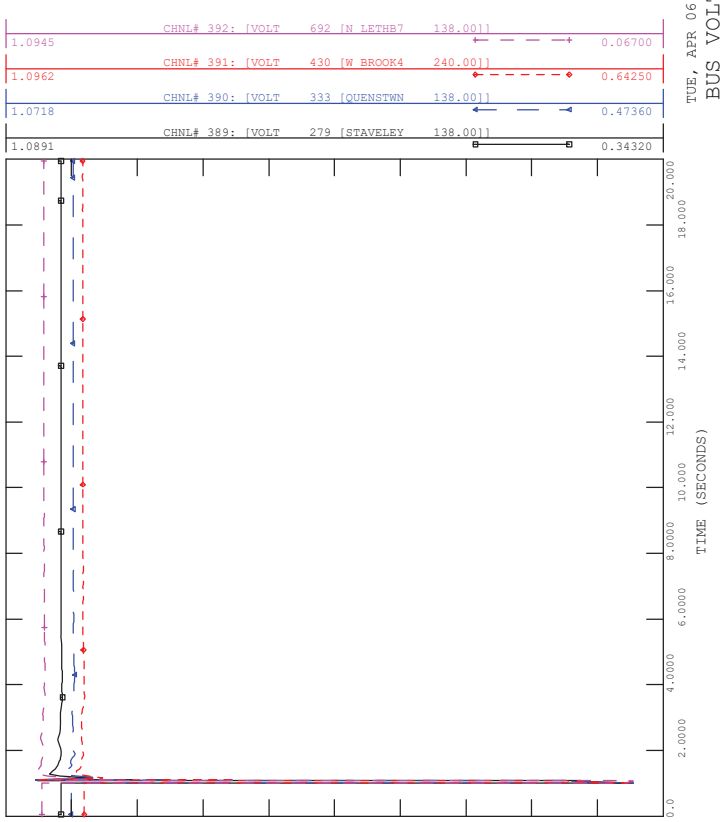
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_11_1041L

FILE: scn3_SP_11_1041L.out

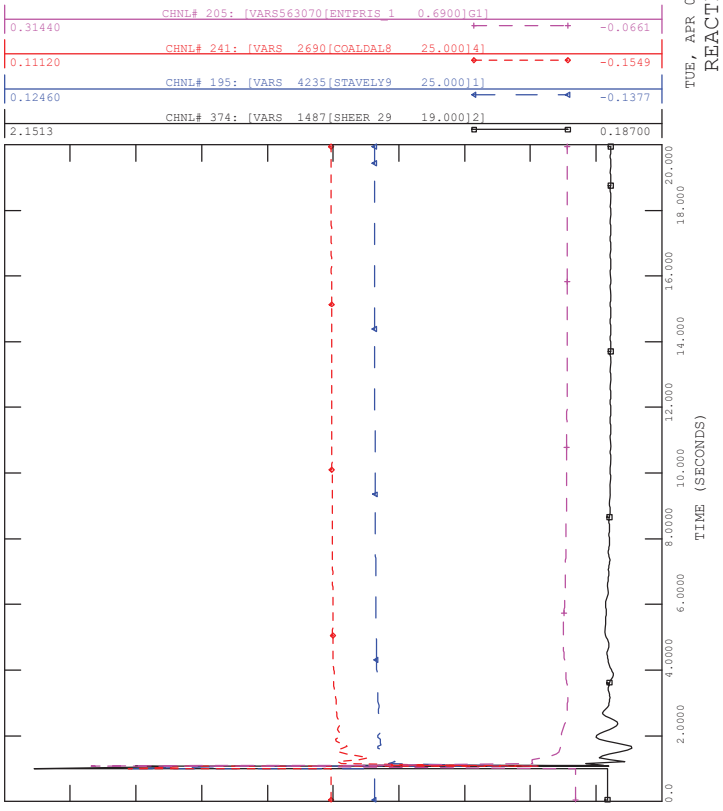
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_11_1041L

FILE: scn3_SP_11_1041L.out

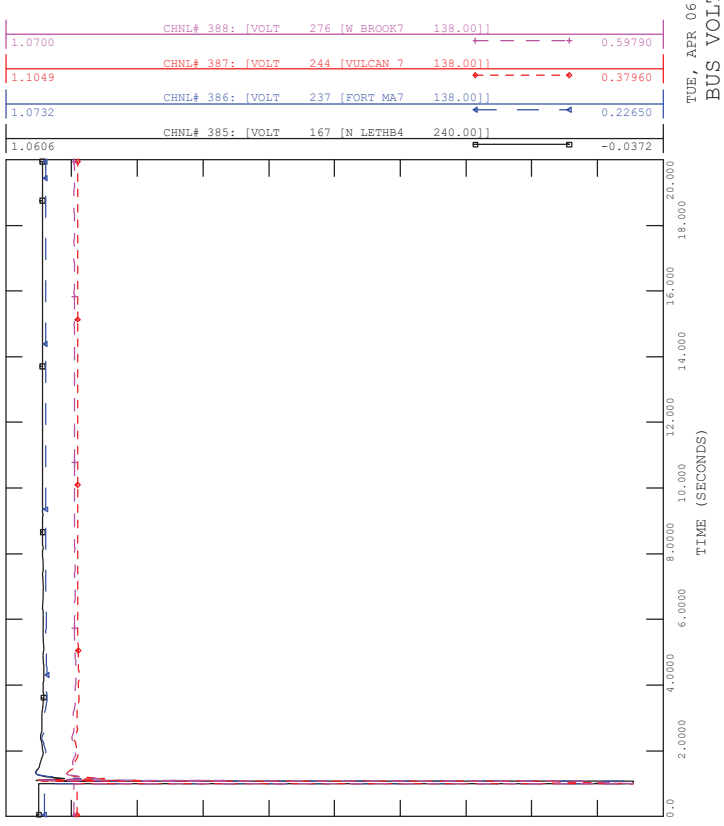
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_11_1041L

FILE: scn3_SP_11_1041L.out

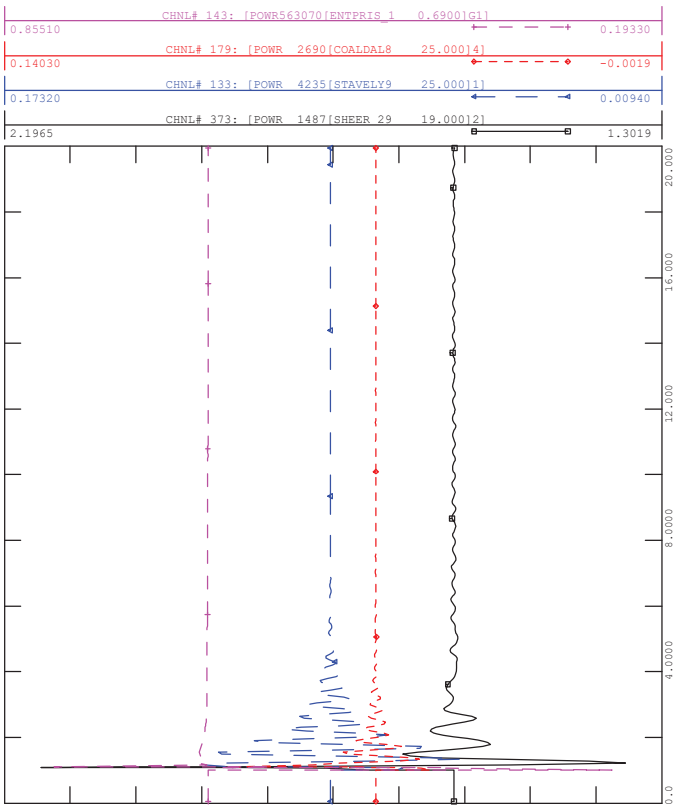
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_12_1041L

FILE: scn3_SP_12_1041L.out

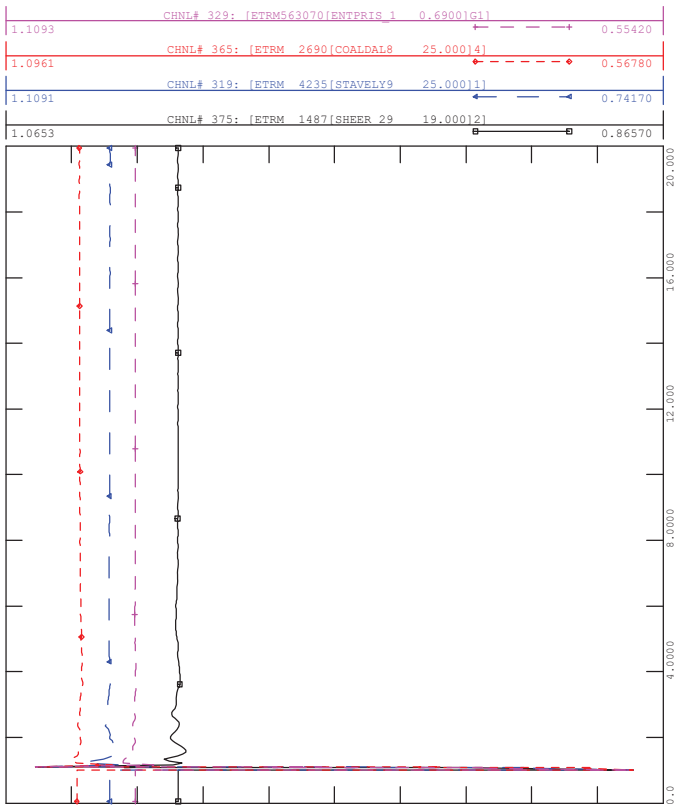
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_12_1041L

FILE: scn3_SP_12_1041L.out

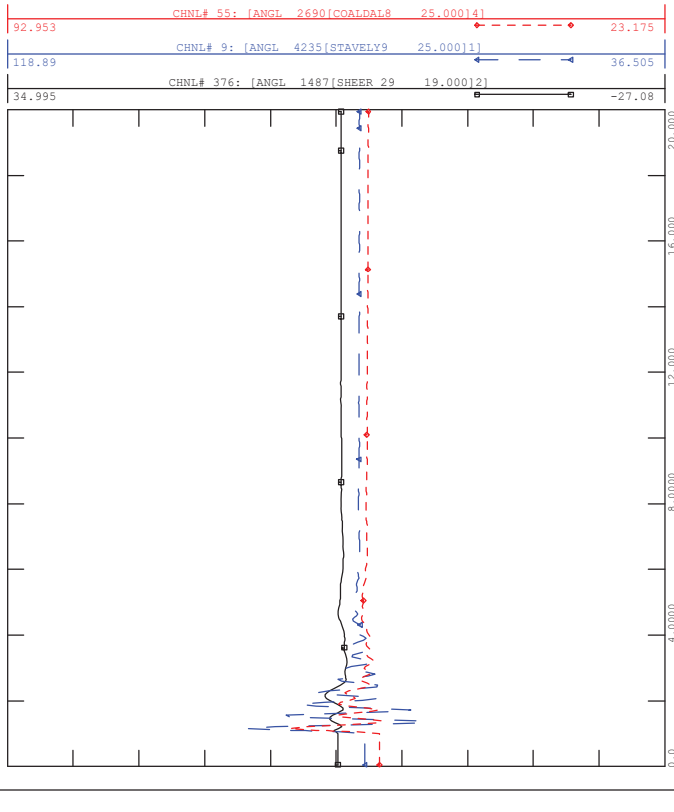
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_12_1041L

FILE: scn3_SP_12_1041L.out

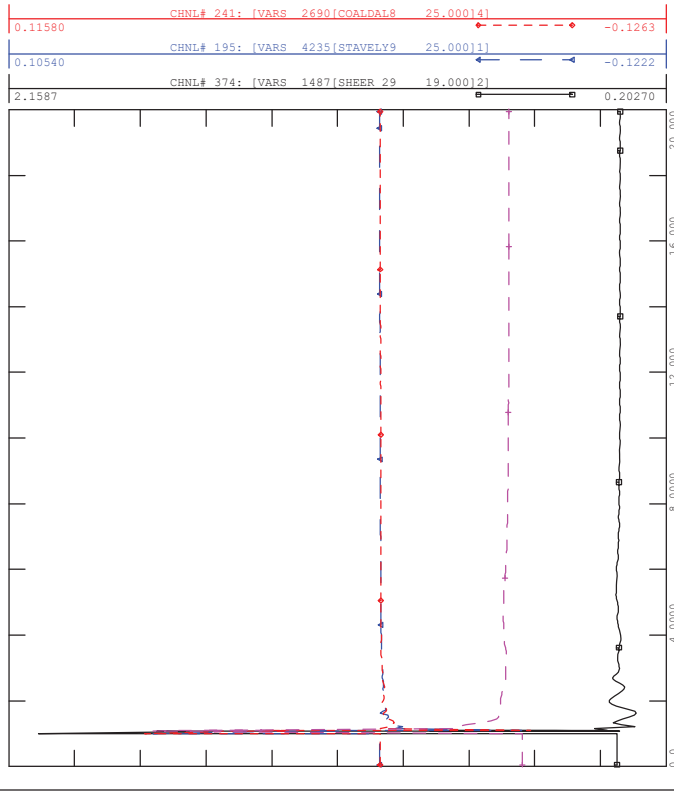
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_12_1041L

FILE: scn3_SP_12_1041L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

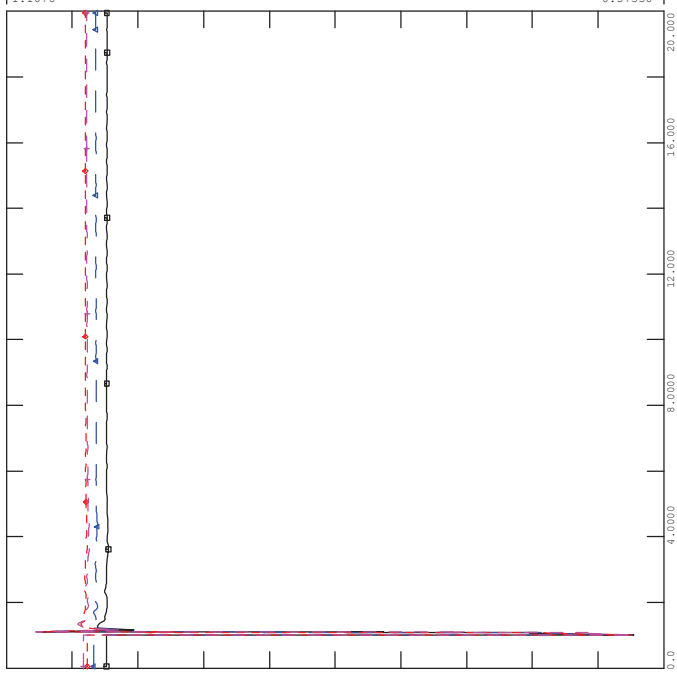


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_12_1041L

FILE: scn3_SP_12_1041L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.1135 0.47390
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.0987 0.63600
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.0777 0.58380
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.1076 0.57550

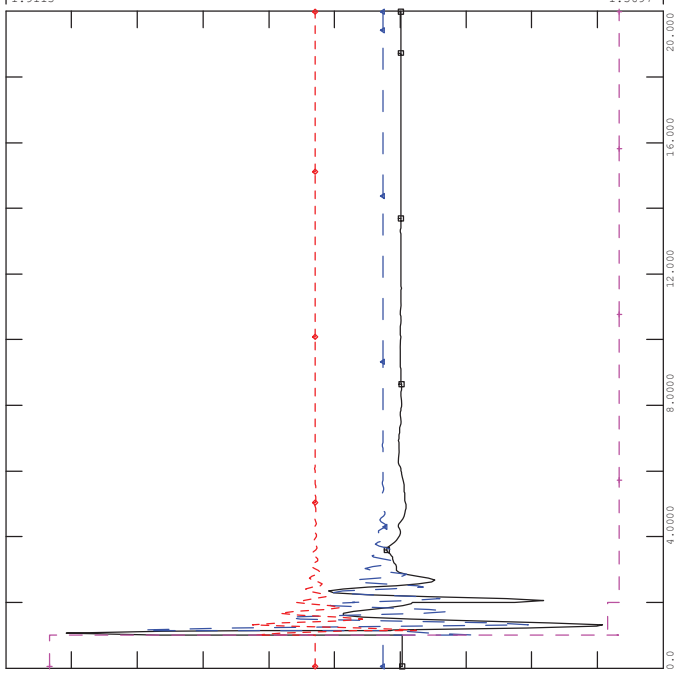


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_13_161L

FILE: scn3_SP_13_161L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900[G1]
0.70000 -0.0500
CHNL# 179: [POWR 2690[COALDAL8 25.000[4]
0.12270 -0.0106
CHNL# 133: [POWR 4235[STAVELY9 25.000[1]
0.23190 -0.0121
CHNL# 373: [POWR 1487[SHEER 29 19.000[2]
1.9113 1.3697

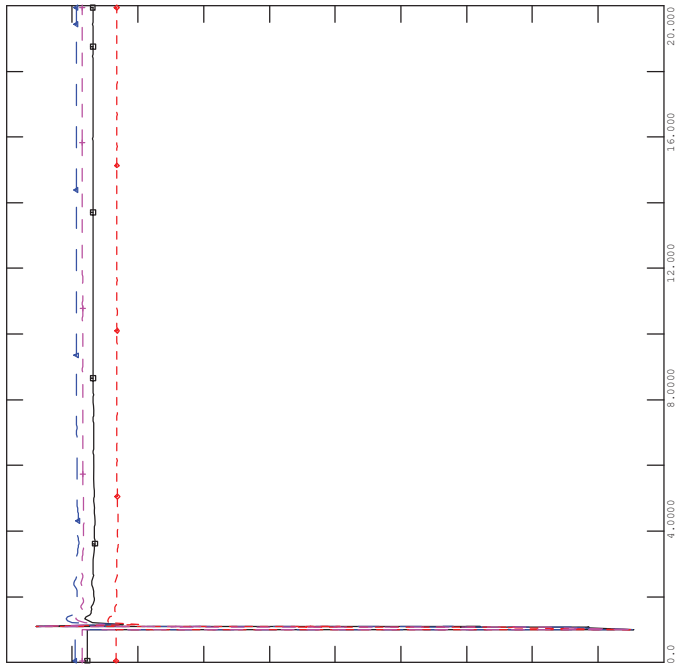


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_12_1041L

FILE: scn3_SP_12_1041L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0739 0.61440
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.1167 0.57490
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0798 0.53660
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.0885 0.41130

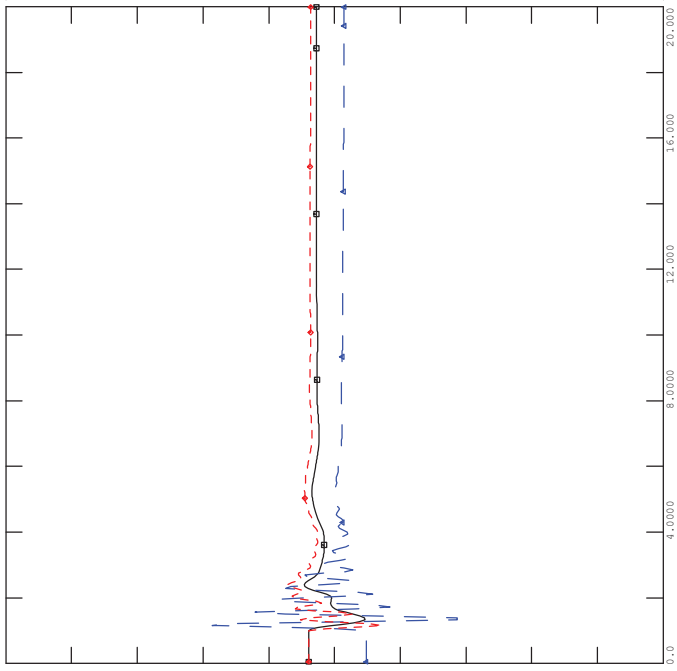


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_13_161L

FILE: scn3_SP_13_161L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

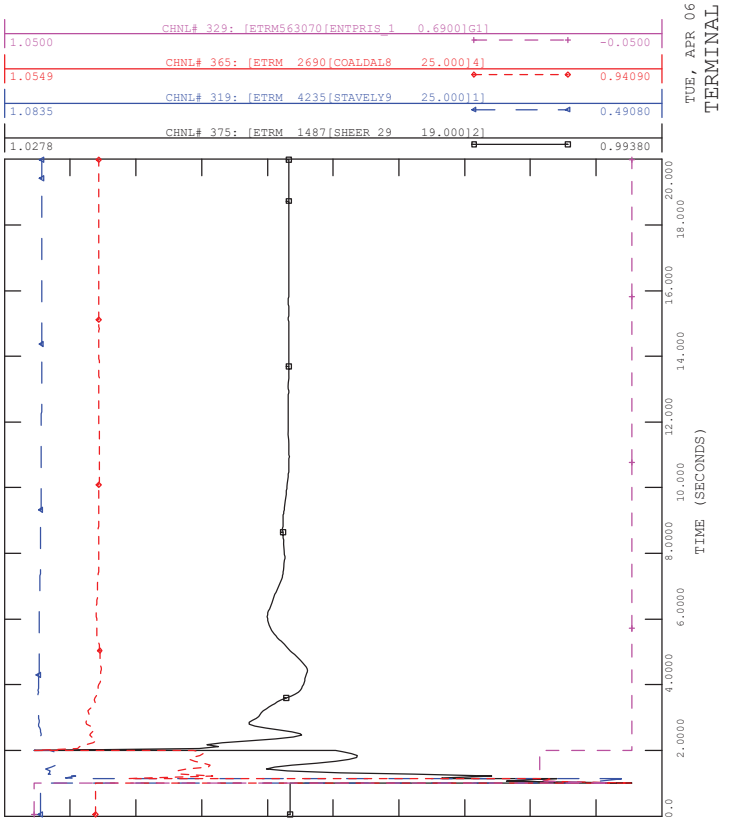
CHNL# 55: [ANGL 2690[COALDAL8 25.000[4]
85.733 15.705
CHNL# 9: [ANGL 4235[STAVELY9 25.000[1]
126.56 30.806
CHNL# 376: [ANGL 1487[SHEER 29 19.000[2]
34.248 -31.84



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_13_161L

FILE: scn3_SP_13_161L.out

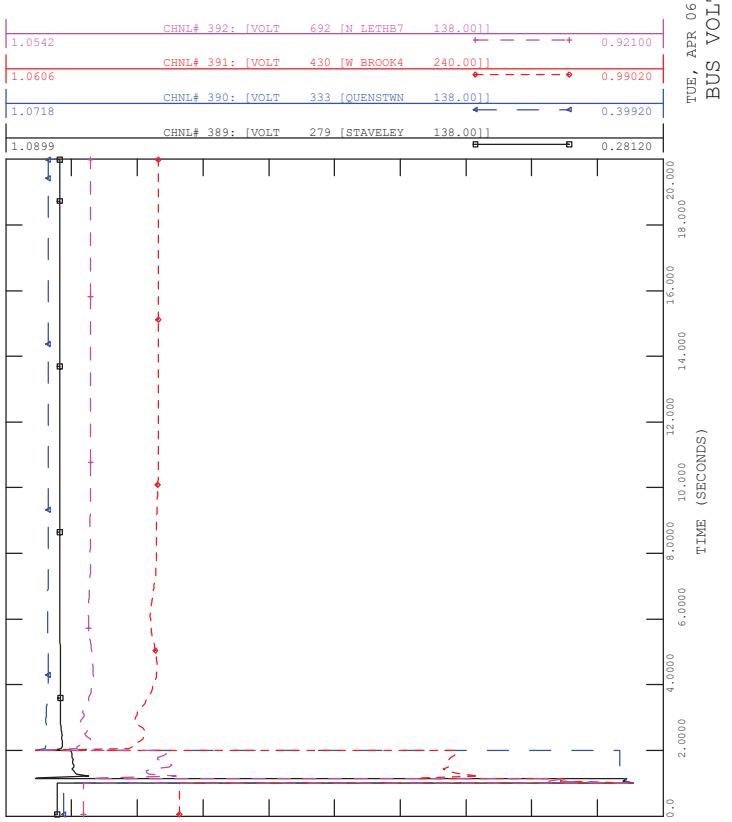
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_13_161L

FILE: scn3_SP_13_161L.out

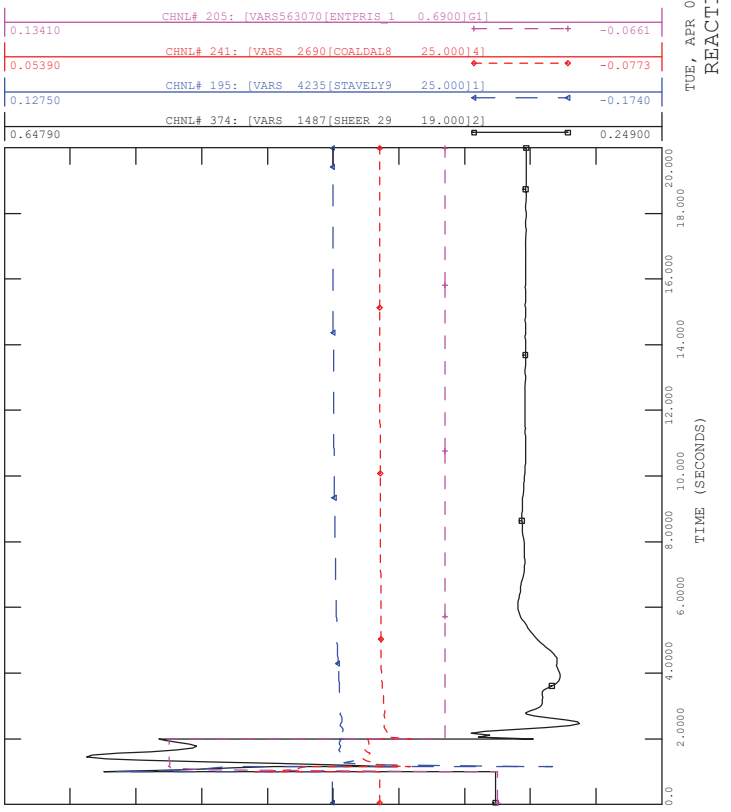
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_13_161L

FILE: scn3_SP_13_161L.out

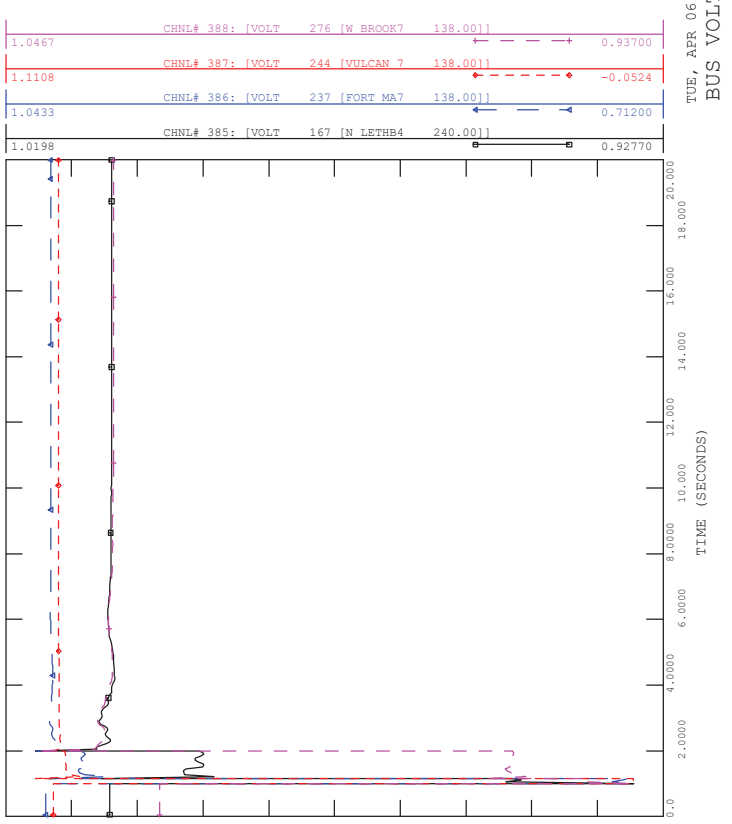
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_13_161L

FILE: scn3_SP_13_161L.out

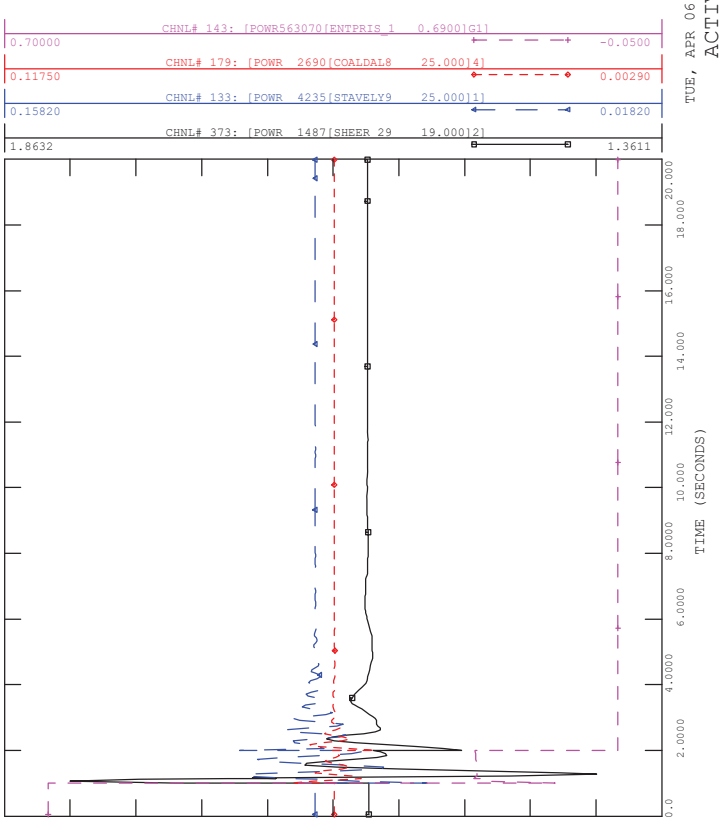
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_14_161L

FILE: scn3_SP_14_161L.out

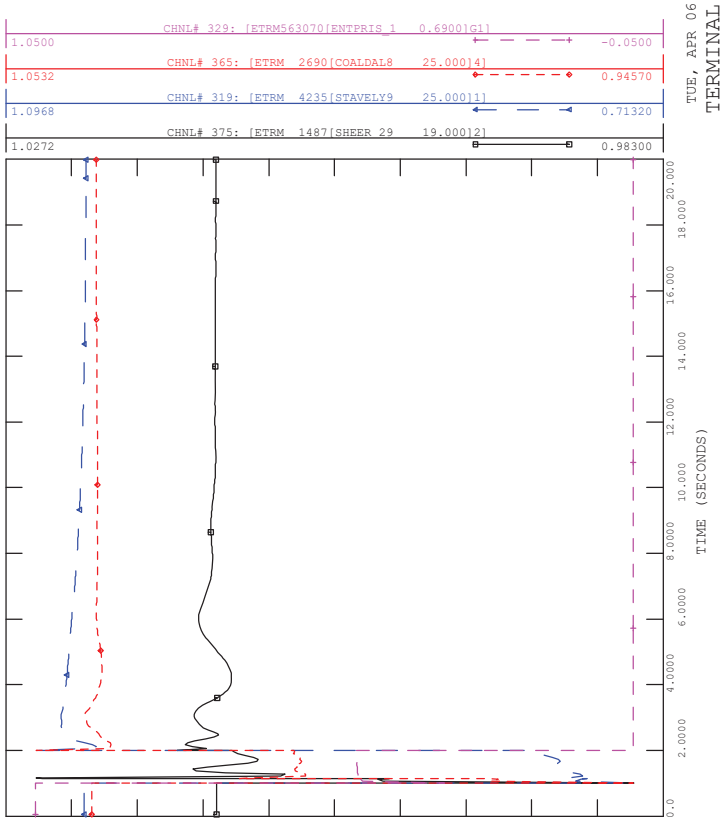
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_14_161L

FILE: scn3_SP_14_161L.out

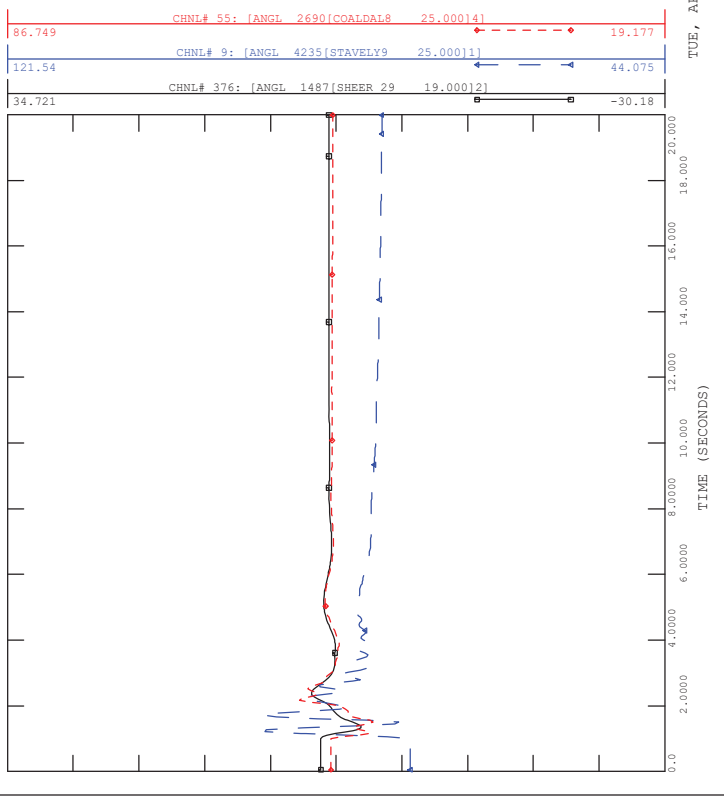
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_14_161L

FILE: scn3_SP_14_161L.out

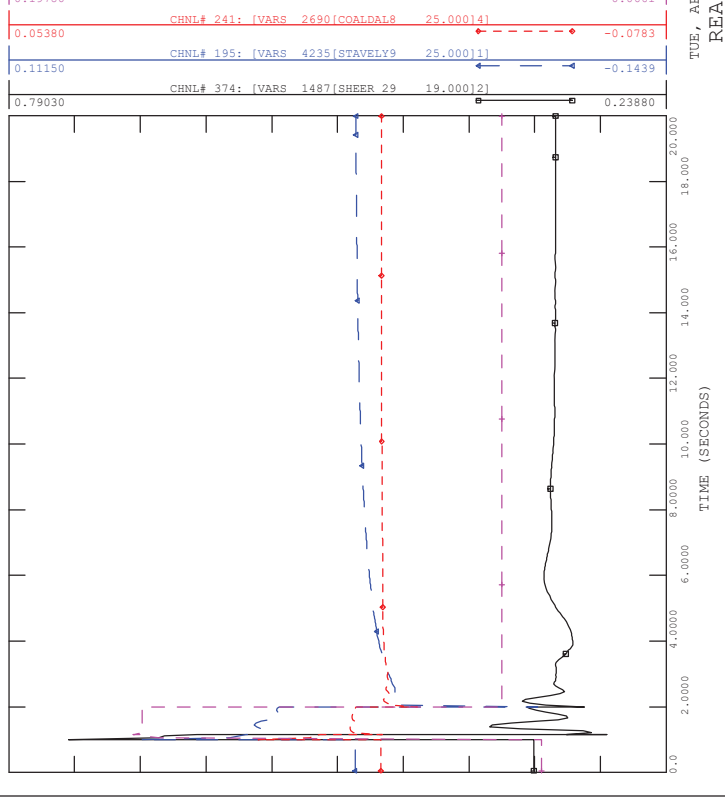
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_14_161L

FILE: scn3_SP_14_161L.out

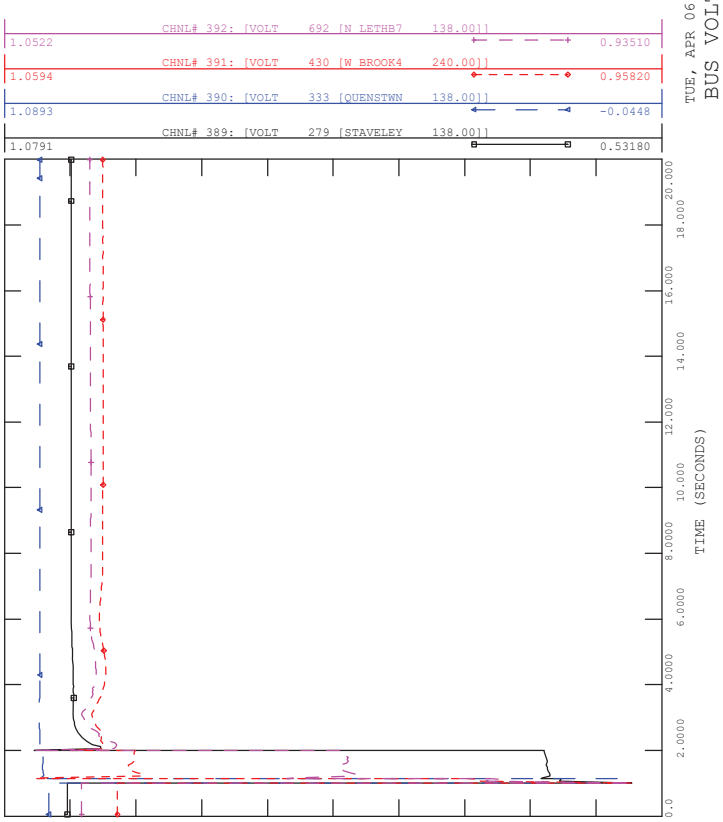
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_14_161L

FILE: scn3_SP_14_161L.out

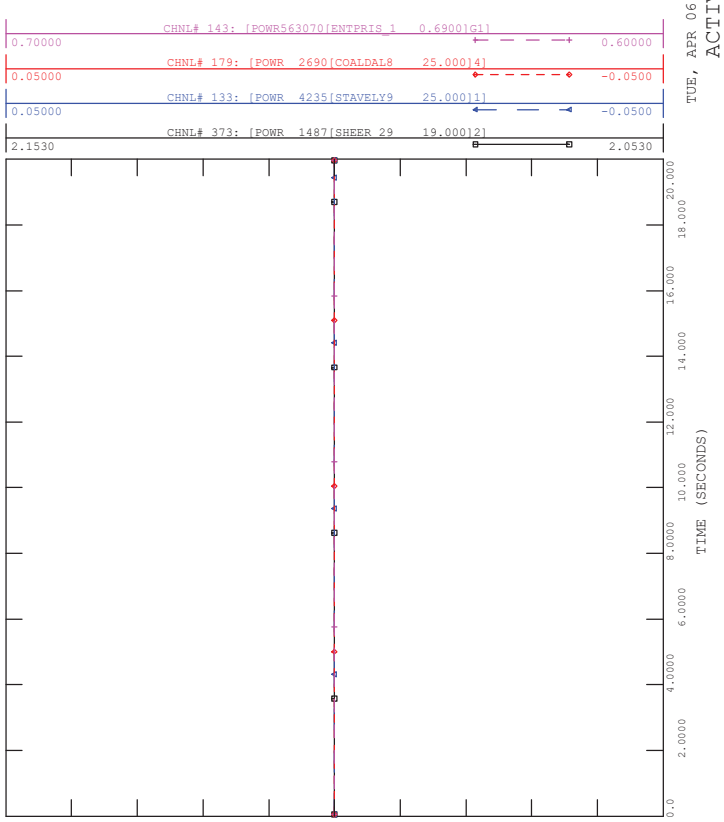
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_NOFAULT

FILE: Scn4_SL_nofault.out

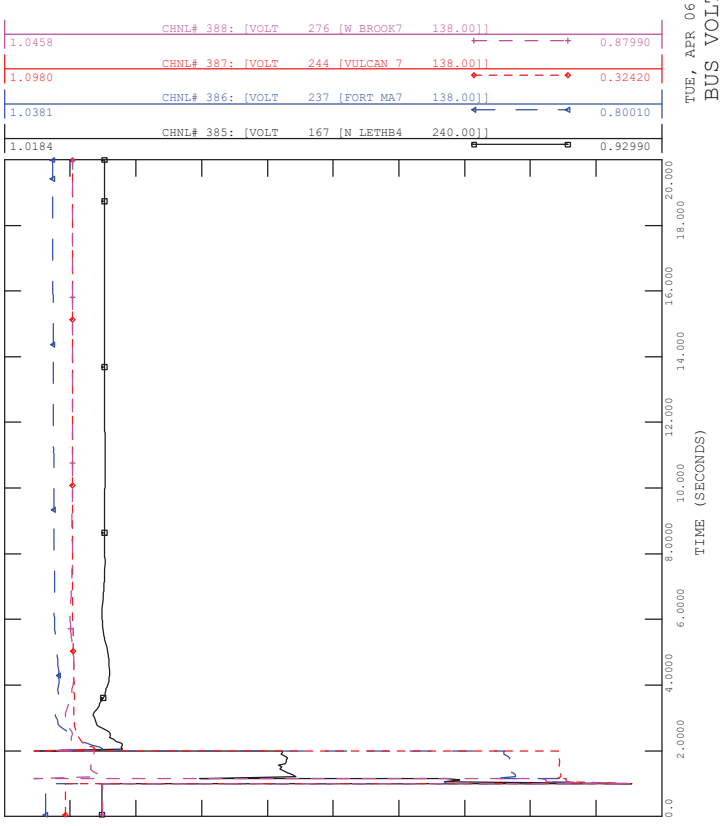
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SP_14_161L

FILE: scn3_SP_14_161L.out

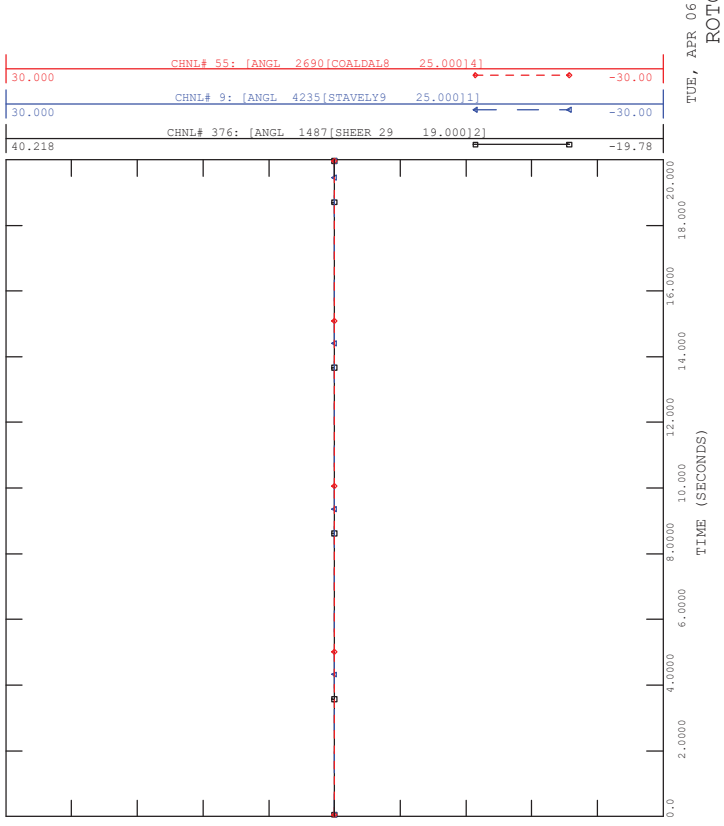
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_NOFAULT

FILE: Scn4_SL_nofault.out

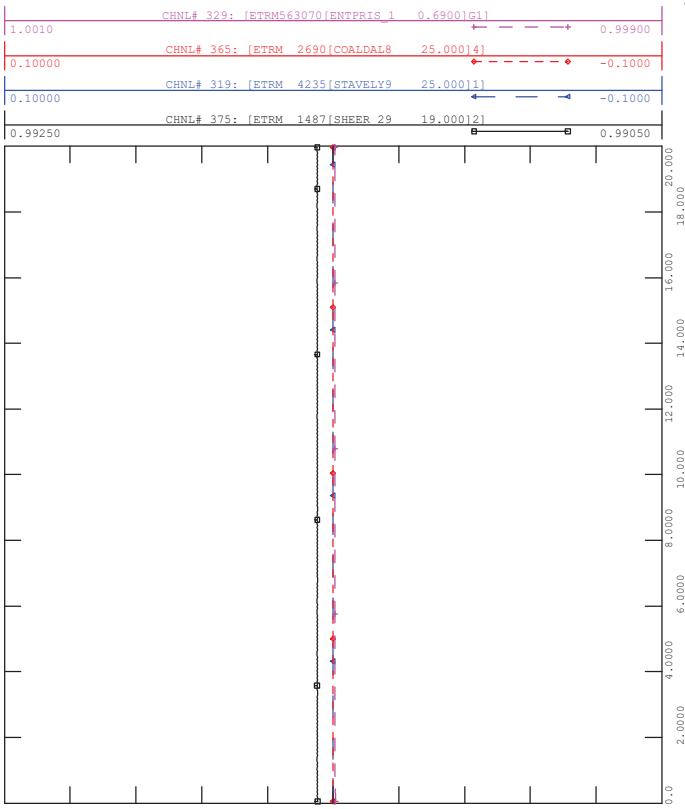
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_NOFAULT

FILE: Scn4_SL_nofault.out

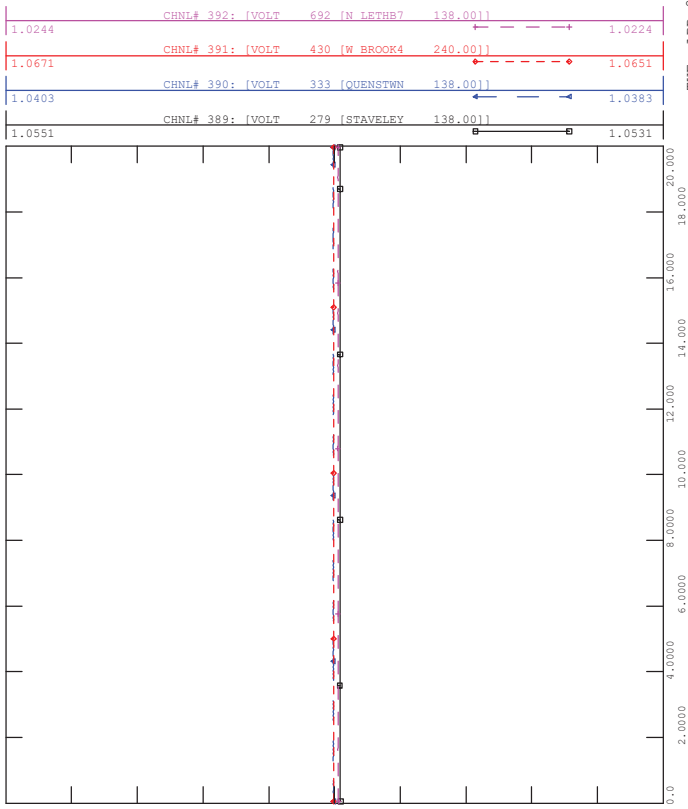
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_NOFAULT

FILE: Scn4_SL_nofault.out

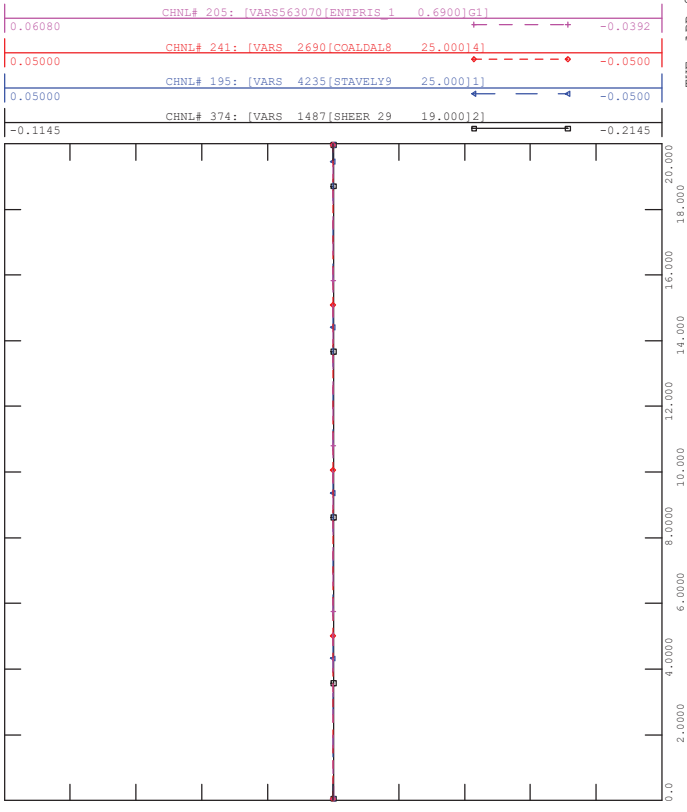
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_NOFAULT

FILE: Scn4_SL_nofault.out

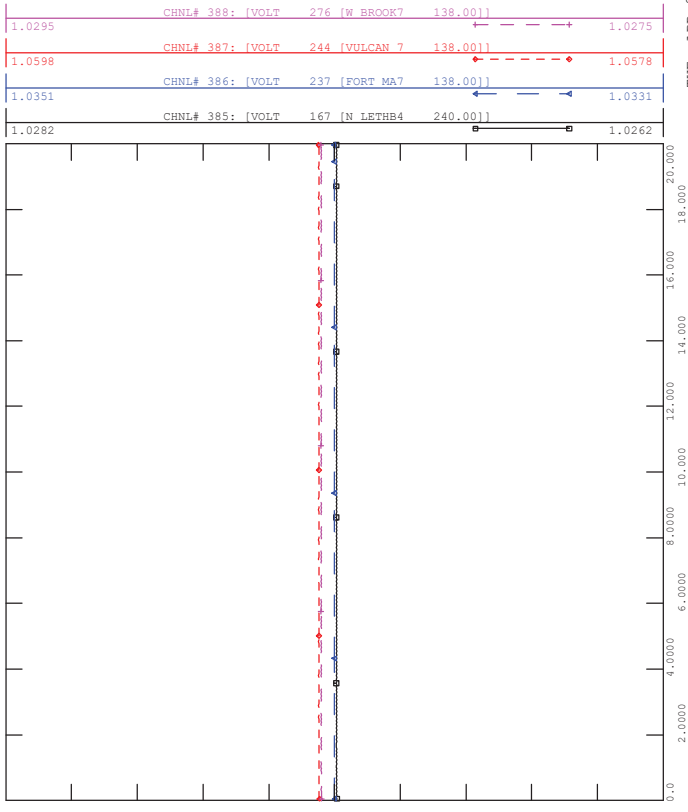
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_NOFAULT

FILE: Scn4_SL_nofault.out

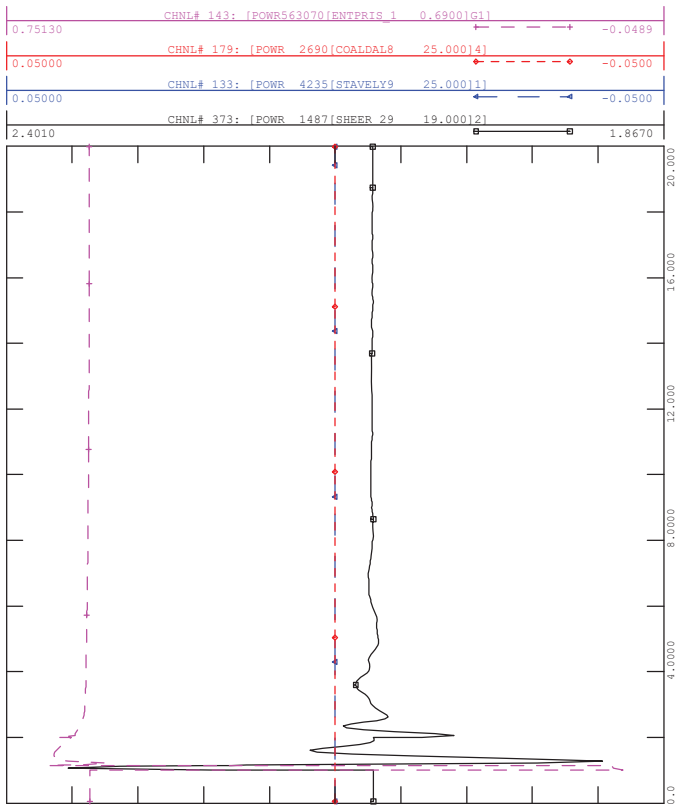
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_01_180L

FILE: Scn4_SL_01_180L.out

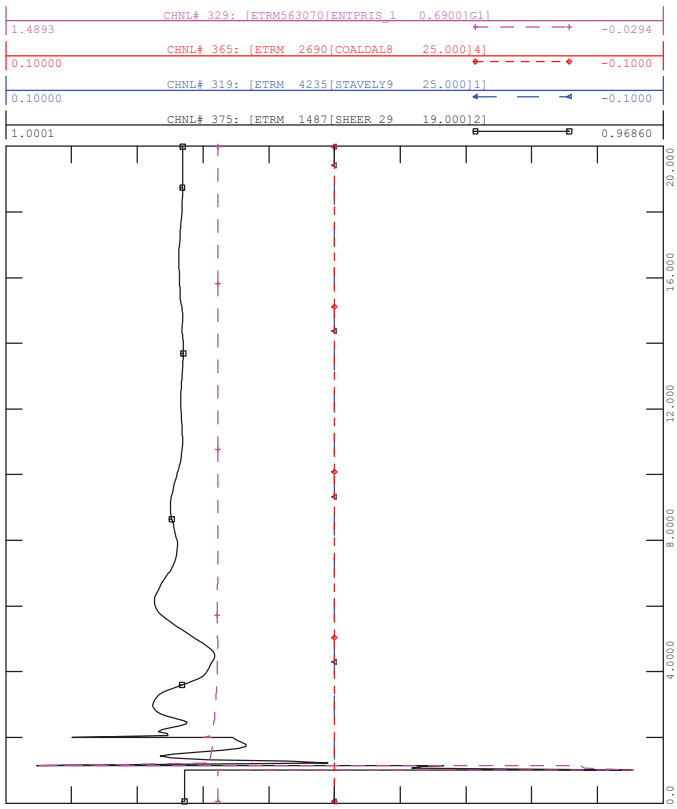
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_01_180L

FILE: Scn4_SL_01_180L.out

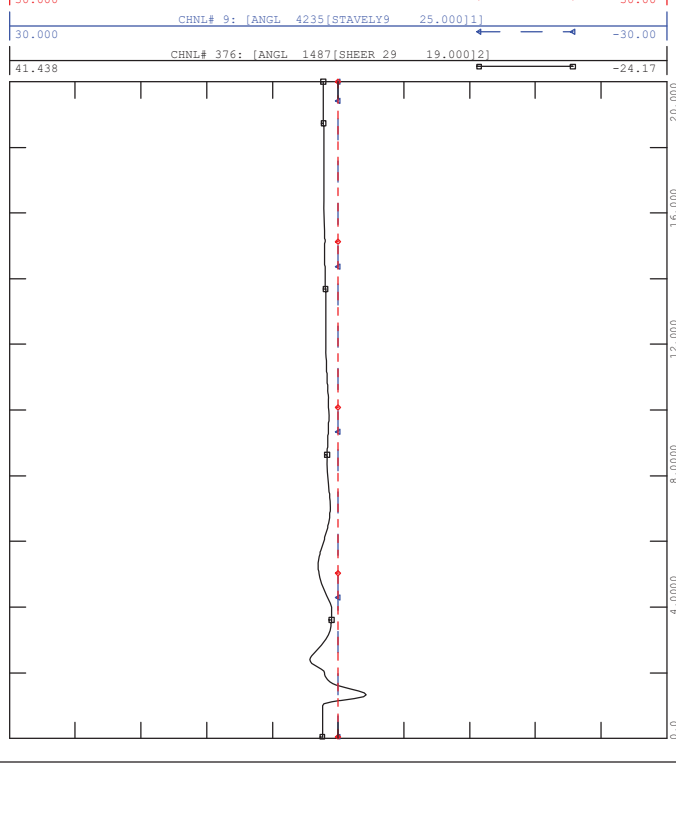
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_01_180L

FILE: Scn4_SL_01_180L.out

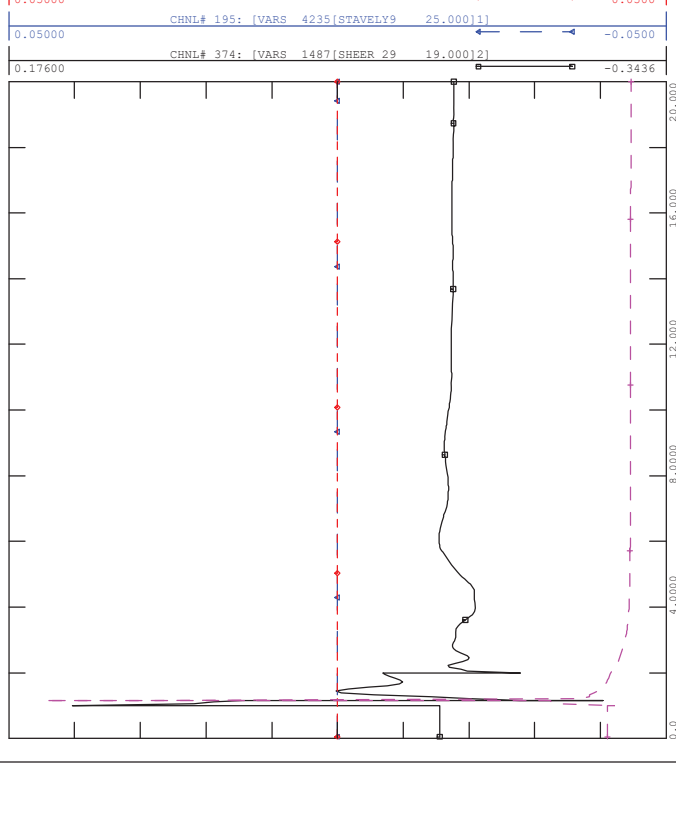
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_01_180L

FILE: Scn4_SL_01_180L.out

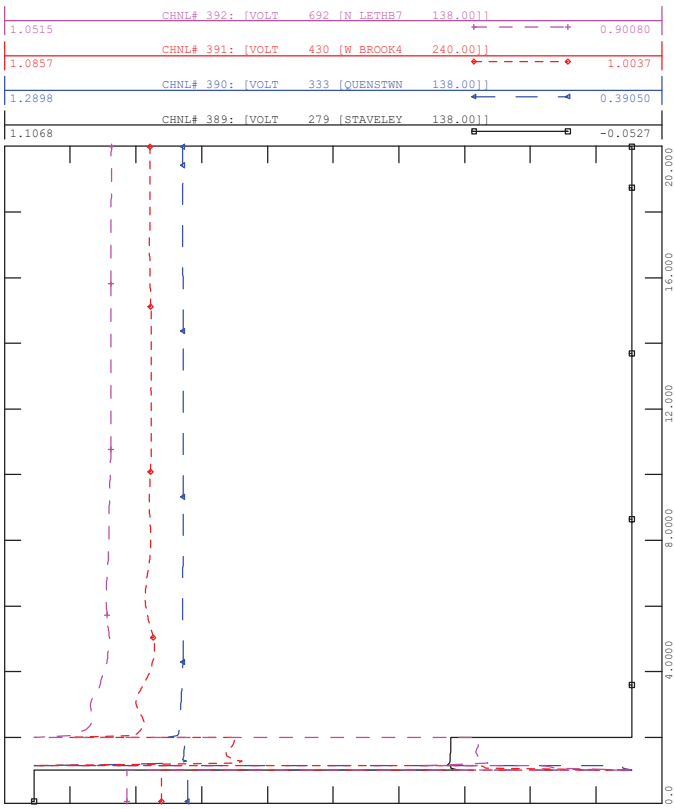
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_01_180L

FILE: Scn4_SL_01_180L.out

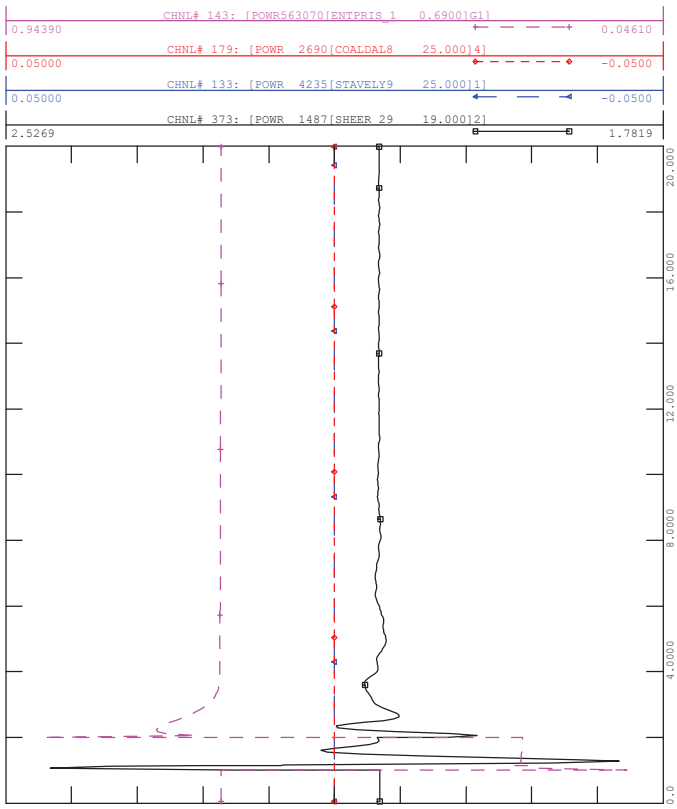
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_02_180L

FILE: Scn4_SL_02_180L.out

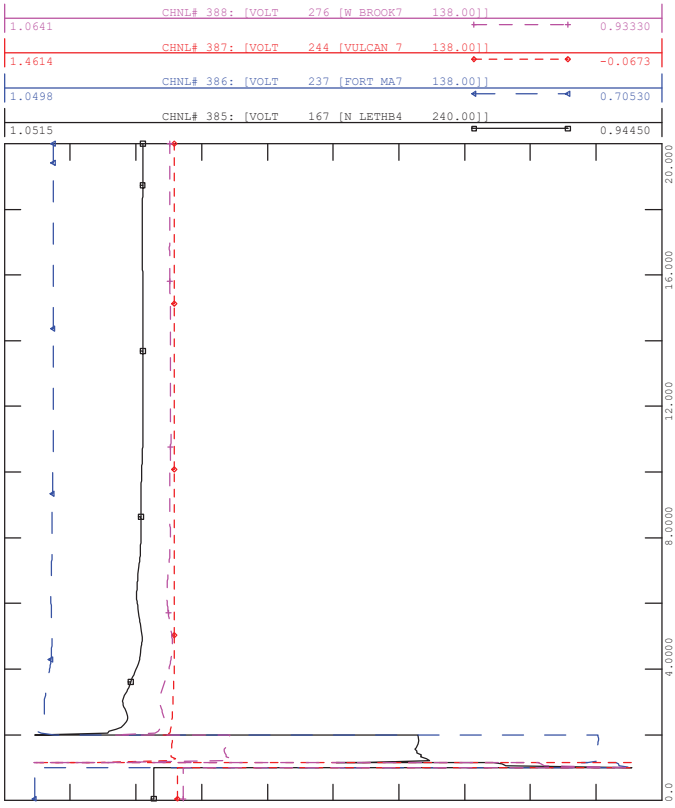
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_01_180L

FILE: Scn4_SL_01_180L.out

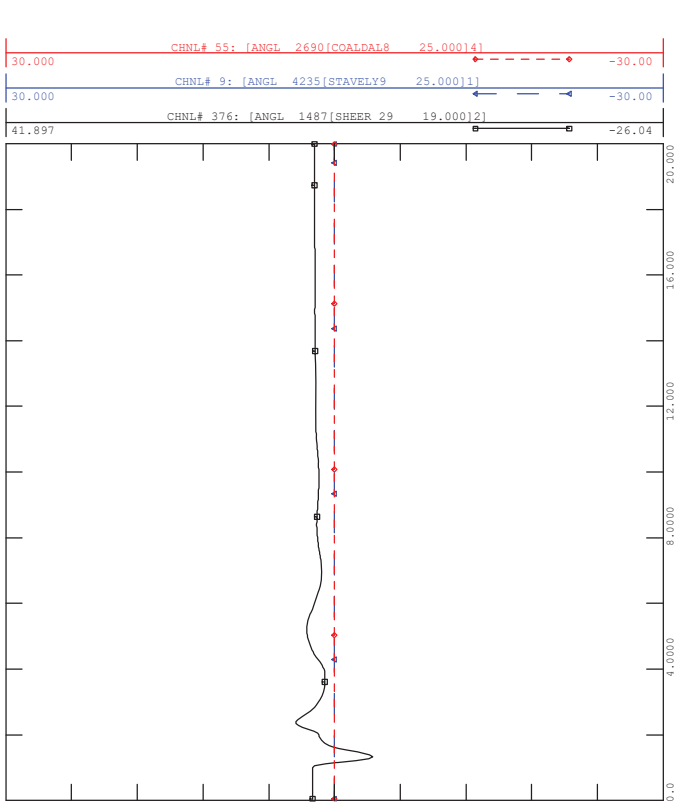
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_02_180L

FILE: Scn4_SL_02_180L.out

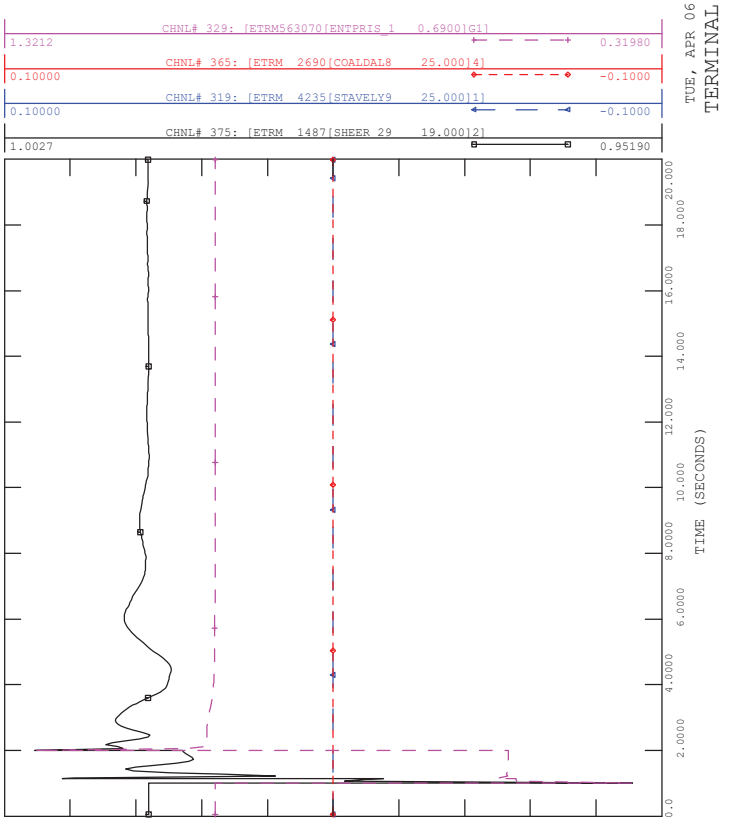
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_02_180L

FILE: Scn4_SL_02_180L.out

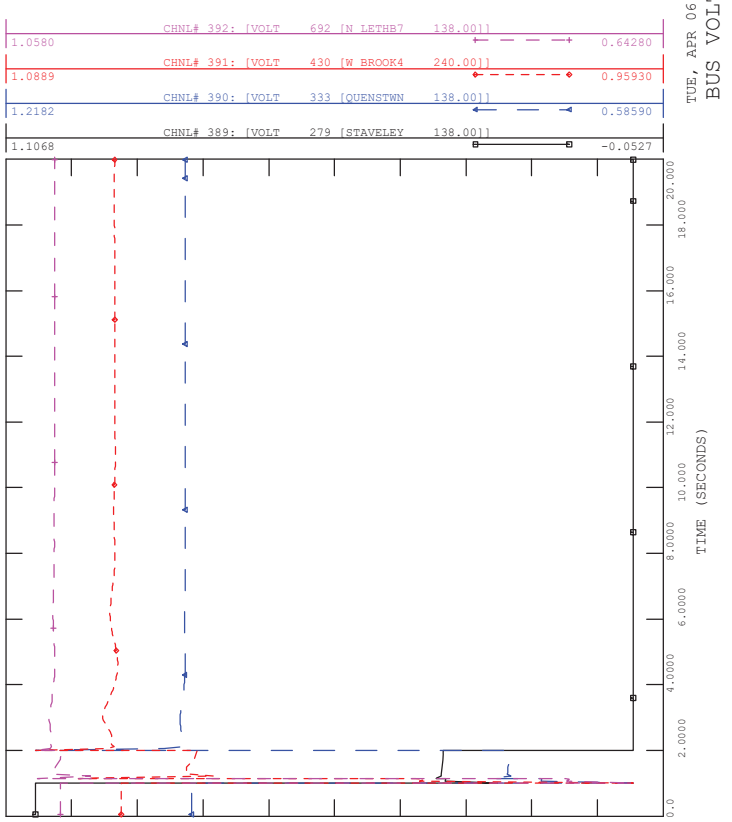
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_02_180L

FILE: Scn4_SL_02_180L.out

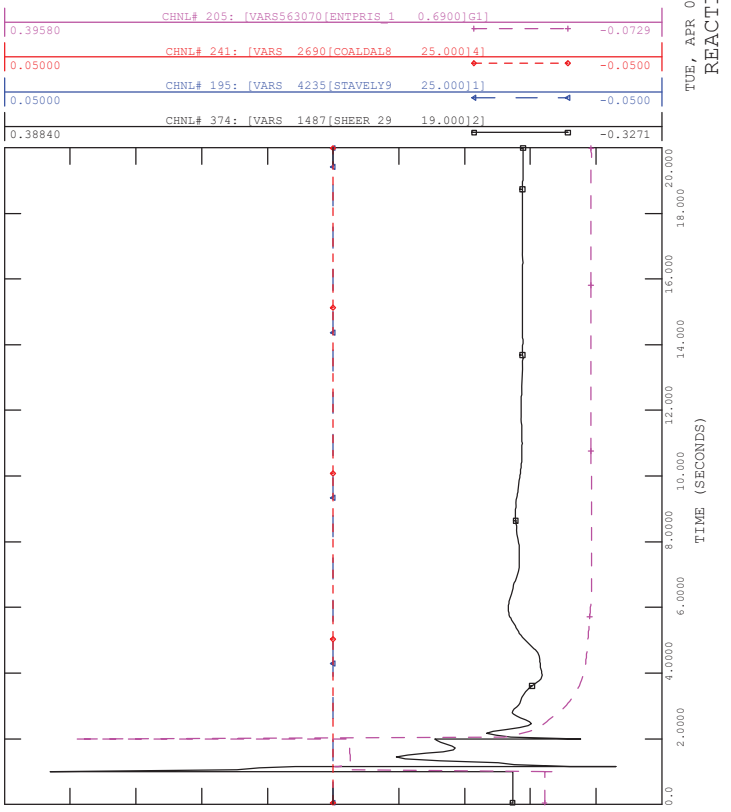
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_02_180L

FILE: Scn4_SL_02_180L.out

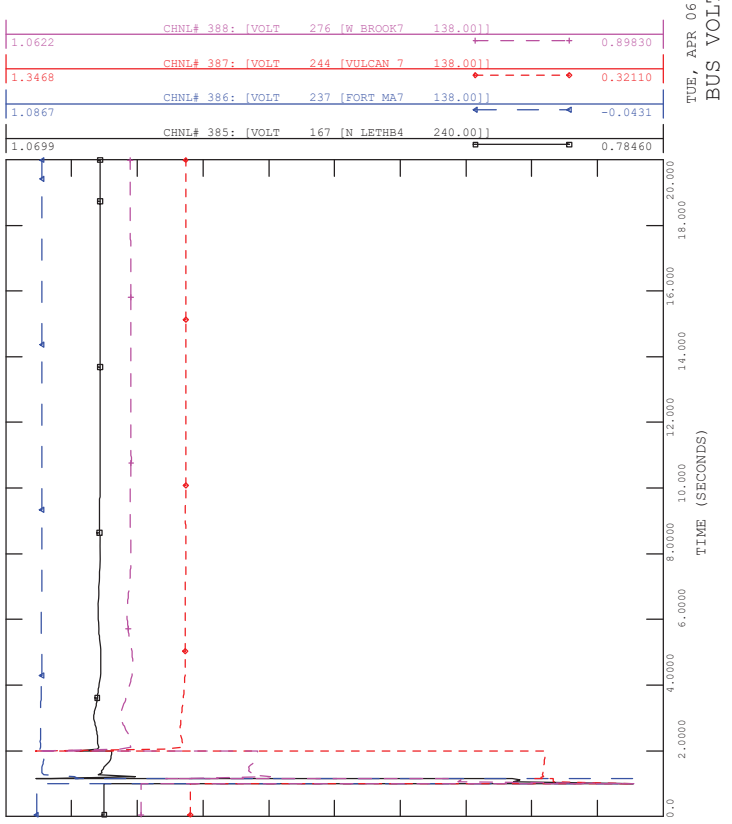
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_02_180L

FILE: Scn4_SL_02_180L.out

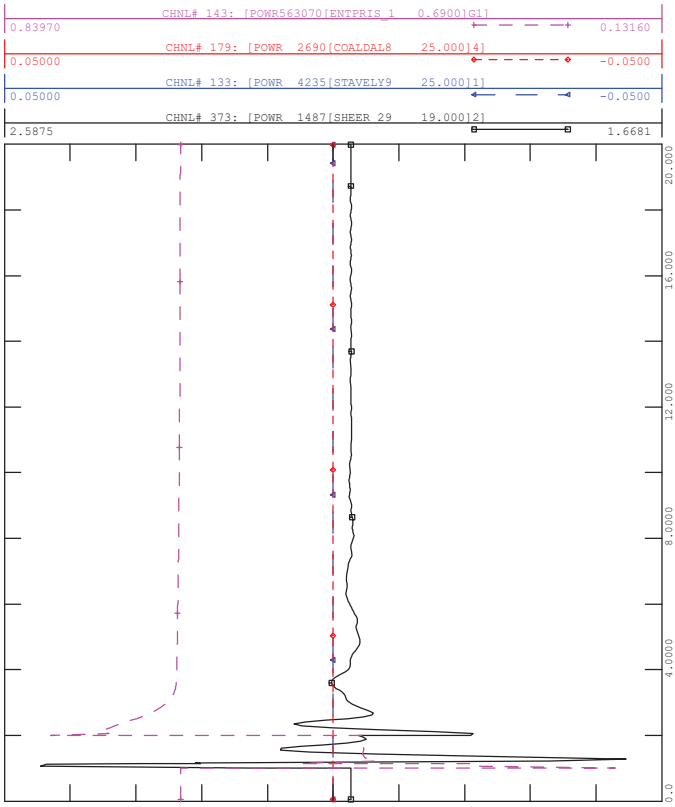
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_03_463L

FILE: Scn4_SL_03_463L.out

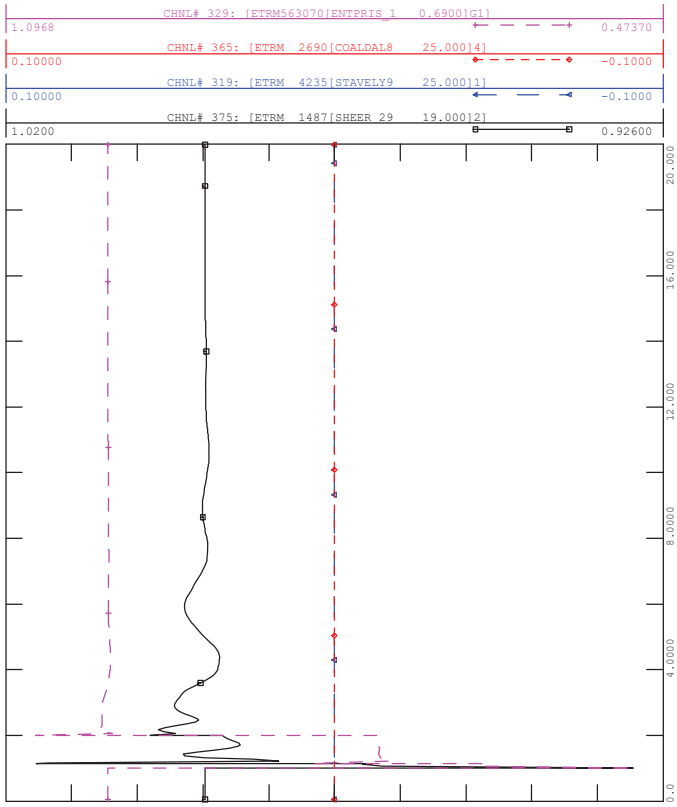
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_03_463L

FILE: Scn4_SL_03_463L.out

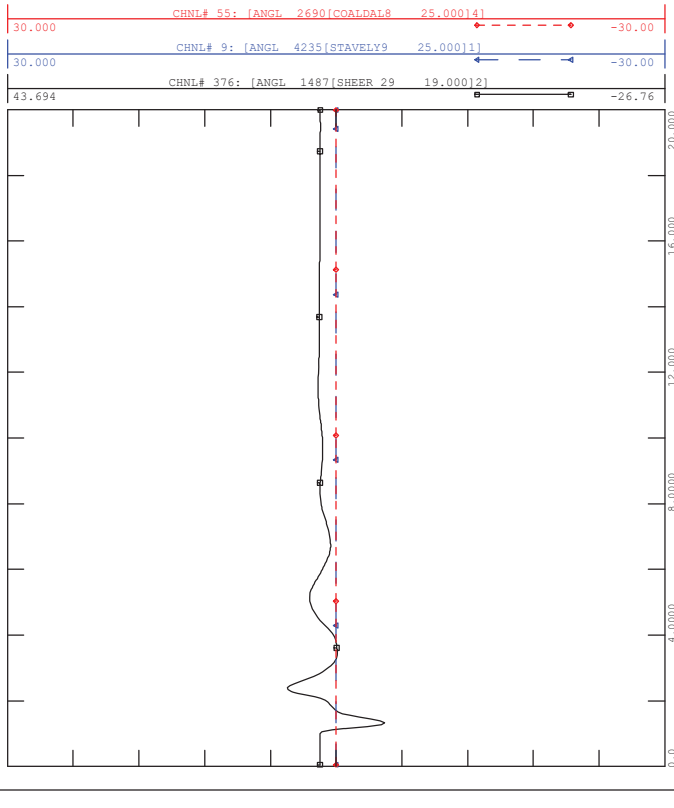
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_03_463L

FILE: Scn4_SL_03_463L.out

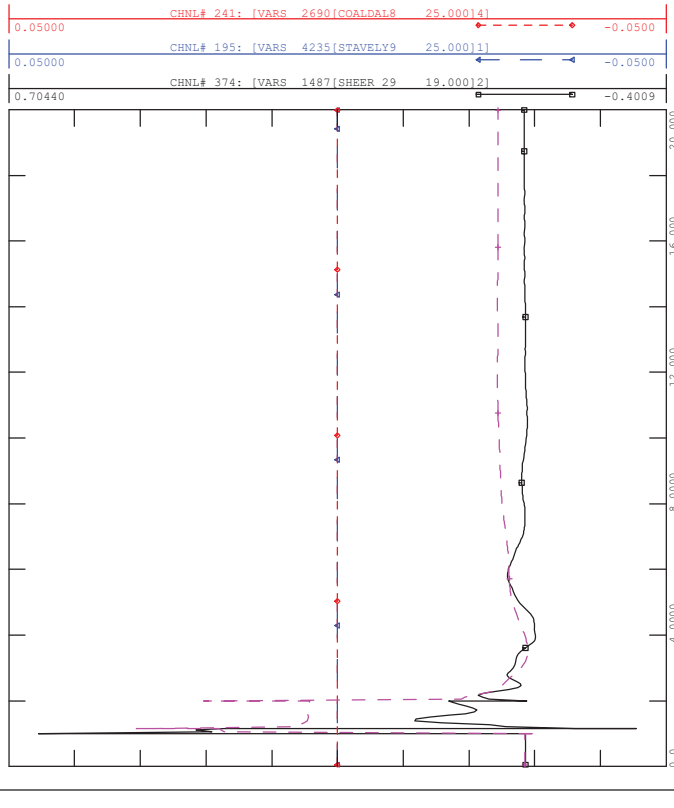
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_03_463L

FILE: Scn4_SL_03_463L.out

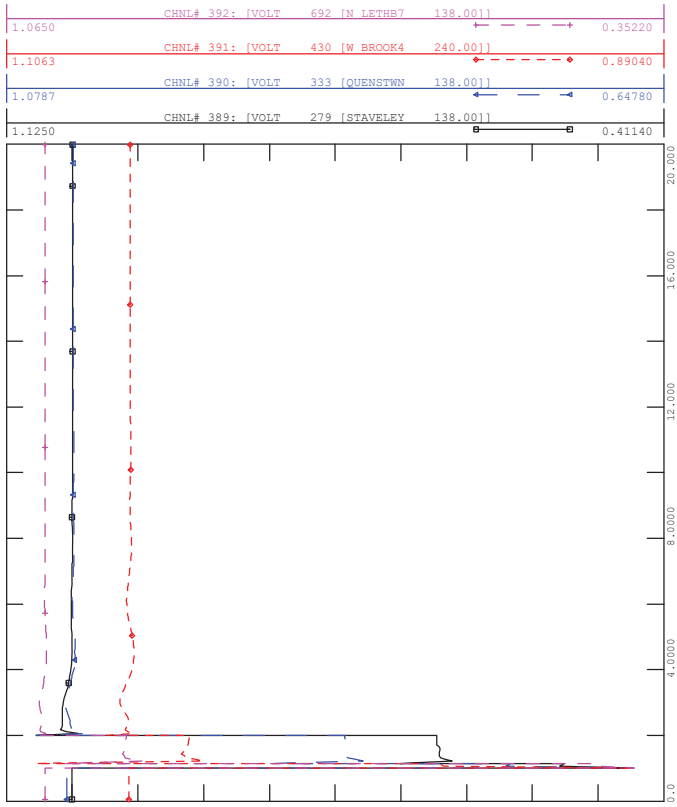
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_03_463L

FILE: Scn4_SL_03_463L.out

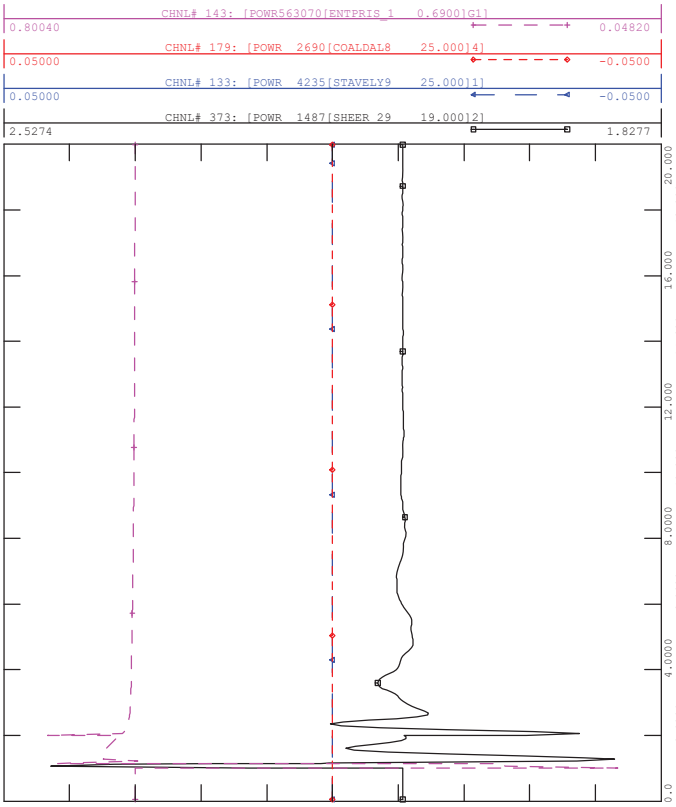
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_04_463L

FILE: Scn4_SL_04_463L.out

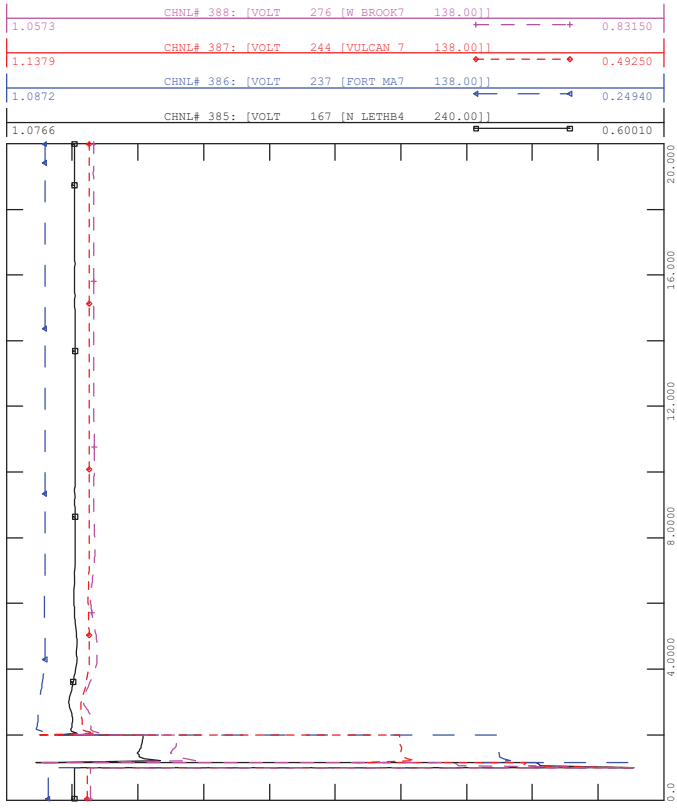
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_03_463L

FILE: Scn4_SL_03_463L.out

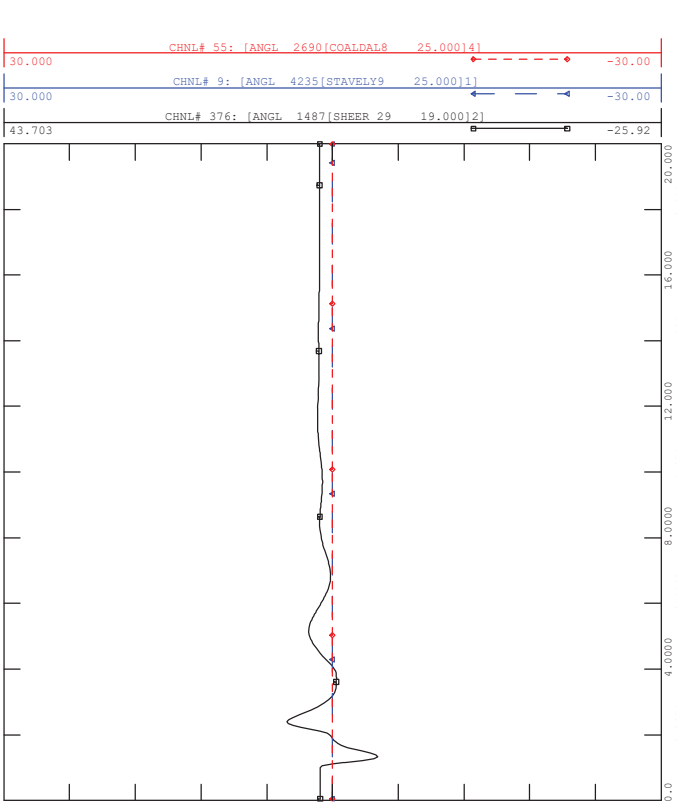
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_04_463L

FILE: Scn4_SL_04_463L.out

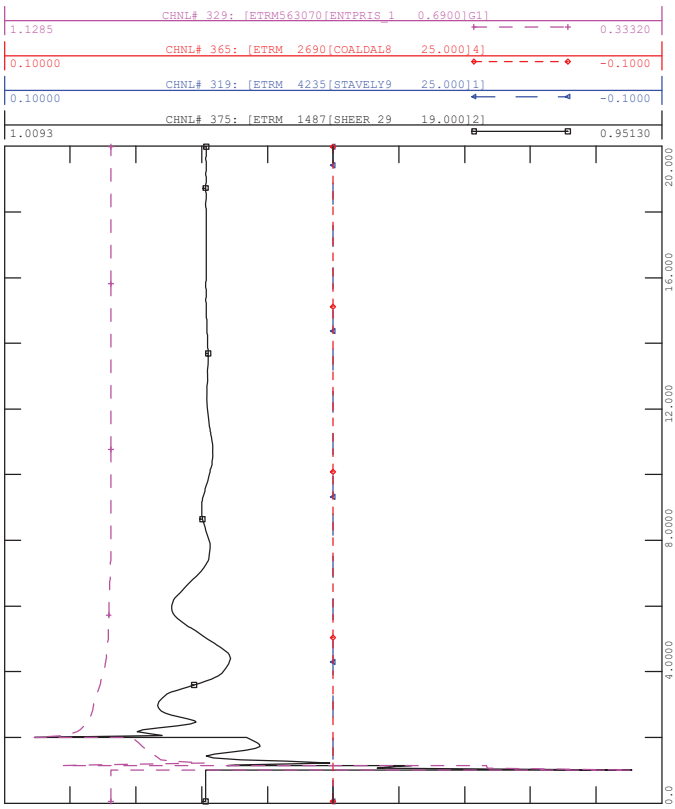
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_04_463L

FILE: Scn4_SL_04_463L.out

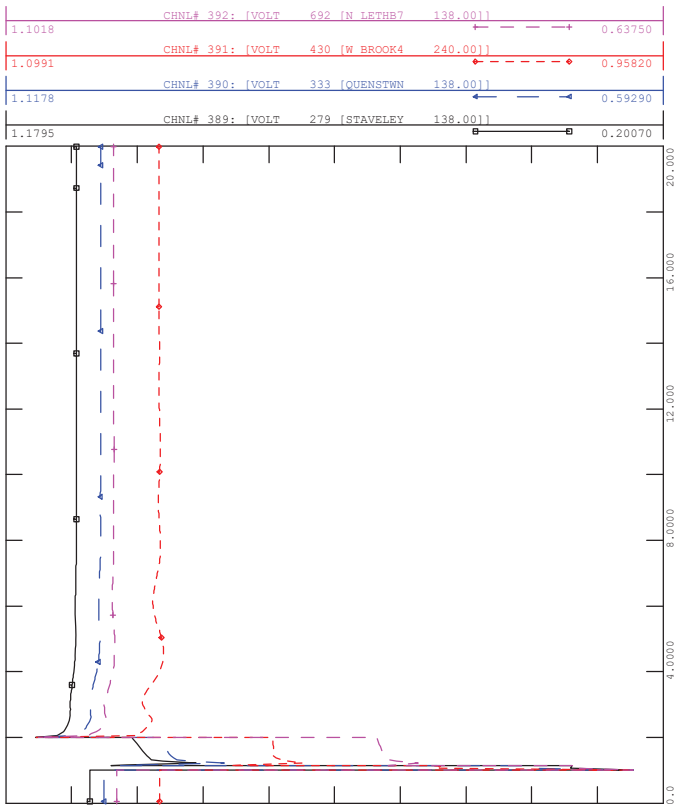
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_04_463L

FILE: Scn4_SL_04_463L.out

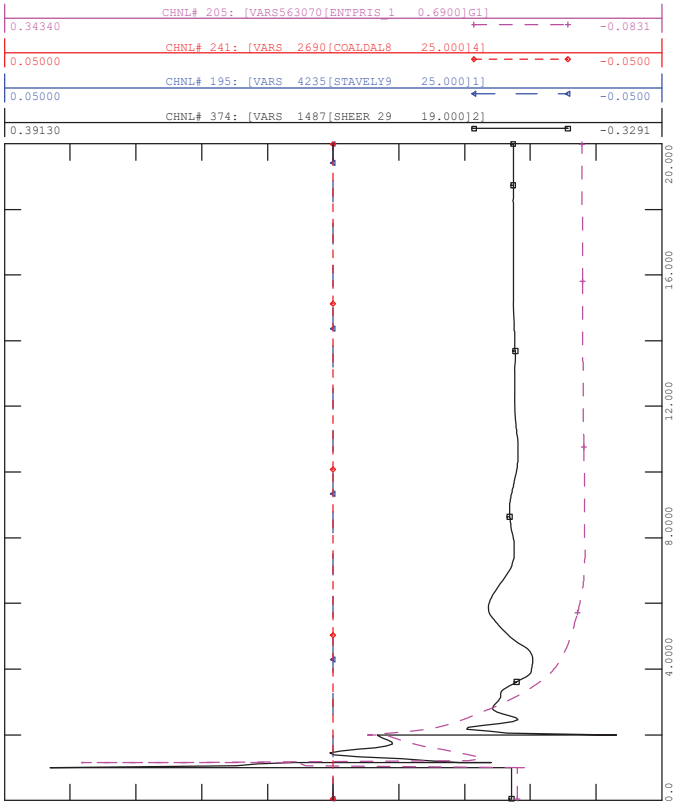
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_04_463L

FILE: Scn4_SL_04_463L.out

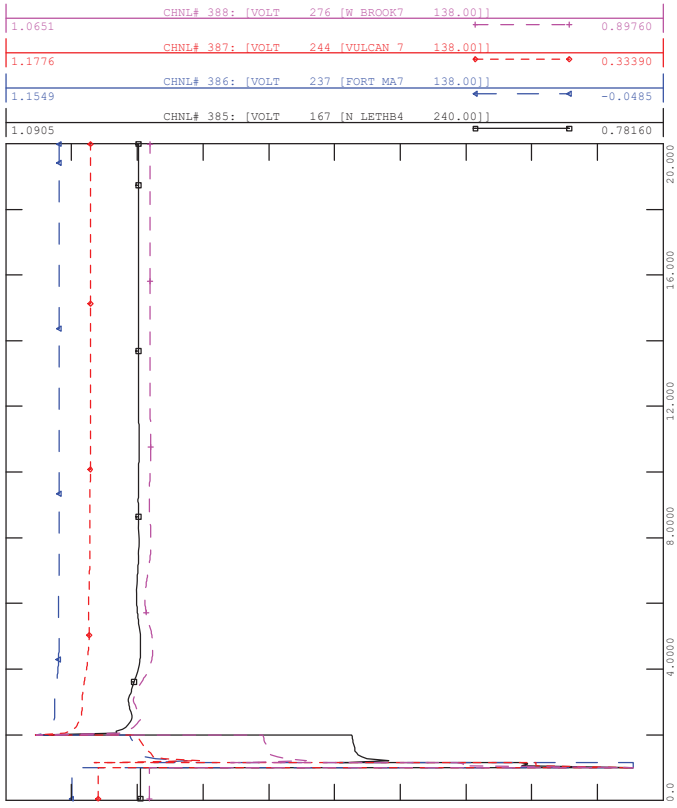
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_04_463L

FILE: Scn4_SL_04_463L.out

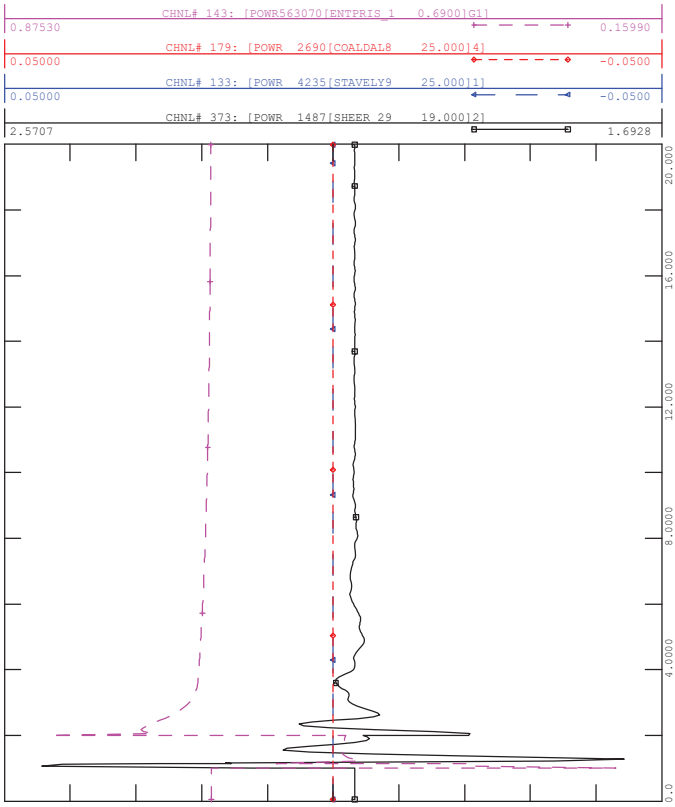
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_05_725L

FILE: Scn4_SL_05_725L.out

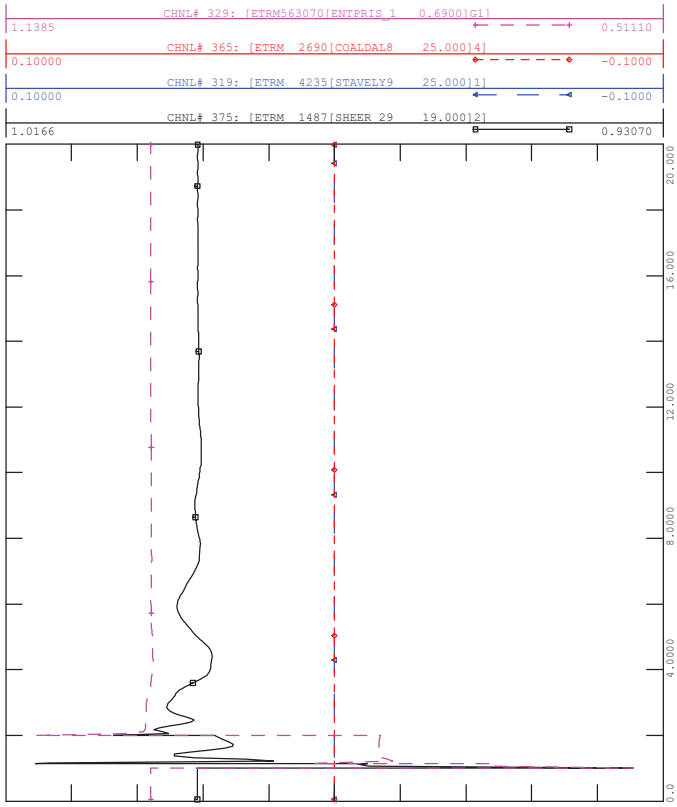
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_05_725L

FILE: Scn4_SL_05_725L.out

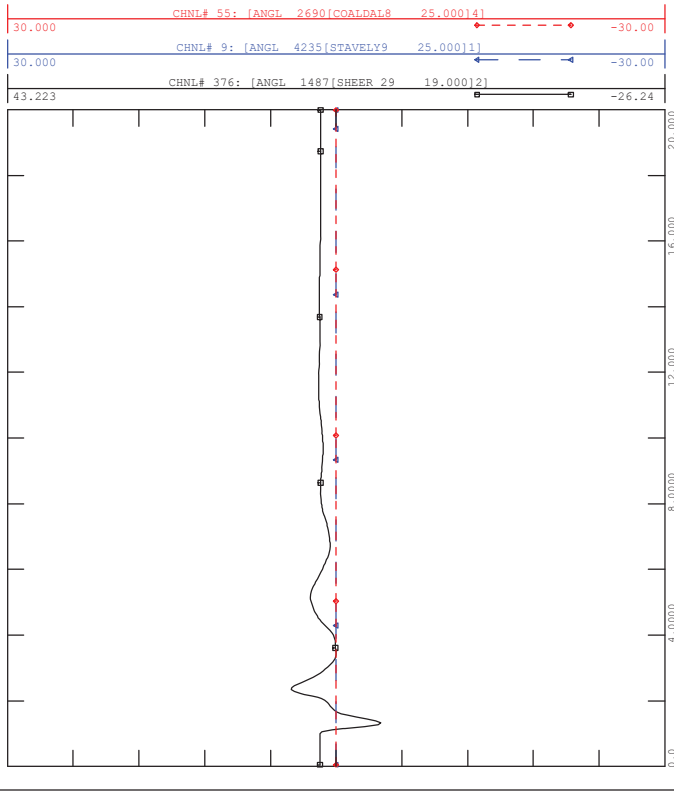
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_05_725L

FILE: Scn4_SL_05_725L.out

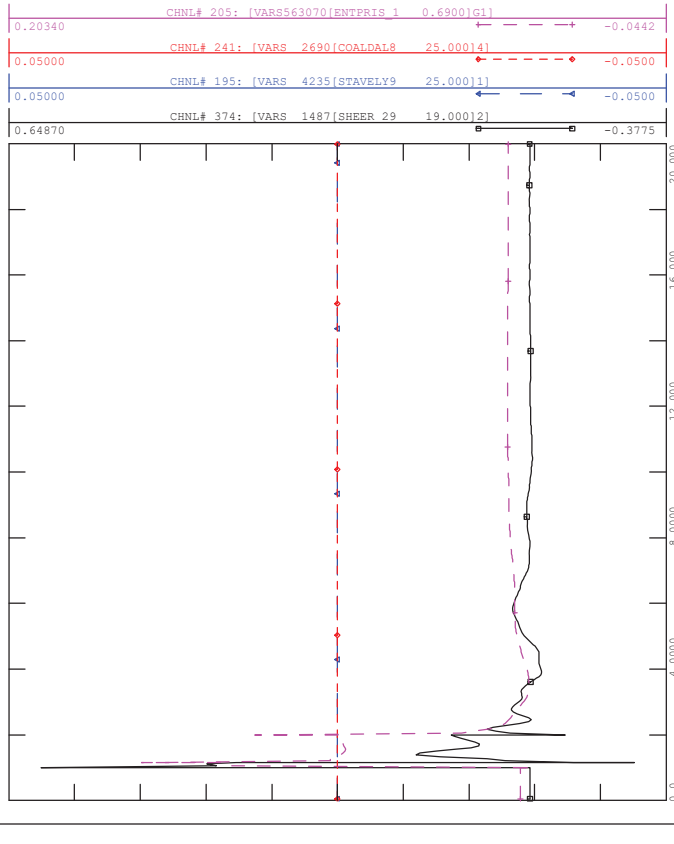
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_05_725L

FILE: Scn4_SL_05_725L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

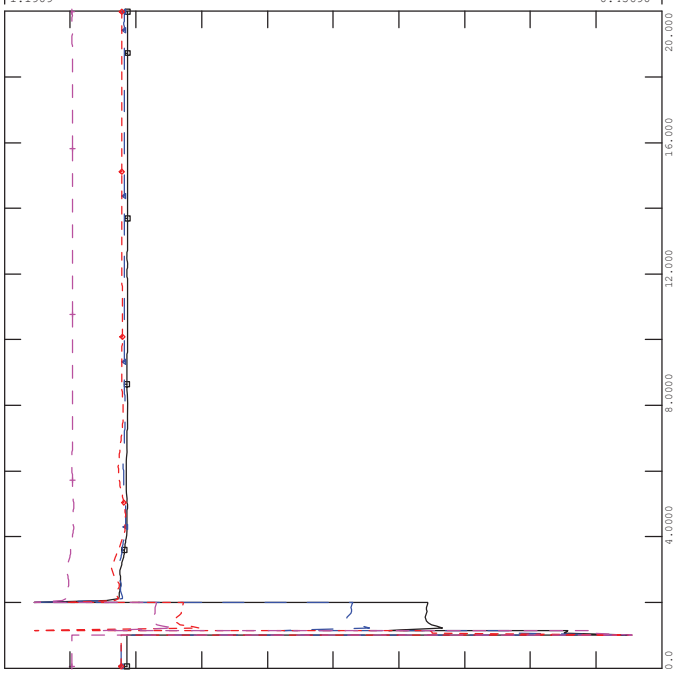


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_05_725L

FILE: Scn4_SL_05_725L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.0953 0.39500
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.1013 0.90310
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.1179 0.67540
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.1909 0.45690

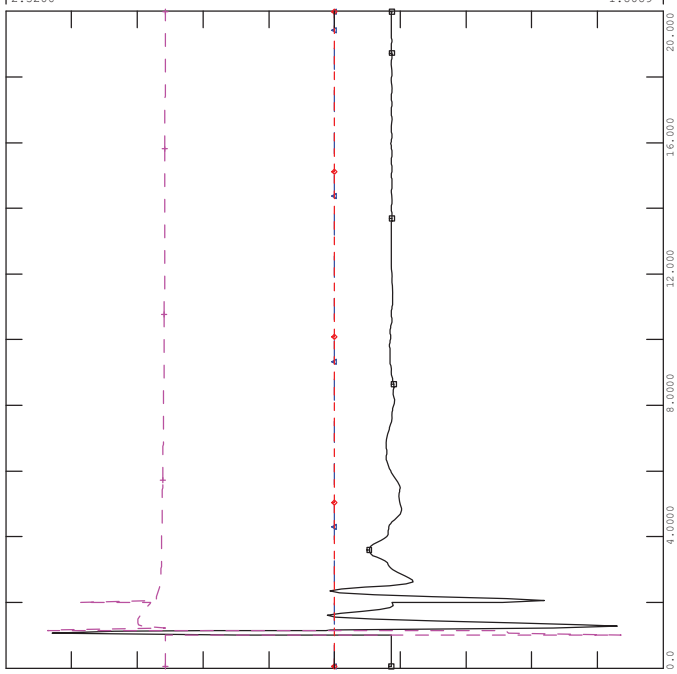


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_06_725L

FILE: Scn4_SL_06_725L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.84010 0.05680
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
2.5206 1.8089

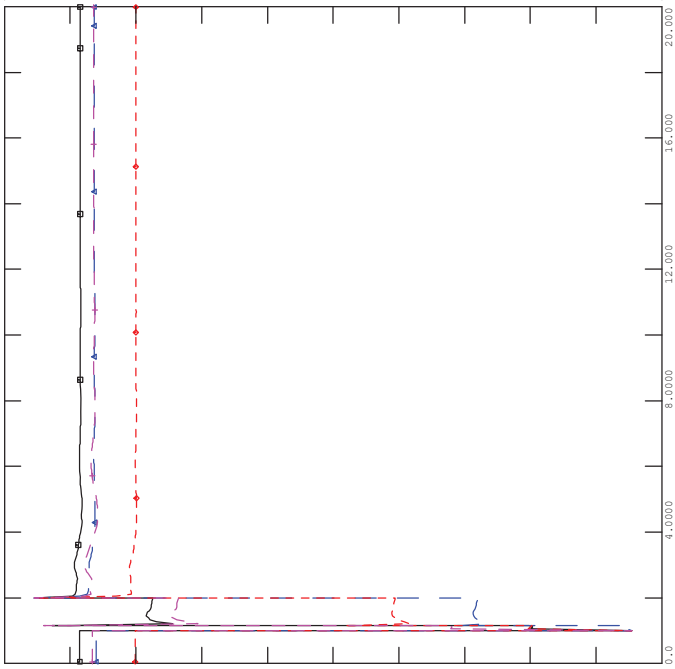


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_05_725L

FILE: Scn4_SL_05_725L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0568 0.84550
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.1893 0.53300
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.1522 0.30650
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.0790 0.62710

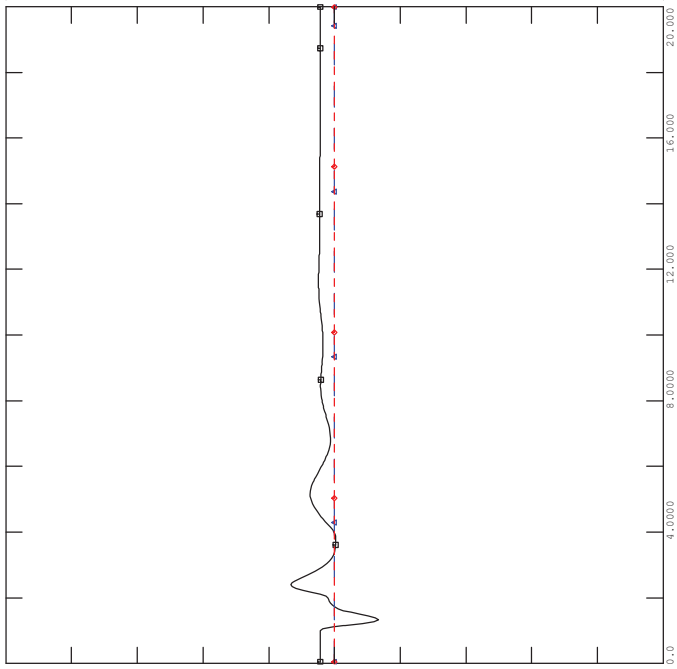


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_06_725L

FILE: Scn4_SL_06_725L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

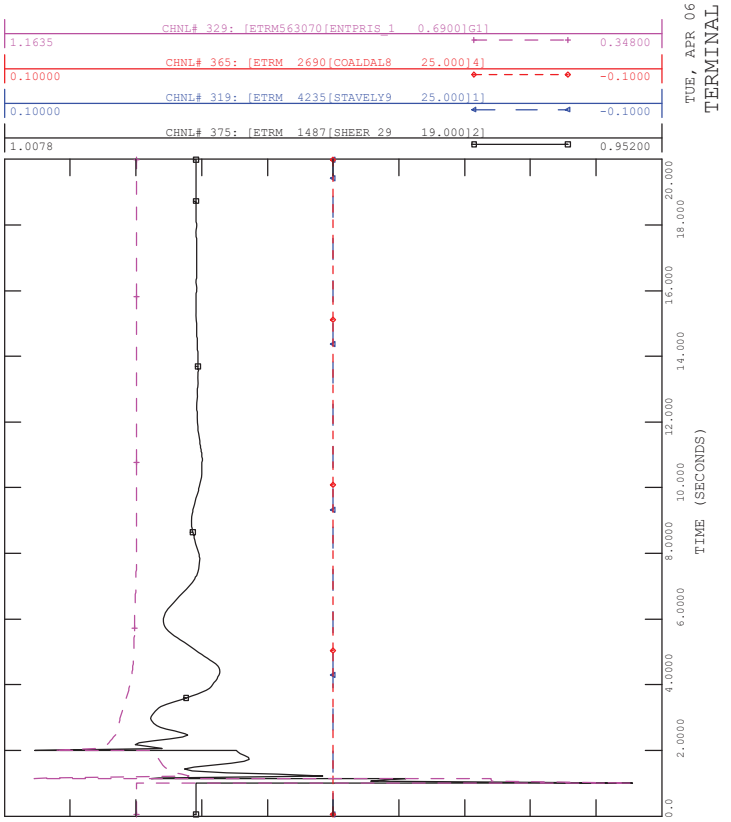
CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
30.000 -30.00
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
30.000 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
43.345 -25.87



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_06_725L

FILE: Scn4_SL_06_725L.out

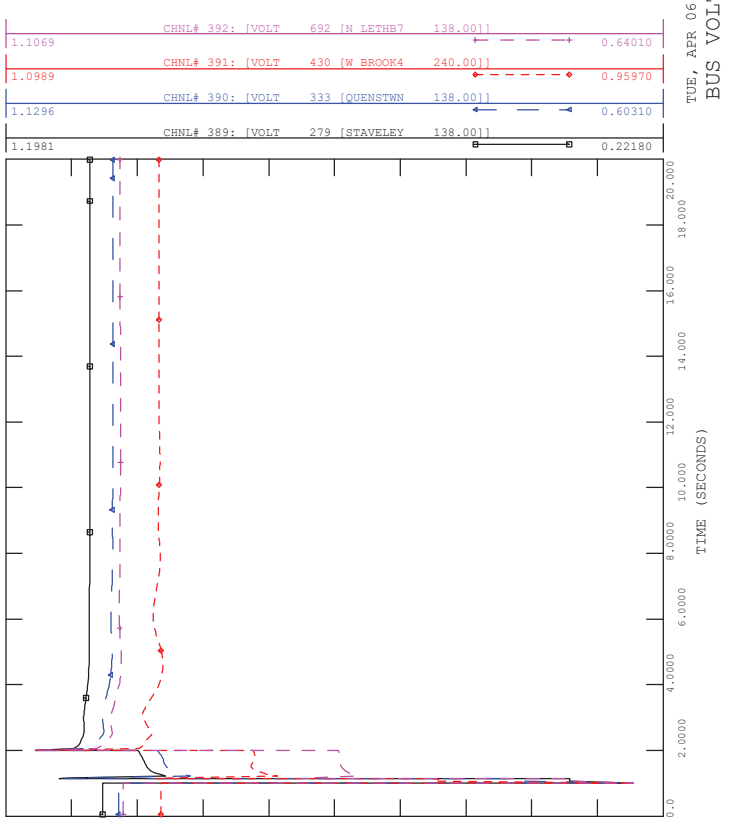
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_06_725L

FILE: Scn4_SL_06_725L.out

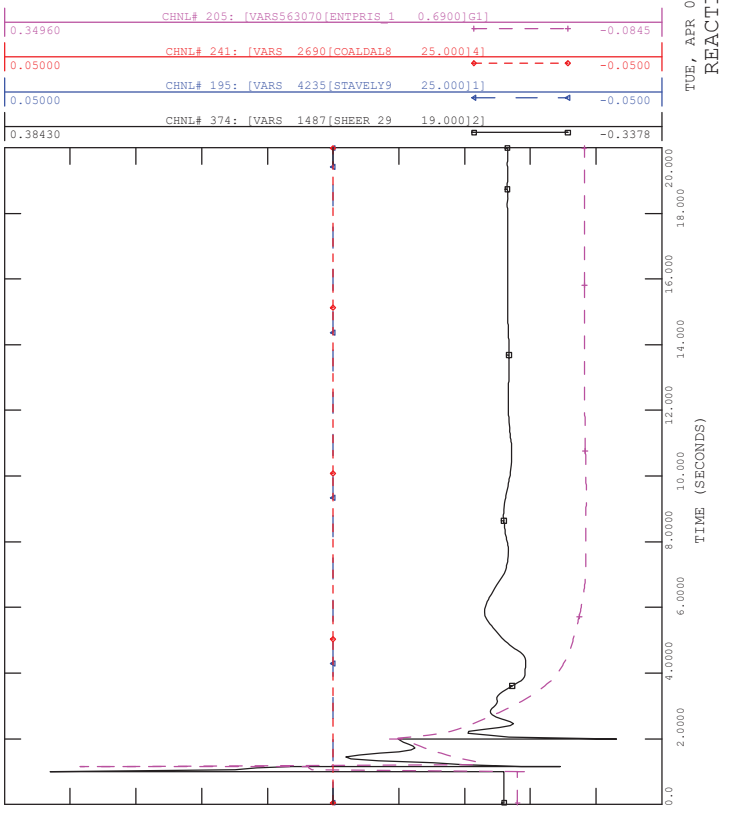
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_06_725L

FILE: Scn4_SL_06_725L.out

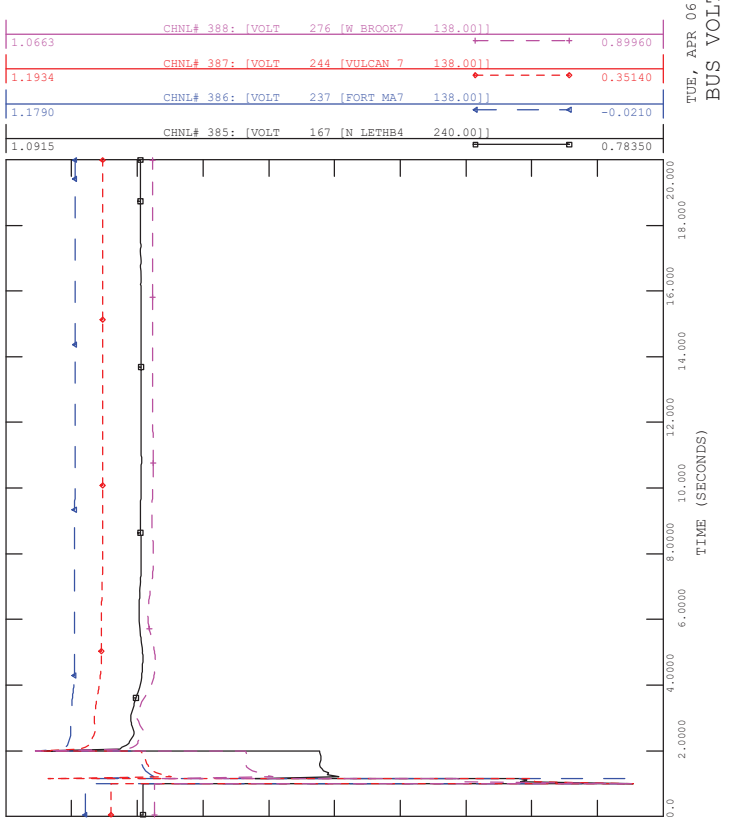
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_06_725L

FILE: Scn4_SL_06_725L.out

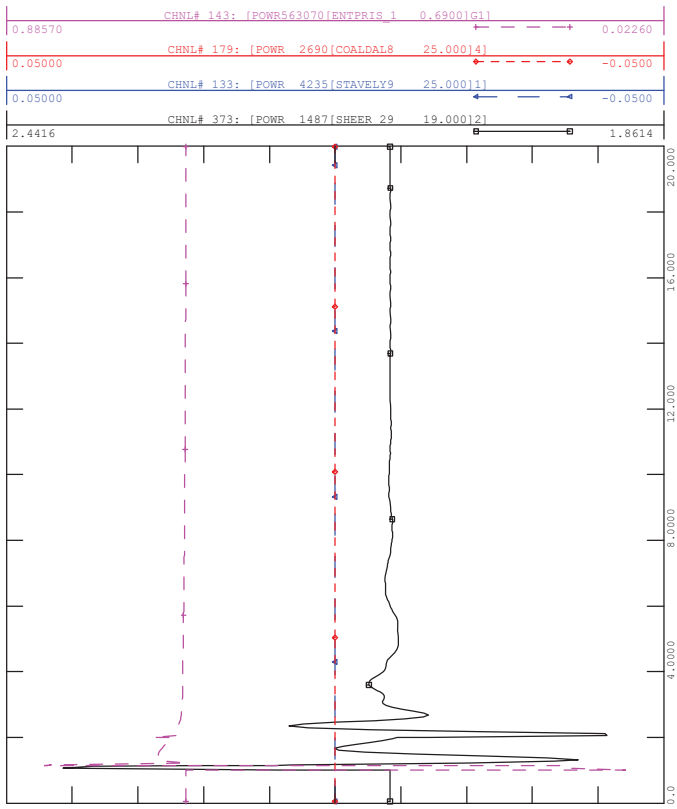
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_07_853L

FILE: Scn4_SL_07_853L.out

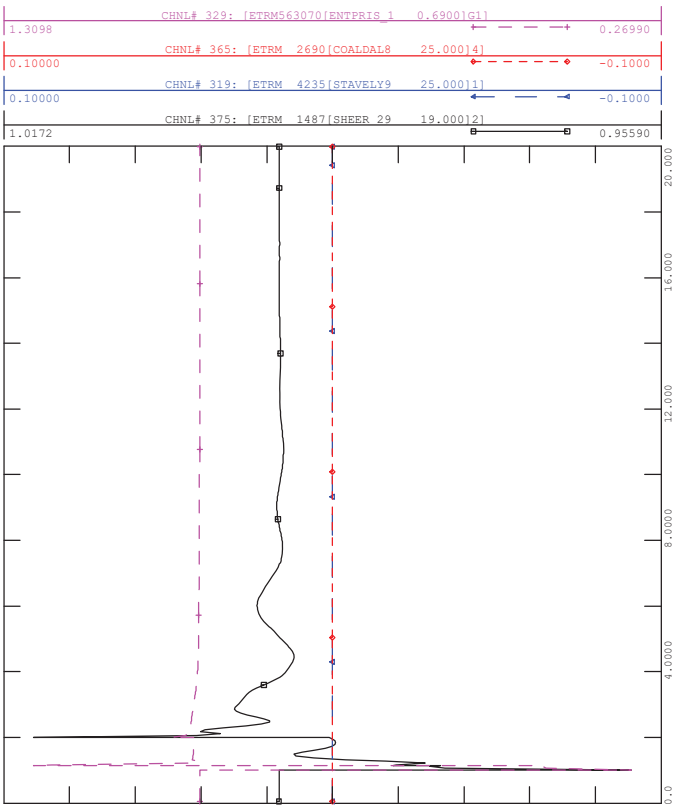
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_07_853L

FILE: Scn4_SL_07_853L.out

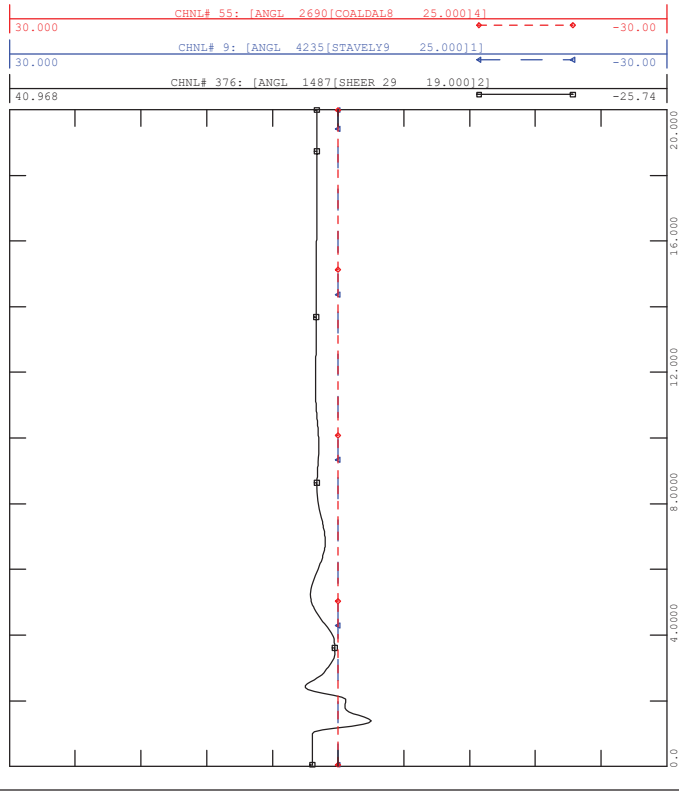
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_07_853L

FILE: Scn4_SL_07_853L.out

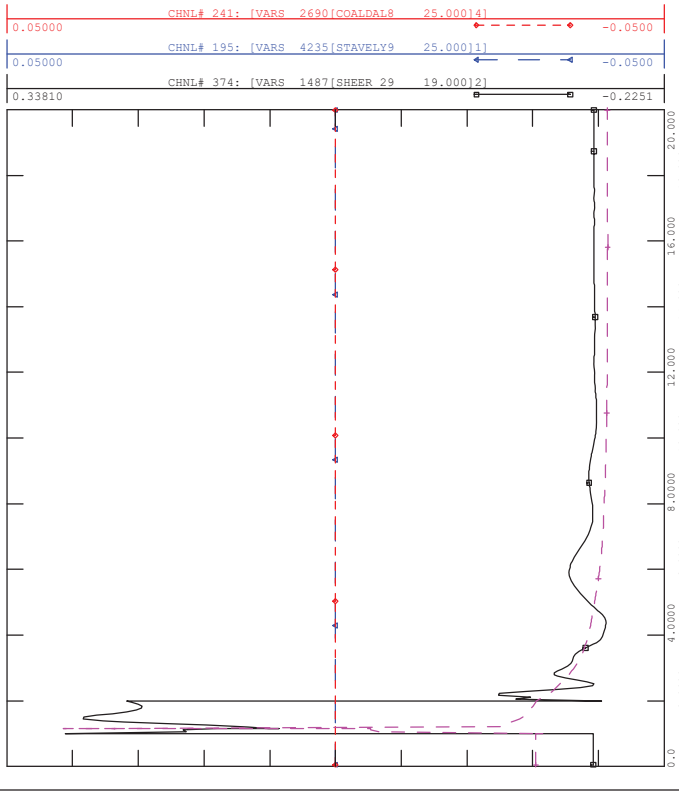
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_07_853L

FILE: Scn4_SL_07_853L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

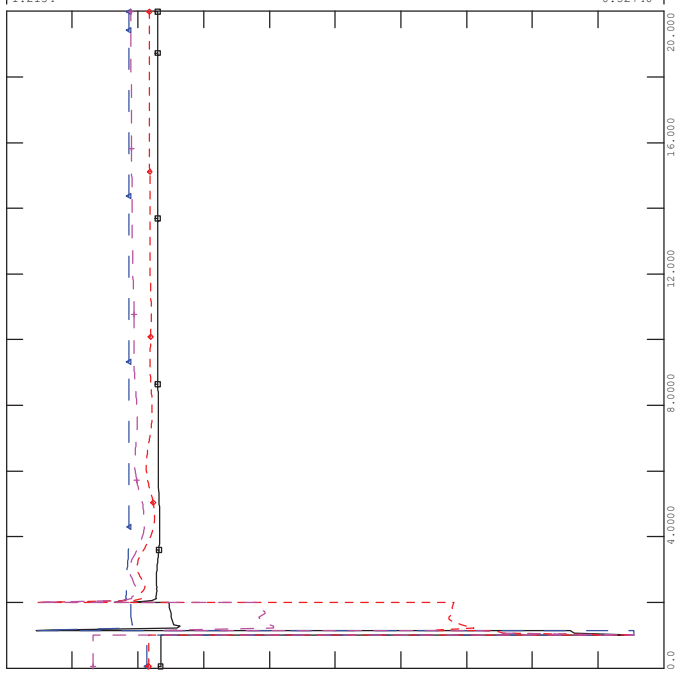


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_07_853L

FILE: Scn4_SL_07_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.0395 0.91690
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.0929 0.96900
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.3369 -0.0602
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.2154 0.52740

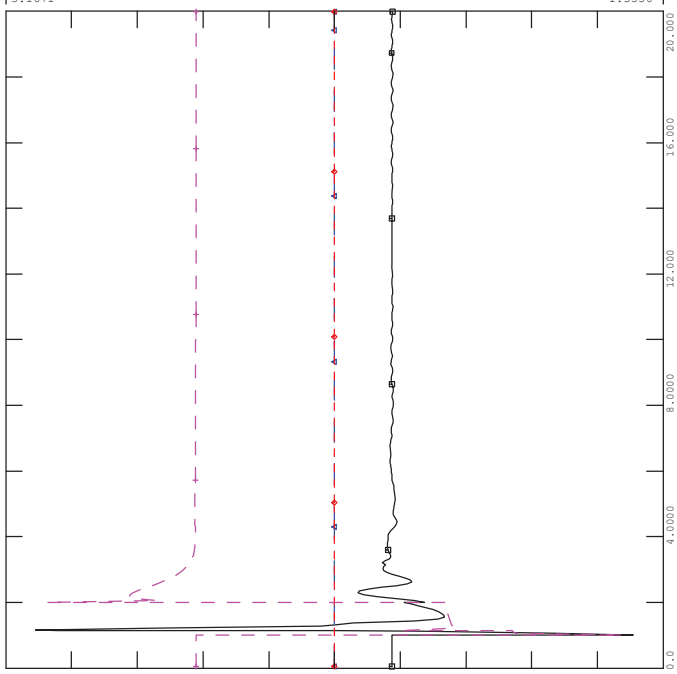


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_08_853L

FILE: Scn4_SL_08_853L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.88680 0.06930
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
3.1671 1.3556

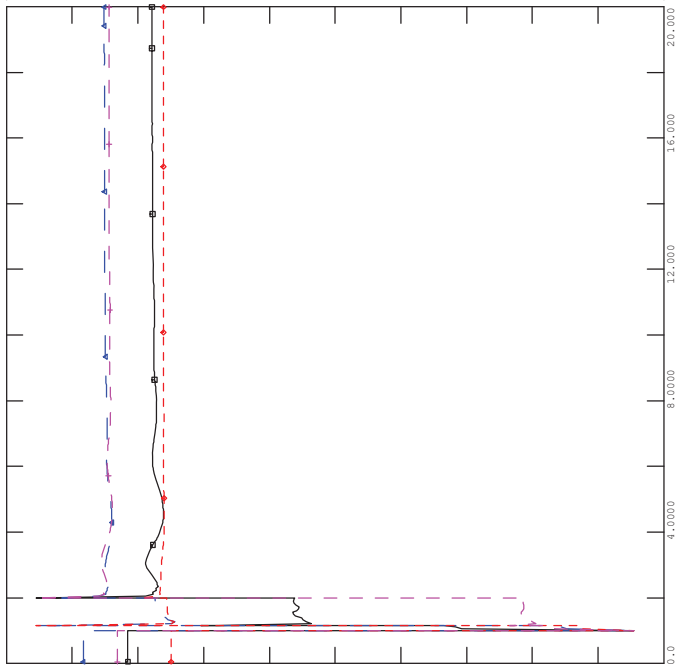


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_07_853L

FILE: Scn4_SL_07_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0599 0.87410
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.3052 0.32240
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0652 0.79940
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.0453 0.94730

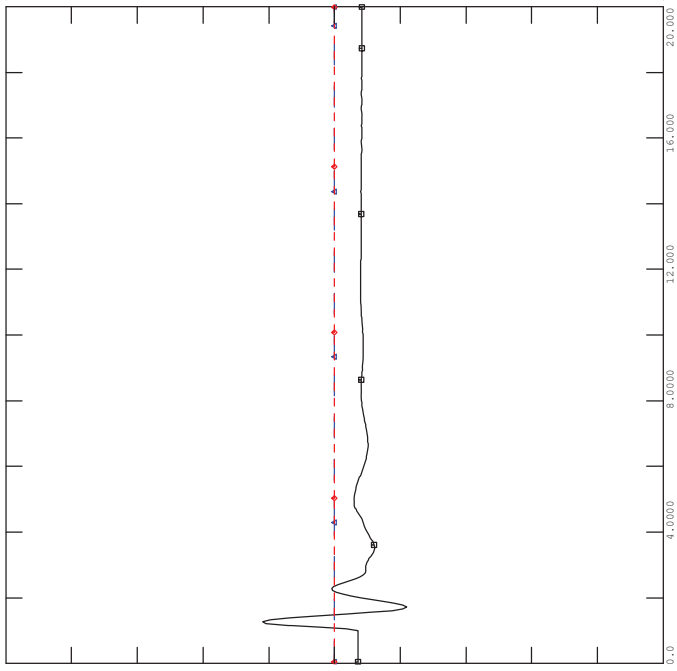


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_08_853L

FILE: Scn4_SL_08_853L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

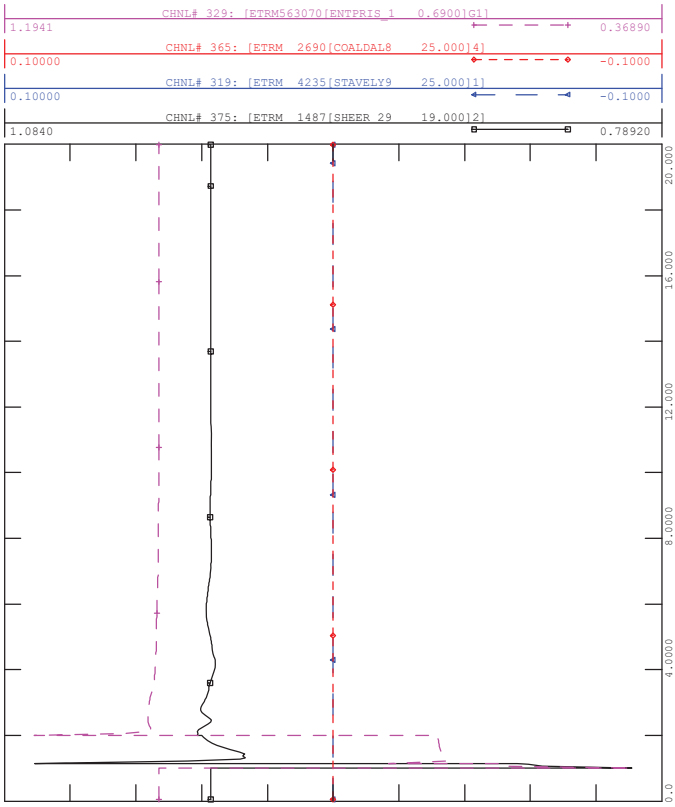
CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
30.000 -30.00
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
30.000 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
51.364 -25.42



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_08_853L

FILE: Scn4_SL_08_853L.out

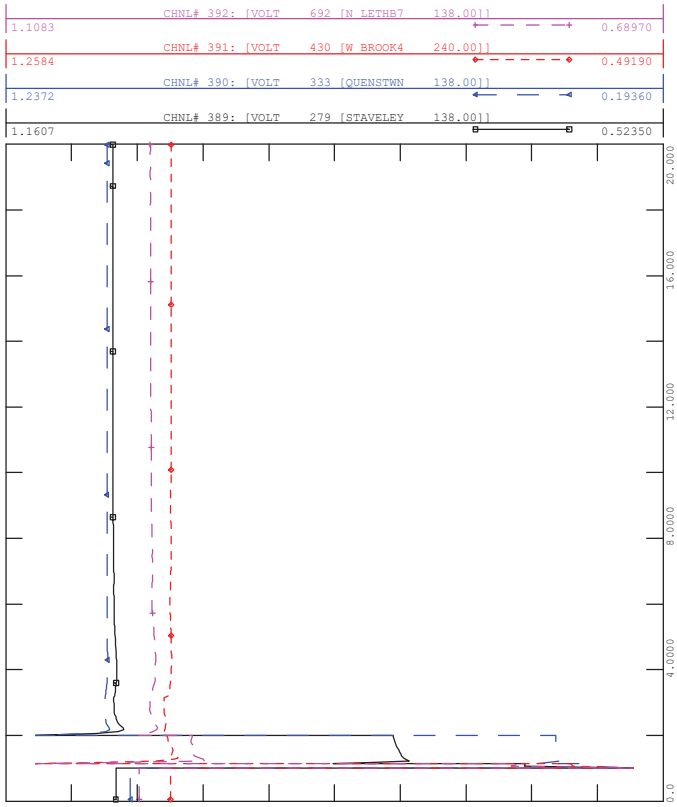
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_08_853L

FILE: Scn4_SL_08_853L.out

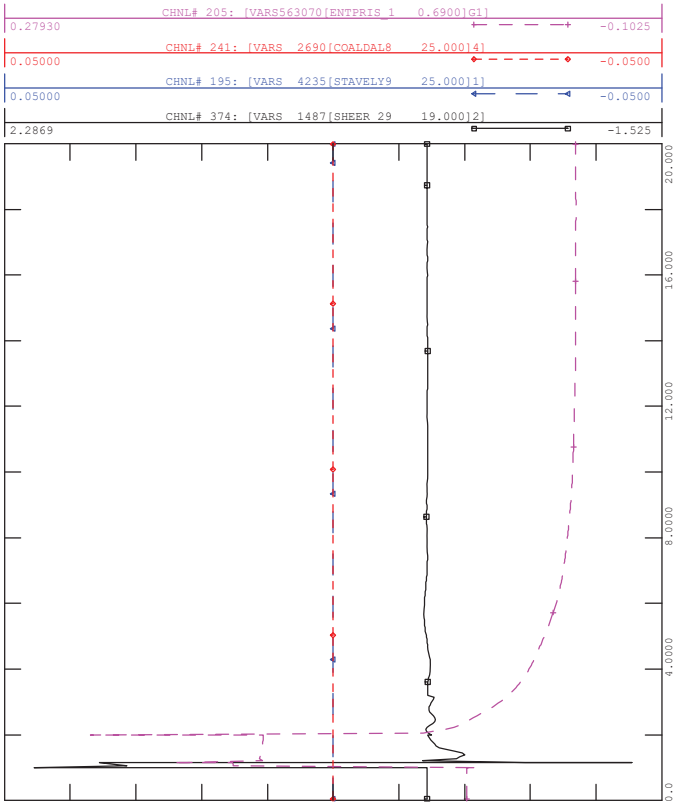
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_08_853L

FILE: Scn4_SL_08_853L.out

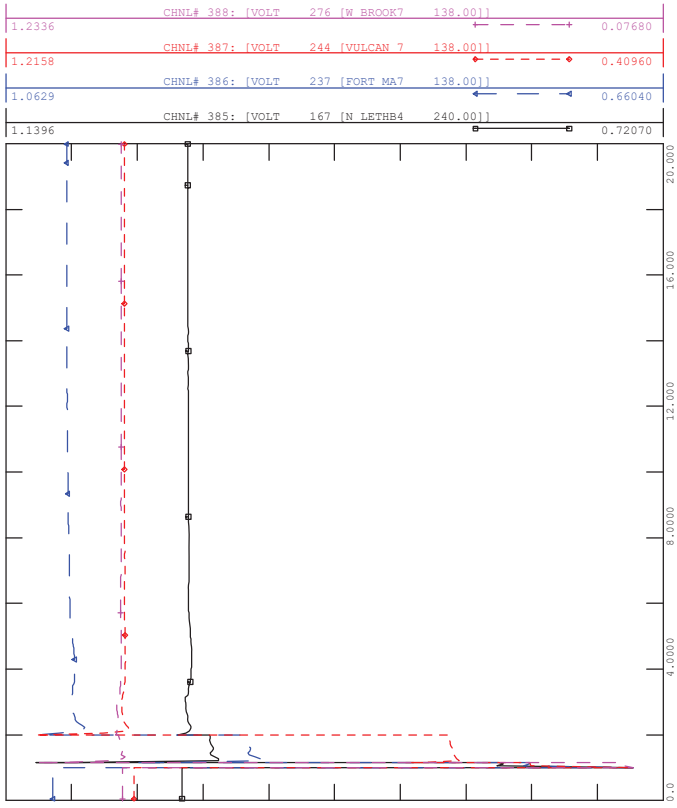
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_08_853L

FILE: Scn4_SL_08_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

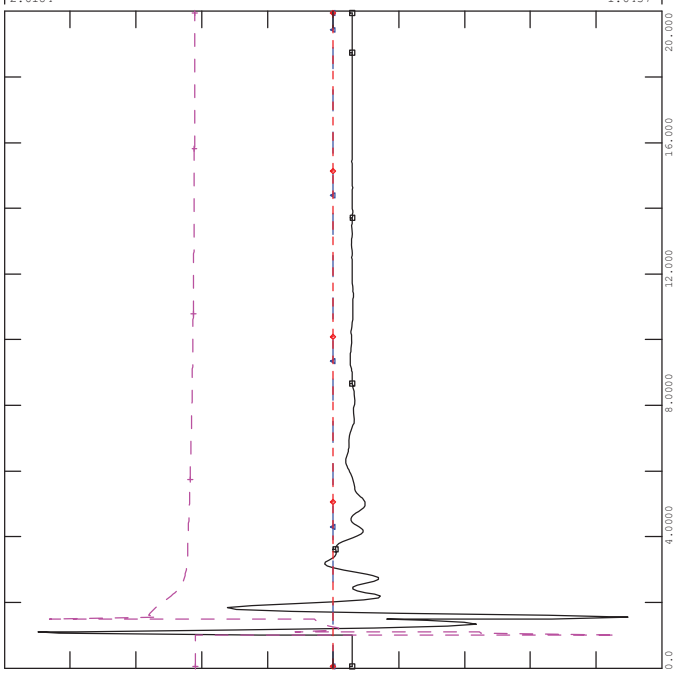


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_09_172L

FILE: Scn4_SL_09_172L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.86210 0.13110
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
2.6184 1.6437

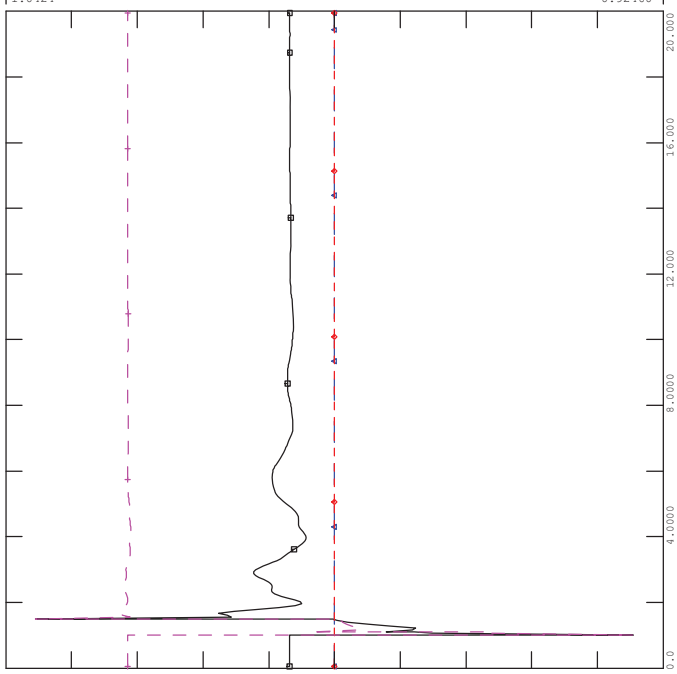


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_09_172L

FILE: Scn4_SL_09_172L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 329: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.1204 0.47190
CHNL# 365: [ETRM 2690[COALDAL8 25.000]4]
0.10000 -0.1000
CHNL# 319: [ETRM 4235[STAVELY9 25.000]1]
0.10000 -0.1000
CHNL# 375: [ETRM 1487[SHEER 29 19.000]2]
1.0424 0.92460

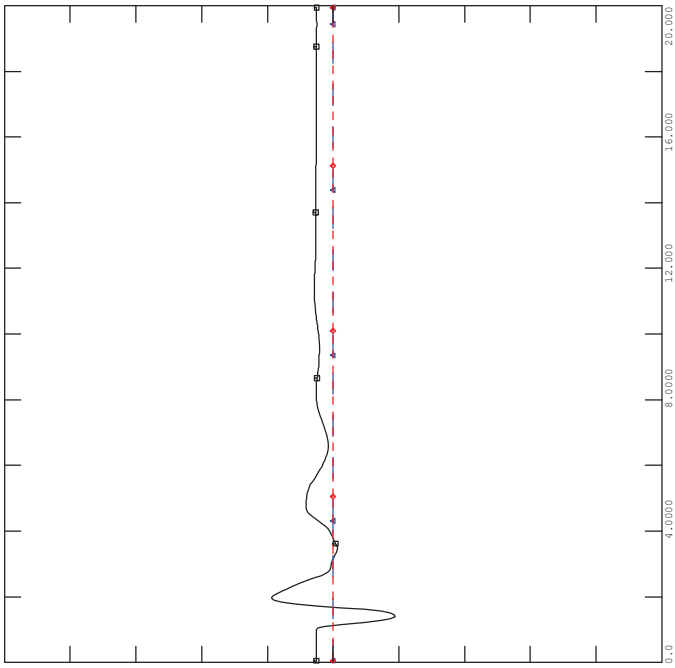


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_09_172L

FILE: Scn4_SL_09_172L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
30.000 -30.00
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
30.000 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
45.280 -28.62

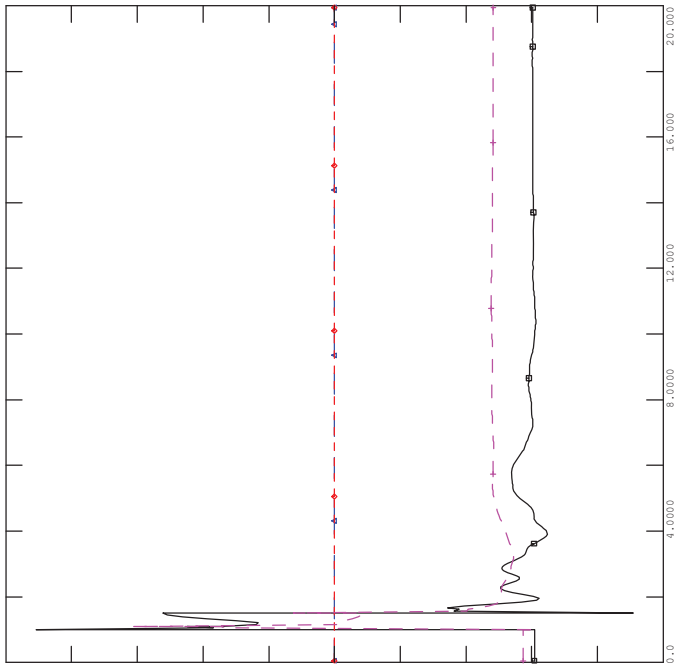


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_09_172L

FILE: Scn4_SL_09_172L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

CHNL# 205: [VARS563070[ENTPRIS_1 0.6900]G1]
0.21480 -0.0446
CHNL# 241: [VARS 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 195: [VARS 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 374: [VARS 1487[SHEER 29 19.000]2]
0.70800 -0.3773

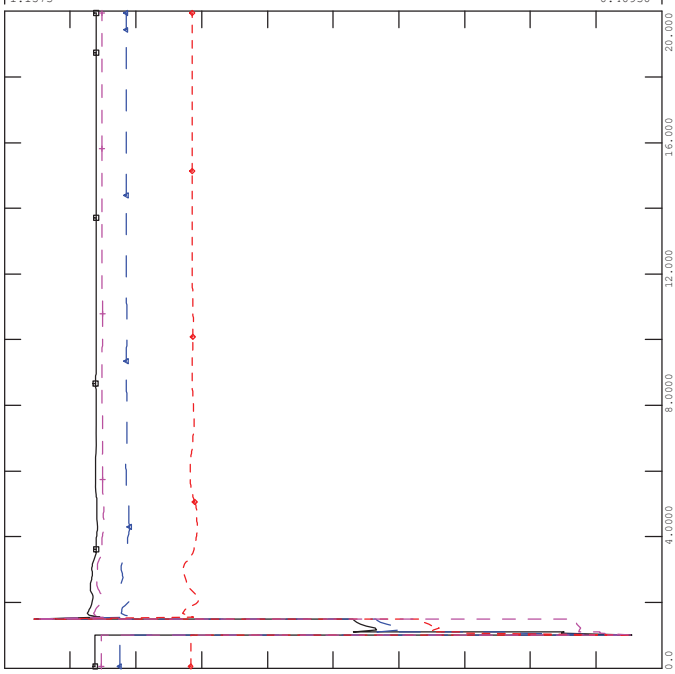


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_09_172L

FILE: Scn4_SL_09_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.1407 0.34510
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.1364 0.88810
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.1230 0.64490
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.1573 0.40930

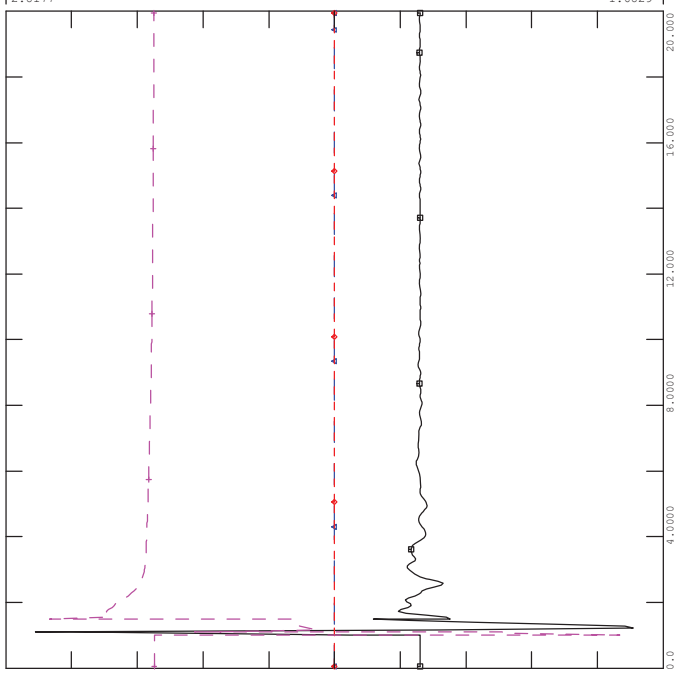


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_10_172L

FILE: Scn4_SL_10_172L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.81980 0.06750
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
2.8177 1.6829

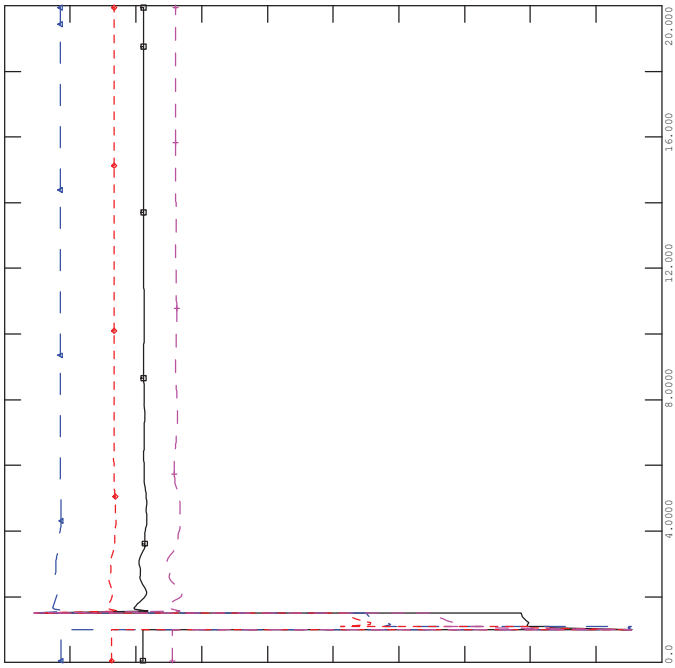


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_09_172L

FILE: Scn4_SL_09_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0970 0.82870
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.1698 0.49040
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.1079 0.24850
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.1425 0.59480

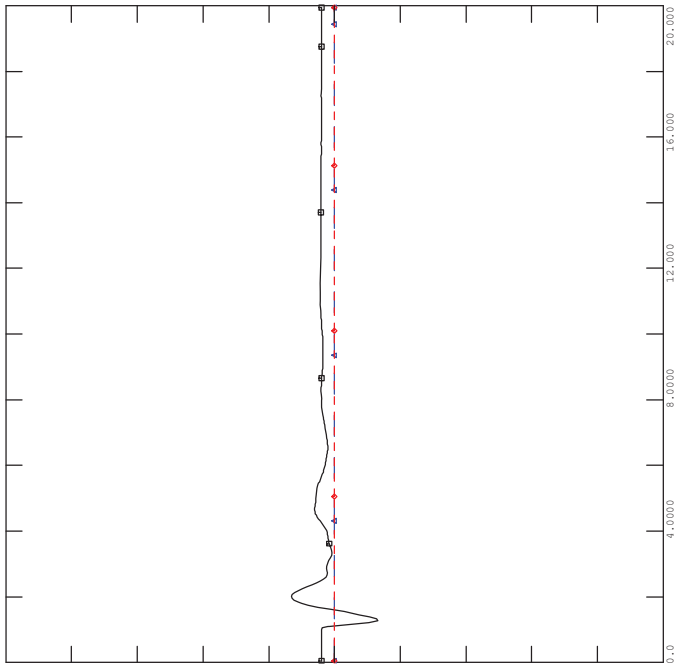


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_10_172L

FILE: Scn4_SL_10_172L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
30.000 -30.00
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
30.000 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
43.361 -25.71

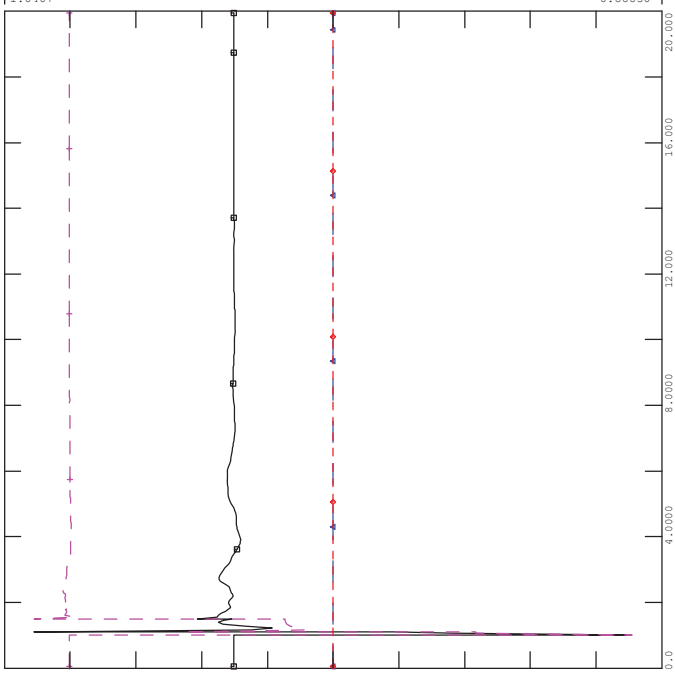


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_10_172L

FILE: Scn4_SL_10_172L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 329: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.0688 0.37160
CHNL# 365: [ETRM 2690[COALDAL8 25.000]4]
0.10000 -0.1000
CHNL# 319: [ETRM 4235[STAVELY9 25.000]1]
0.10000 -0.1000
CHNL# 375: [ETRM 1487[SHEER 29 19.000]2]
1.0467 0.88850

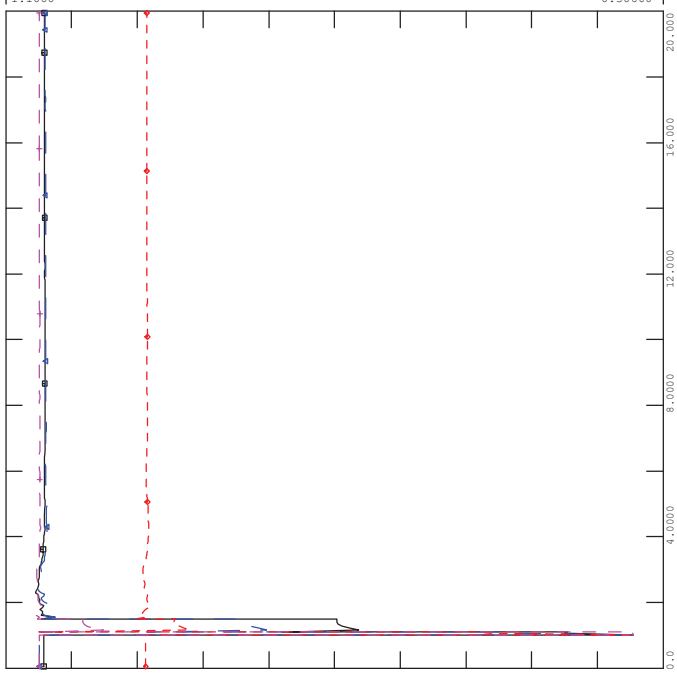


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_10_172L

FILE: Scn4_SL_10_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.0802 -0.0445
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.1405 0.79120
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.0661 0.54020
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.1000 0.30660

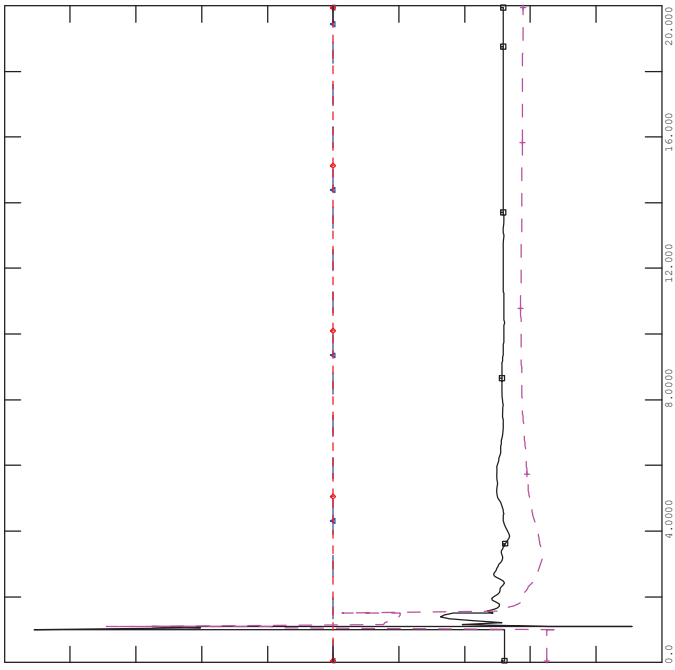


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_10_172L

FILE: Scn4_SL_10_172L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

CHNL# 205: [VARS563070[ENTPRIS_1 0.6900]G1]
0.27720 -0.0457
CHNL# 241: [VARS 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 195: [VARS 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 374: [VARS 1487[SHEER 29 19.000]2]
1.1497 -0.5781

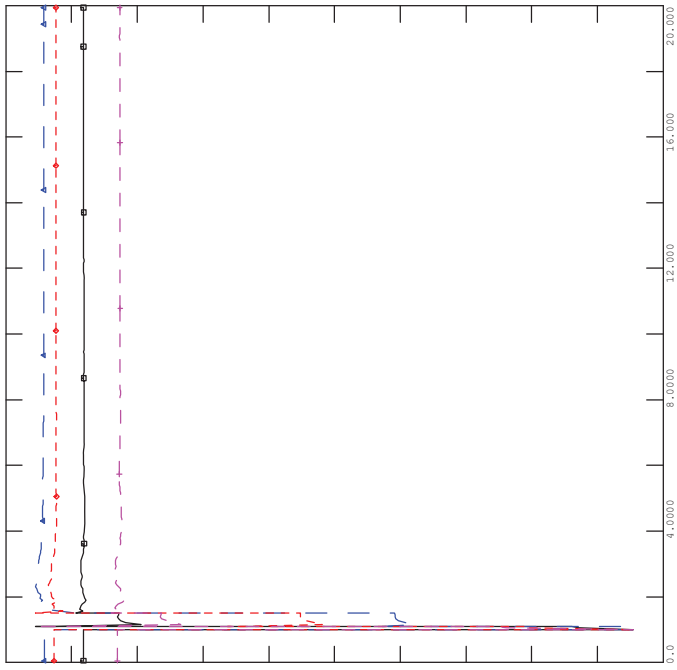


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_10_172L

FILE: Scn4_SL_10_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.0910 0.72250
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.1119 0.38470
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0900 0.13350
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.1157 0.36400



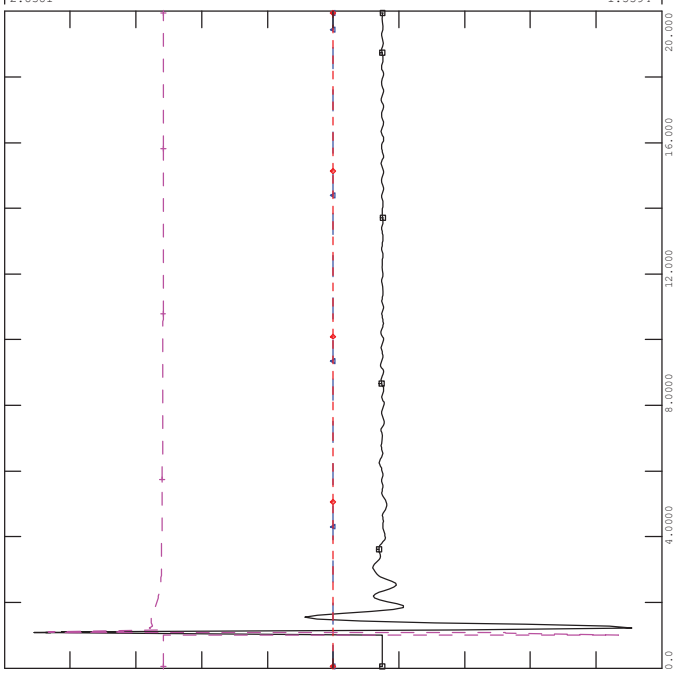
SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_11_1041L

FILE: Scn4_SL_11_1041L.out

TUE, APR 06 2021 18:57

ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.83250 0.07860
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
2.8381 1.5594



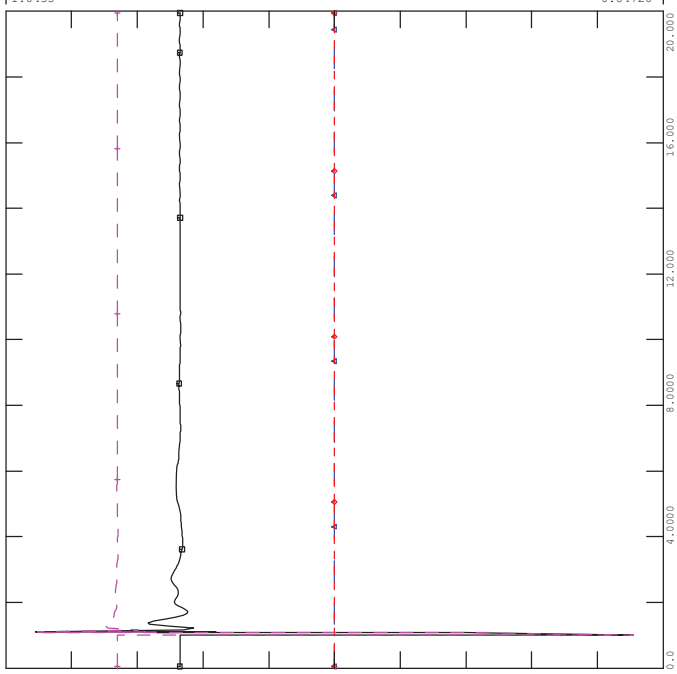
SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_11_1041L

FILE: Scn4_SL_11_1041L.out

TUE, APR 06 2021 18:57

TERMINAL VOLTAGE

CHNL# 329: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.1249 0.38920
CHNL# 365: [ETRM 2690[COALDAL8 25.000]4]
0.10000 -0.1000
CHNL# 319: [ETRM 4235[STAVELY9 25.000]1]
0.10000 -0.1000
CHNL# 375: [ETRM 1487[SHEER 29 19.000]2]
1.0435 0.84720



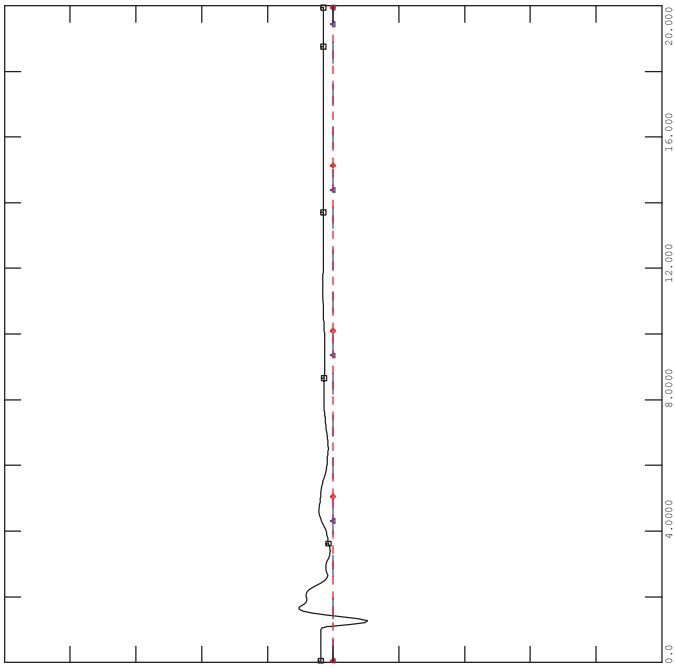
SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_11_1041L

FILE: Scn4_SL_11_1041L.out

TUE, APR 06 2021 18:57

ROTOR ANGLE

CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
30.000 -30.00
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
30.000 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
42.439 -24.56



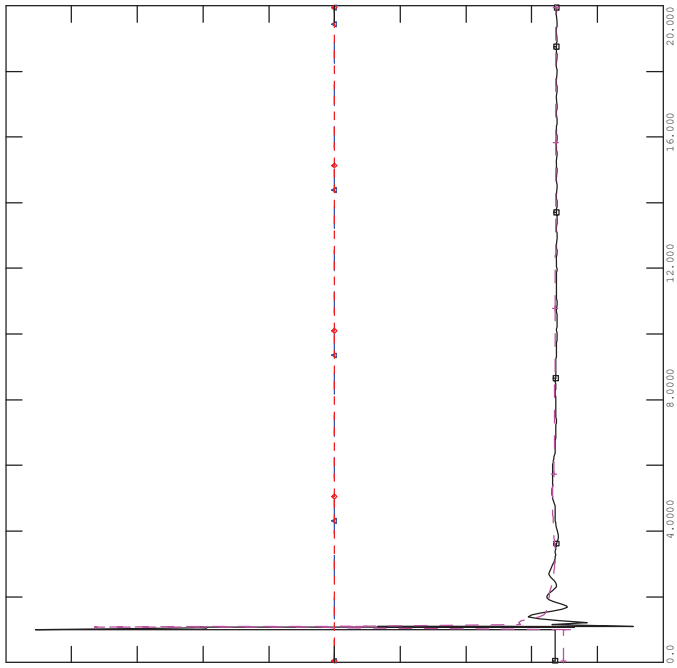
SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_11_1041L

FILE: Scn4_SL_11_1041L.out

TUE, APR 06 2021 18:57

REACTIVE POWER

CHNL# 205: [VARS563070[ENTPRIS_1 0.6900]G1]
0.32580 -0.0455
CHNL# 241: [VARS 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 195: [VARS 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 374: [VARS 1487[SHEER 29 19.000]2]
1.6118 -0.5148

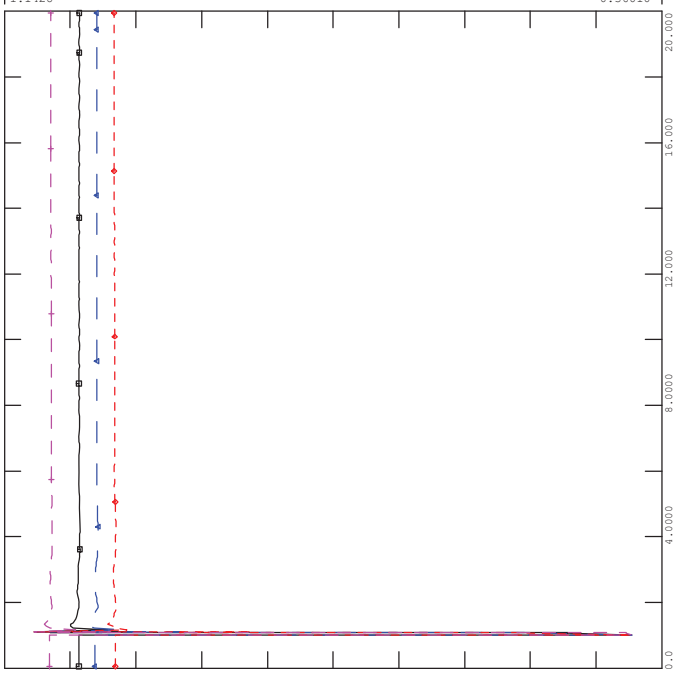


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_11_1041L

FILE: Scn4_SL_11_1041L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 392: [VOLT 692 [N LETHB7 138.00]]
1.0909 0.09980
CHNL# 391: [VOLT 430 [W BROOK4 240.00]]
1.1447 0.67810
CHNL# 390: [VOLT 333 [QUENSTWN 138.00]]
1.1244 0.50420
CHNL# 389: [VOLT 279 [STAVELEY 138.00]]
1.1428 0.36010

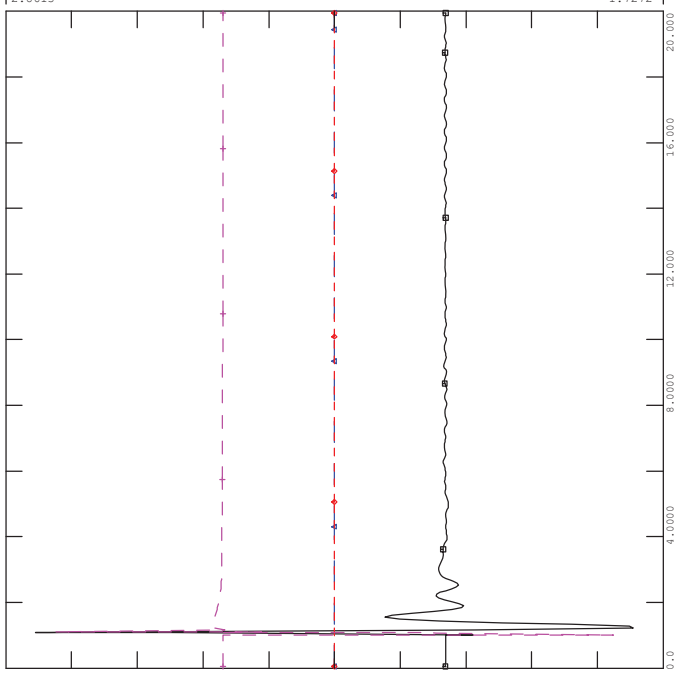


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_12_1041L

FILE: Scn4_SL_12_1041L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 143: [POWR563070[ENTPRIS_1 0.6900]G1]
0.86710 0.21020
CHNL# 179: [POWR 2690[COALDAL8 25.000]4]
0.05000 -0.0500
CHNL# 133: [POWR 4235[STAVELY9 25.000]1]
0.05000 -0.0500
CHNL# 373: [POWR 1487[SHEER 29 19.000]2]
2.8613 1.7272

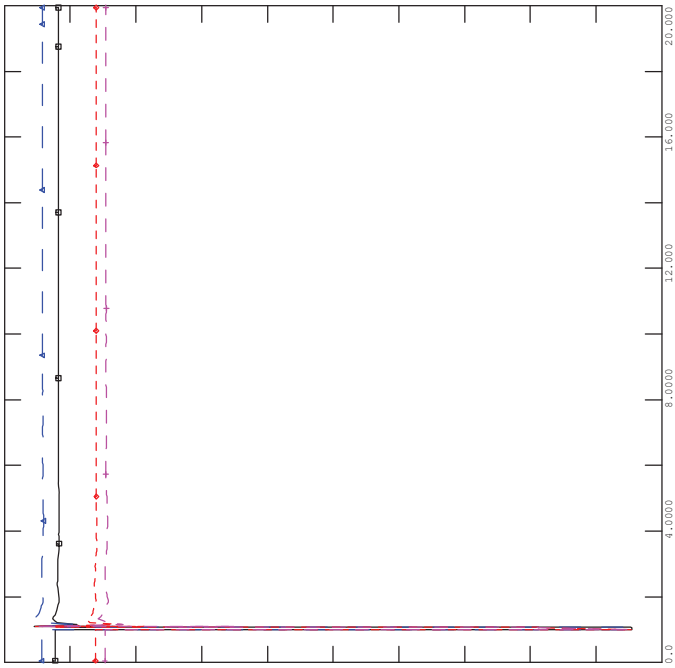


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_11_1041L

FILE: Scn4_SL_11_1041L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 388: [VOLT 276 [W BROOK7 138.00]]
1.1011 0.62590
CHNL# 387: [VOLT 244 [VULCAN 7 138.00]]
1.1634 0.40710
CHNL# 386: [VOLT 237 [FORT MA7 138.00]]
1.0813 0.24840
CHNL# 385: [VOLT 167 [N LETHB4 240.00]]
1.1163 -0.0392

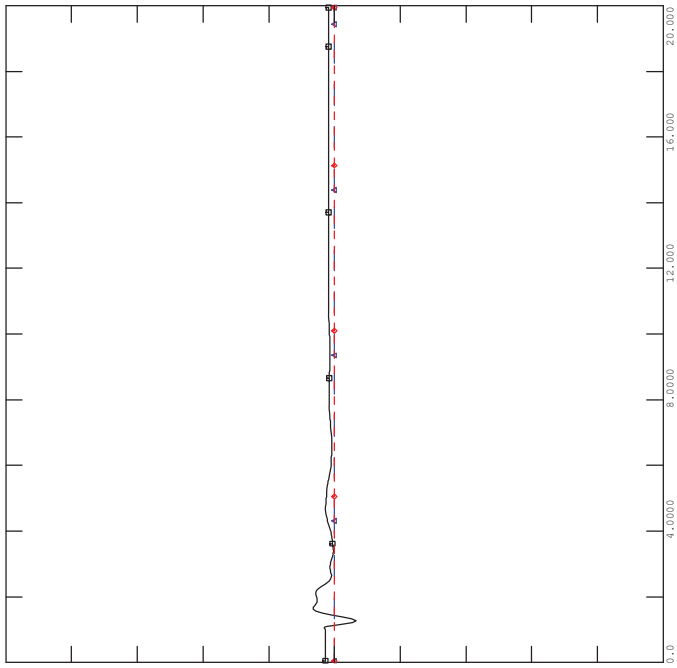


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_12_1041L

FILE: Scn4_SL_12_1041L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

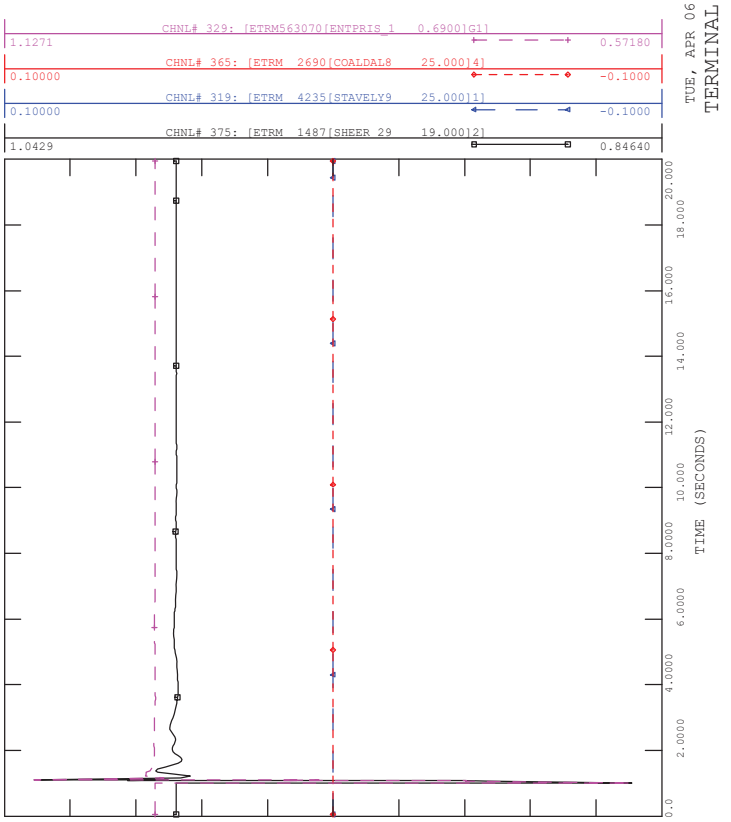
CHNL# 55: [ANGL 2690[COALDAL8 25.000]4]
30.000 -30.00
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
30.000 -30.00
CHNL# 376: [ANGL 1487[SHEER 29 19.000]2]
41.459 -22.76



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_12_1041L

FILE: Scn4_SL_12_1041L.out

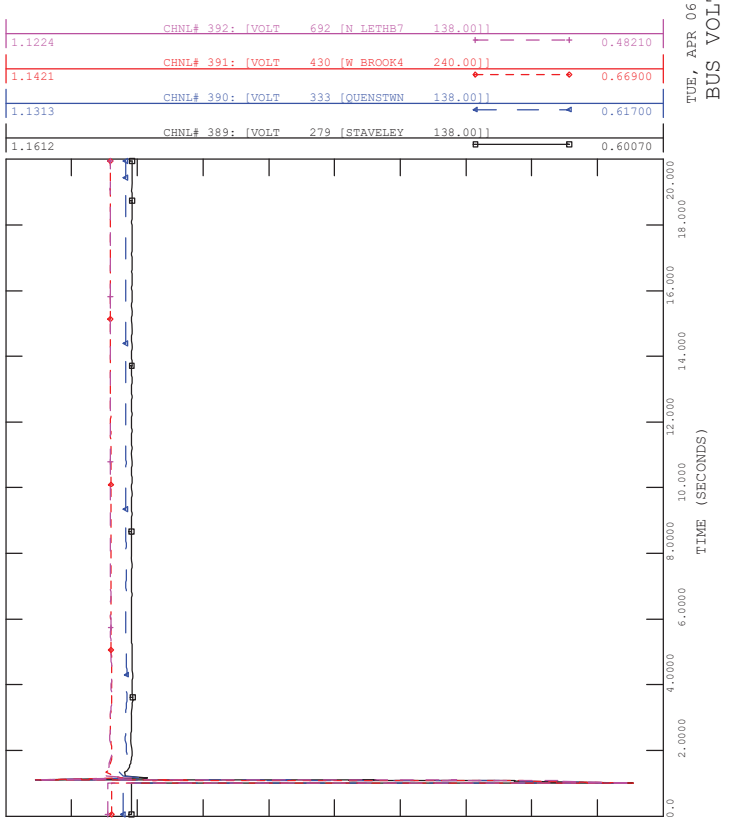
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_12_1041L

FILE: Scn4_SL_12_1041L.out

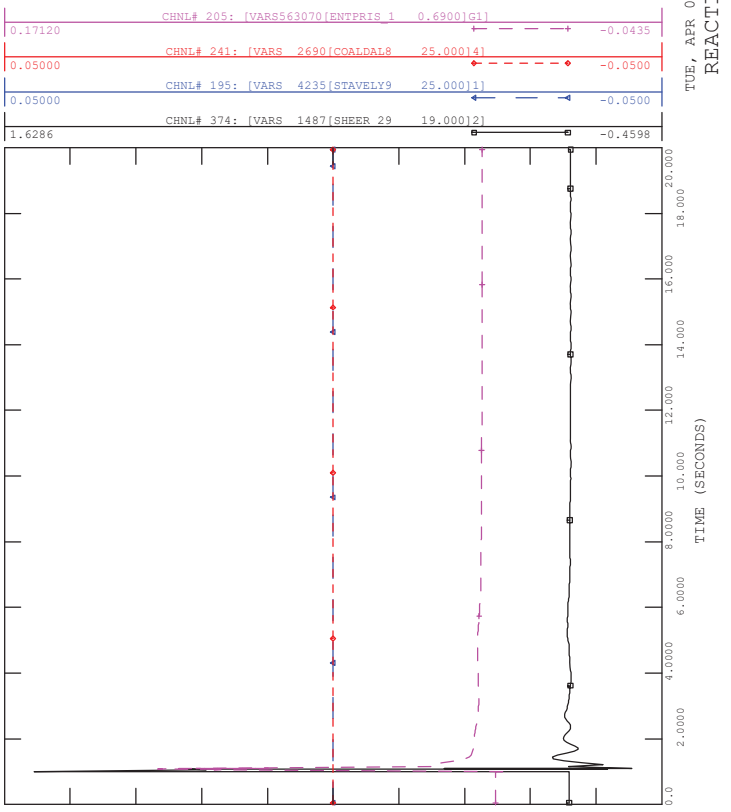
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_12_1041L

FILE: Scn4_SL_12_1041L.out

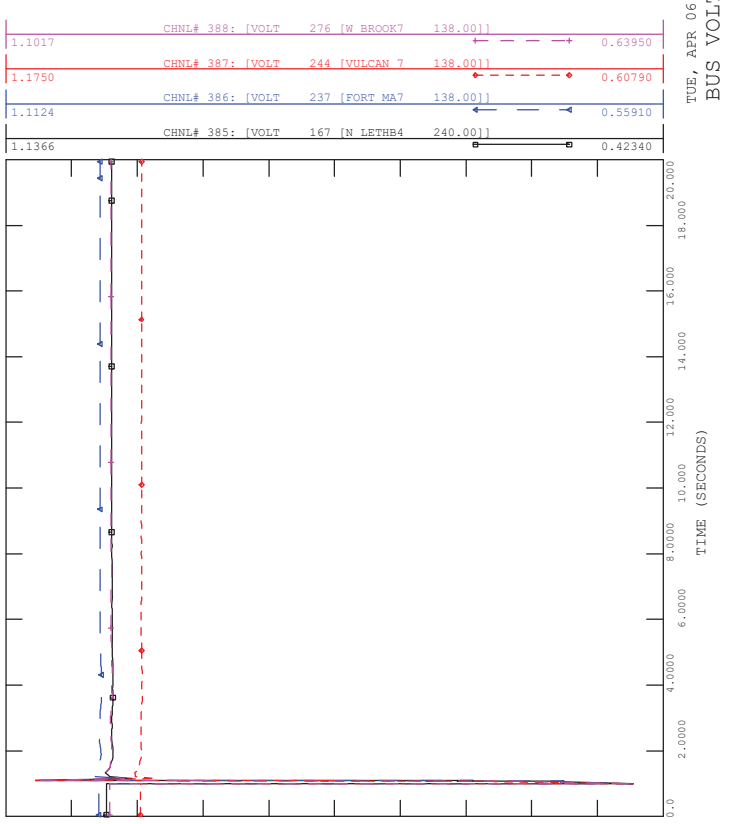
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_12_1041L

FILE: Scn4_SL_12_1041L.out

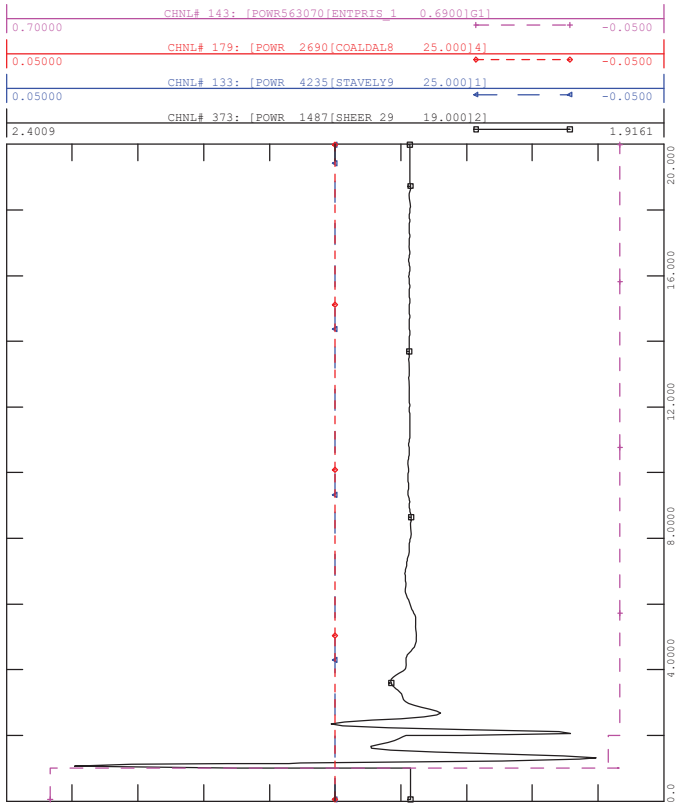
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_13_161L

FILE: Scn4_SL_13_161L.out

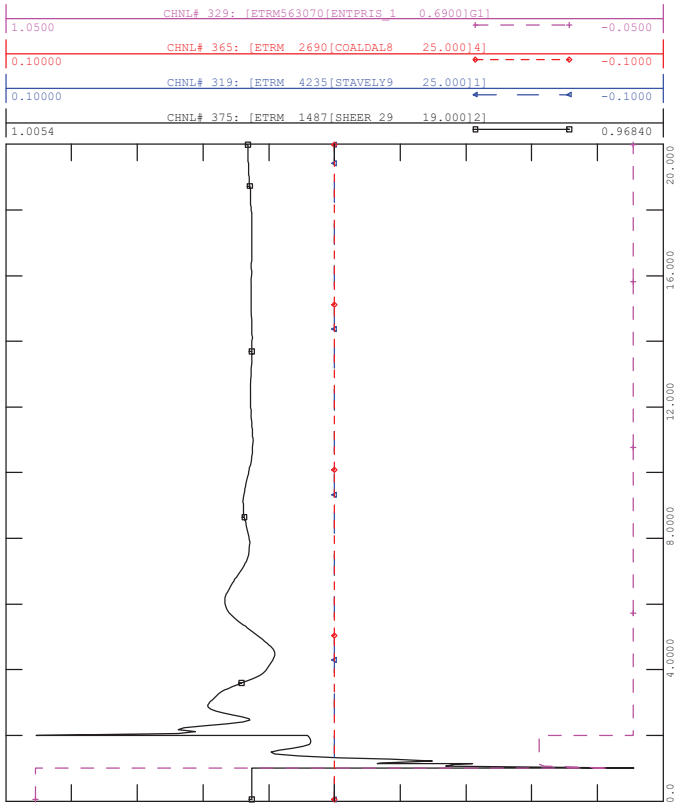
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_13_161L

FILE: Scn4_SL_13_161L.out

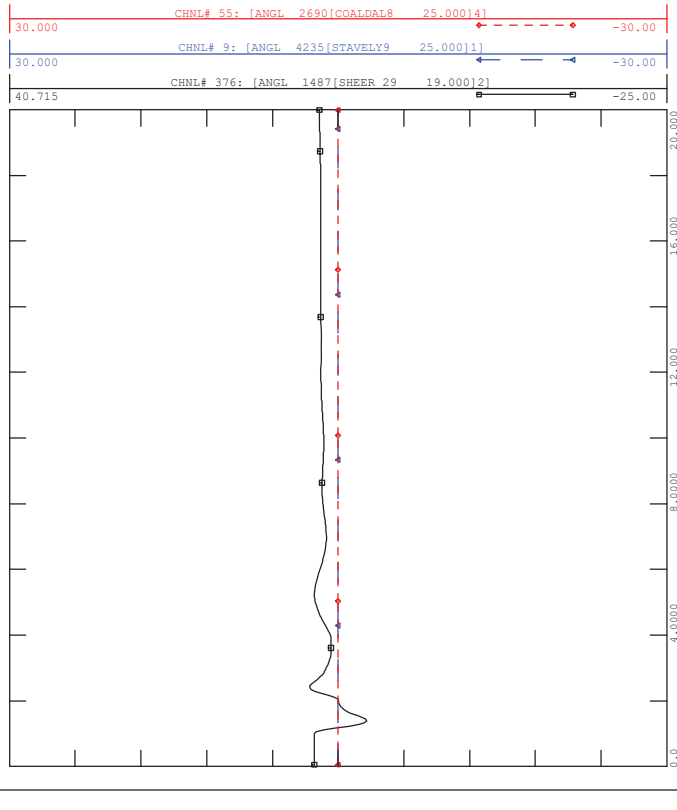
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_13_161L

FILE: Scn4_SL_13_161L.out

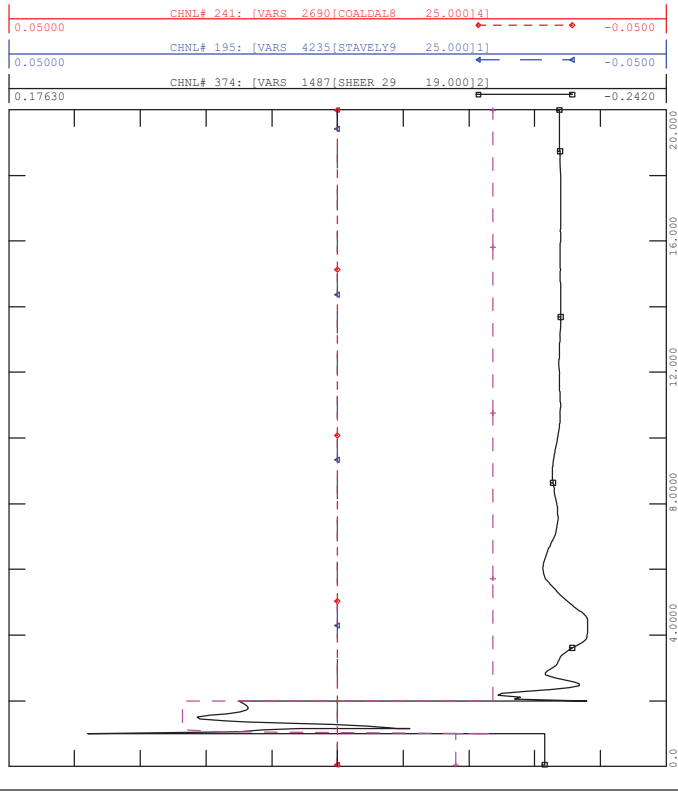
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_13_161L

FILE: Scn4_SL_13_161L.out

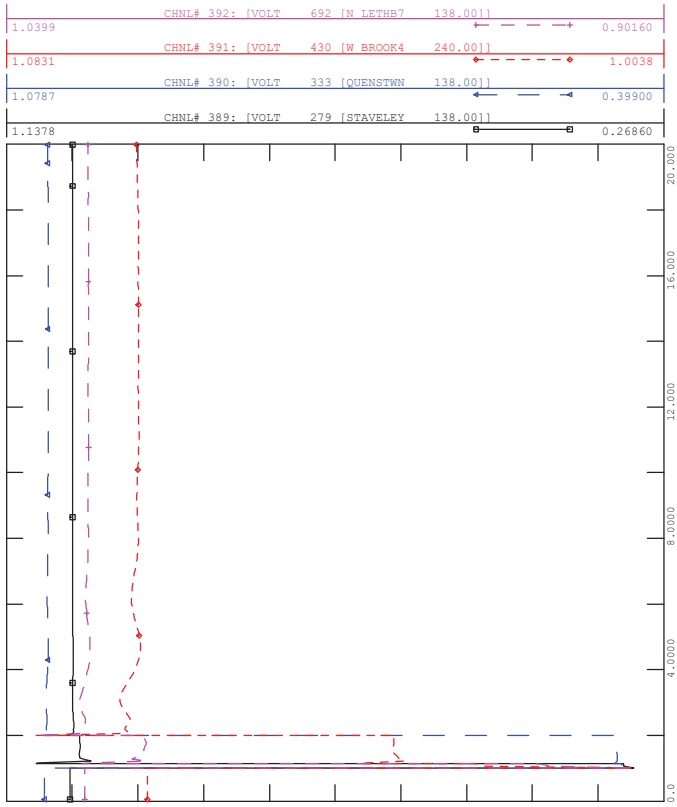
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_13_161L

FILE: Scn4_SL_13_161L.out

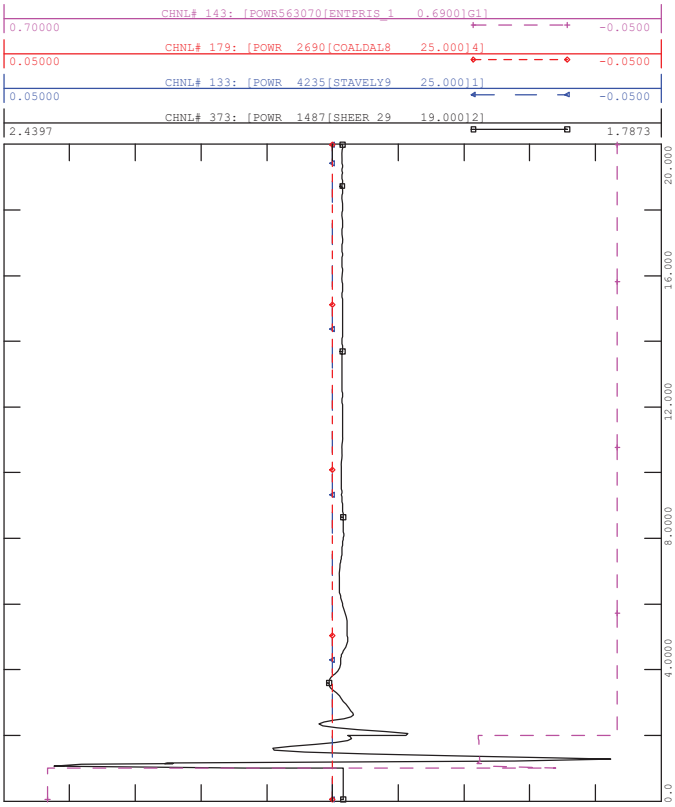
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_14_161L

FILE: Scn4_SL_14_161L.out

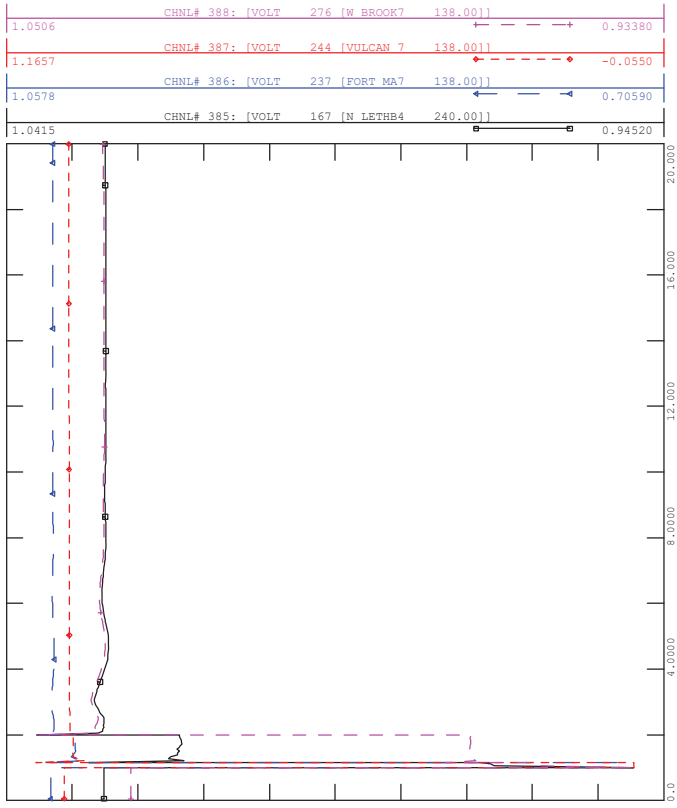
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_13_161L

FILE: Scn4_SL_13_161L.out

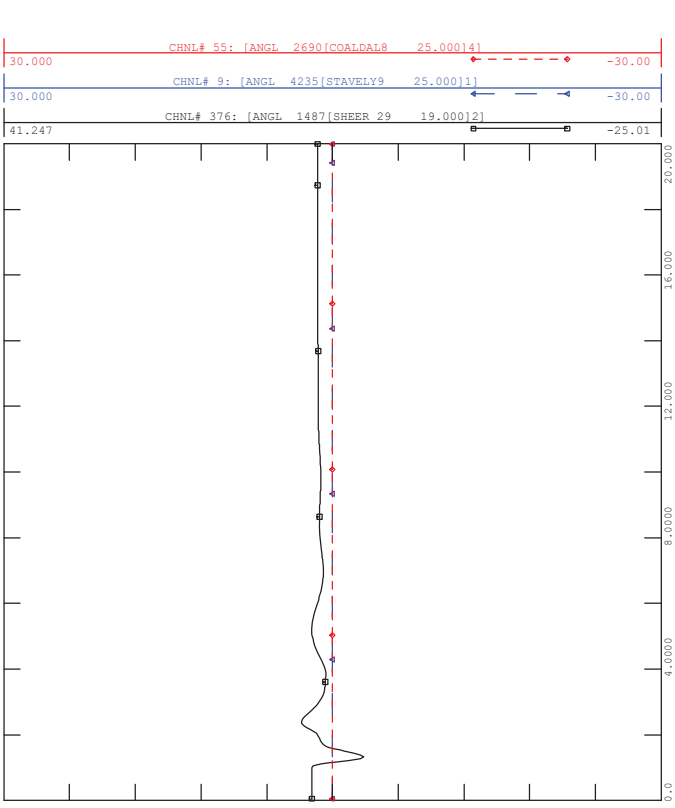
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_14_161L

FILE: Scn4_SL_14_161L.out

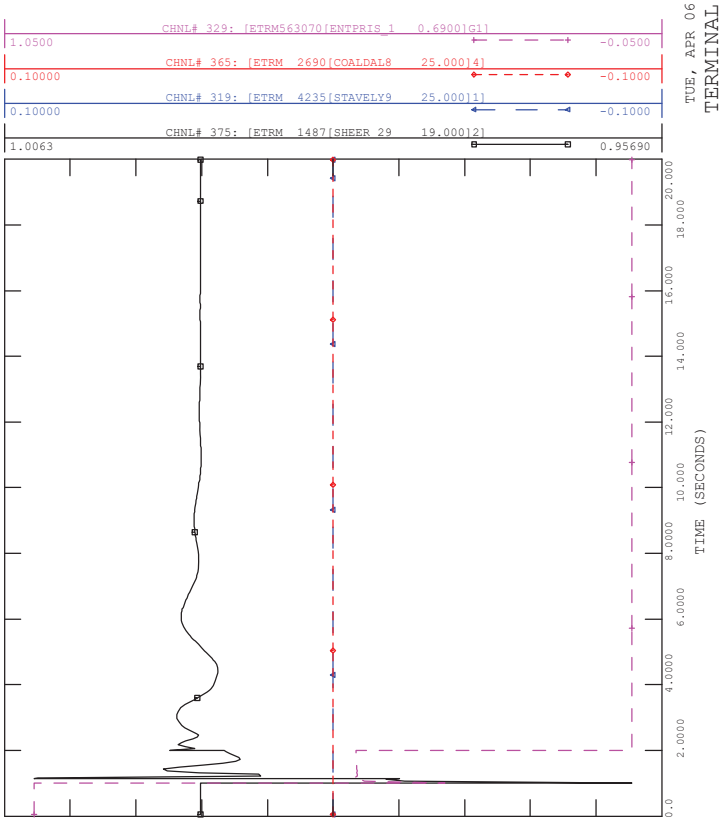
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_14_161L

FILE: Scn4_SL_14_161L.out

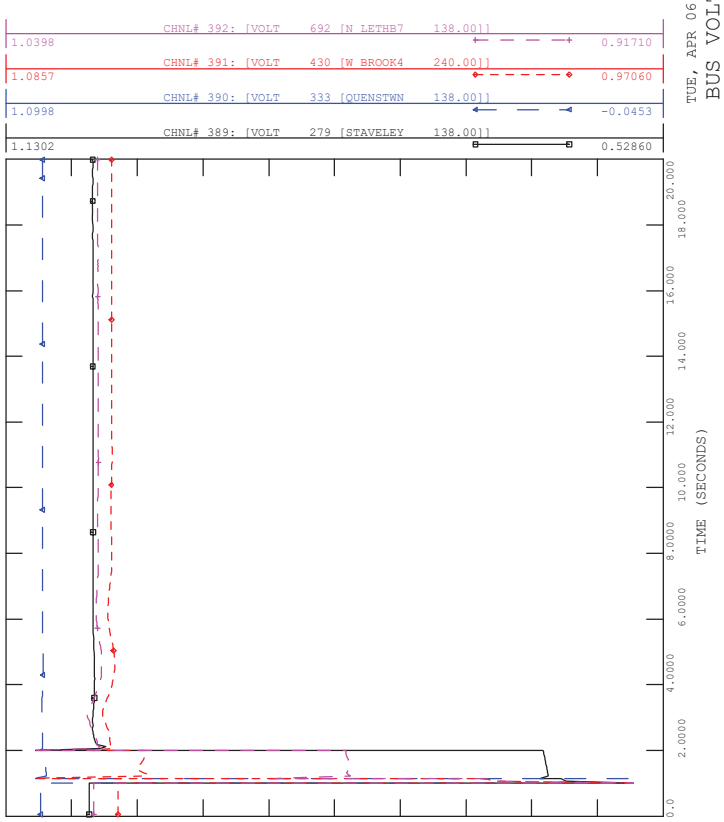
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_14_161L

FILE: Scn4_SL_14_161L.out

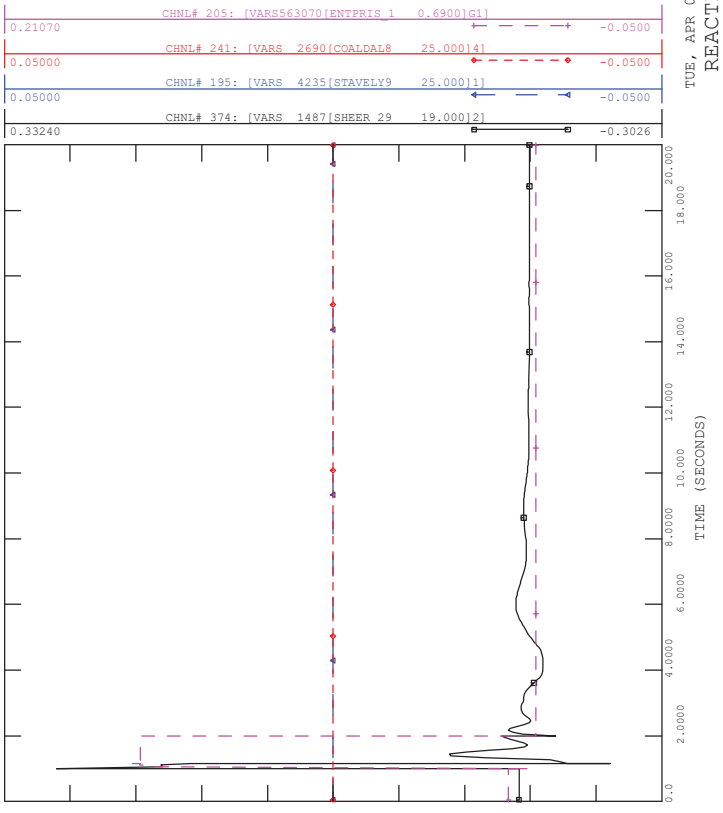
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_14_161L

FILE: Scn4_SL_14_161L.out

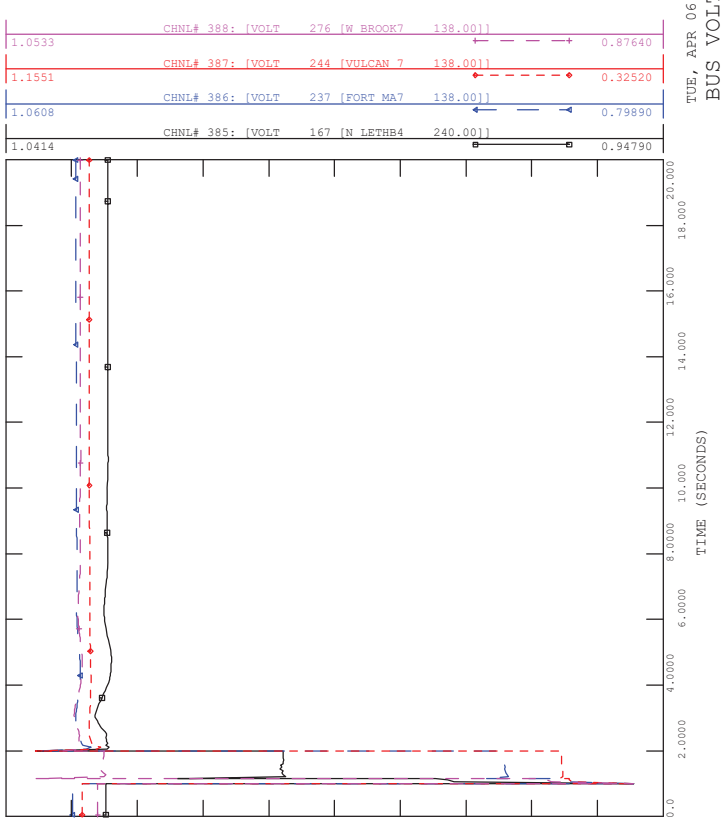
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SL_14_161L

FILE: Scn4_SL_14_161L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

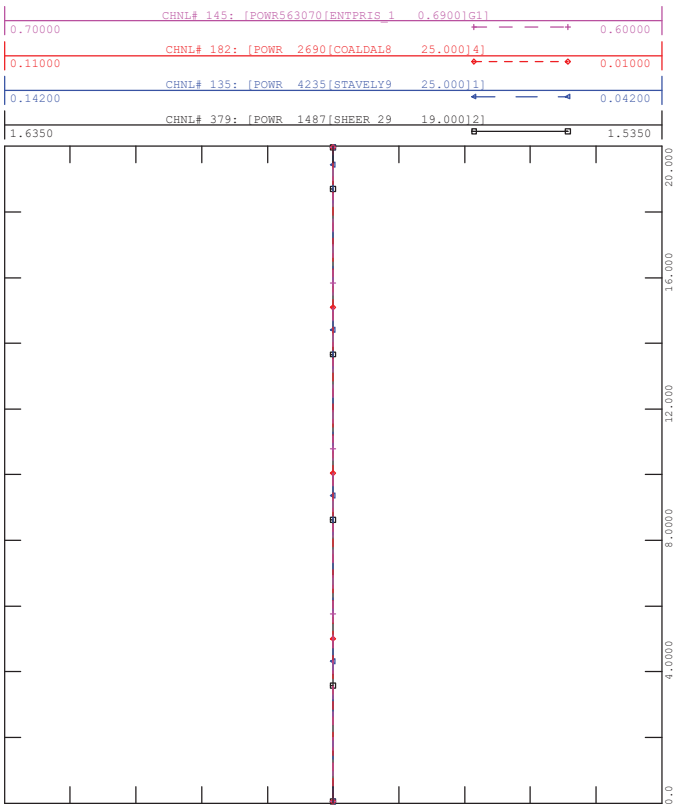


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_NOFAULT

FILE: Scn7_SP_nofault.out

TUE, APR 06 2021 18:57

ACTIVE POWER

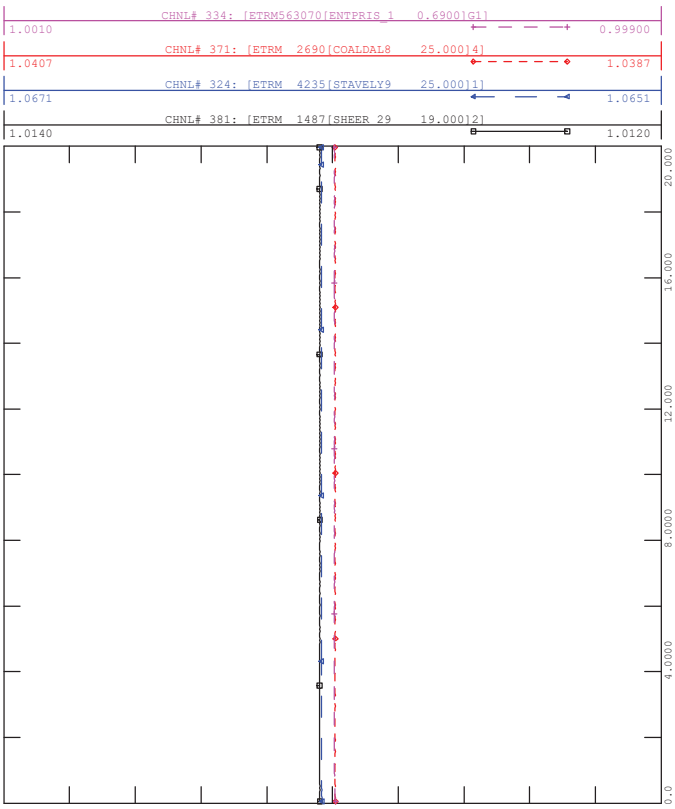


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_NOFAULT

FILE: Scn7_SP_nofault.out

TUE, APR 06 2021 18:57

TERMINAL VOLTAGE

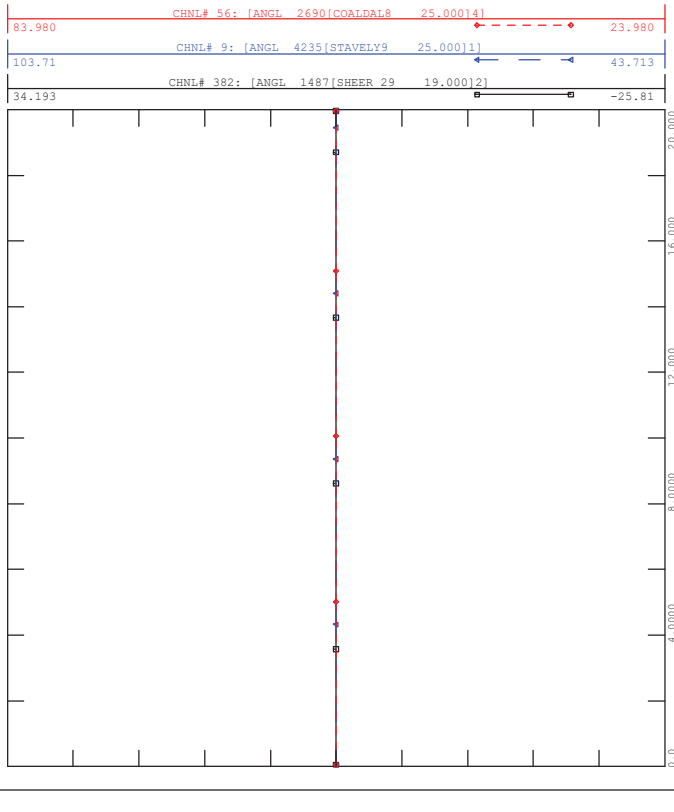


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_NOFAULT

FILE: Scn7_SP_nofault.out

TUE, APR 06 2021 18:57

ROTOR ANGLE

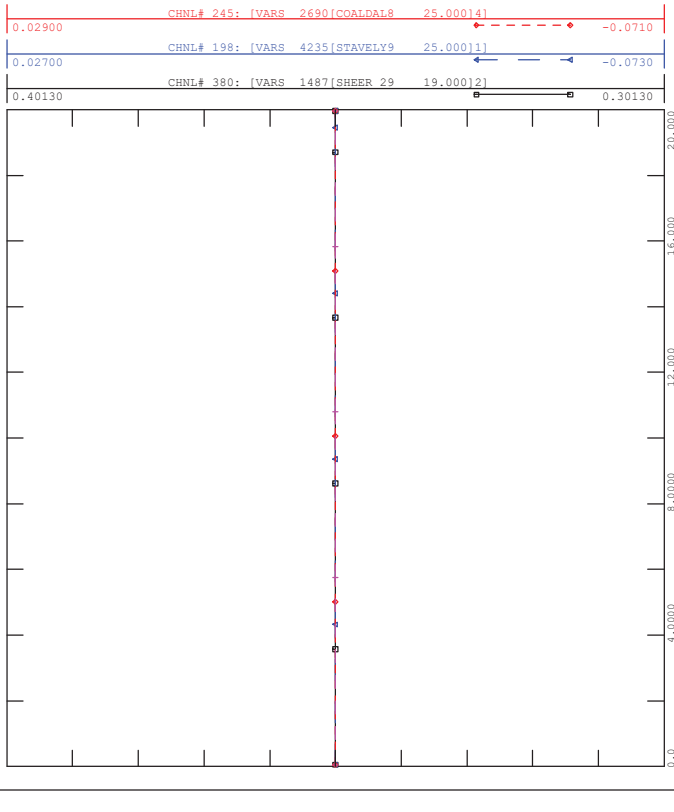


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_NOFAULT

FILE: Scn7_SP_nofault.out

TUE, APR 06 2021 18:57

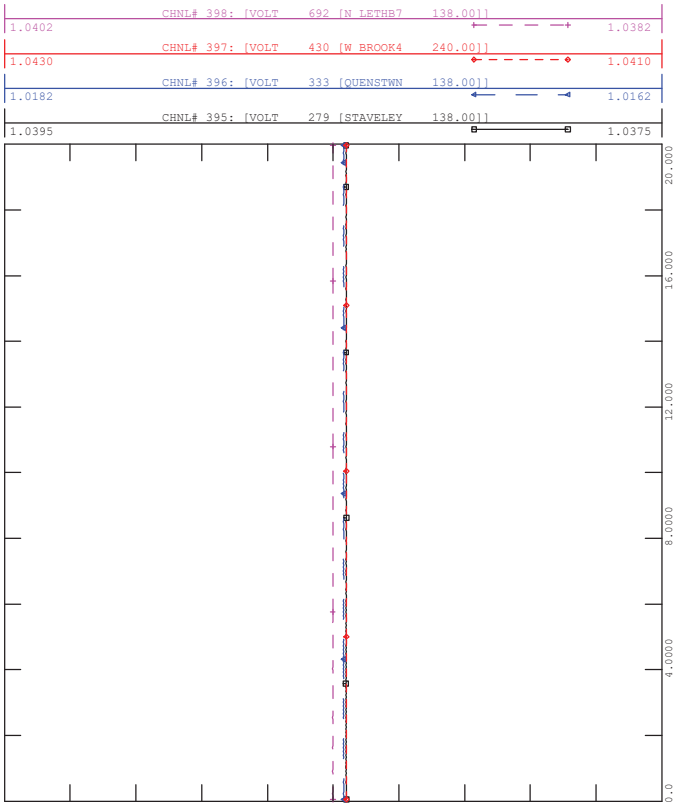
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_NOFAULT

FILE: Scn7_SP_nofault.out

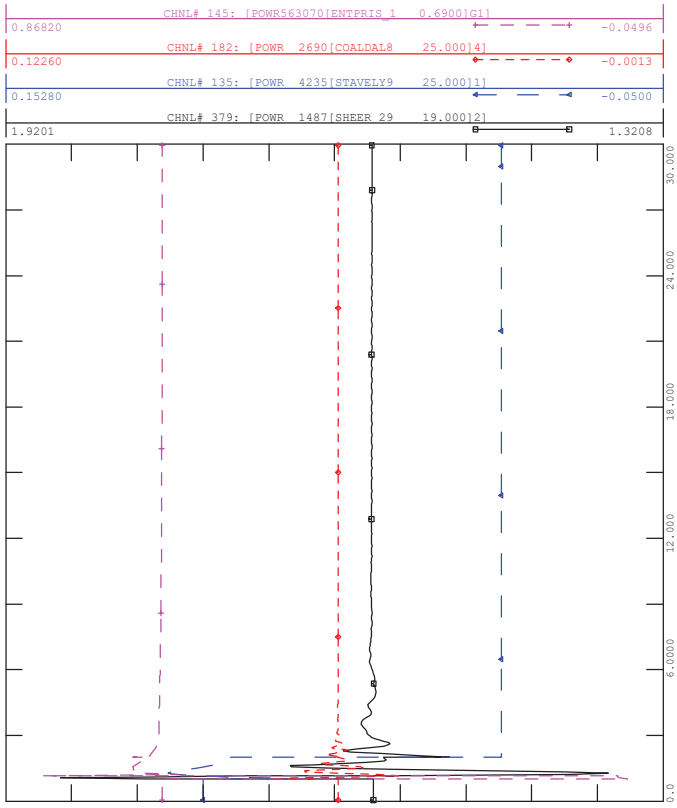
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_01_180L

FILE: Scn7_SP_01_180L.out

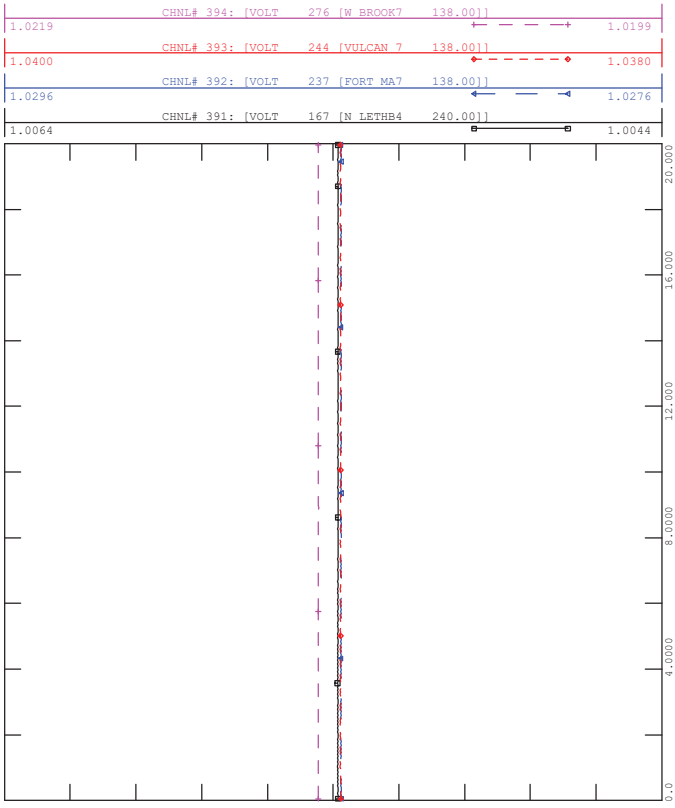
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_NOFAULT

FILE: Scn7_SP_nofault.out

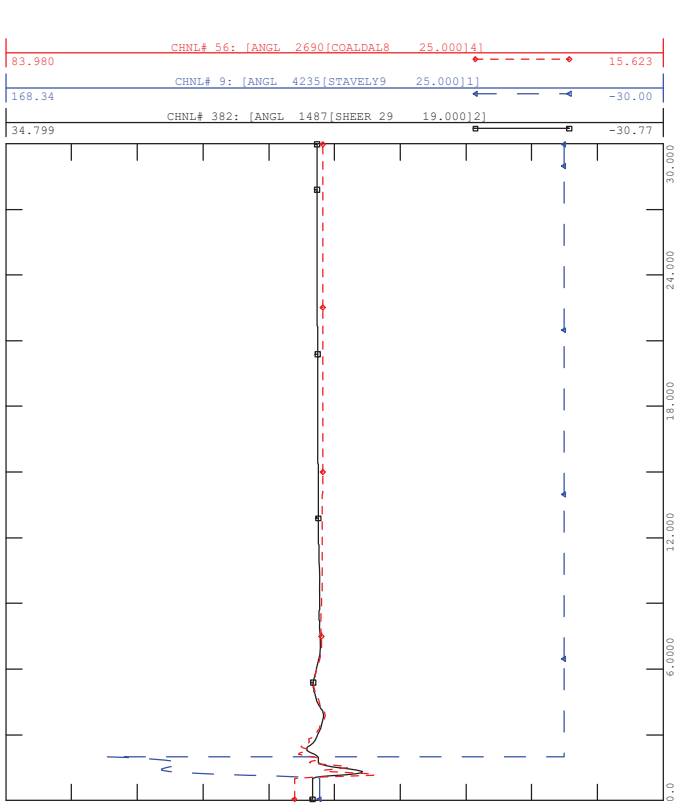
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_01_180L

FILE: Scn7_SP_01_180L.out

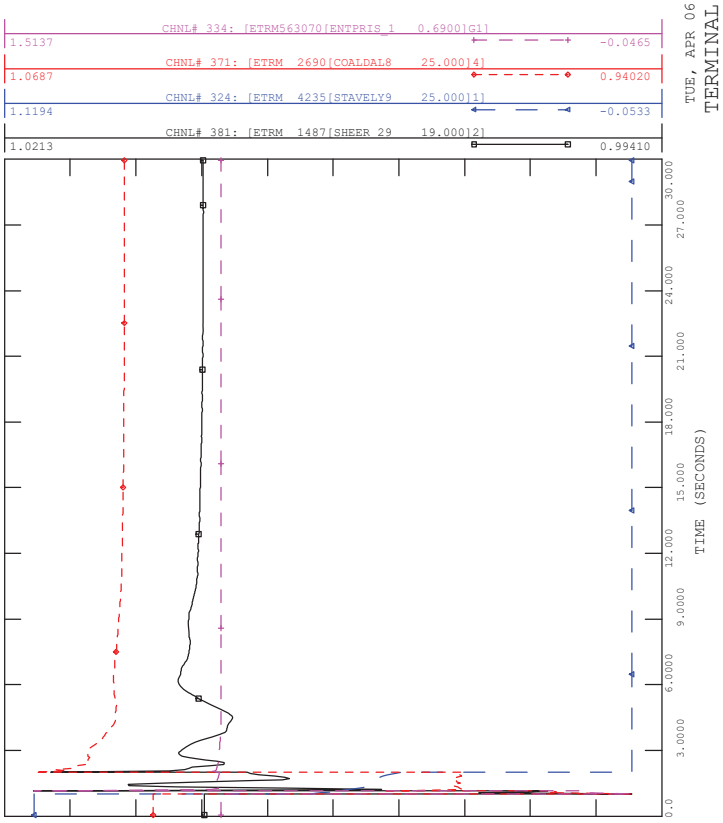
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_01_180L

FILE: Scn7_SP_01_180L.out

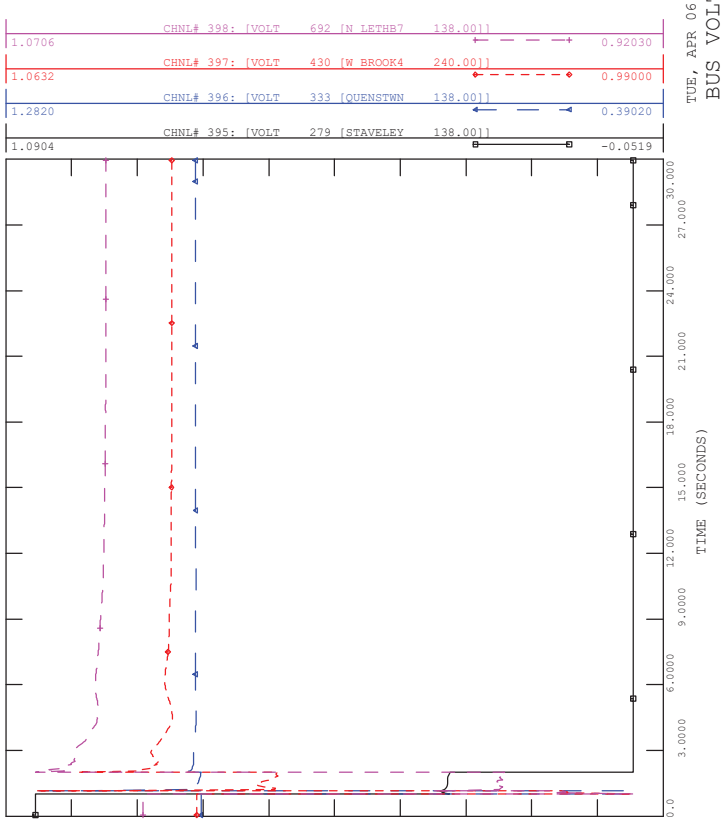
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_01_180L

FILE: Scn7_SP_01_180L.out

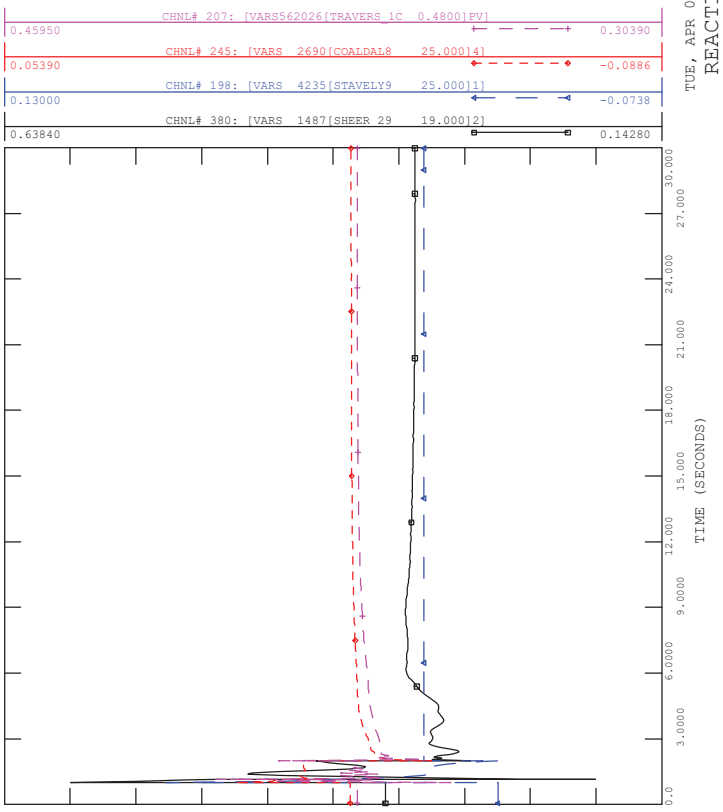
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_01_180L

FILE: Scn7_SP_01_180L.out

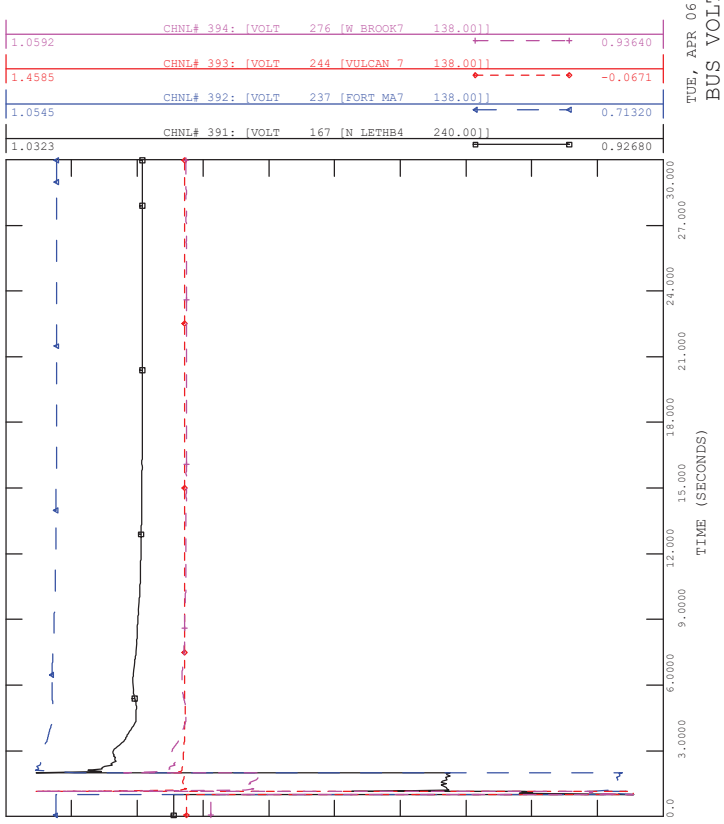
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_01_180L

FILE: Scn7_SP_01_180L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

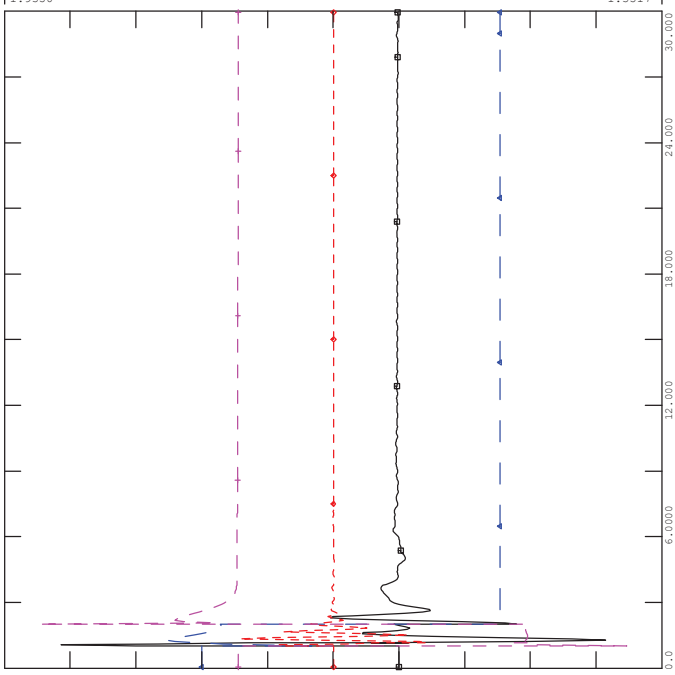


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_02_180L

FILE: Scn7_SP_02_180L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.98330 0.04520
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.13000 -0.0099
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.15280 -0.0500
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
1.9350 1.3517

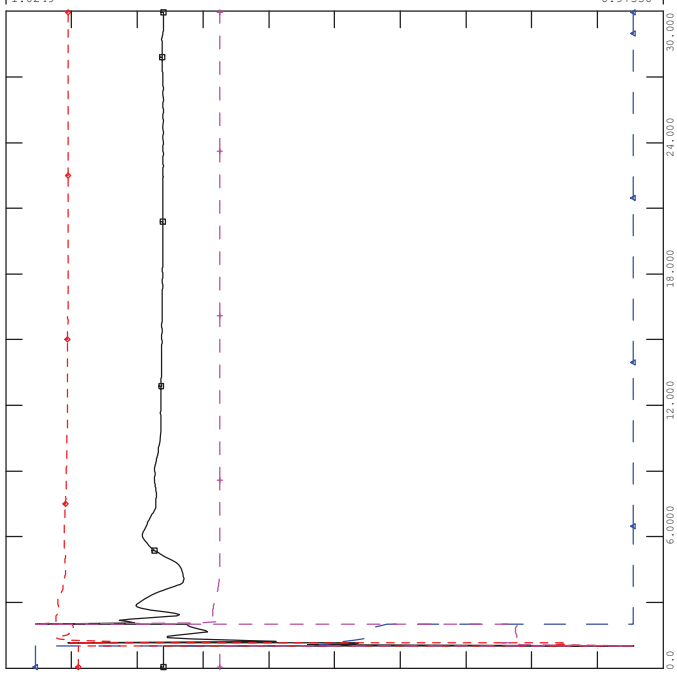


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_02_180L

FILE: Scn7_SP_02_180L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 334: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.3298 0.31760
CHNL# 371: [ETRM 2690[COALDAL8 25.000]4]
1.0789 0.72450
CHNL# 324: [ETRM 4235[STAVELY9 25.000]1]
1.1194 -0.0533
CHNL# 381: [ETRM 1487[SHEER 29 19.000]2]
1.0249 0.97550

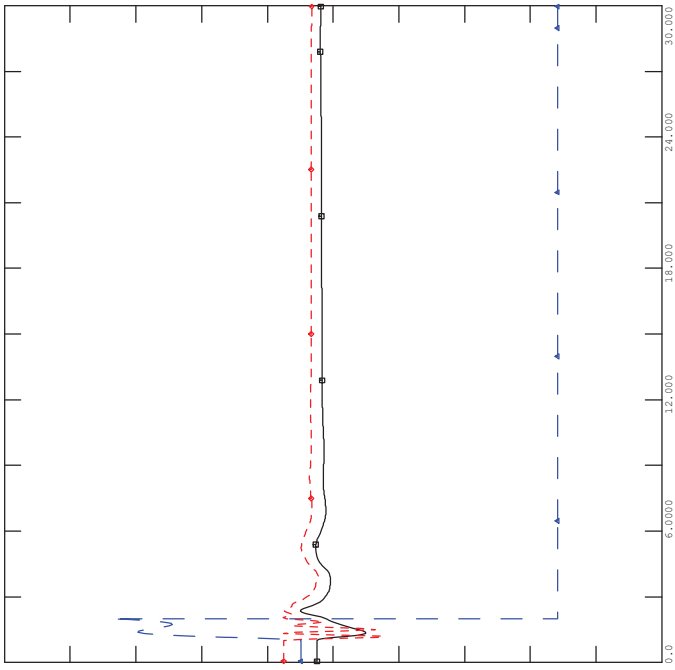


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_02_180L

FILE: Scn7_SP_02_180L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
84.005 13.252
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
158.88 -30.00
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
35.836 -30.78

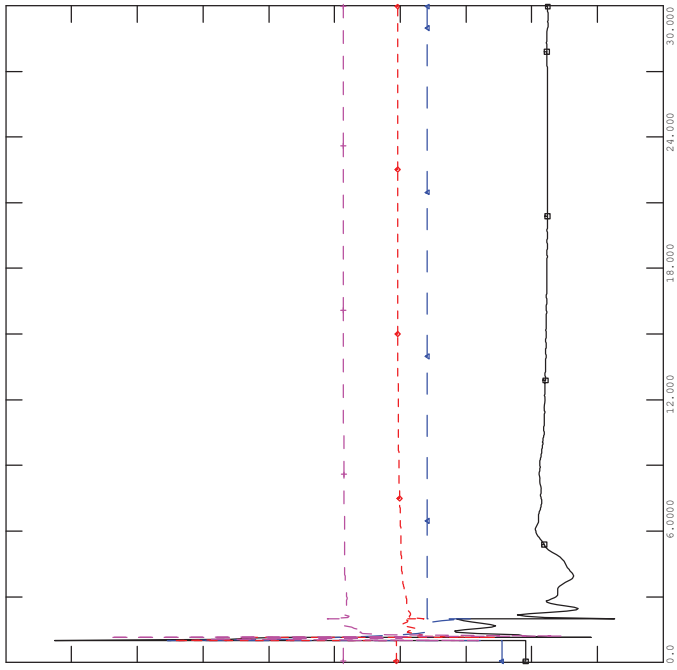


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_02_180L

FILE: Scn7_SP_02_180L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

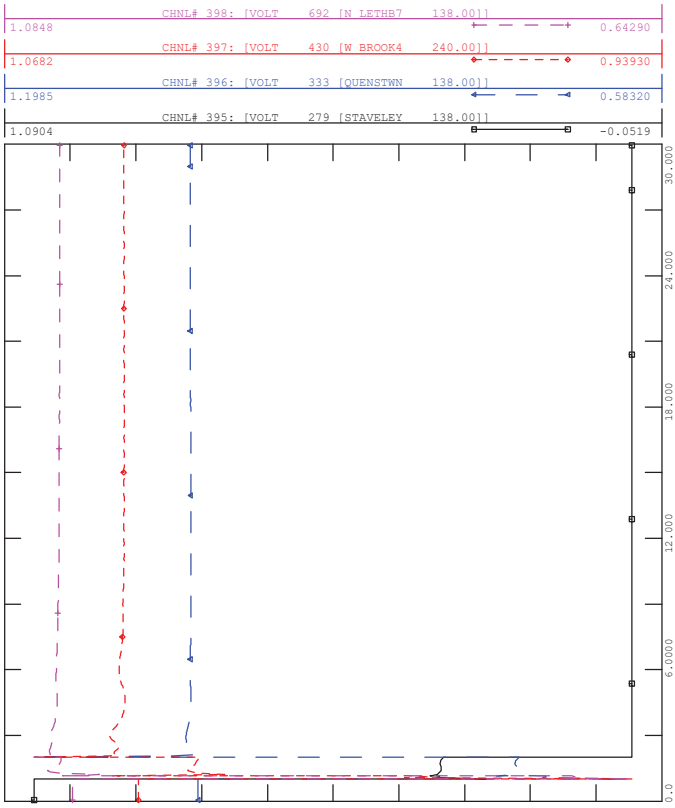
CHNL# 207: [VARS562026[TRAVERS_1C 0.4800]PV]
0.54270 0.21810
CHNL# 245: [VARS 2690[COALDAL8 25.000]4]
0.09520 -0.1003
CHNL# 198: [VARS 4235[STAVELY9 25.000]1]
0.13050 -0.0730
CHNL# 380: [VARS 1487[SHEER 29 19.000]2]
0.88230 0.21060



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_02_180L

FILE: Scn7_SP_02_180L.out

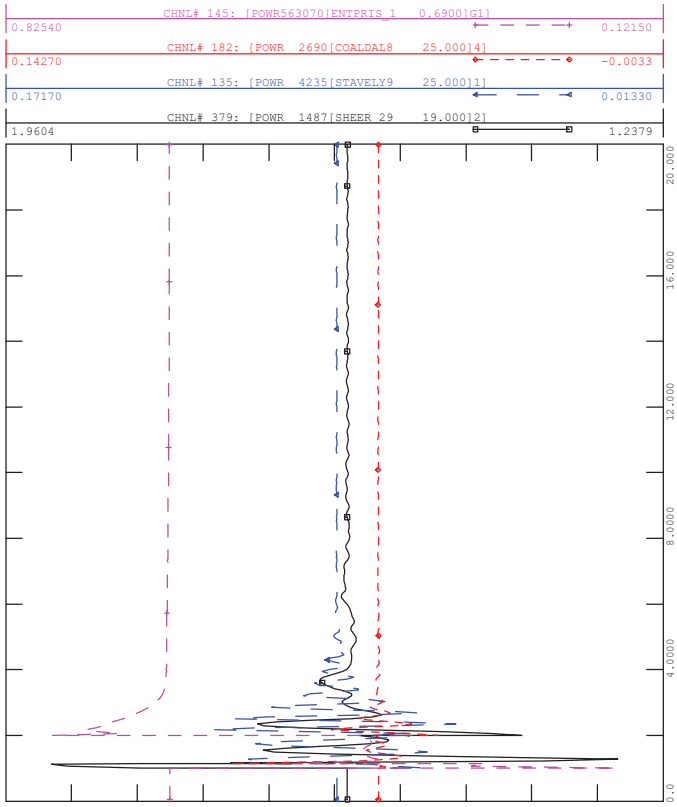
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_03_463L

FILE: Scn7_SP_03_463L.out

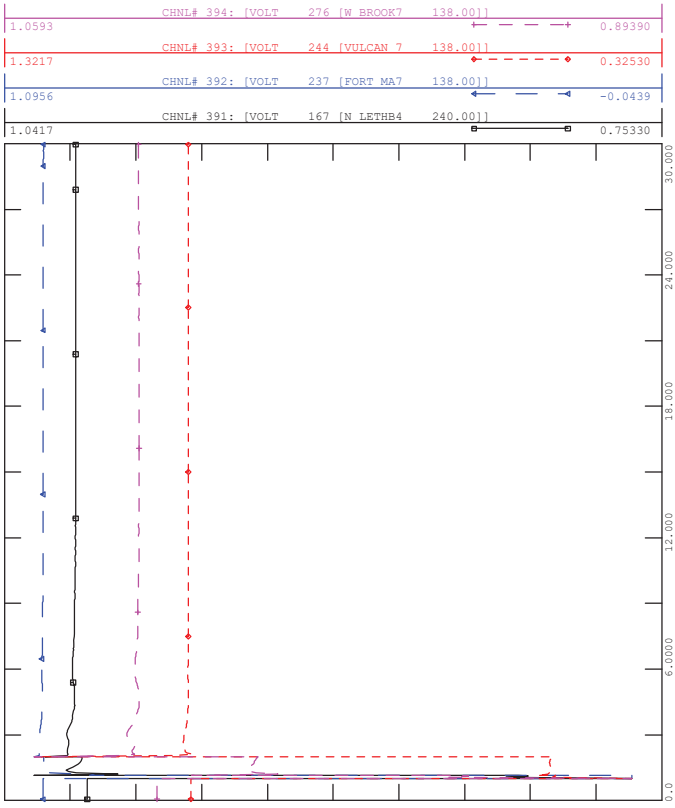
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_02_180L

FILE: Scn7_SP_02_180L.out

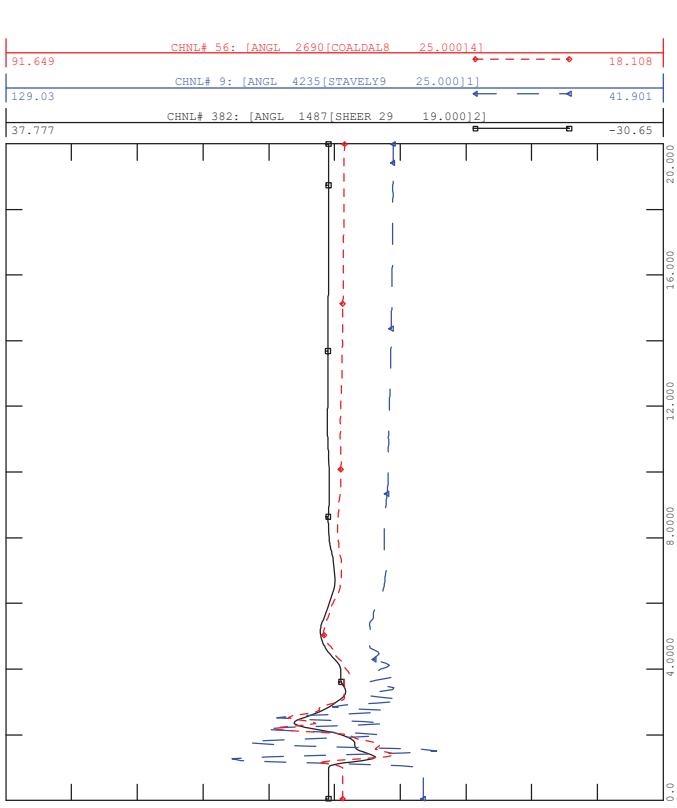
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_03_463L

FILE: Scn7_SP_03_463L.out

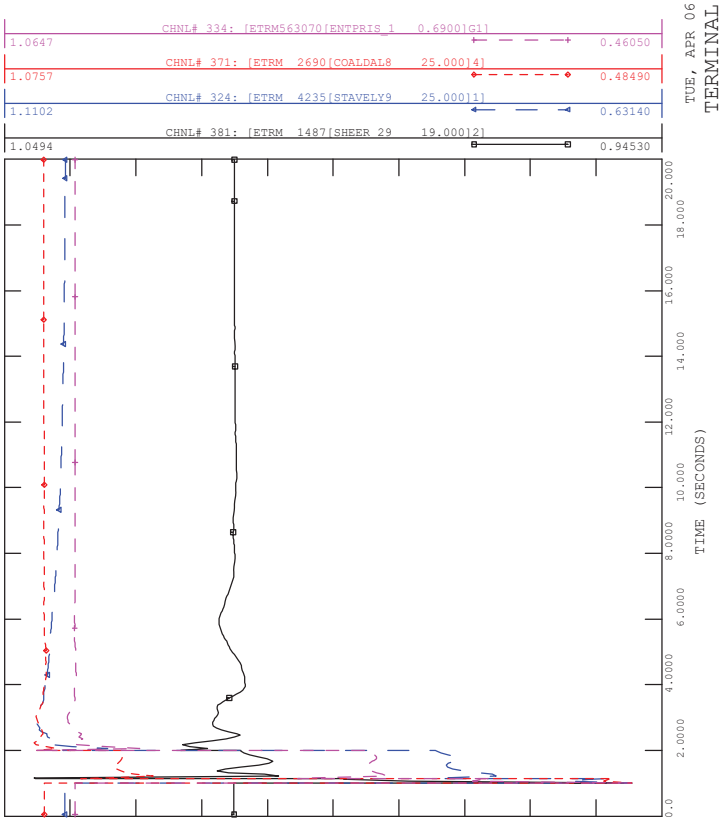
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_03_463L

FILE: Scn7_SP_03_463L.out

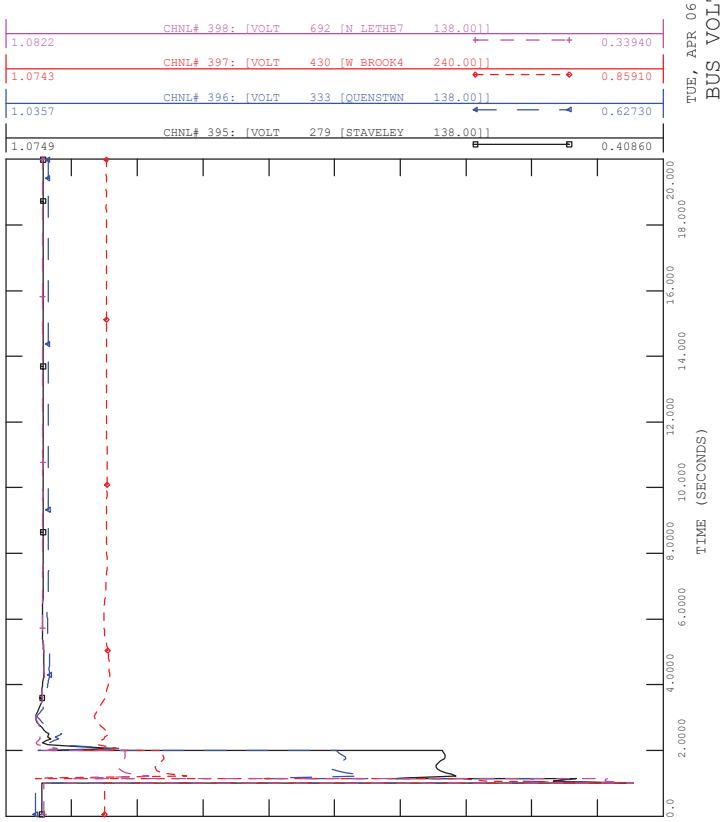
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_03_463L

FILE: Scn7_SP_03_463L.out

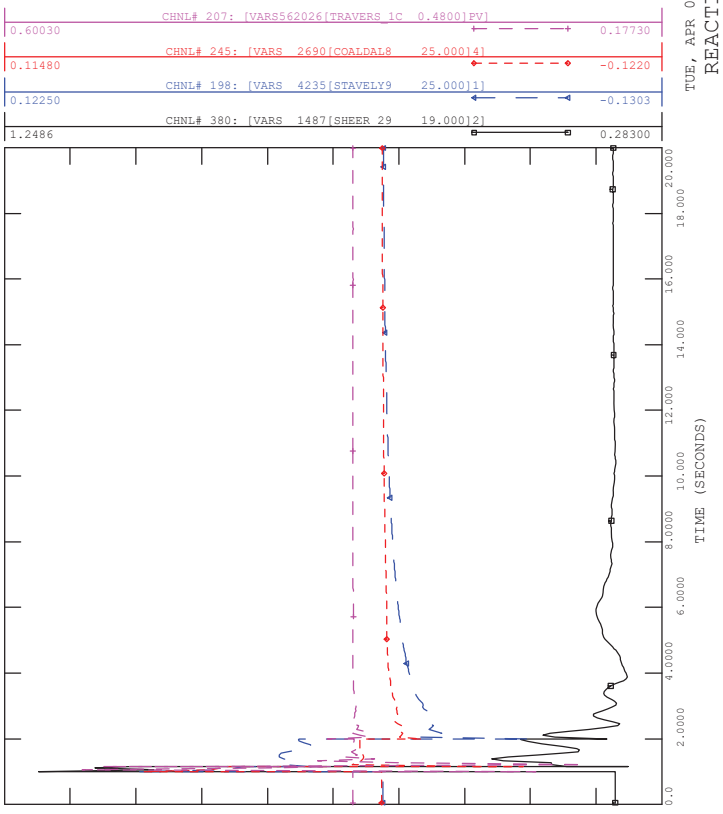
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_03_463L

FILE: Scn7_SP_03_463L.out

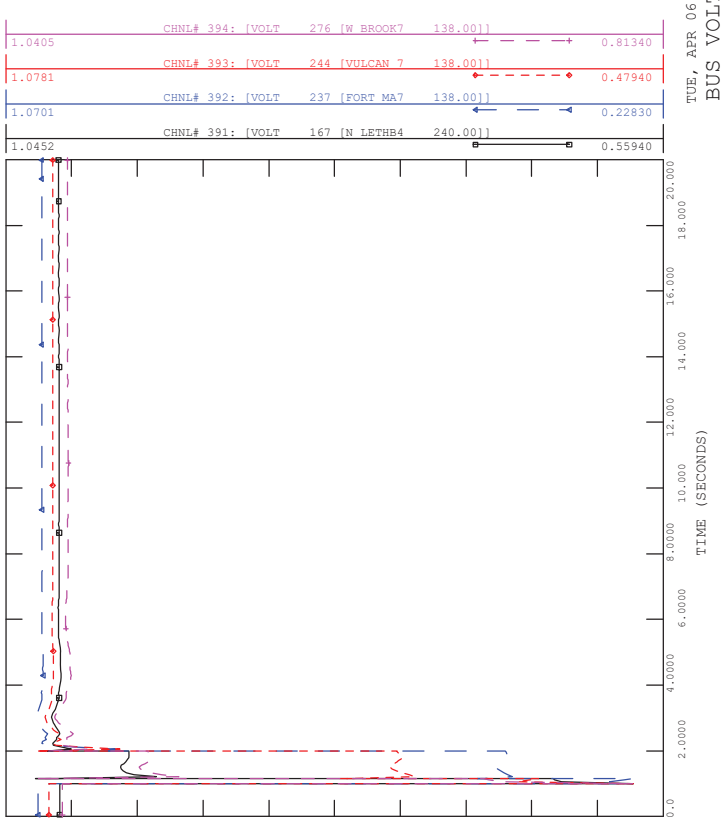
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_03_463L

FILE: Scn7_SP_03_463L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

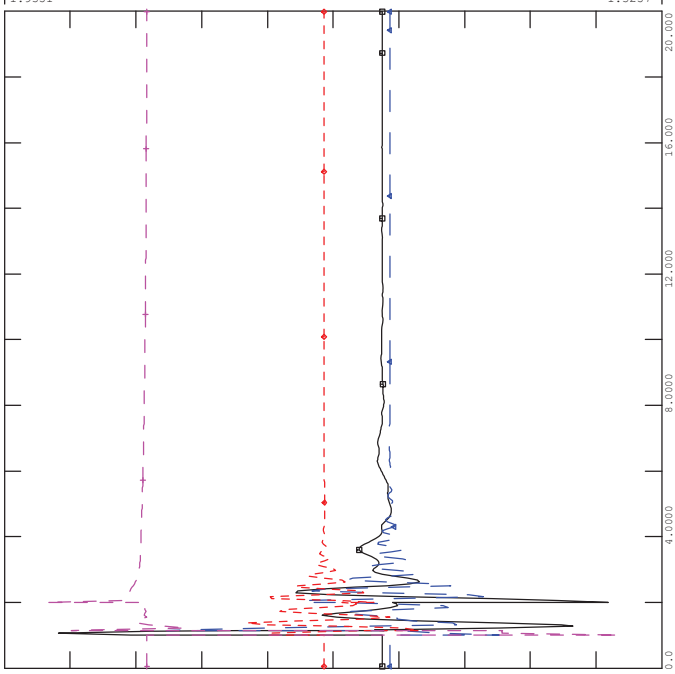


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_04_463L

FILE: Scn7_SP_04_463L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.81690 0.04730
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.12600 -0.0097
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.21050 0.00830
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
1.9351 1.3257

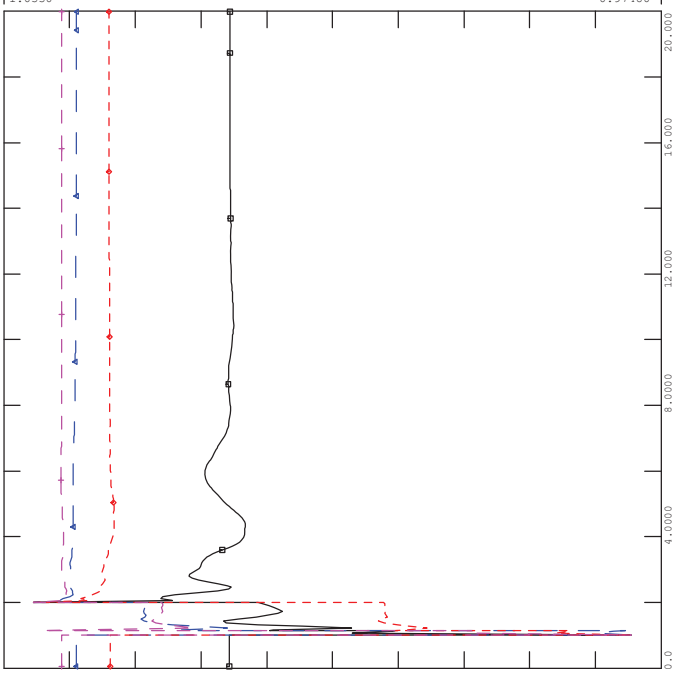


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_04_463L

FILE: Scn7_SP_04_463L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 334: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.0641 0.33450
CHNL# 371: [ETRM 2690[COALDAL8 25.000]4]
1.1012 0.72070
CHNL# 324: [ETRM 4235[STAVELY9 25.000]1]
1.1359 0.50150
CHNL# 381: [ETRM 1487[SHEER 29 19.000]2]
1.0330 0.97480

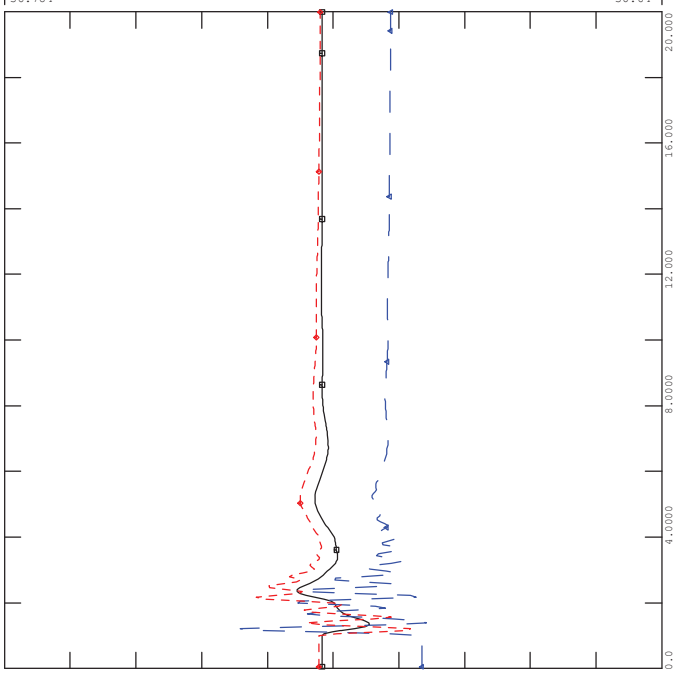


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_04_463L

FILE: Scn7_SP_04_463L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
91.511 13.106
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
126.82 43.169
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
36.784 -30.64

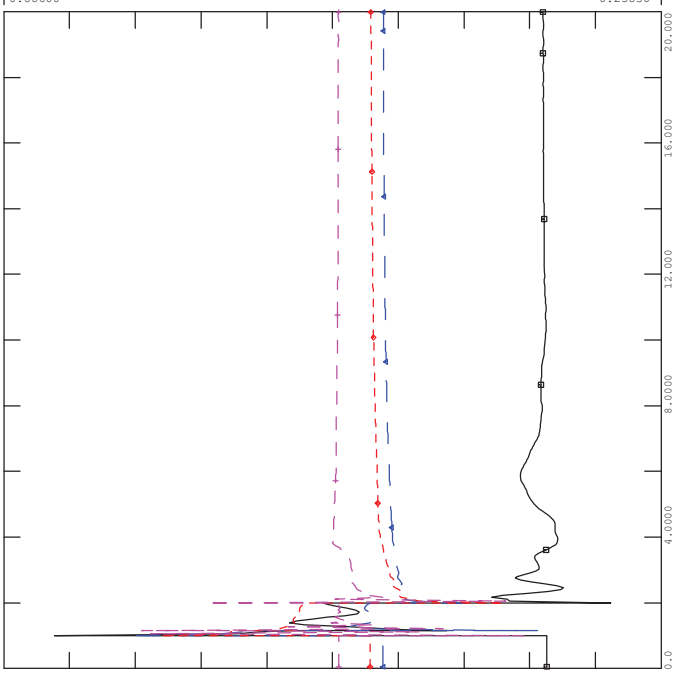


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_04_463L

FILE: Scn7_SP_04_463L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

CHNL# 207: [VARS562026[TRAVERS_1C 0.4800]PV]
0.49760 0.25870
CHNL# 245: [VARS 2690[COALDAL8 25.000]4]
0.09560 -0.1137
CHNL# 198: [VARS 4235[STAVELY9 25.000]1]
0.13040 -0.1356
CHNL# 380: [VARS 1487[SHEER 29 19.000]2]
0.88600 0.23830

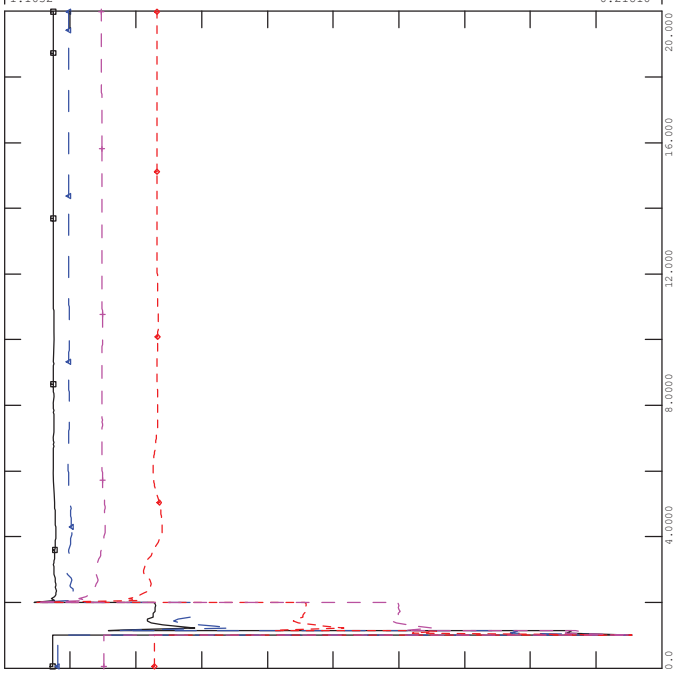


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_04_463L

FILE: Scn7_SP_04_463L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 398: [VOLT 692 [N LETHB7 138.00]]
1.1105 0.63830
CHNL# 397: [VOLT 430 [W BROOK4 240.00]]
1.0725 0.93840
CHNL# 396: [VOLT 333 [QUENSTWN 138.00]]
1.0546 0.59210
CHNL# 395: [VOLT 279 [STAVELEY 138.00]]
1.1032 0.21810

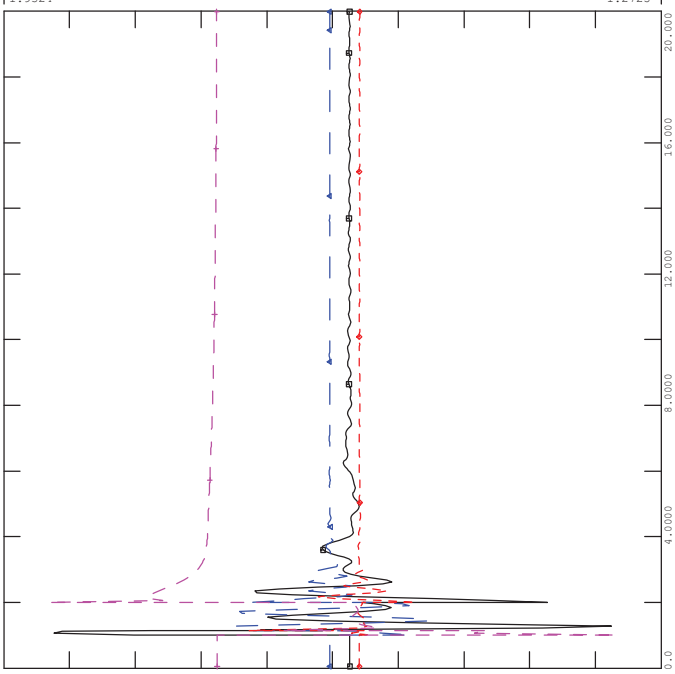


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_05_725L

FILE: Scn7_SP_05_725L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.89020 0.15060
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.13250 -0.0015
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.16250 0.02020
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
1.9324 1.2725

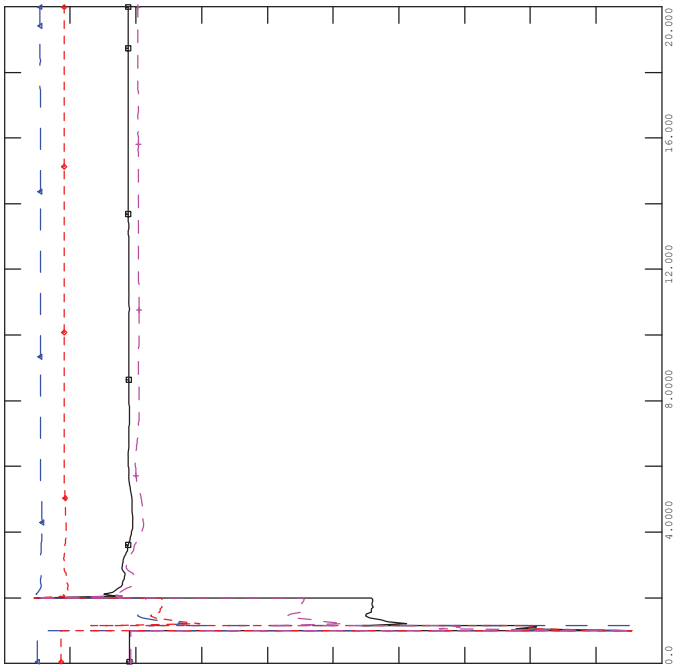


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_04_463L

FILE: Scn7_SP_04_463L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 394: [VOLT 276 [W BROOK7 138.00]]
1.0512 0.89360
CHNL# 393: [VOLT 244 [VULCAN 7 138.00]]
1.1051 0.34020
CHNL# 392: [VOLT 237 [FORT MA7 138.00]]
1.0856 -0.0453
CHNL# 391: [VOLT 167 [N LETHB4 240.00]]
1.0654 0.75000

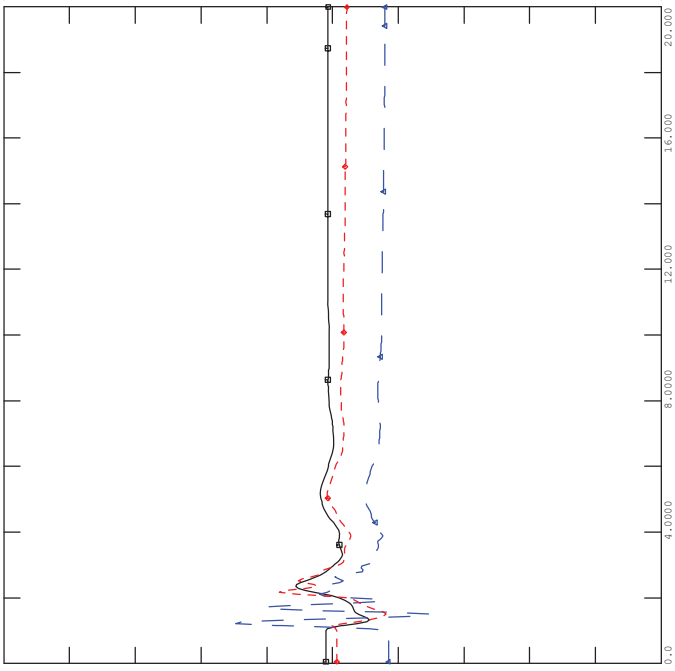


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_05_725L

FILE: Scn7_SP_05_725L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

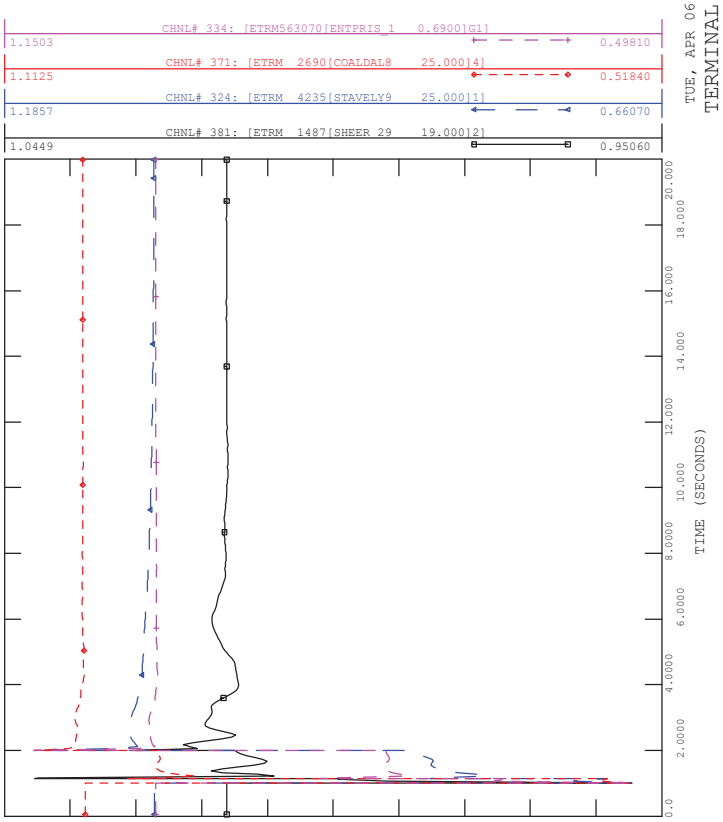
CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
90.240 18.624
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
123.49 38.392
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
37.341 -30.26



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_05_725L

FILE: Scn7_SP_05_725L.out

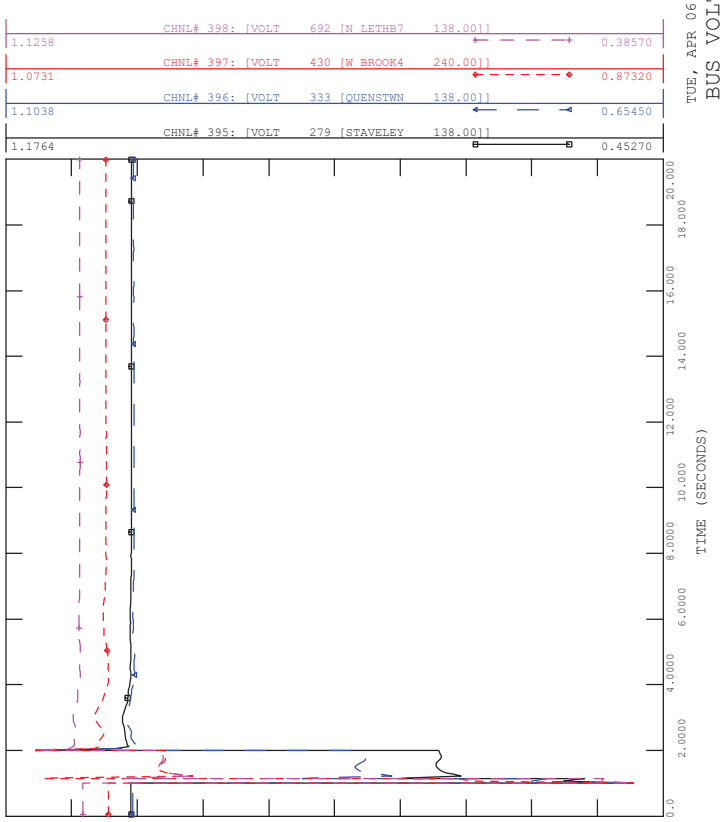
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_05_725L

FILE: Scn7_SP_05_725L.out

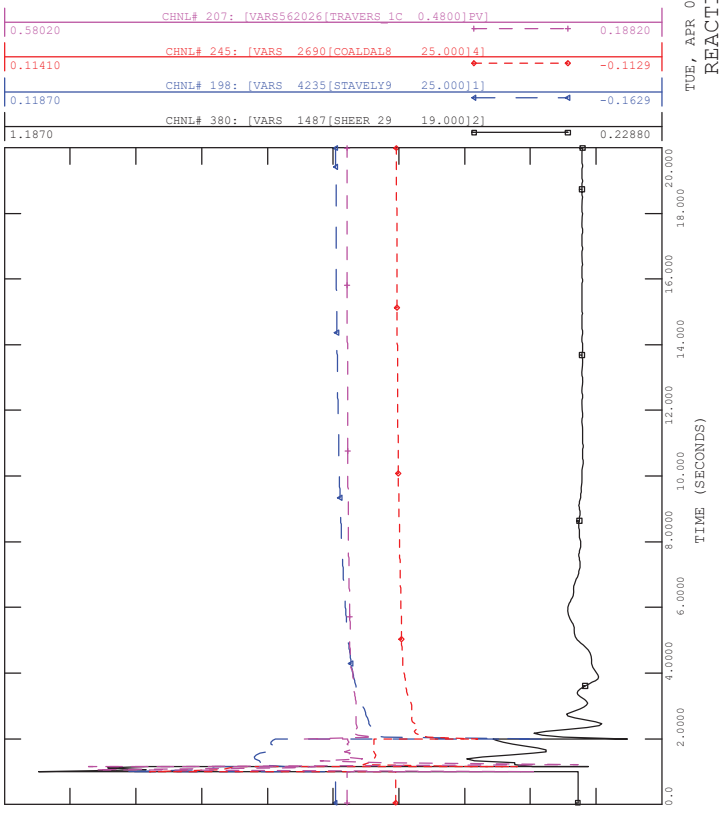
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_05_725L

FILE: Scn7_SP_05_725L.out

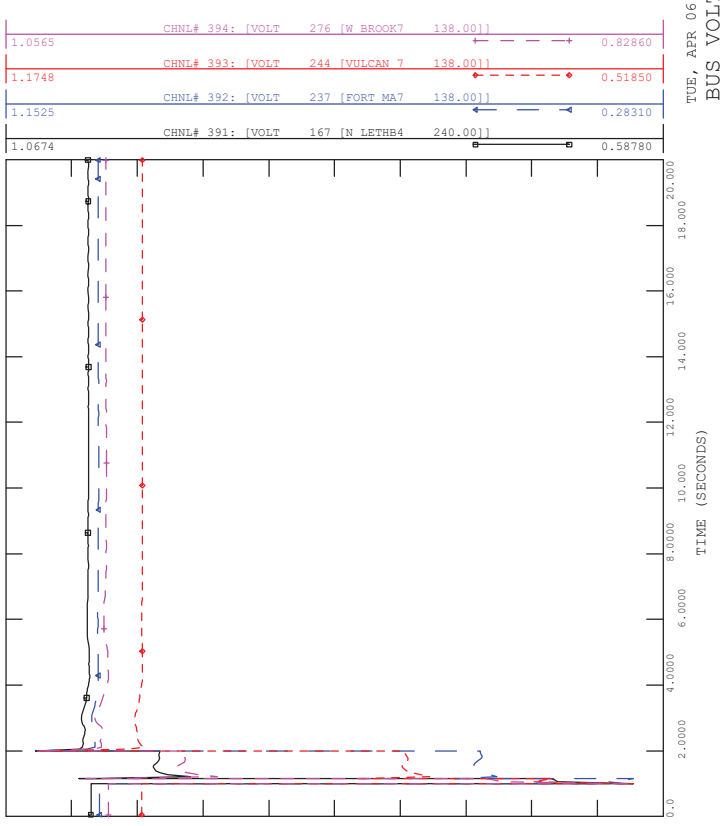
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_05_725L

FILE: Scn7_SP_05_725L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

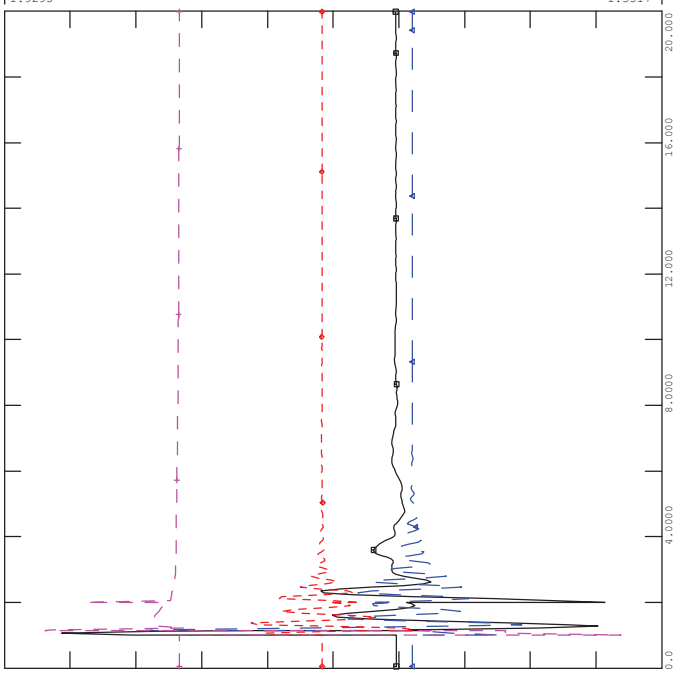


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_06_725L

FILE: Scn7_SP_06_725L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.86540 0.05620
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.12430 -0.0089
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.23750 0.00300
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
1.9295 1.3517

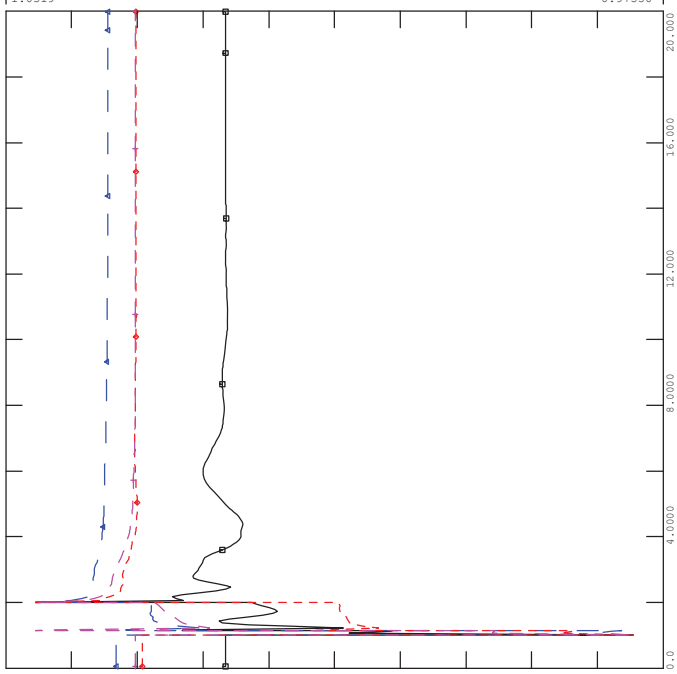


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_06_725L

FILE: Scn7_SP_06_725L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 334: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.1599 0.34710
CHNL# 371: [ETRM 2690[COALDAL8 25.000]4]
1.1229 0.72250
CHNL# 324: [ETRM 4235[STAVELY9 25.000]1]
1.1777 0.51410
CHNL# 381: [ETRM 1487[SHEER 29 19.000]2]
1.0319 0.97550

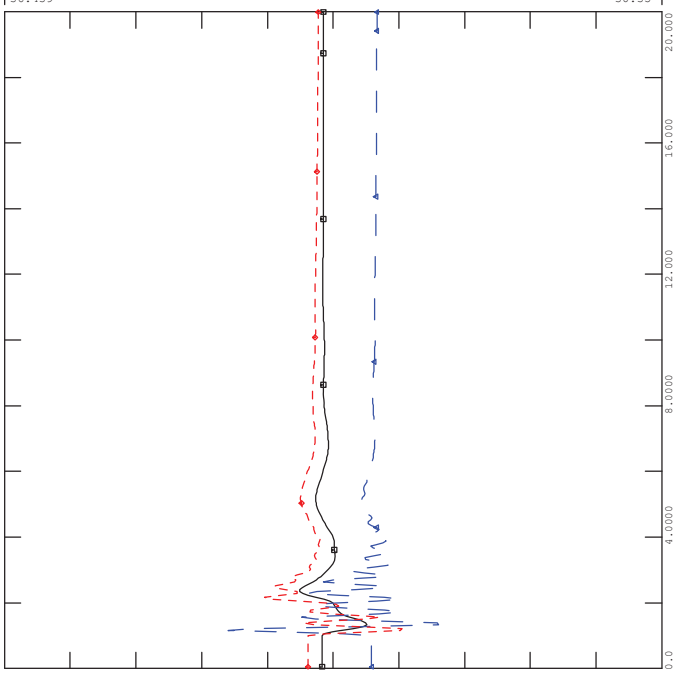


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_06_725L

FILE: Scn7_SP_06_725L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
89.004 13.172
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
123.00 34.754
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
36.439 -30.35

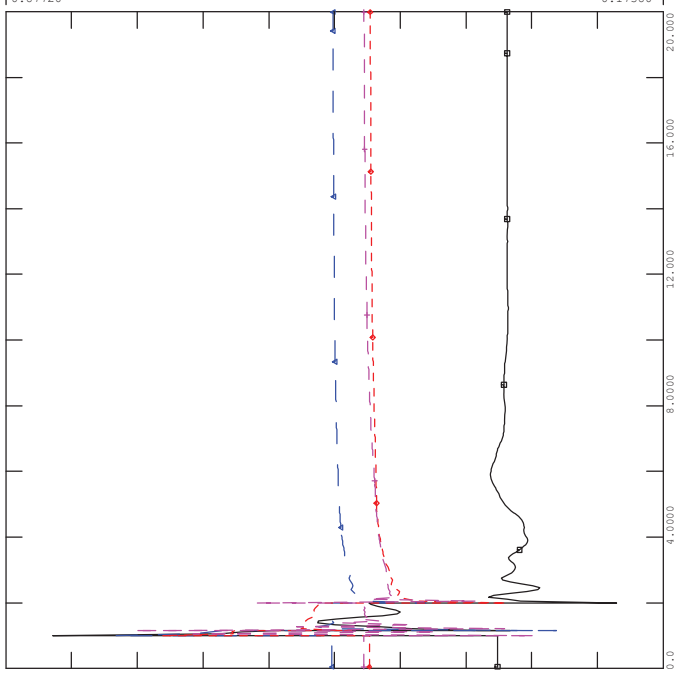


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_06_725L

FILE: Scn7_SP_06_725L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

CHNL# 207: [VARS562026[TRAVERS_1C 0.4800]PV]
0.51510 0.25950
CHNL# 245: [VARS 2690[COALDAL8 25.000]4]
0.09520 -0.1150
CHNL# 198: [VARS 4235[STAVELY9 25.000]1]
0.12990 -0.1782
CHNL# 380: [VARS 1487[SHEER 29 19.000]2]
0.87720 0.17380

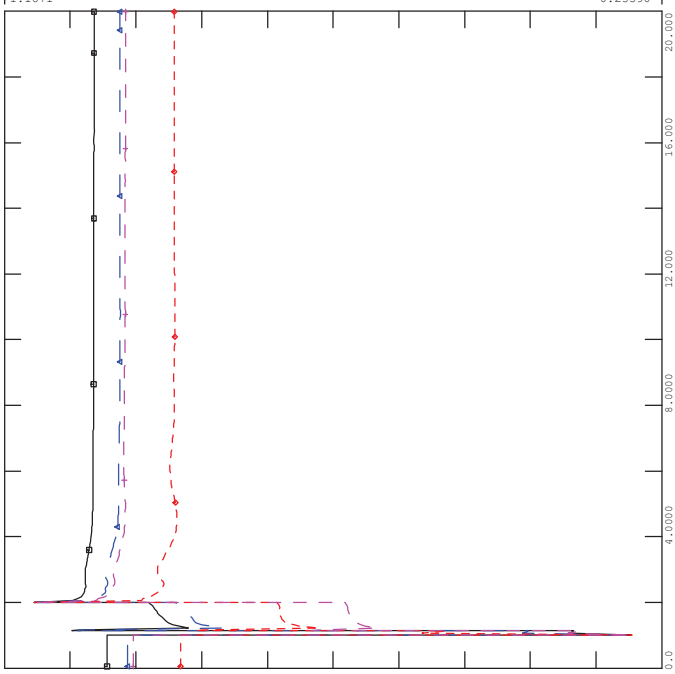


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_06_725L

FILE: Scn7_SP_06_725L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 398: [VOLT 692 [N LETHB7 138.00]]
1.1364 0.64050
CHNL# 397: [VOLT 430 [W BROOK4 240.00]]
1.0793 0.93990
CHNL# 396: [VOLT 333 [QUENSTWN 138.00]]
1.1133 0.60020
CHNL# 395: [VOLT 279 [STAVELEY 138.00]]
1.1871 0.23590

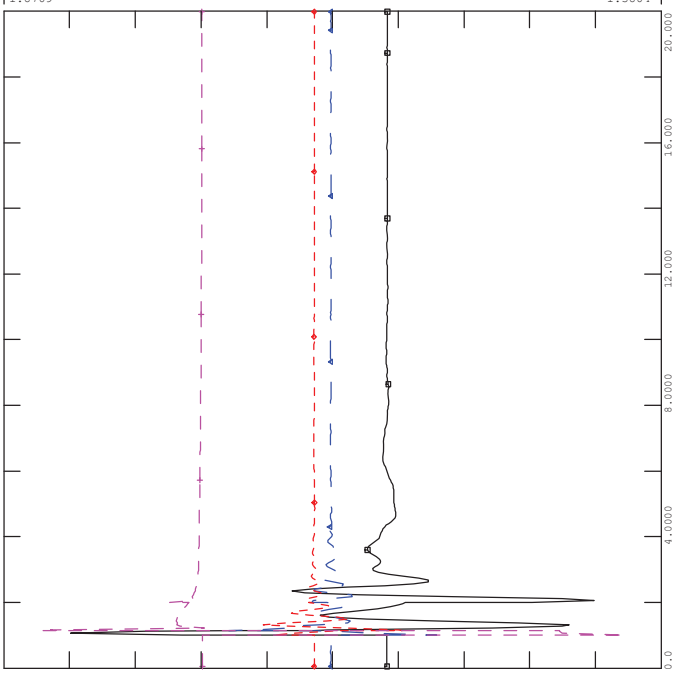


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_07_853L

FILE: Scn7_SP_07_853L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.92200 0.02040
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.11980 -0.0069
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.16480 0.01840
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
1.8709 1.3804

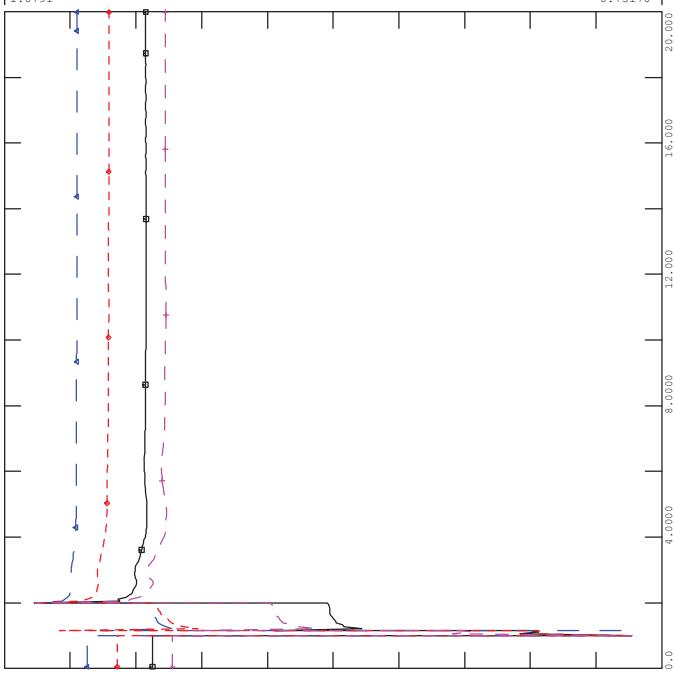


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_06_725L

FILE: Scn7_SP_06_725L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 394: [VOLT 276 [W BROOK7 138.00]]
1.0641 0.89540
CHNL# 393: [VOLT 244 [VULCAN 7 138.00]]
1.1808 0.35490
CHNL# 392: [VOLT 237 [FORT MA7 138.00]]
1.1791 -0.0204
CHNL# 391: [VOLT 167 [N LETHB4 240.00]]
1.0791 0.75170

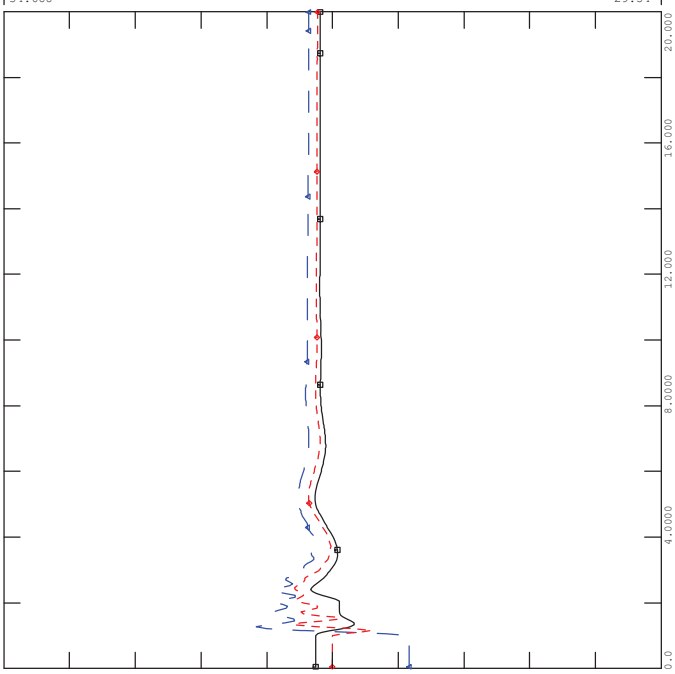


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_07_853L

FILE: Scn7_SP_07_853L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

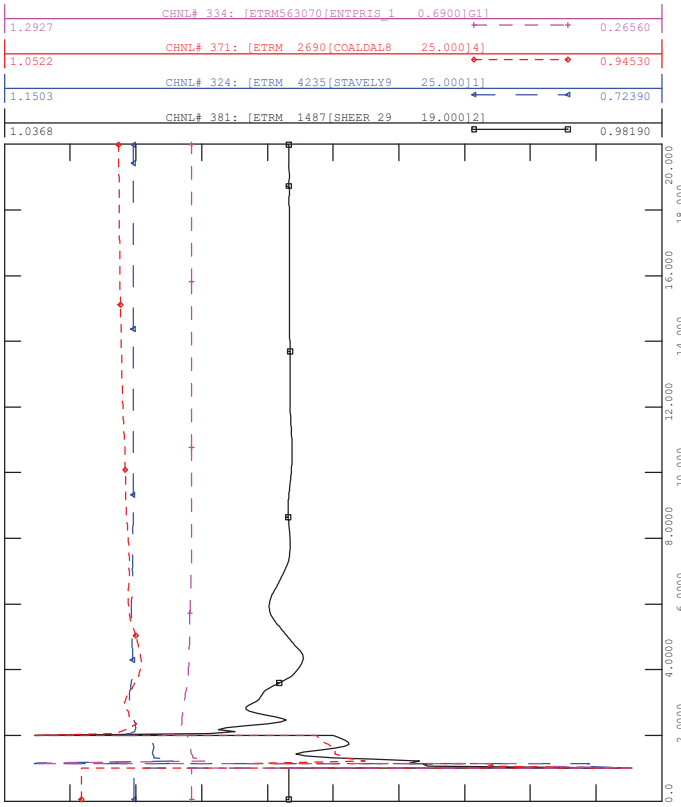
CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
87.982 19.969
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
121.95 43.710
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
34.688 -29.54



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_07_853L

FILE: Scn7_SP_07_853L.out

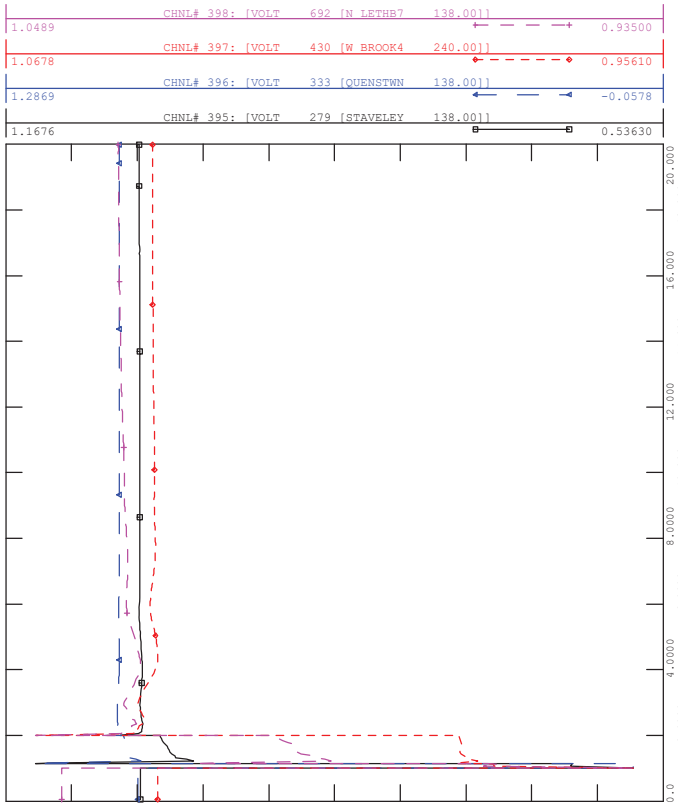
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_07_853L

FILE: Scn7_SP_07_853L.out

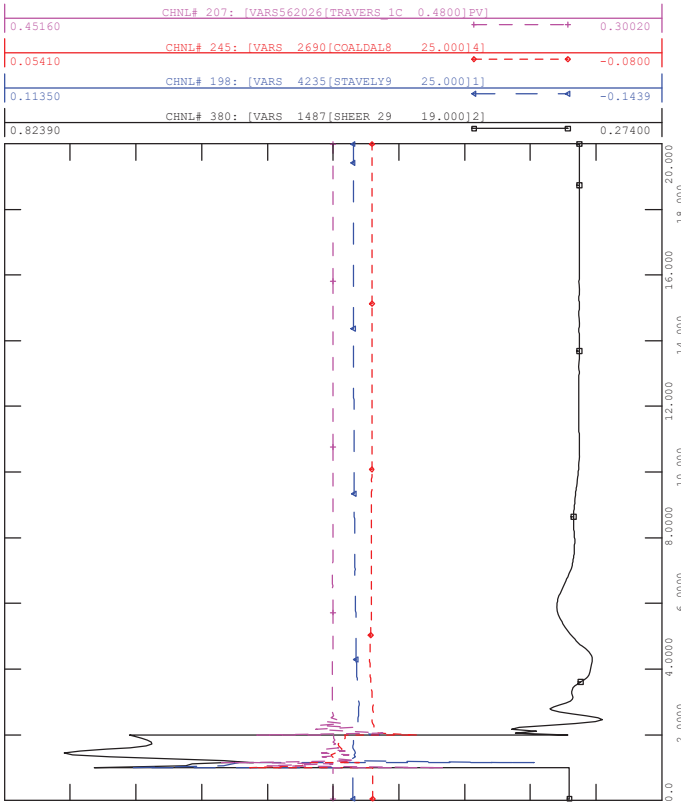
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_07_853L

FILE: Scn7_SP_07_853L.out

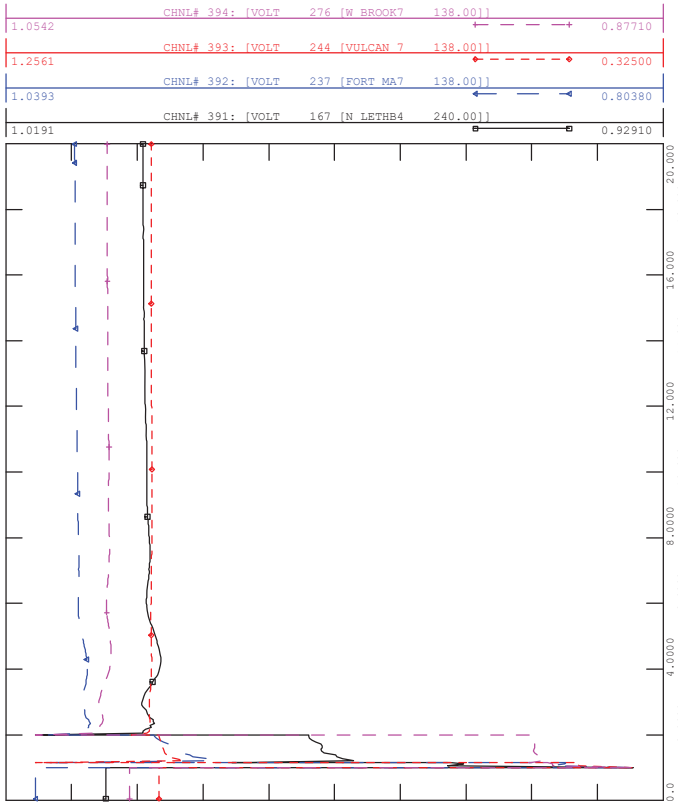
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_07_853L

FILE: Scn7_SP_07_853L.out

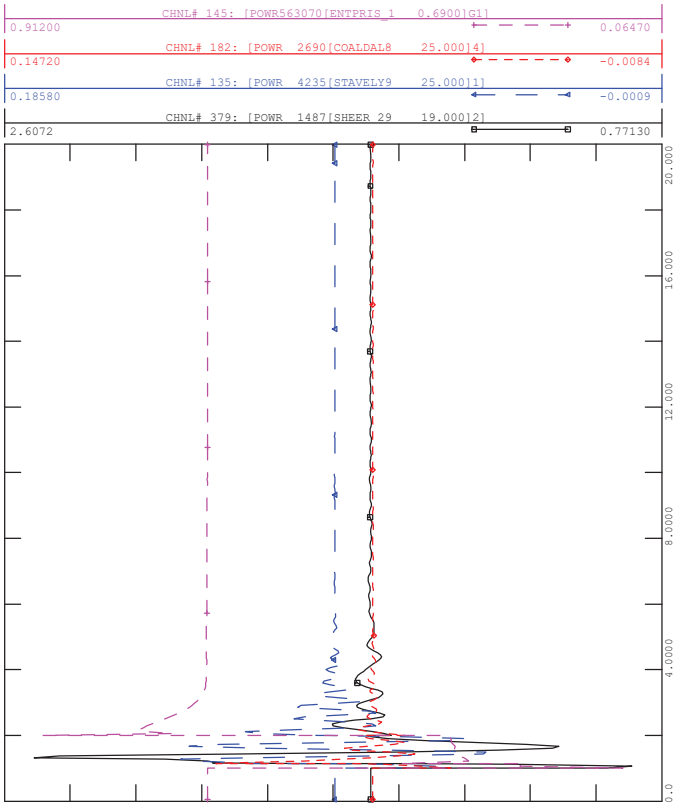
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_08_853L

FILE: Scn7_SP_08_853L.out

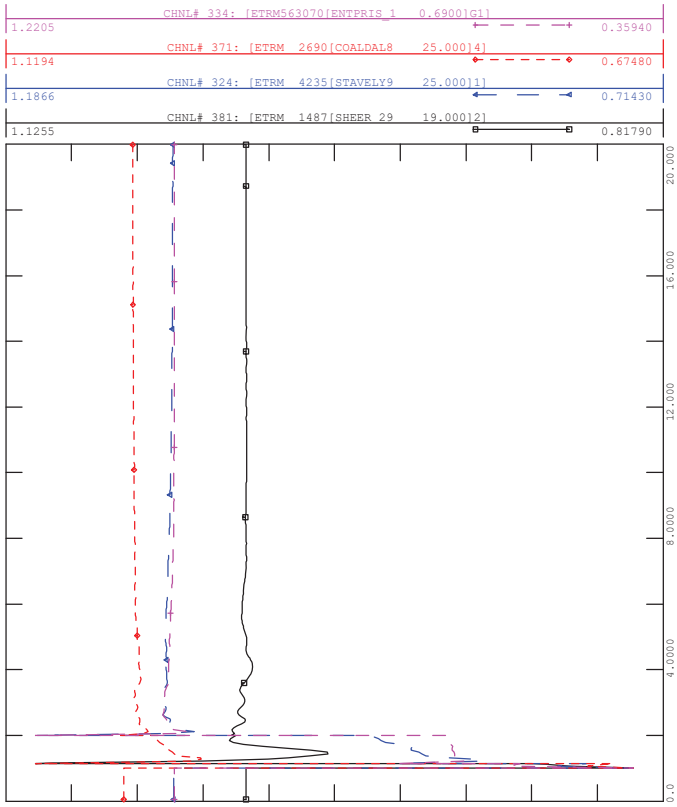
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_08_853L

FILE: Scn7_SP_08_853L.out

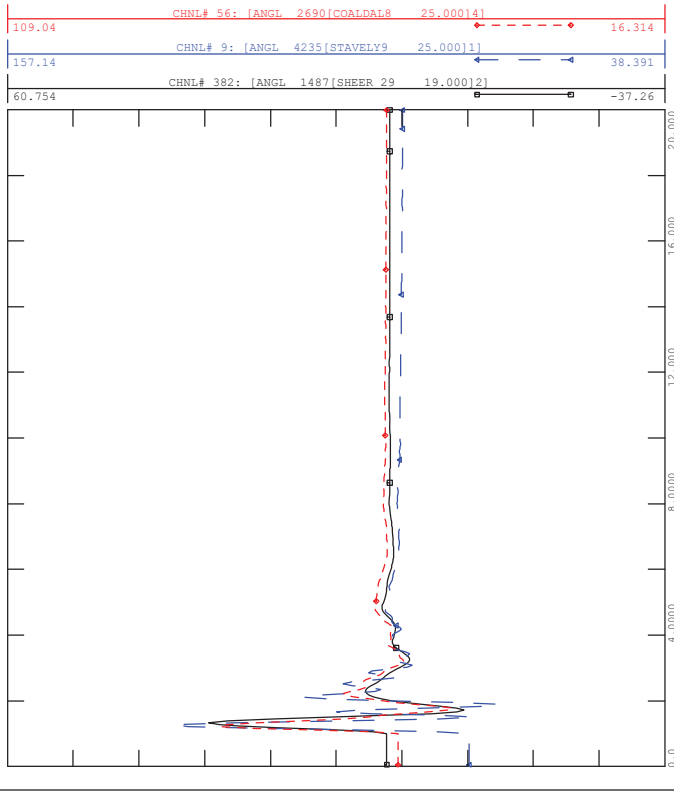
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_08_853L

FILE: Scn7_SP_08_853L.out

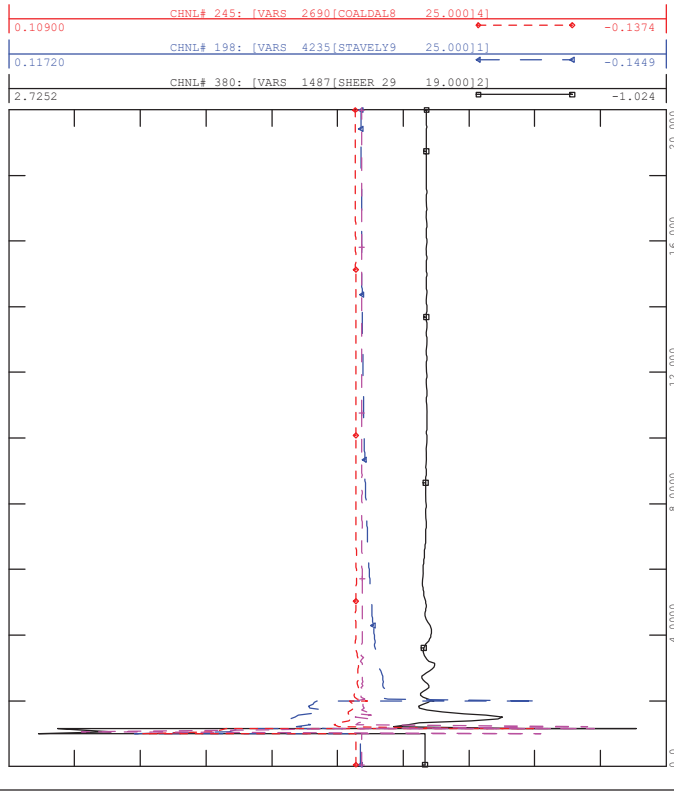
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_08_853L

FILE: Scn7_SP_08_853L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

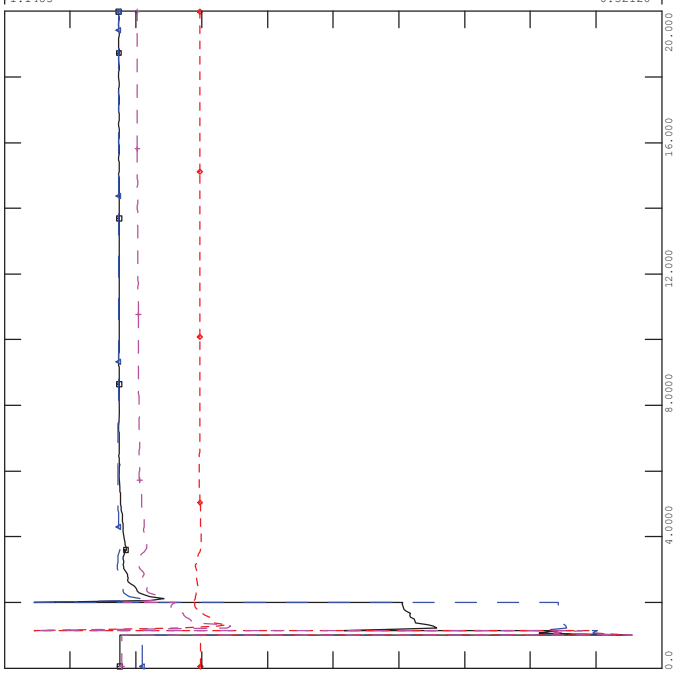


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_08_853L

FILE: Scn7_SP_08_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 398: [VOLT 692 [N LETHB7 138.00]]
1.1147 0.69130
CHNL# 397: [VOLT 430 [W BROOK4 240.00]]
1.2783 0.48620
CHNL# 396: [VOLT 333 [QUENSTWN 138.00]]
1.2369 0.18890
CHNL# 395: [VOLT 279 [STAVELEY 138.00]]
1.1485 0.52120

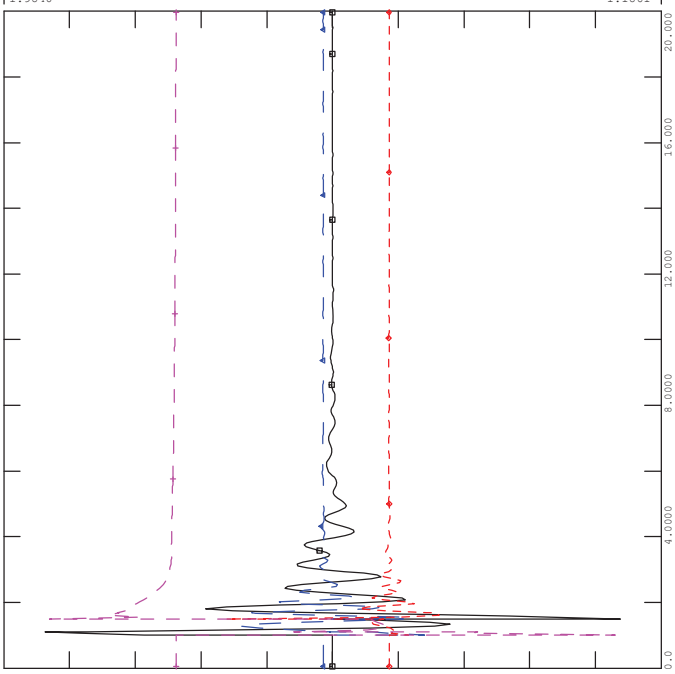


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_09_172L

FILE: Scn7_SP_09_172L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900[G1]
0.83800 0.12100
CHNL# 182: [POWR 2690[COALDAL8 25.000[4]
0.14660 -0.0012
CHNL# 135: [POWR 4235[STAVELY9 25.000[1]
0.15950 0.02050
CHNL# 379: [POWR 1487[SHEER 29 19.000[2]
1.9840 1.1861

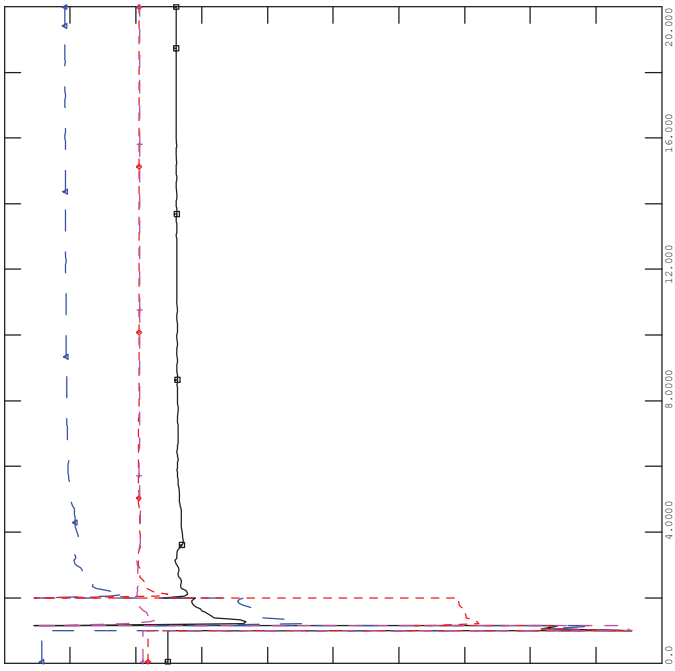


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_08_853L

FILE: Scn7_SP_08_853L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 394: [VOLT 276 [W BROOK7 138.00]]
1.2730 0.07520
CHNL# 393: [VOLT 244 [VULCAN 7 138.00]]
1.2165 0.40250
CHNL# 392: [VOLT 237 [FORT MA7 138.00]]
1.0513 0.65140
CHNL# 391: [VOLT 167 [N LETHB4 240.00]]
1.1072 0.69790

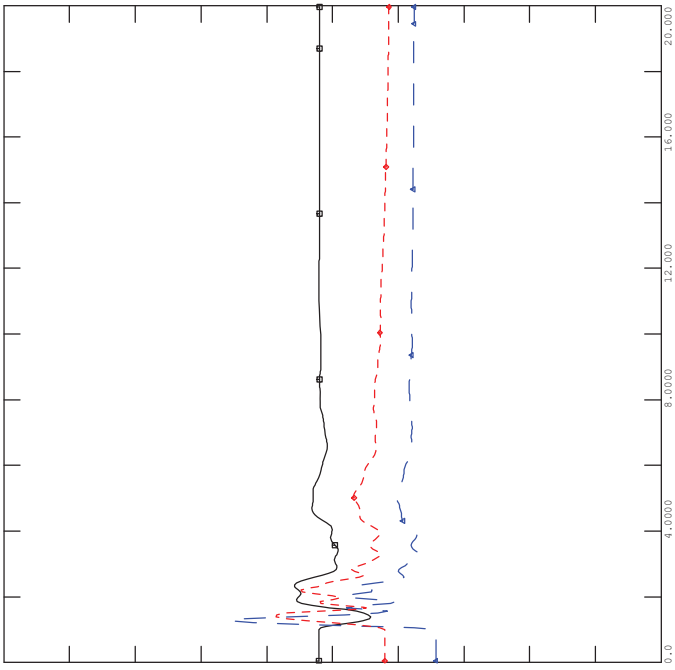


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_09_172L

FILE: Scn7_SP_09_172L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

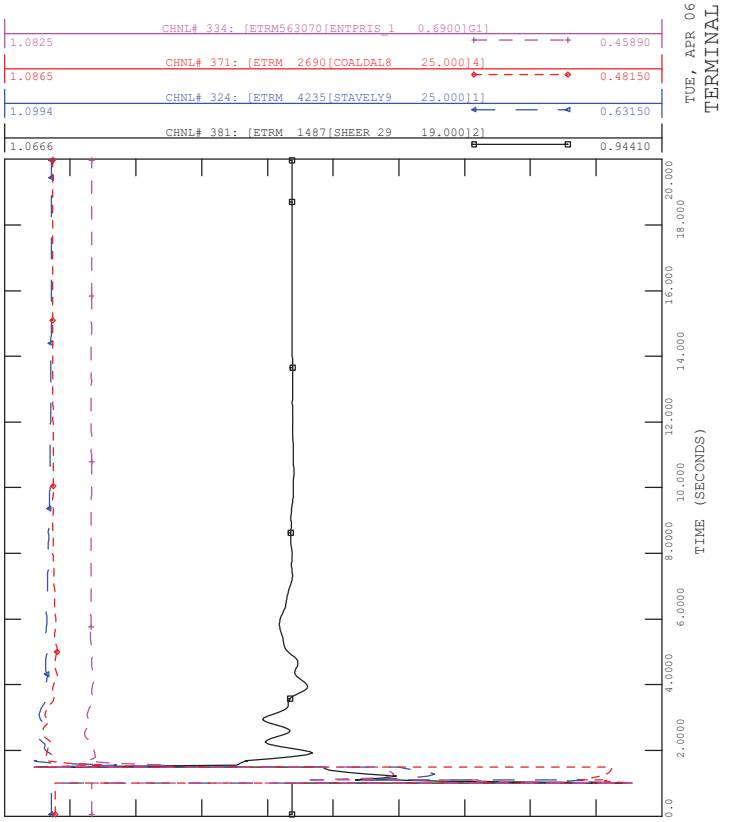
CHNL# 56: [ANGL 2690[COALDAL8 25.000[4]
95.964 23.515
CHNL# 9: [ANGL 4235[STAVELY9 25.000[1]
131.20 43.713
CHNL# 382: [ANGL 1487[SHEER 29 19.000[2]
36.738 -31.11



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_09_172L

FILE: Scn7_SP_09_172L.out

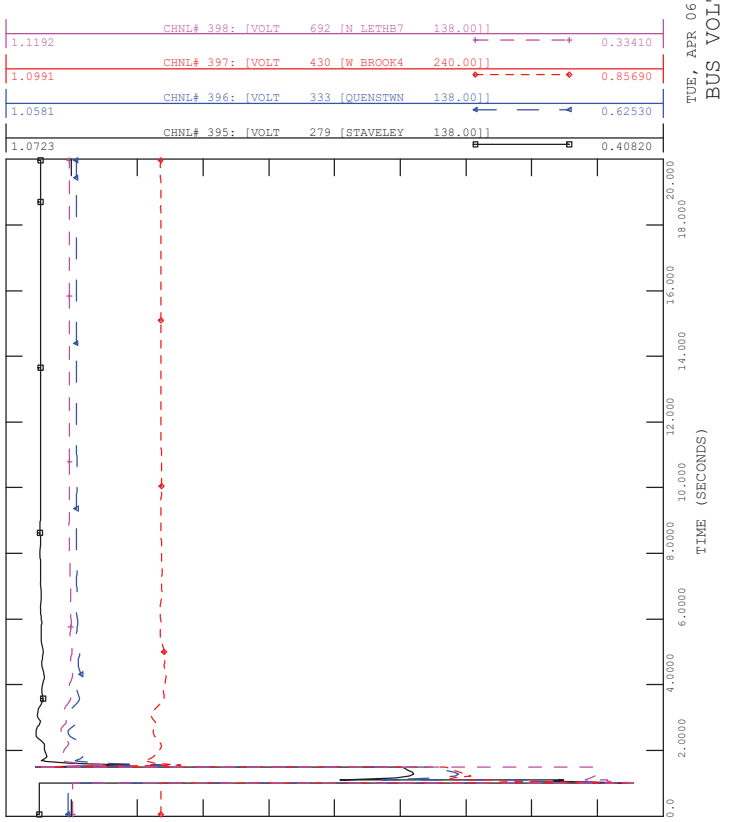
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_09_172L

FILE: Scn7_SP_09_172L.out

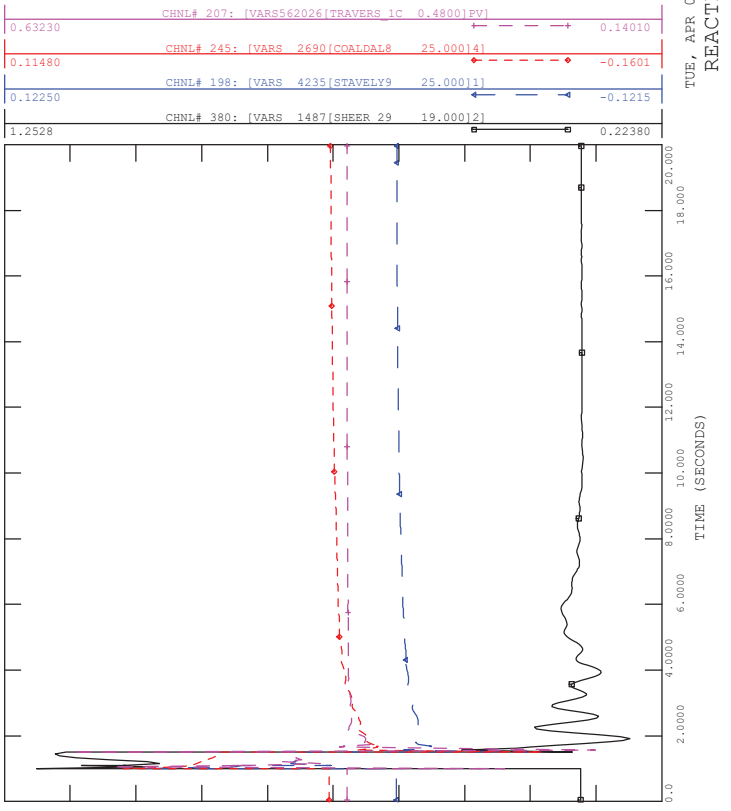
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_09_172L

FILE: Scn7_SP_09_172L.out

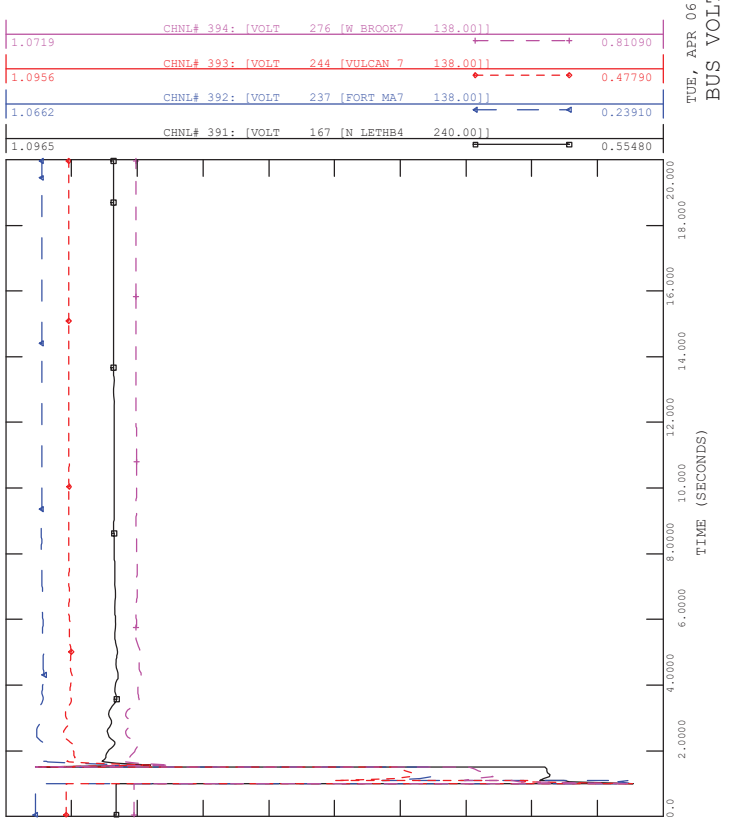
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_09_172L

FILE: Scn7_SP_09_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

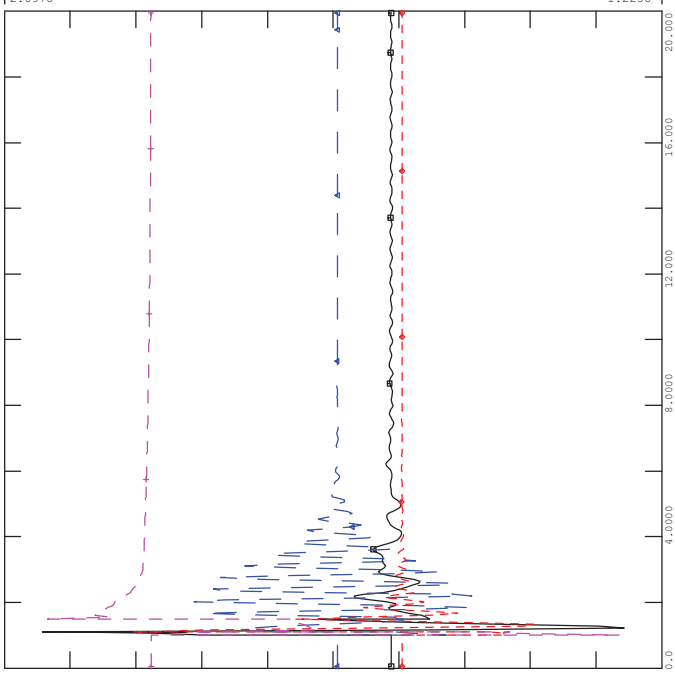


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_10_172L

FILE: Scn7_SP_10_172L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.82010 0.05840
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.21490 -0.0413
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.17980 0.00640
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
2.0978 1.2258

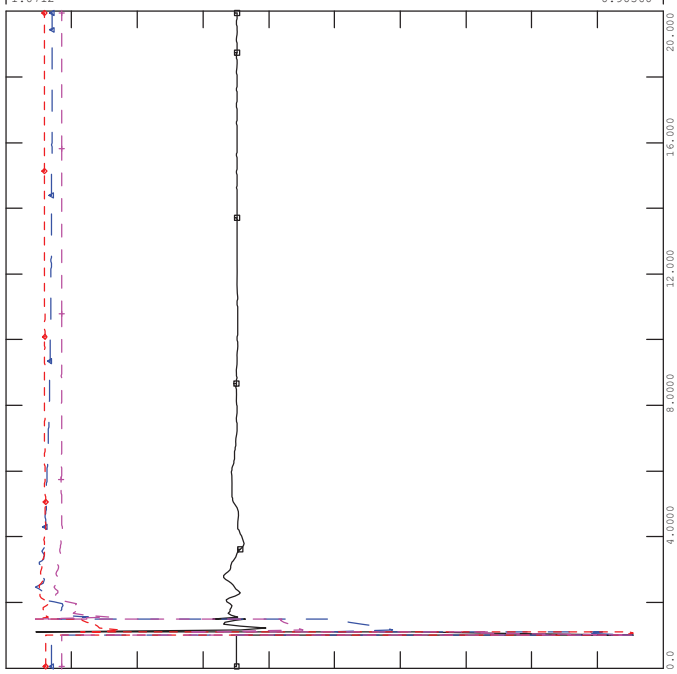


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_10_172L

FILE: Scn7_SP_10_172L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 334: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.0597 0.35530
CHNL# 371: [ETRM 2690[COALDAL8 25.000]4]
1.0965 0.15930
CHNL# 324: [ETRM 4235[STAVELY9 25.000]1]
1.1038 0.56450
CHNL# 381: [ETRM 1487[SHEER 29 19.000]2]
1.0712 0.90560

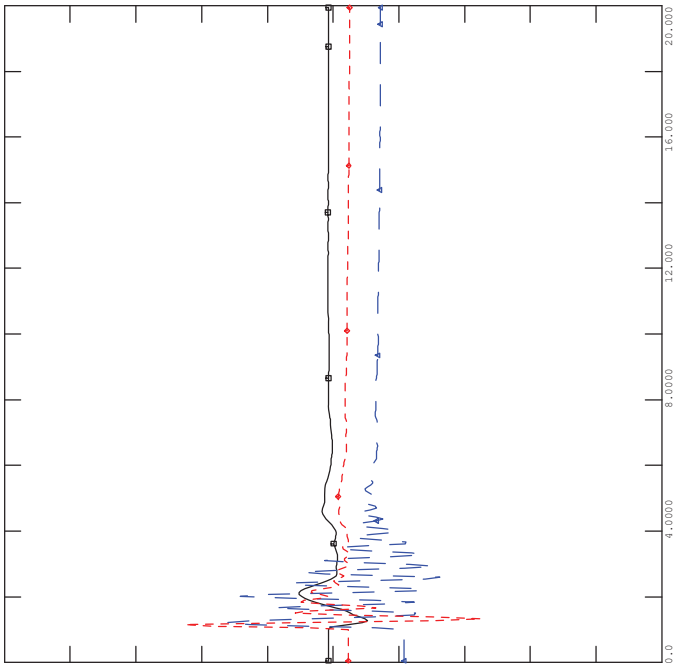


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_10_172L

FILE: Scn7_SP_10_172L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
111.01 1.9355
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
127.76 38.881
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
37.189 -29.75

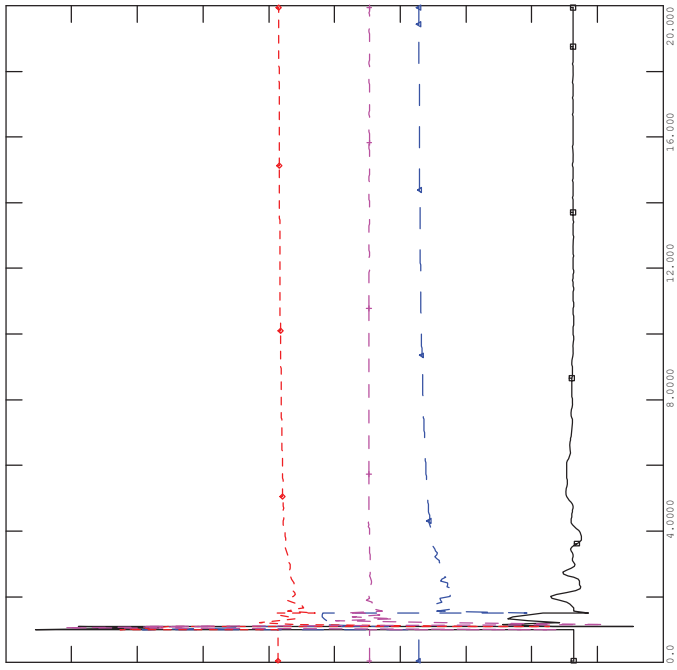


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_10_172L

FILE: Scn7_SP_10_172L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

CHNL# 207: [VARS562026[TRAVERS_1C 0.4800]PV]
0.69090 0.12120
CHNL# 245: [VARS 2690[COALDAL8 25.000]4]
0.09840 -0.1898
CHNL# 198: [VARS 4235[STAVELY9 25.000]1]
0.12820 -0.1126
CHNL# 380: [VARS 1487[SHEER 29 19.000]2]
1.7129 0.13590

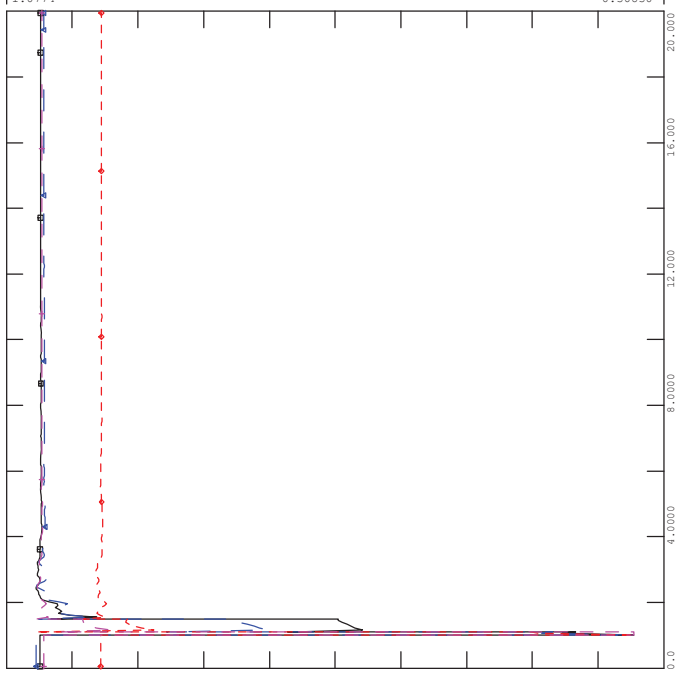


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_10_172L

FILE: Scn7_SP_10_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 398: [VOLT 692 [N LETHB7 138.00]]
1.1040 -0.0460
CHNL# 397: [VOLT 430 [W BROOK4 240.00]]
1.0904 0.75290
CHNL# 396: [VOLT 333 [QUENSTWN 138.00]]
1.0410 0.51570
CHNL# 395: [VOLT 279 [STAVELEY 138.00]]
1.0774 0.30830

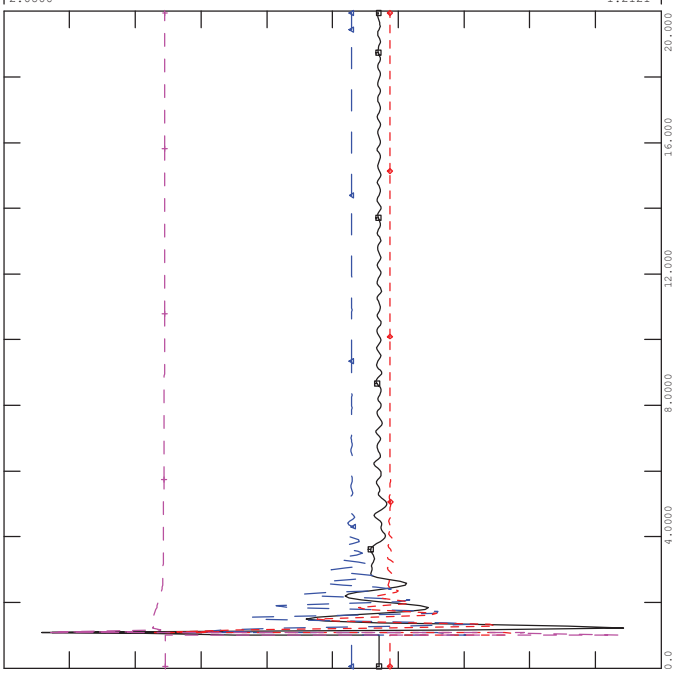


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_11_1041L

FILE: Scn7_SP_11_1041L.out

TUE, APR 06 2021 18:57
ACTIVE POWER

CHNL# 145: [POWR563070[ENTPRIS_1 0.6900]G1]
0.84070 0.06310
CHNL# 182: [POWR 2690[COALDAL8 25.000]4]
0.18830 -0.0301
CHNL# 135: [POWR 4235[STAVELY9 25.000]1]
0.18580 0.00850
CHNL# 379: [POWR 1487[SHEER 29 19.000]2]
2.0806 1.2121

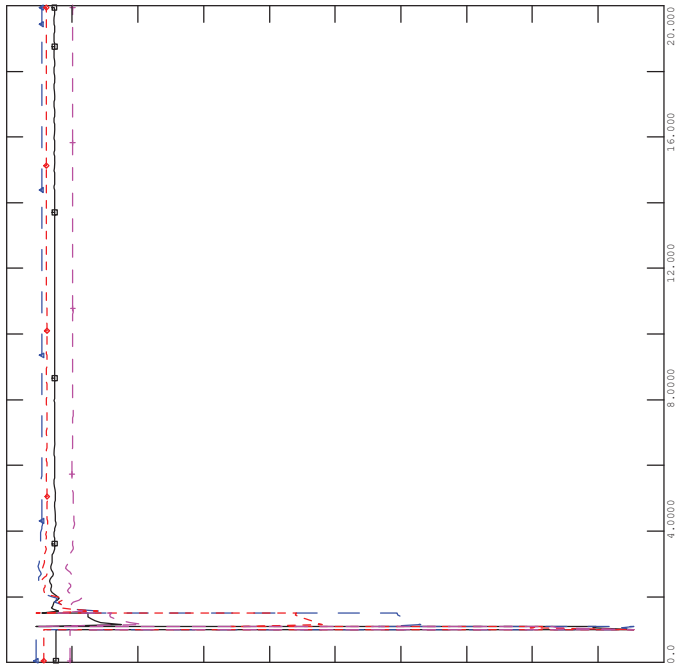


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_10_172L

FILE: Scn7_SP_10_172L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

CHNL# 394: [VOLT 276 [W BROOK7 138.00]]
1.0559 0.69570
CHNL# 393: [VOLT 244 [VULCAN 7 138.00]]
1.0792 0.37240
CHNL# 392: [VOLT 237 [FORT MA7 138.00]]
1.0710 0.13840
CHNL# 391: [VOLT 167 [N LETHB4 240.00]]
1.0600 0.33120

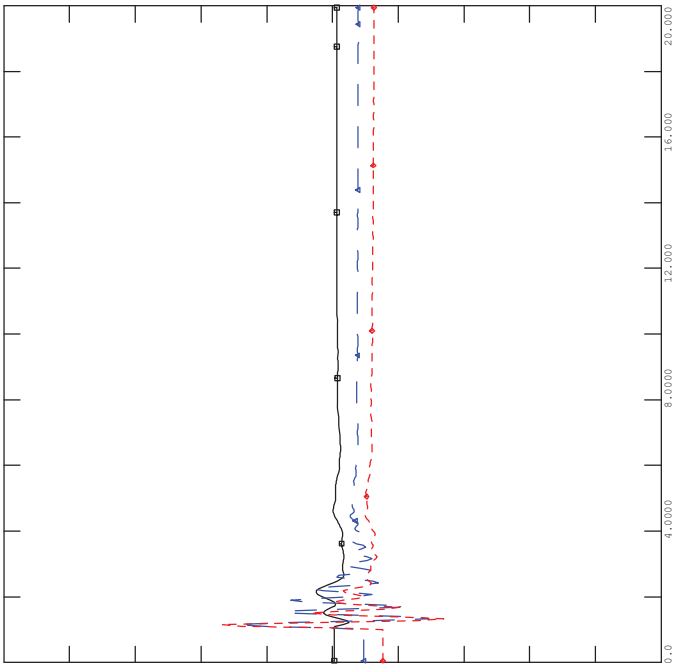


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_11_1041L

FILE: Scn7_SP_11_1041L.out

TUE, APR 06 2021 18:57
ROTOR ANGLE

CHNL# 56: [ANGL 2690[COALDAL8 25.000]4]
106.26 15.609
CHNL# 9: [ANGL 4235[STAVELY9 25.000]1]
120.22 35.285
CHNL# 382: [ANGL 1487[SHEER 29 19.000]2]
35.921 -27.23

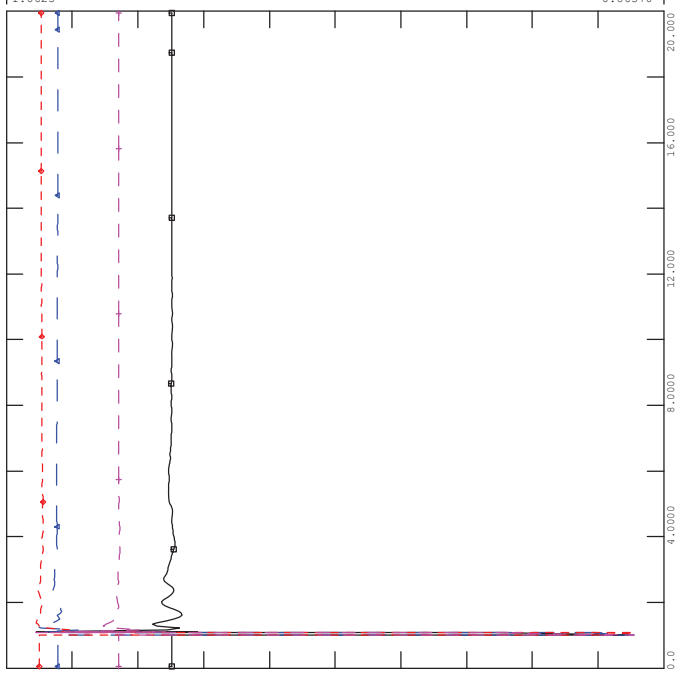


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_11_1041L

FILE: Scn7_SP_11_1041L.out

TUE, APR 06 2021 18:57
TERMINAL VOLTAGE

CHNL# 334: [ETRM563070[ENTPRIS_1 0.6900]G1]
1.1313 0.36200
CHNL# 371: [ETRM 2690[COALDAL8 25.000]4]
1.0838 0.20790
CHNL# 324: [ETRM 4235[STAVELY9 25.000]1]
1.1058 0.59630
CHNL# 381: [ETRM 1487[SHEER 29 19.000]2]
1.0625 0.86570

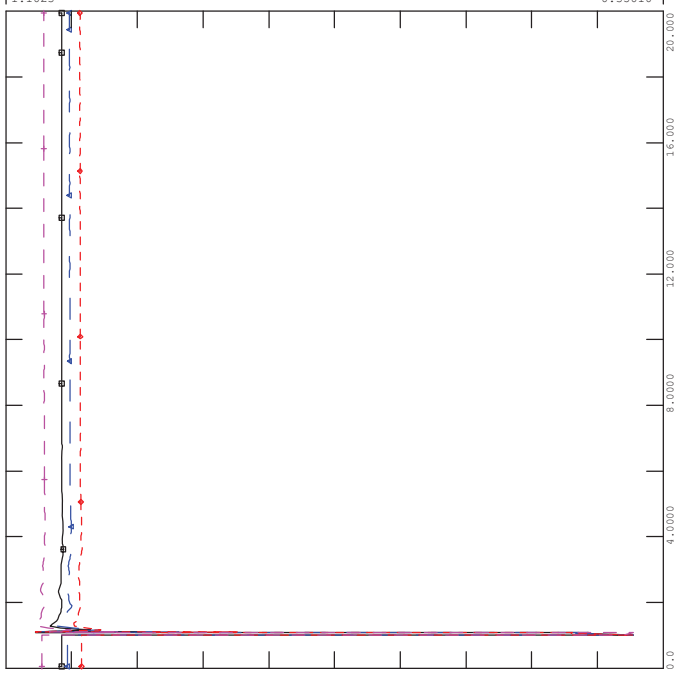


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_11_1041L

FILE: Scn7_SP_11_1041L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (2)

CHNL# 398: [VOLT 692 [N LETHB7 138.00]]
1.0955 0.06660
CHNL# 397: [VOLT 430 [W BROOK4 240.00]]
1.0941 0.64220
CHNL# 396: [VOLT 333 [QUENSTWN 138.00]]
1.0734 0.47360
CHNL# 395: [VOLT 279 [STAVELEY 138.00]]
1.1023 0.35010

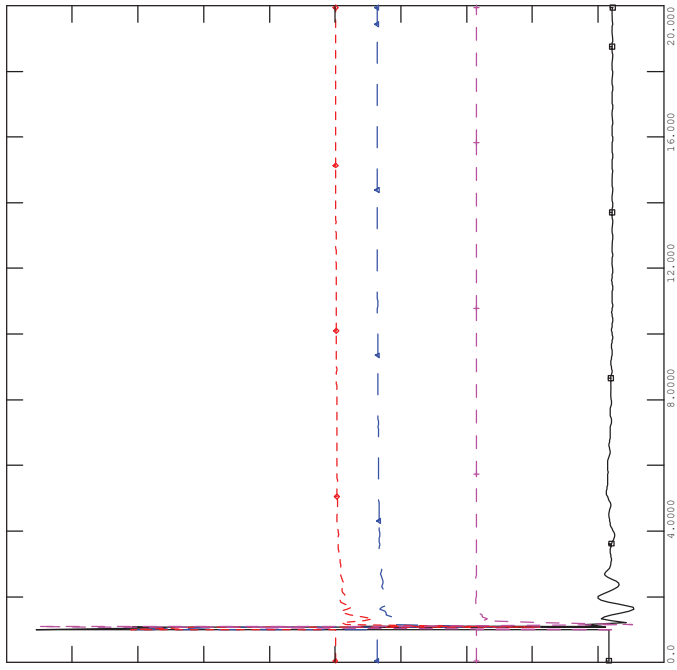


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_11_1041L

FILE: Scn7_SP_11_1041L.out

TUE, APR 06 2021 18:57
REACTIVE POWER

CHNL# 207: [VARS562026[TRAVERS_1C 0.4800]PV]
1.1319 0.07470
CHNL# 245: [VARS 2690[COALDAL8 25.000]4]
0.11130 -0.1532
CHNL# 198: [VARS 4235[STAVELY9 25.000]1]
0.12750 -0.1395
CHNL# 380: [VARS 1487[SHEER 29 19.000]2]
2.1533 0.18740

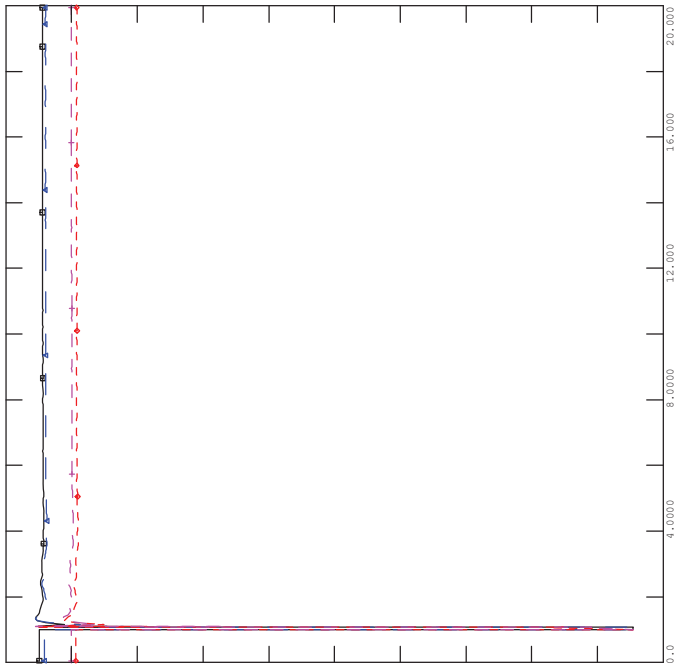


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_11_1041L

FILE: Scn7_SP_11_1041L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

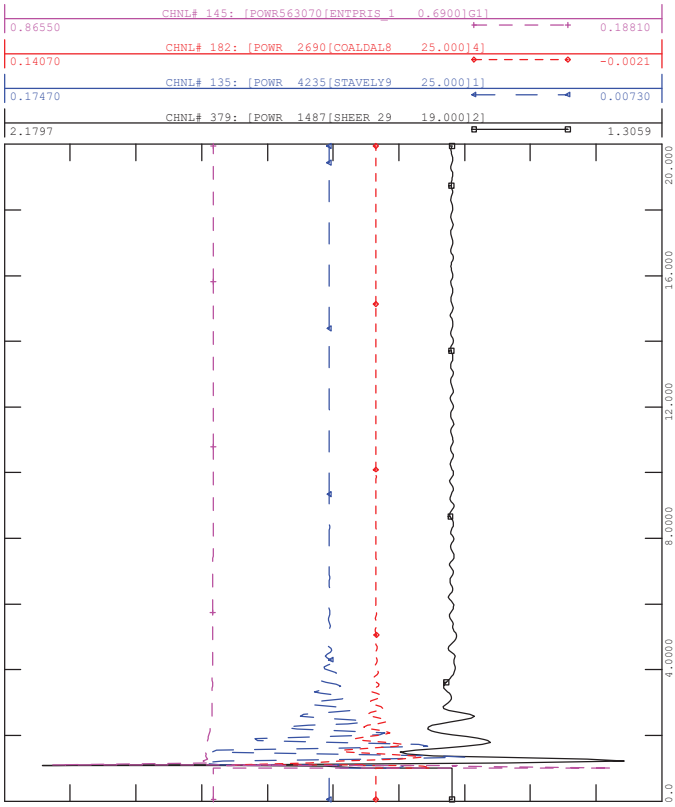
CHNL# 394: [VOLT 276 [W BROOK7 138.00]]
1.0676 0.59730
CHNL# 393: [VOLT 244 [VULCAN 7 138.00]]
1.1171 0.38450
CHNL# 392: [VOLT 237 [FORT MA7 138.00]]
1.0791 0.22150
CHNL# 391: [VOLT 167 [N LETHB4 240.00]]
1.0609 -0.0375



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_12_1041L

FILE: Scn7_SP_12_1041L.out

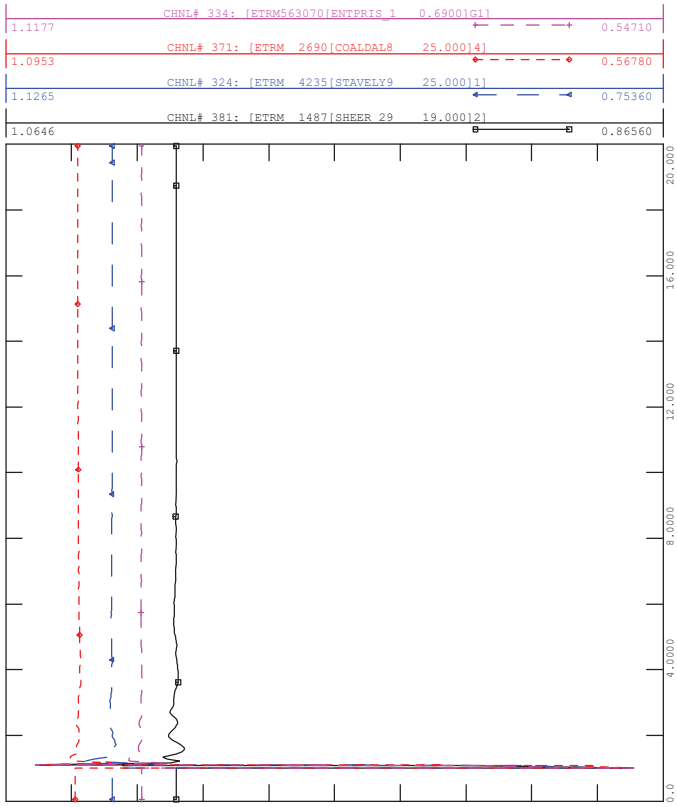
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_12_1041L

FILE: Scn7_SP_12_1041L.out

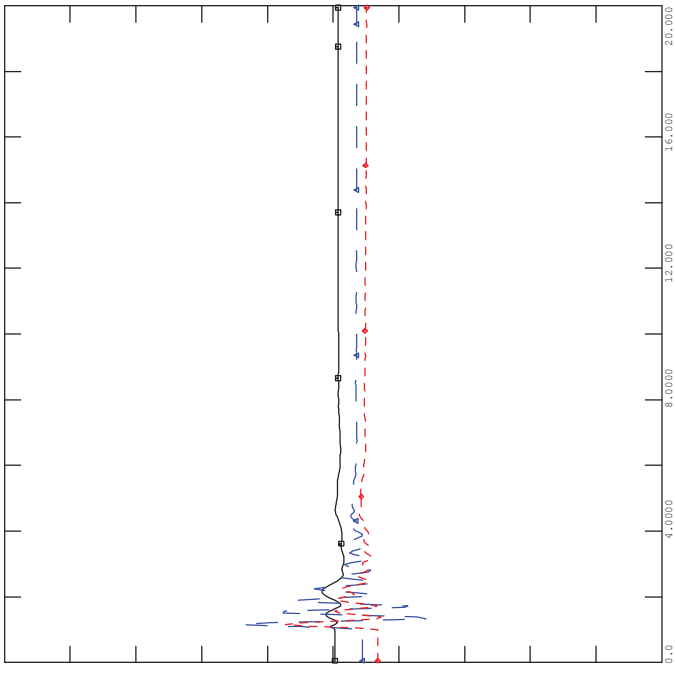
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_12_1041L

FILE: Scn7_SP_12_1041L.out

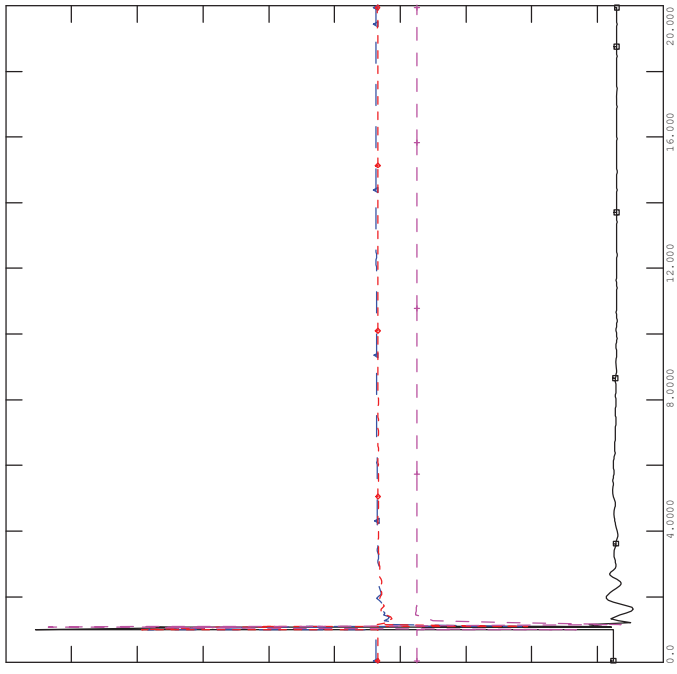
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_12_1041L

FILE: Scn7_SP_12_1041L.out

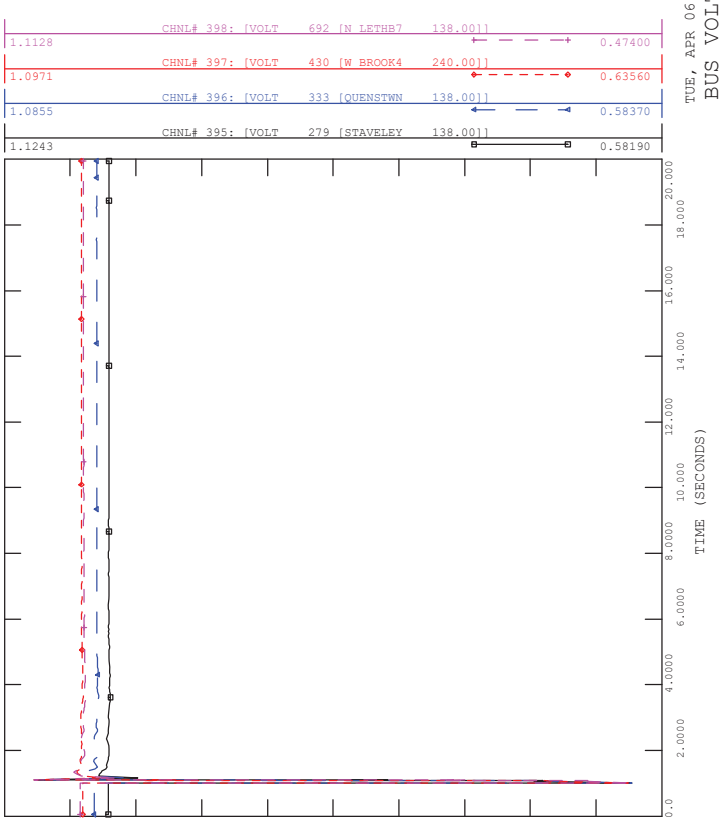
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_12_1041L

FILE: Scn7_SP_12_1041L.out

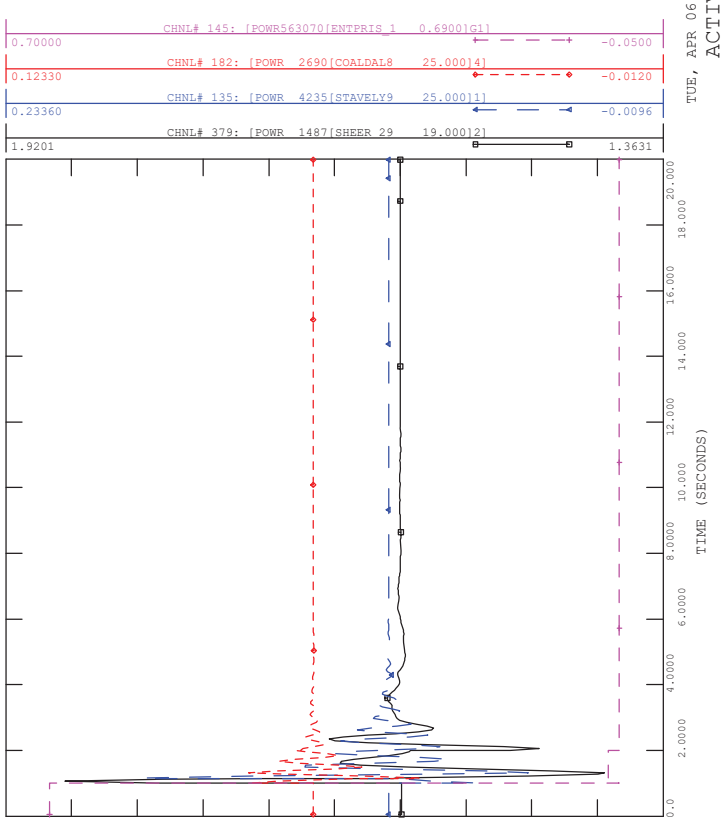
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_13_161L

FILE: Scn7_SP_13_161L.out

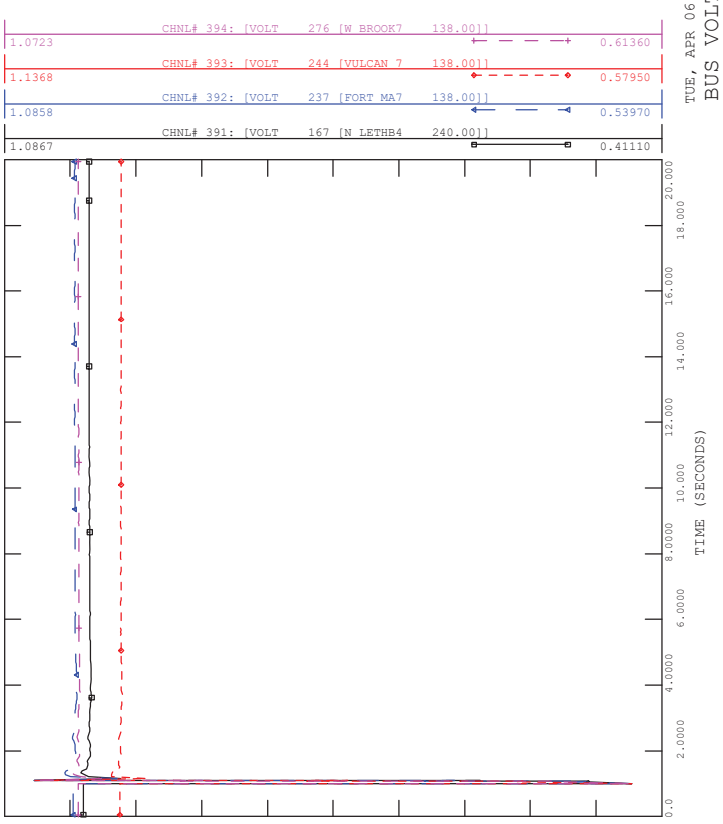
TUE, APR 06 2021 18:57
ACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_12_1041L

FILE: Scn7_SP_12_1041L.out

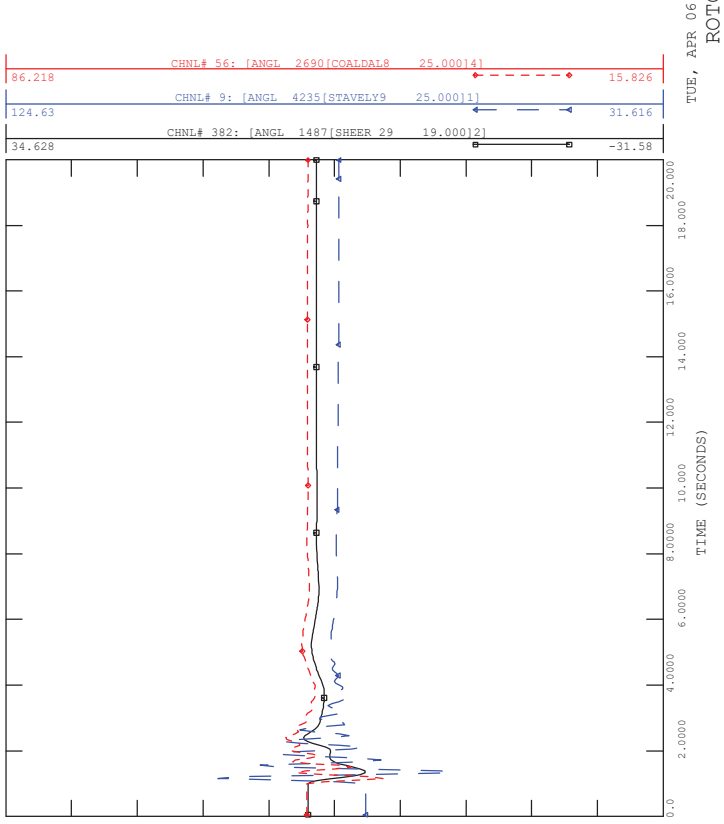
TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_13_161L

FILE: Scn7_SP_13_161L.out

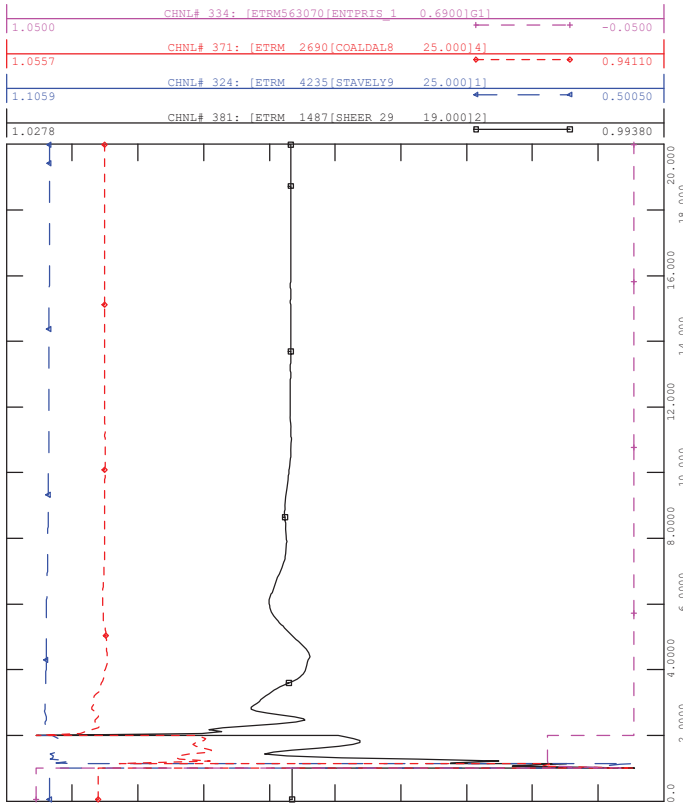
TUE, APR 06 2021 18:57
ROTOR ANGLE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_13_161L

FILE: Scn7_SP_13_161L.out

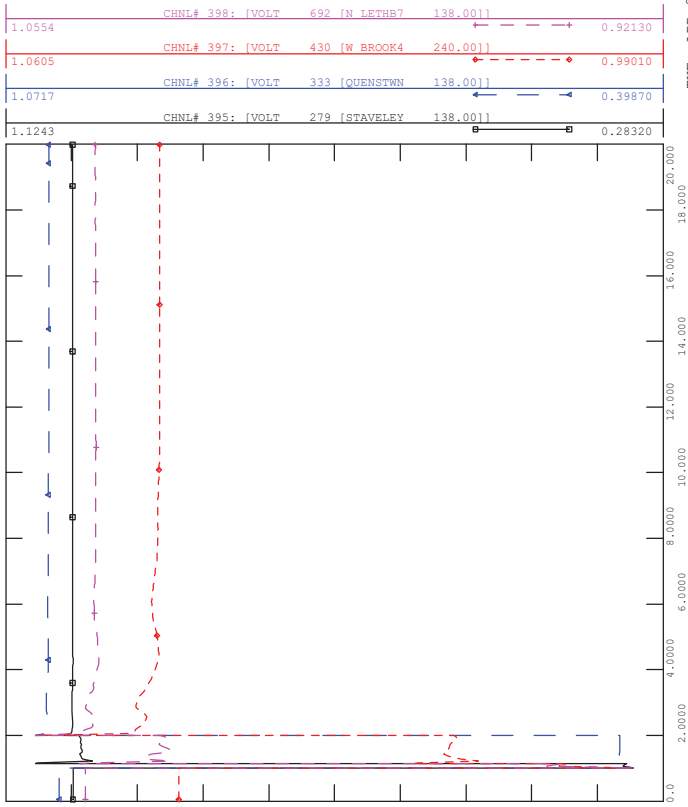
TUE, APR 06 2021 18:57
TERMINAL VOLTAGE



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_13_161L

FILE: Scn7_SP_13_161L.out

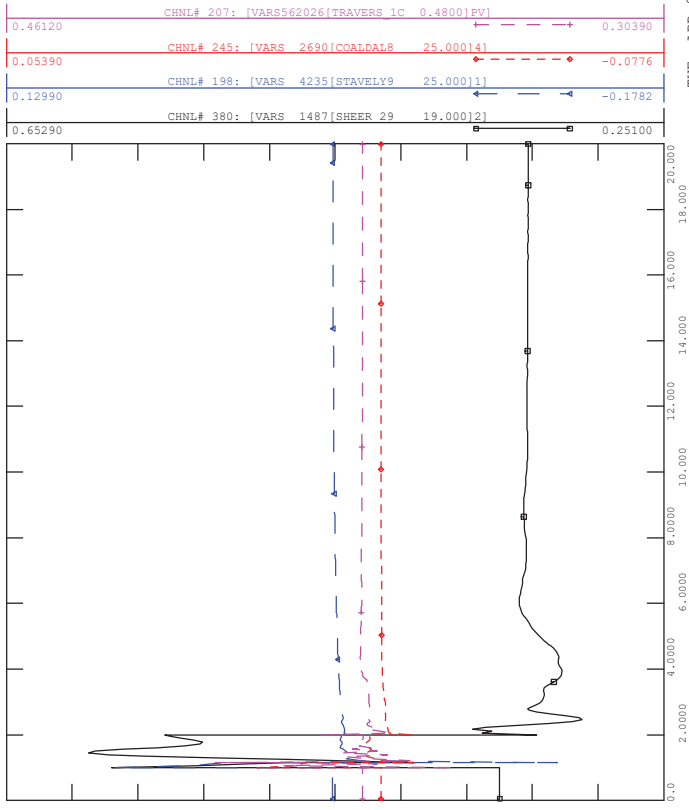
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_13_161L

FILE: Scn7_SP_13_161L.out

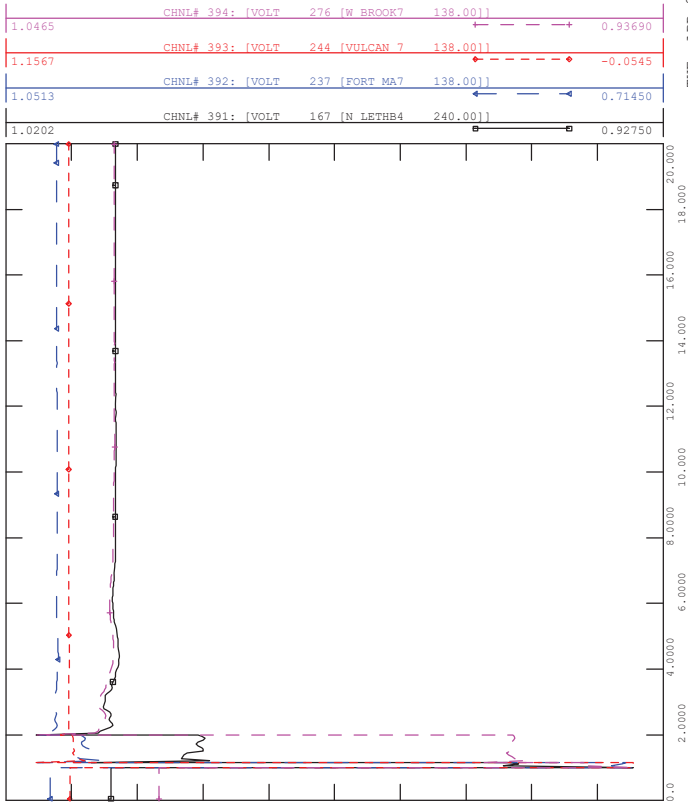
TUE, APR 06 2021 18:57
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_13_161L

FILE: Scn7_SP_13_161L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)

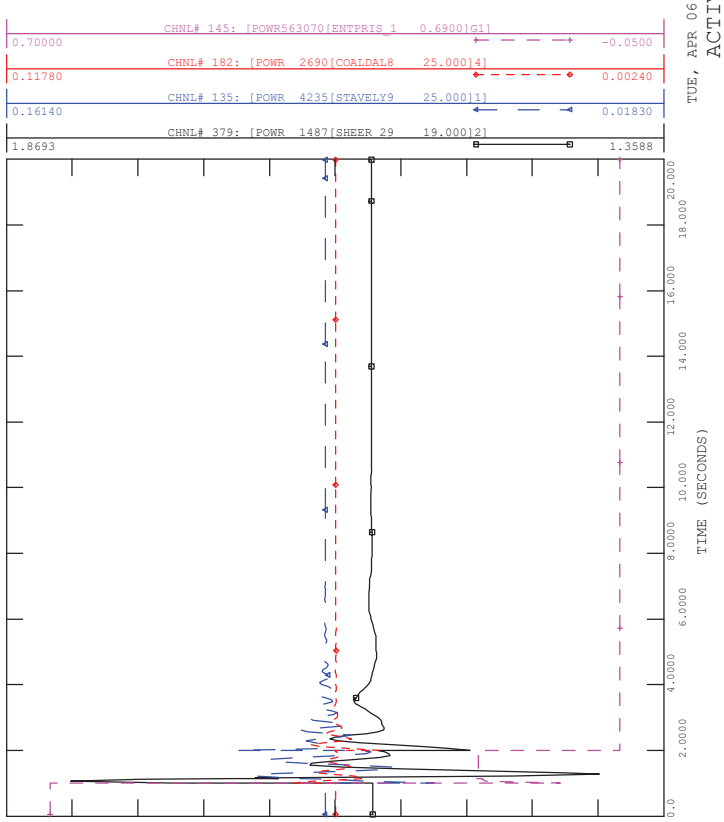


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_14_161L

FILE: Scn7_SP_14_161L.out

TUE, APR 06 2021 18:57

ACTIVE POWER

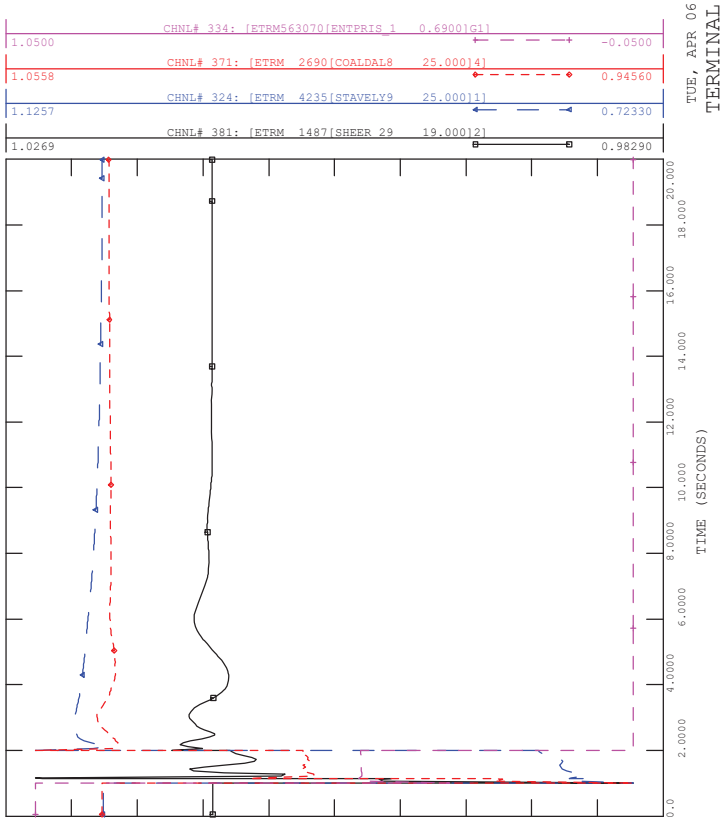


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_14_161L

FILE: Scn7_SP_14_161L.out

TUE, APR 06 2021 18:57

TERMINAL VOLTAGE

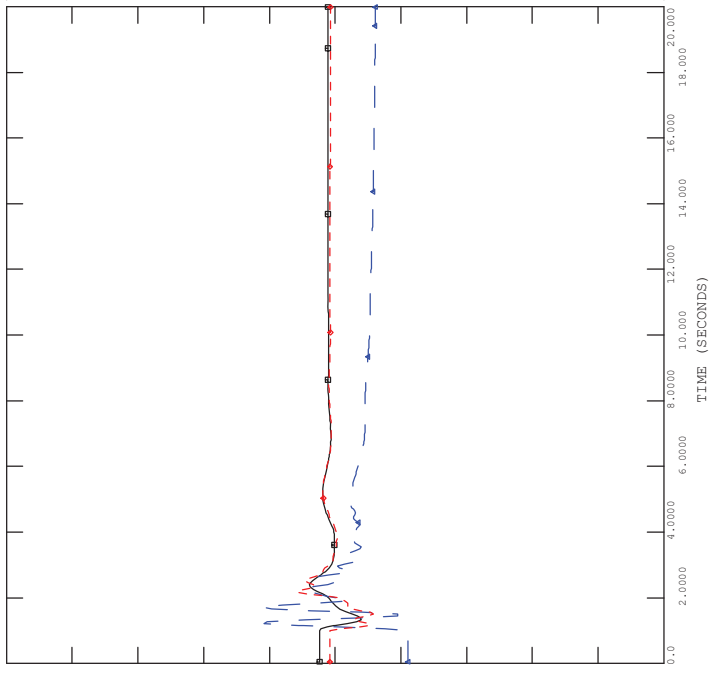


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_14_161L

FILE: Scn7_SP_14_161L.out

TUE, APR 06 2021 18:57

ROTOR ANGLE

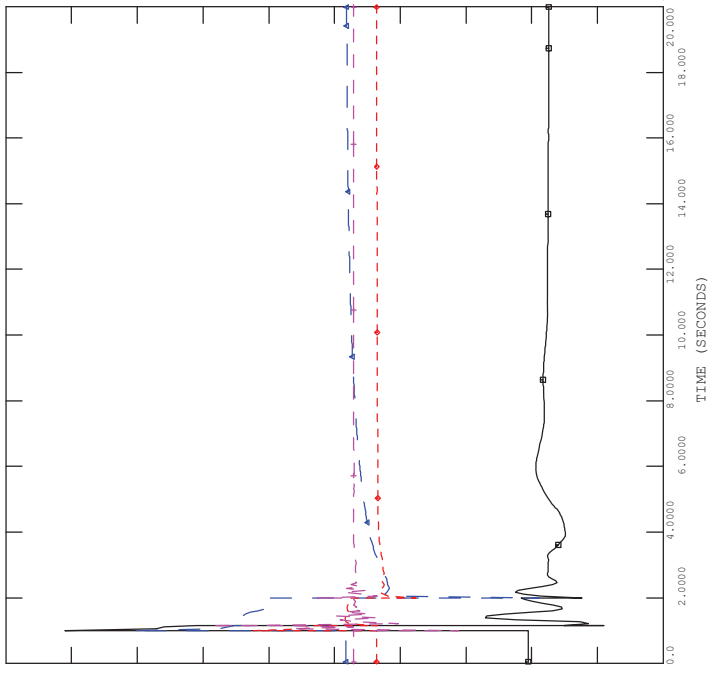


SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_14_161L

FILE: Scn7_SP_14_161L.out

TUE, APR 06 2021 18:57

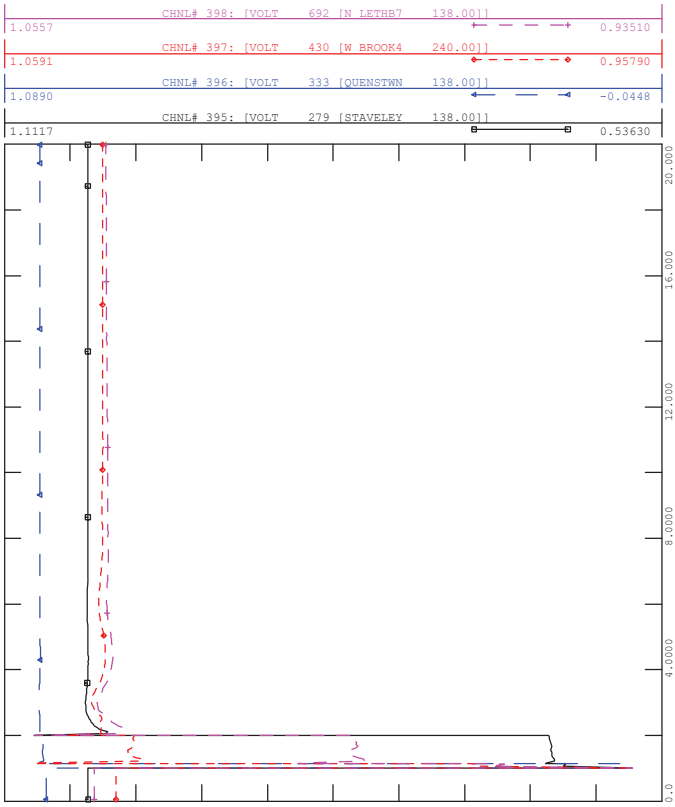
REACTIVE POWER



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_14_161L

FILE: Scn7_SP_14_161L.out

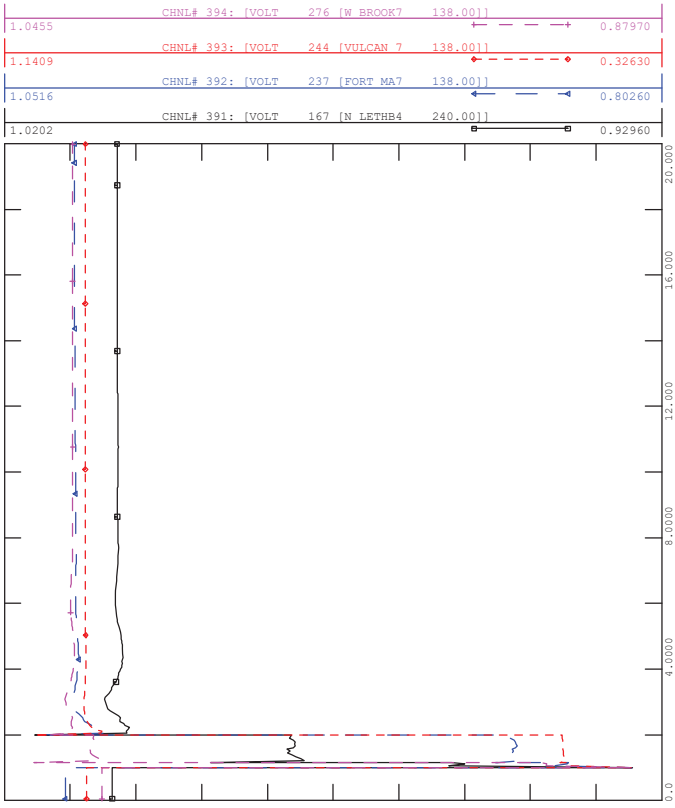
TUE, APR 06 2021 18:57
BUS VOLTAGE (2)



SCENARIO: P2300 SYSTEM IMPACT STUDY
CONTINGENCY -SCN7_SP_14_161L

FILE: Scn7_SP_14_161L.out

TUE, APR 06 2021 18:57
BUS VOLTAGE (1)



Attachment A5
Dynamic Data and Assumptions

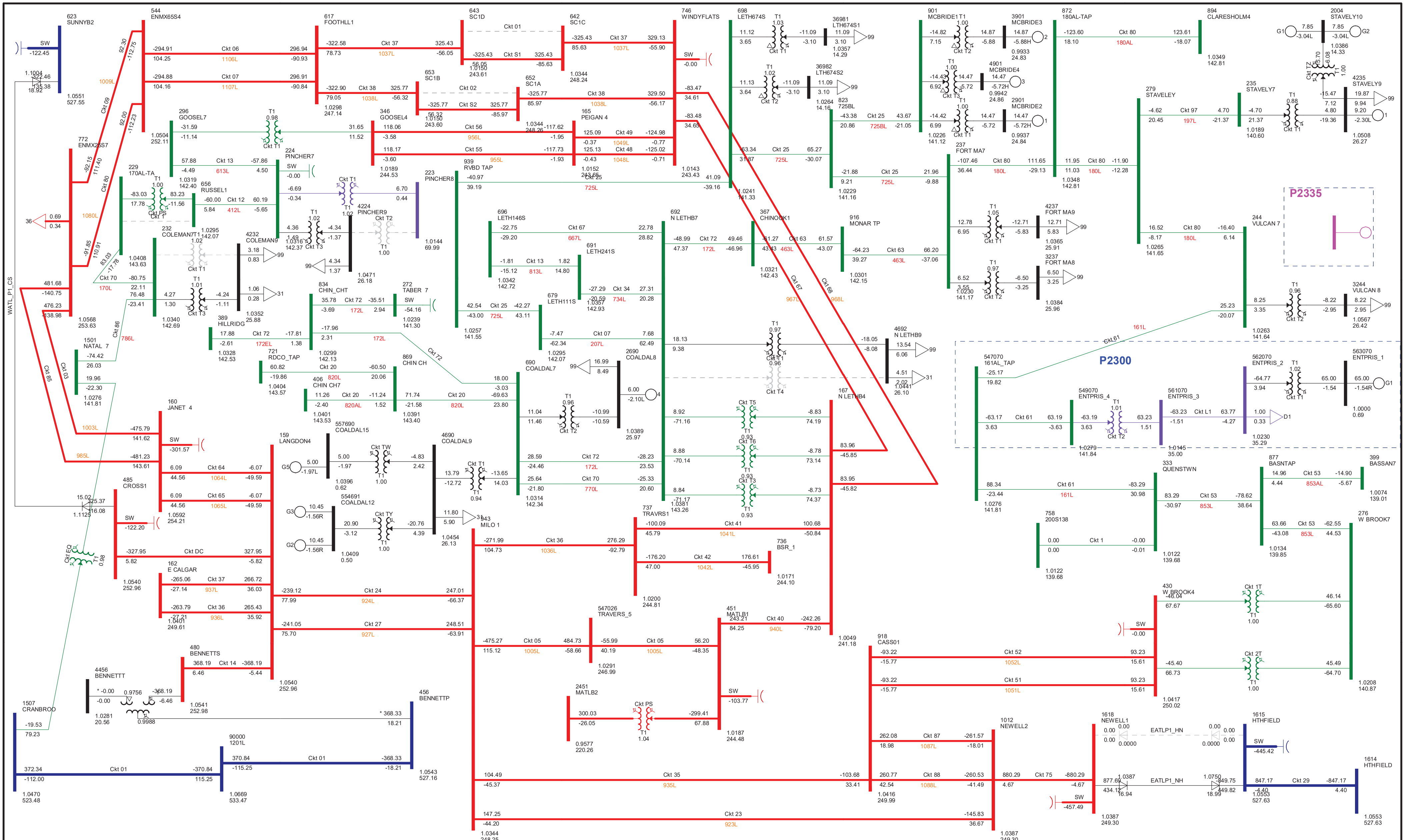
Table 1: Generic Renewable Energy Generator/Converter Model

Renewable Energy Generator/Converter Model (REGCAU1)													
Tg	Rrpwr	Brkpt	Zerox	Lvpl1	Volim	Lvpnt1	Lvpnt0	Iolim	Tfltr	Khv	Iqrmax	Iqrmin	Accel
0.02	10	0.9	0.5	1.22	1.2	0.8	0.4	-1.3	0.02	0.7	9999	-9999	1
Lvplsw													
1													

Table 2: Generic Renewable Electrical Control Model

Generic Renewable Electrical Control Model (REECBU1)													
Vdip	Vup	Trv	dbd1	dbd2	Kqv	Iqh1	Iql1	Vref0	Tp	QMax	QMin	VMAX	VMIN
0.9	1.1	0	-0.1	0.1	1.98	1	-1	0	0.05	0.5	-0.5	1.1	0.9
Kqp	Kqi	Kvp	Kvi	Tiq	dPmax	dPmin	PMAX	PMIN	Imax	Tpord	Bus	PFFLAG	VFLAG
0	3	18	5	0.05	106.2	-10.62	1.05	0.05	1.44	0.01	0	0	0
QFLAG	PQFLAG												
1	0												

Attachment A6
Post-Mitigation Power Flow Diagrams



P2300 RESC Enterprise MPC Solar

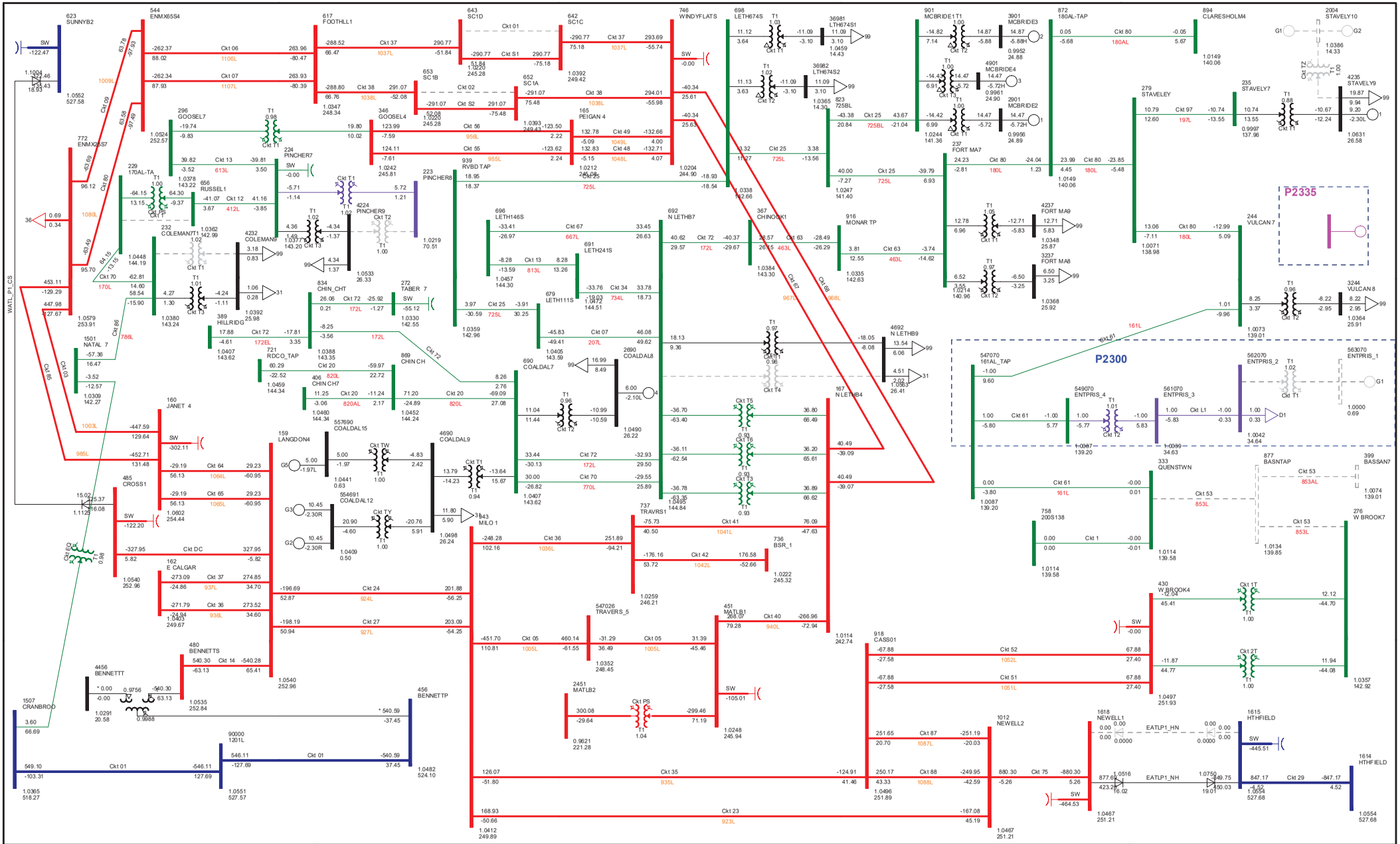
BC Import:-305.10 MW Sask Import:-0.00 MW MATL Import:-300.03 MW

MH Export: 22.21 MW

FIGURE A6-1-1-N-0: NORMAL OPERATION

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-501.34 MW Sask Import:0.00 MW MATL Import:-300.08 MW

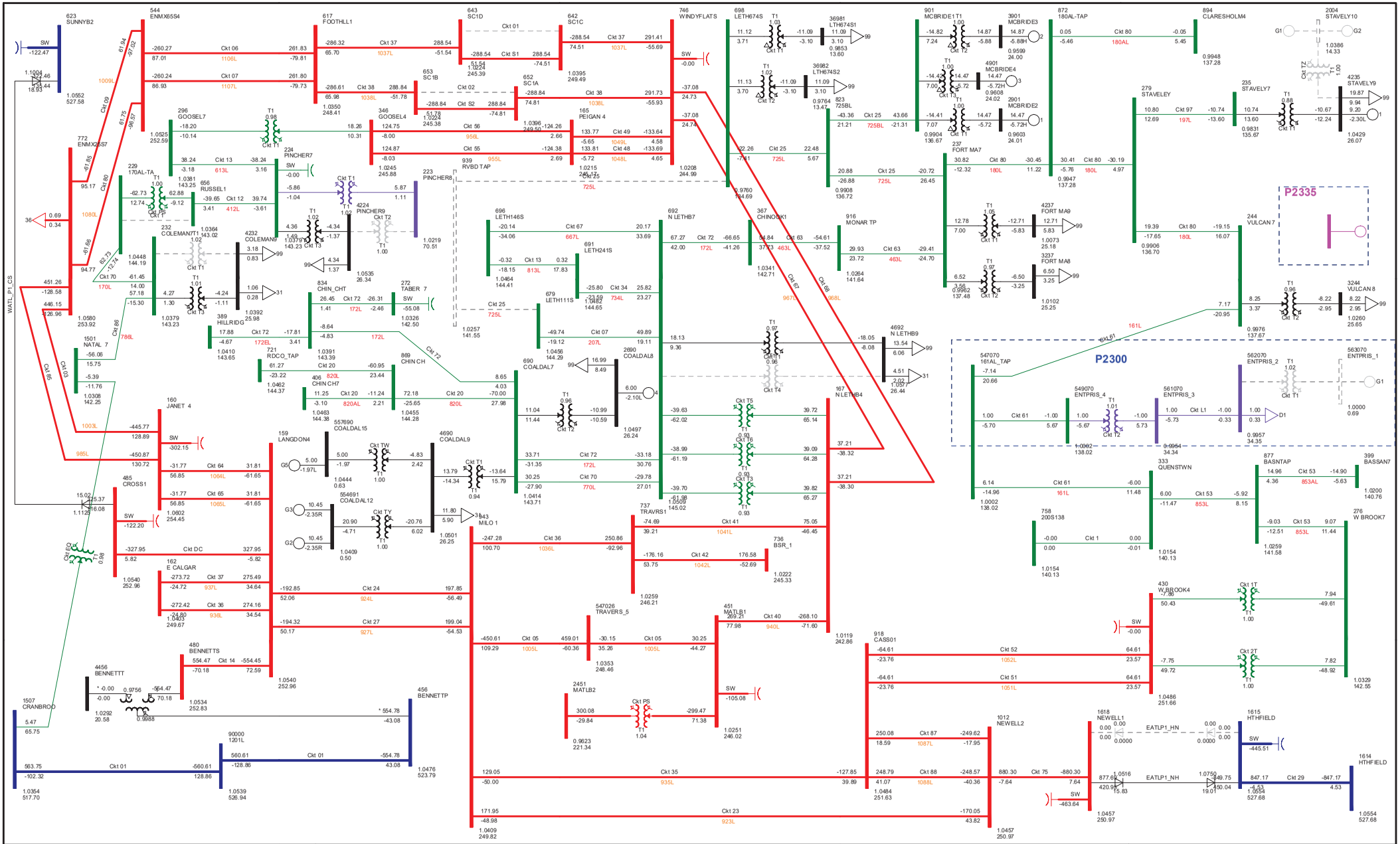
MH Export: 22.21 MW

FIGURE A6-1-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900LN
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-517.41 MW Sask Import:-0.00 MW MATL Import:-300.08 MW

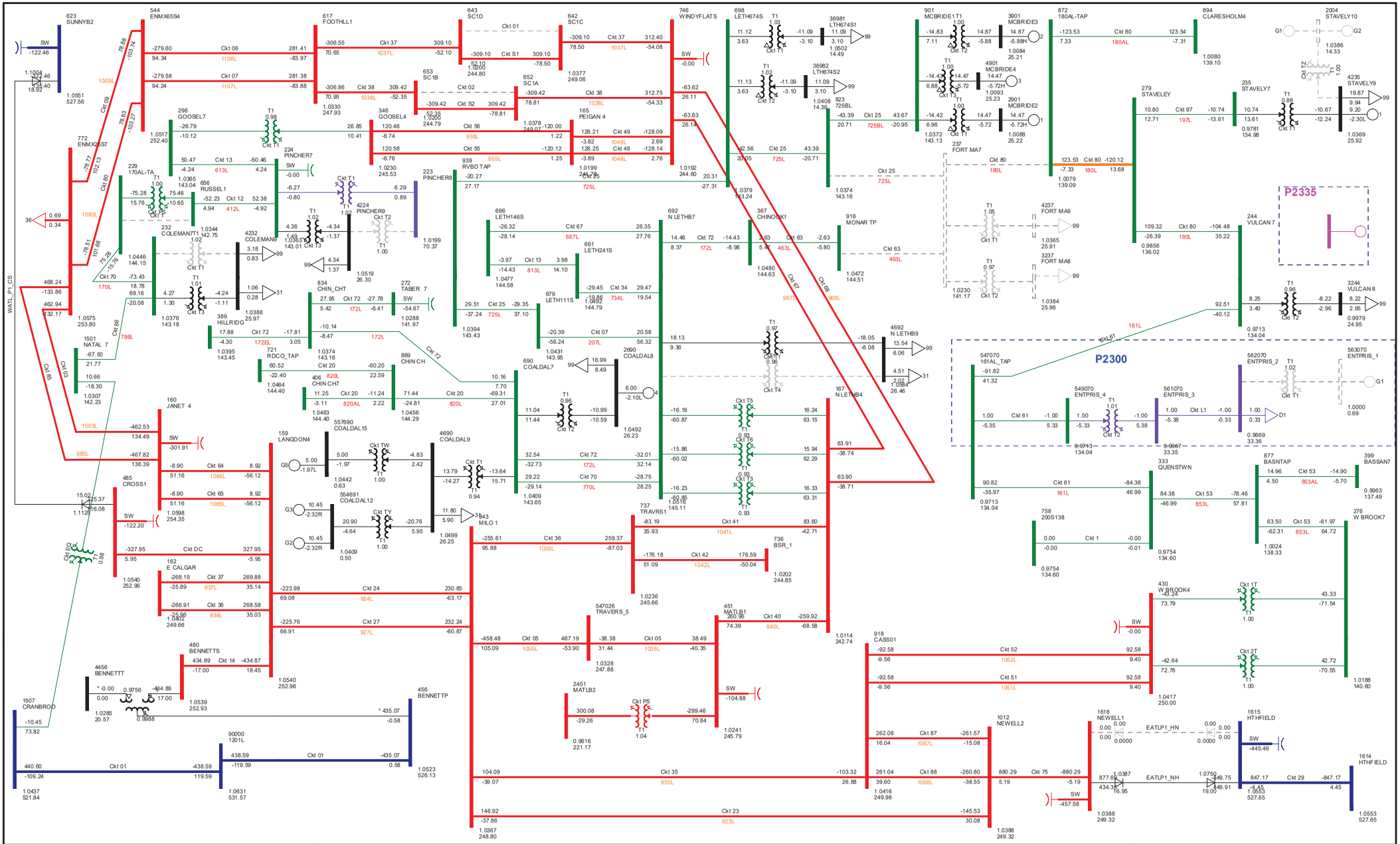
MH Export: 22.21 MW

FIGURE A6-1-3 N-1: 725L (BOWRON 674S TO COALBANKS 111S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-381.42 MW Sask Import:-0.00 MW MATL Import:-300.08 MW

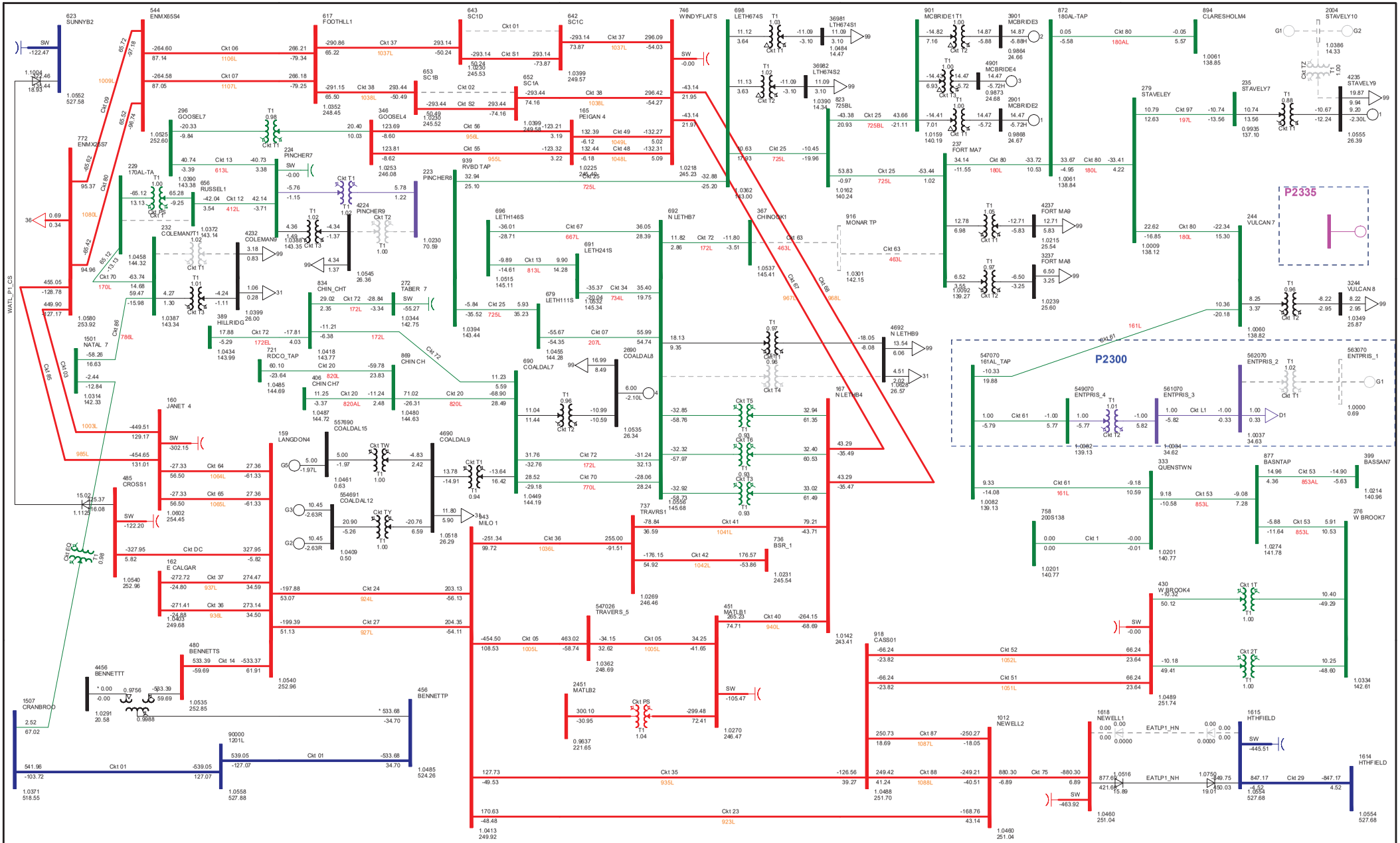
MH Export: 22.21 MW

FIGURE A6-1-4 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900LN
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-493.32 MW Sask Import:-0.00 MW MATL Import:-300.10 MW

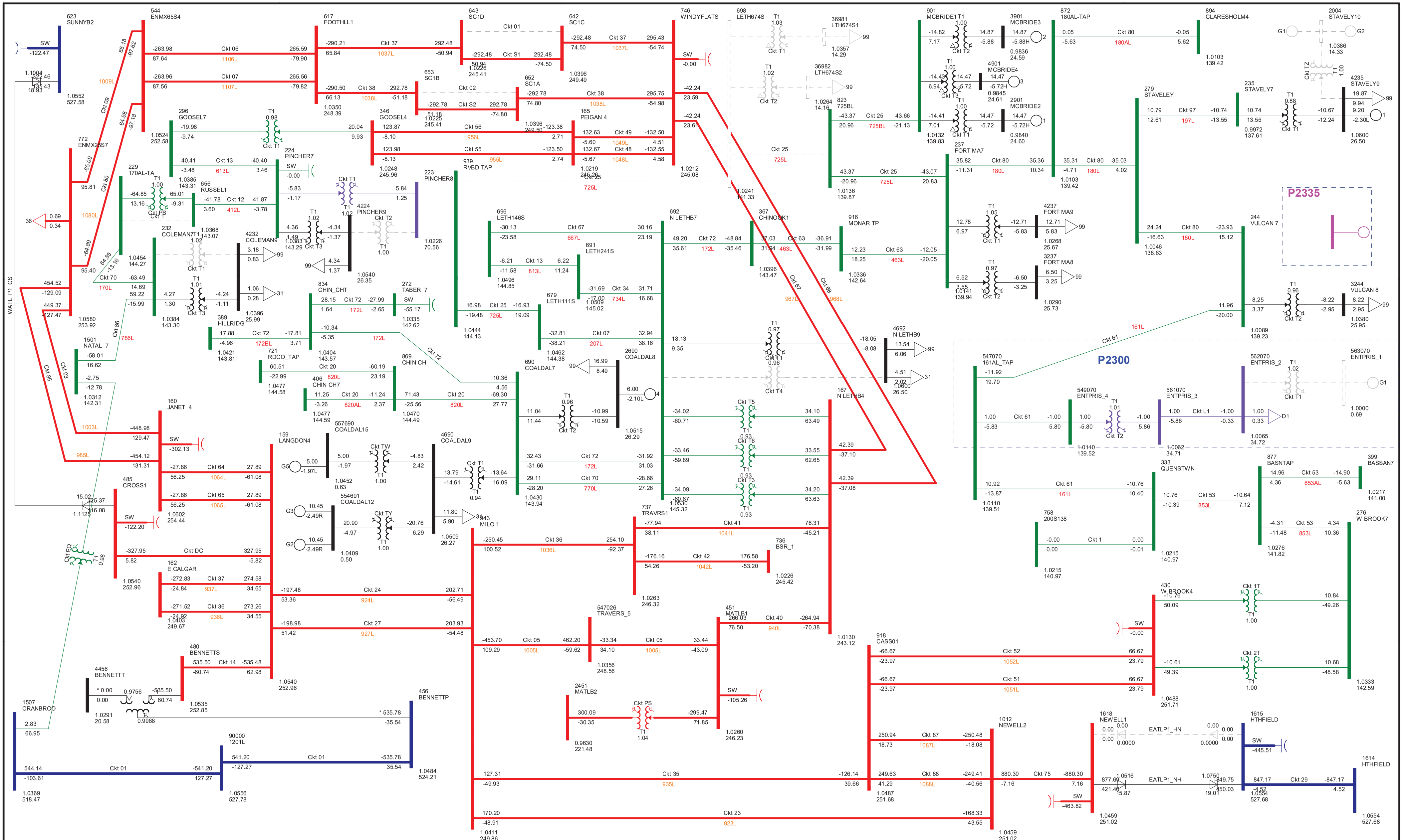
MH Export: 22.21 MW

FIGURE A6-1-5 N-1: 463L (FORT MACLEOD 15S TO CHINOOK 181S) AFTER RAS#169

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

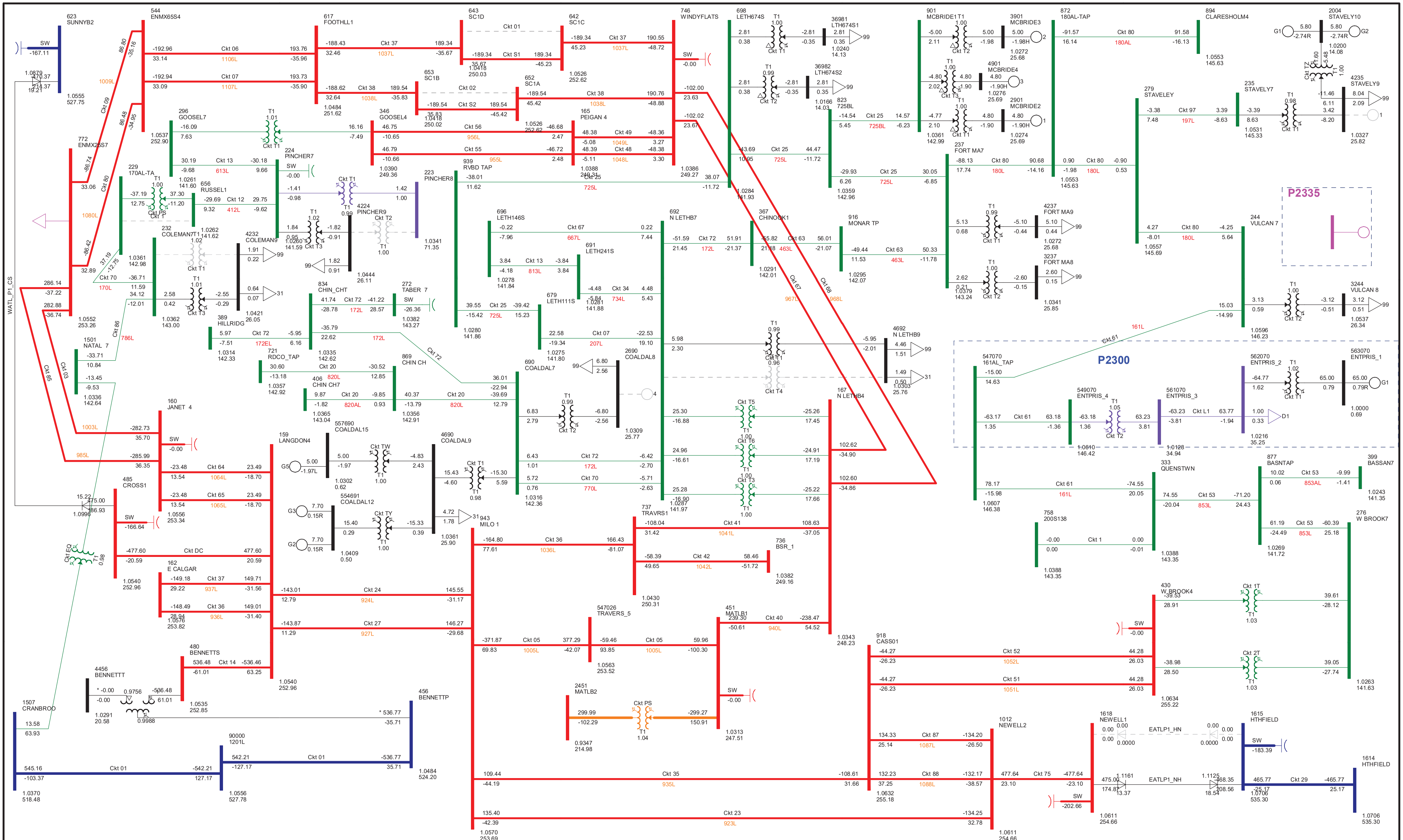
BC Import:-495.74 MW Sask Import:0.00 MW MATL Import:-300.09 MW

MH Export: 22.21 MW

FIGURE A6-1-6 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION)

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

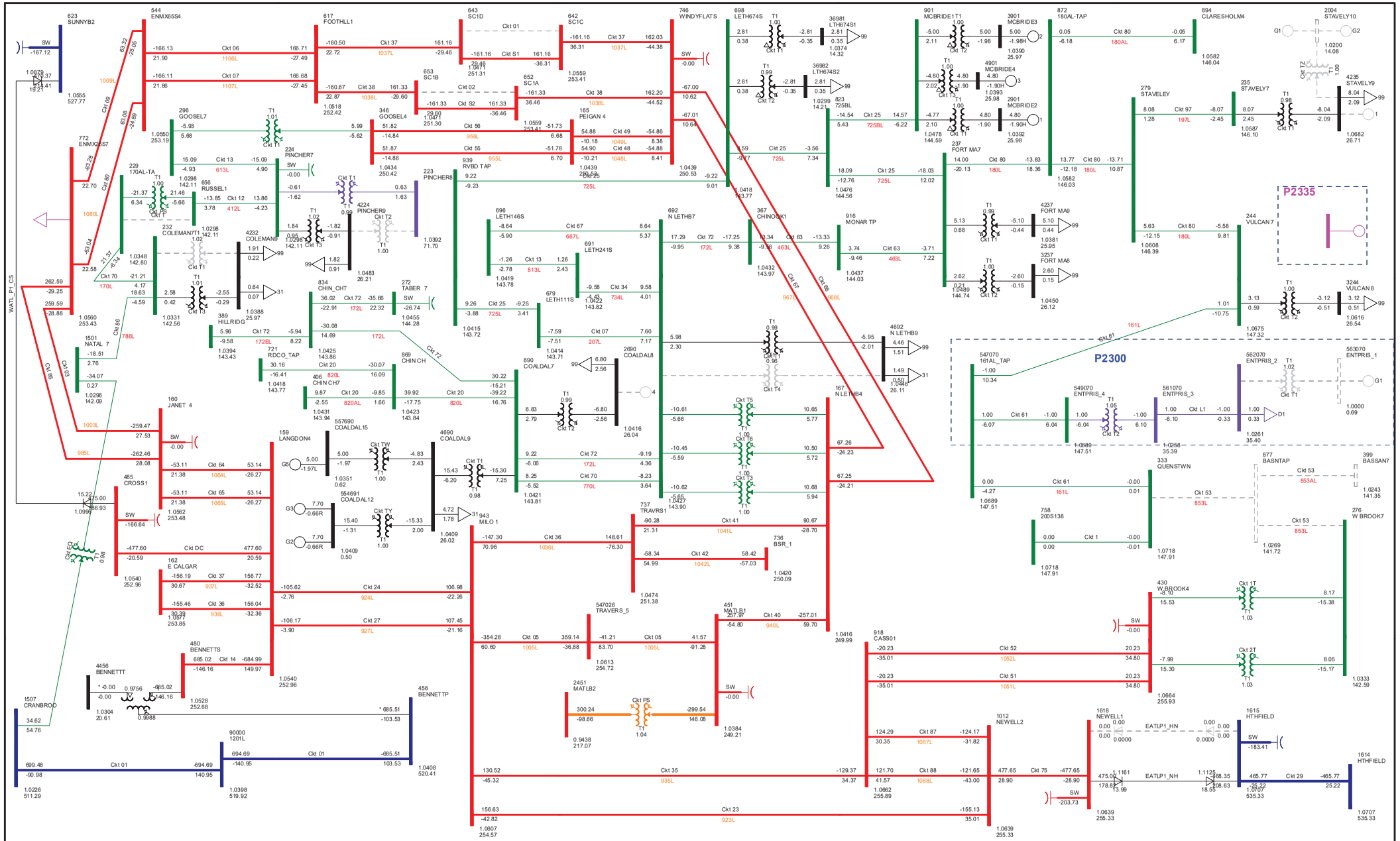
BC Import:-509.01 MW Sask Import:-0.00 MW MATL Import:-299.99 MW

MH Export: 16.33 MW

FIGURE A6-2-1-N-0: NORMAL OPERATION

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-678.38 MW Sask Import:0.00 MW MATL Import:-300.24 MW

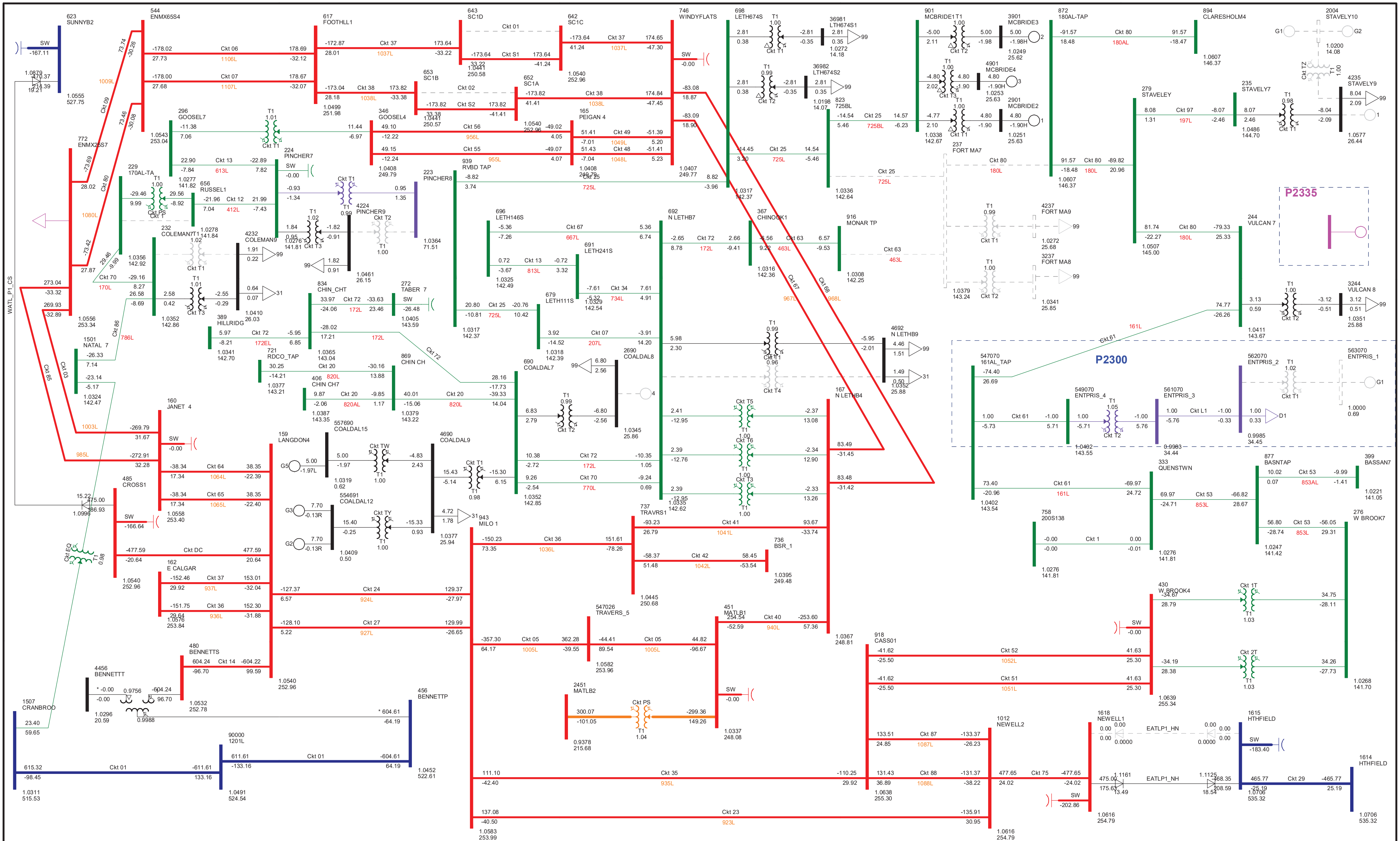
MH Export: 16.33 MW

FIGURE A6-2-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900kV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

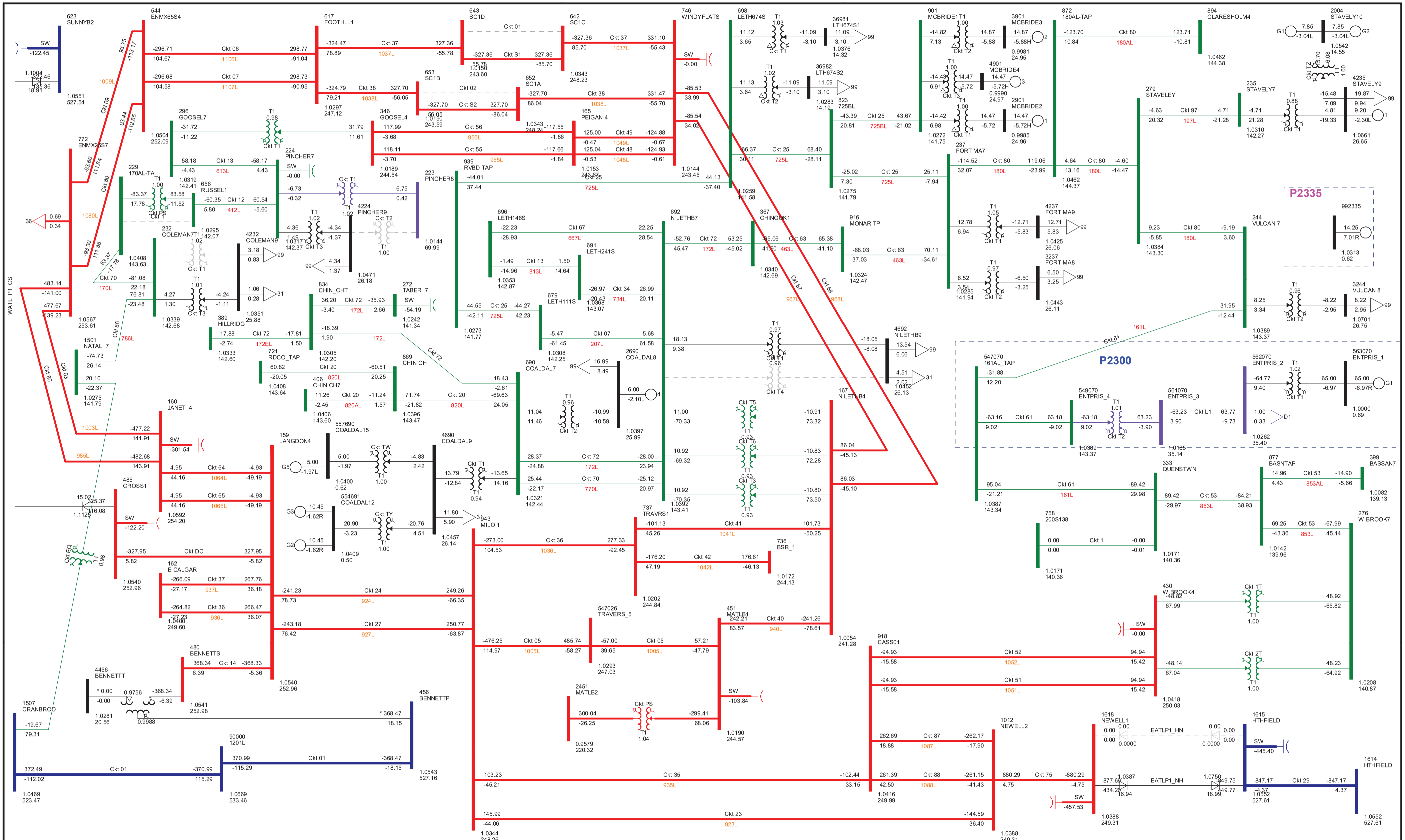
BC Import:-586.59 MW Sask Import:0.00 MW MATL Import:-300.07 MW

MH Export: 16.33 MW

FIGURE A6-2-3 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER LIGHT (POST-CONNECTION)

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

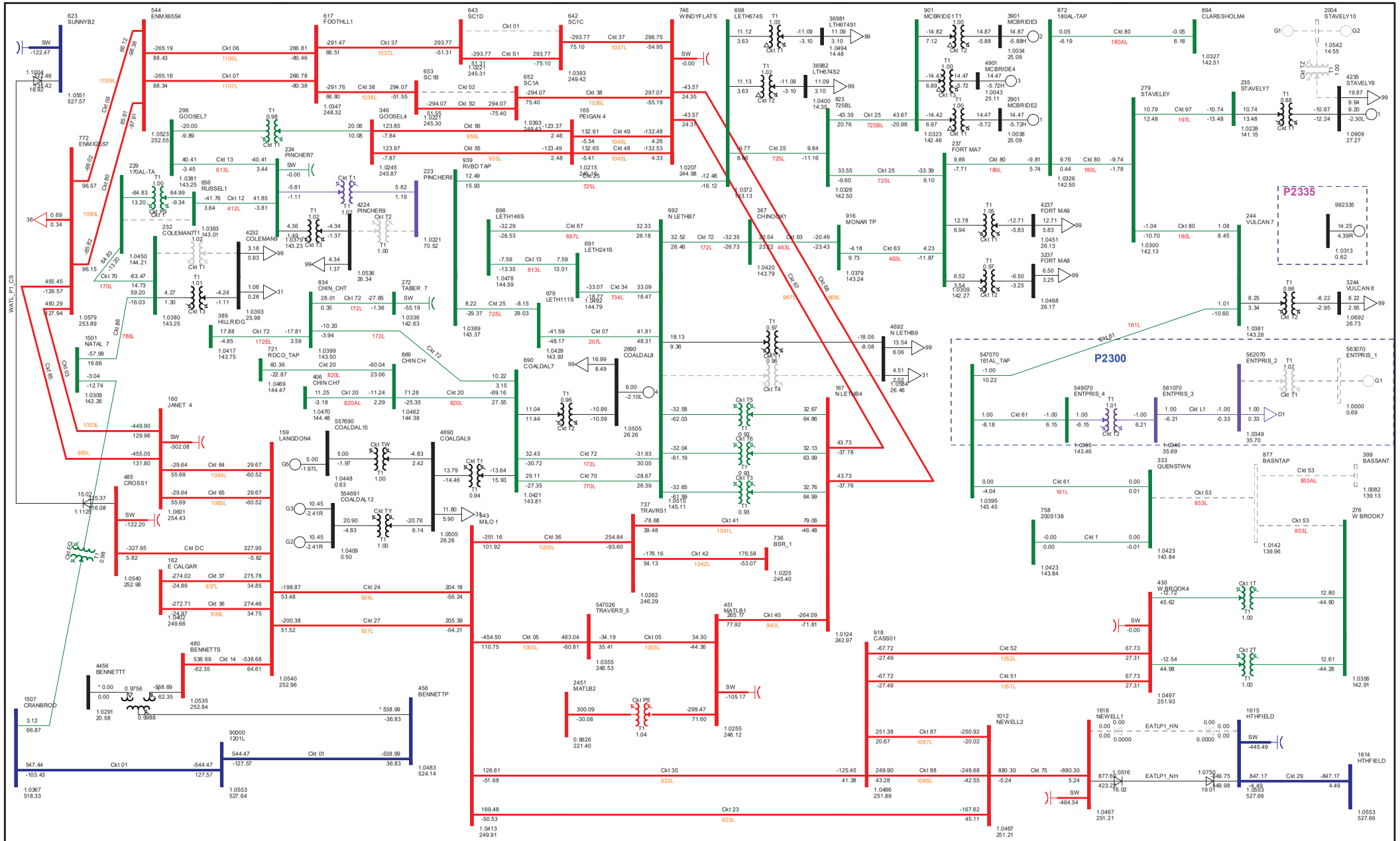
BC Import:-305.07 MW Sask Import:0.00 MW MATL Import:-300.04 MW

MH Export: 22.21 MW

FIGURE A6-3-1-N-0: NORMAL OPERATION

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-499.21 MW Sask Import:0.00 MW MATL Import:-300.09 MW

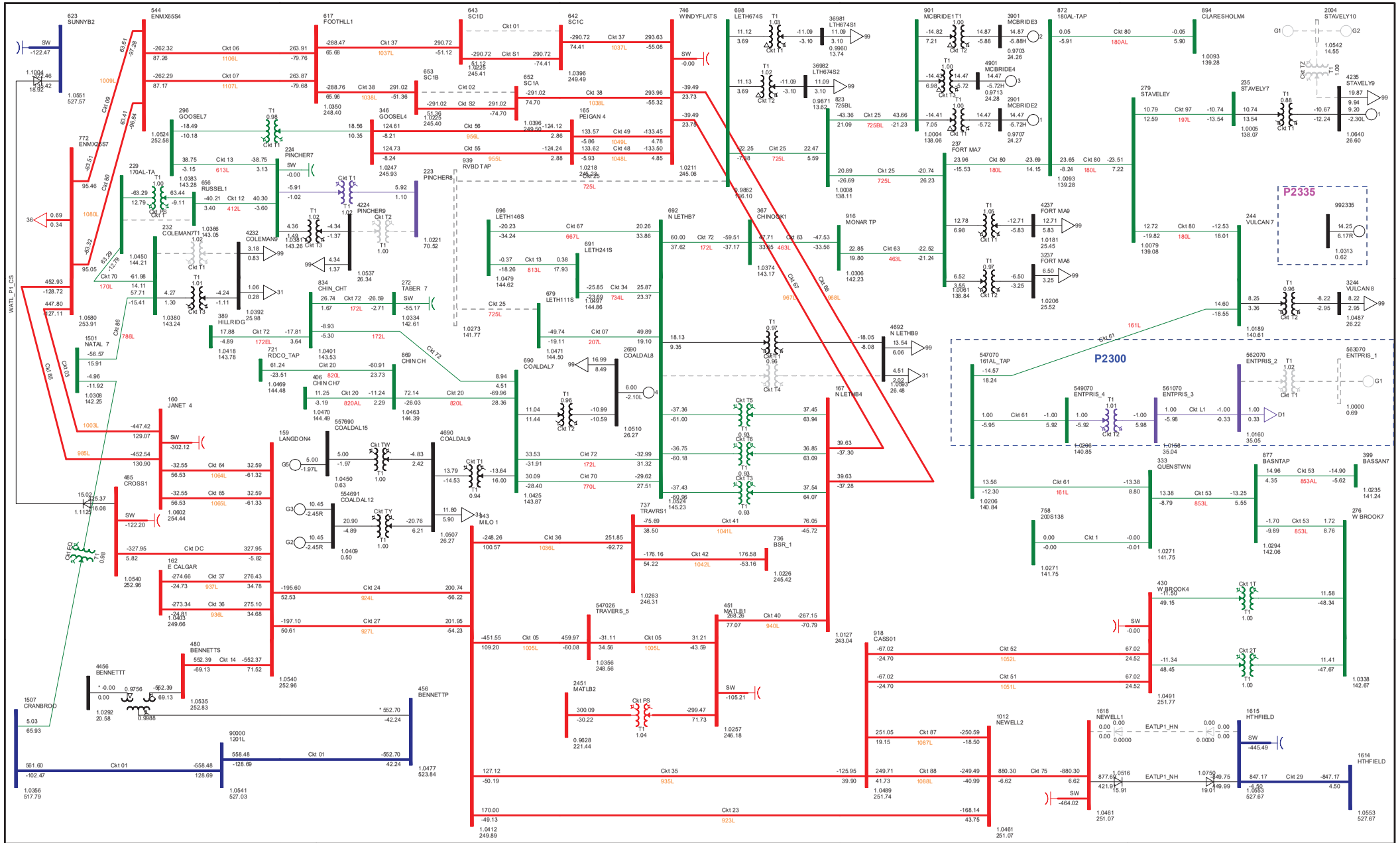
MH Export: 22.21 MW

FIGURE A6-3-2 N-1: 853 (QUEENSTOWN 504S TO WEST BROOKS 28S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-514.87 MW Sask Import:0.00 MW MATL Import:-300.09 MW

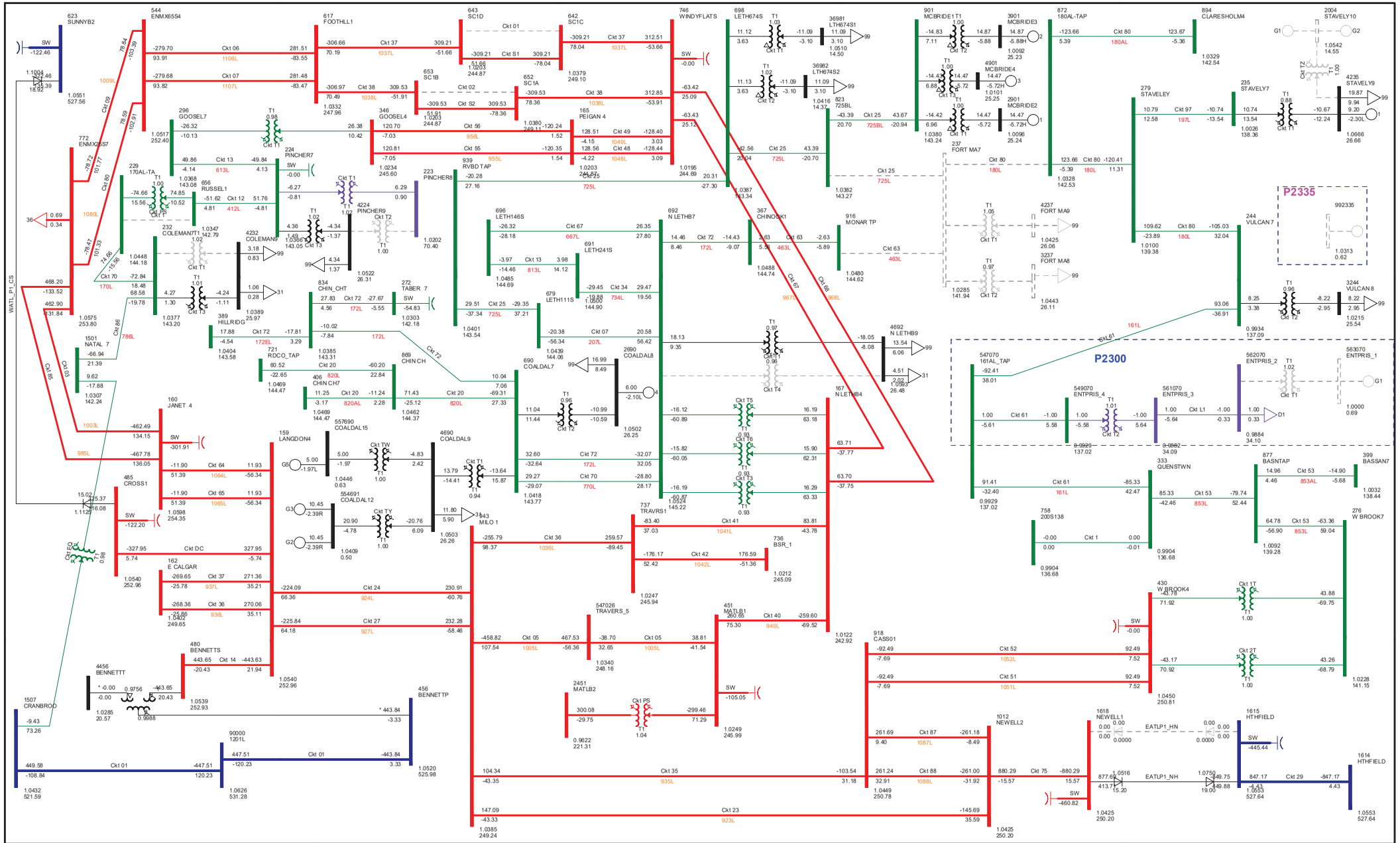
MH Export: 22.21 MW

FIGURE A6-3-3 N-1: 725L (BOWRON 674S TO COALBANKS 111S) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

BC Import:-391.23 MW Sask Import:0.00 MW MATL Import:-300.08 MW

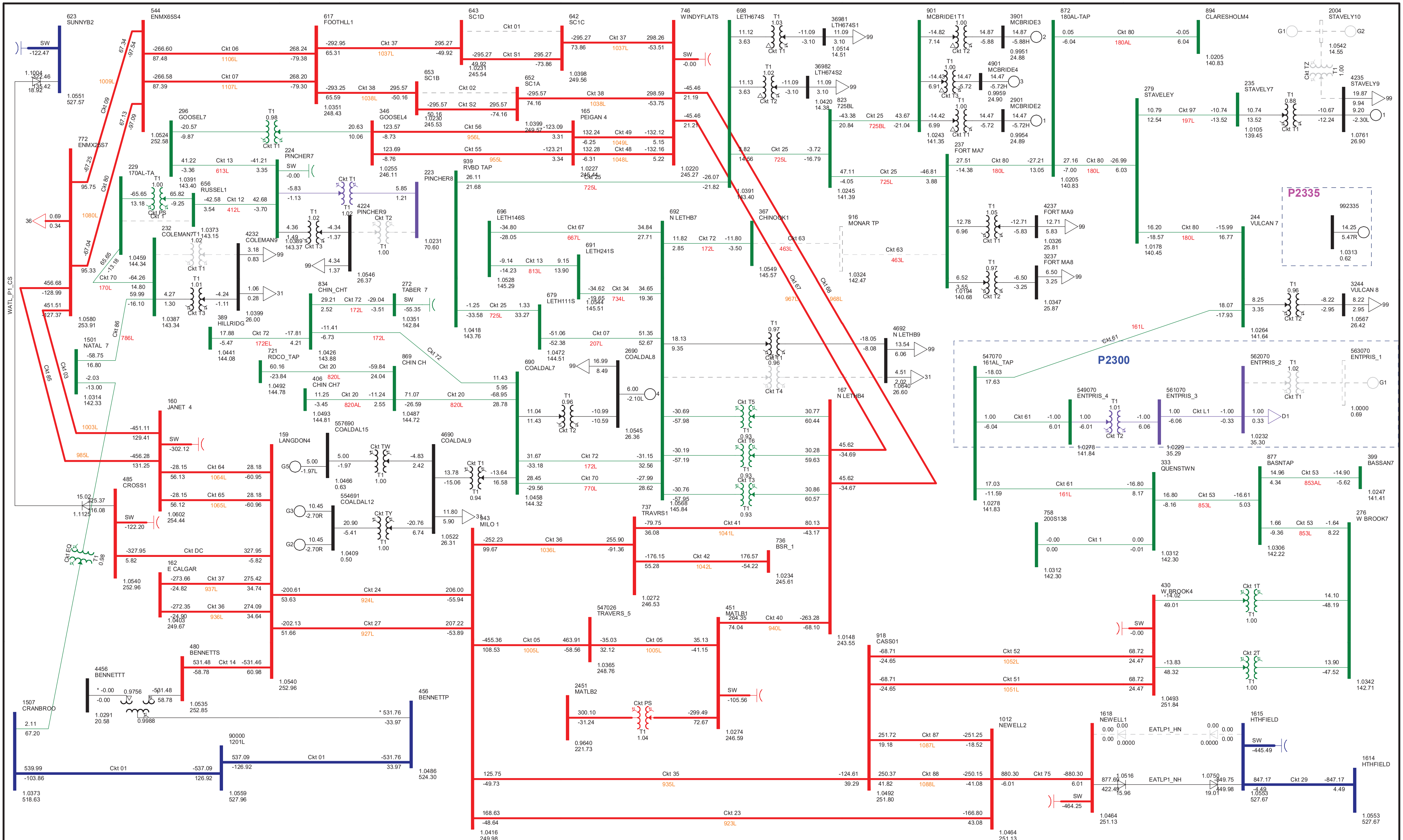
MH Export: 22.21 MW

FIGURE A6-3-4 N-1: 15ST1 (FORT MACLEOD 15S TRANSFORMER T1) AFTER RAS#174

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



P2300 RESC Enterprise MPC Solar

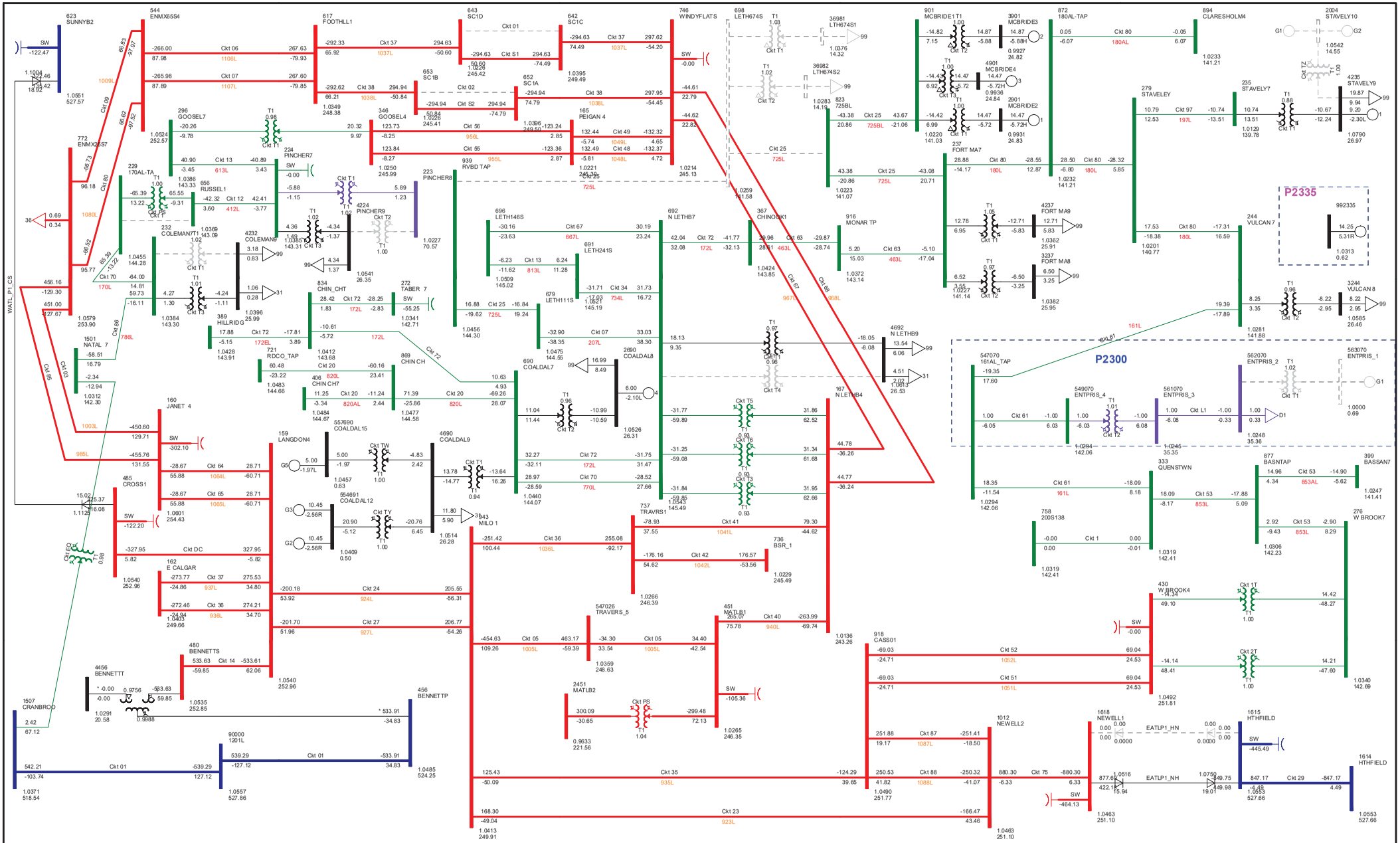
BC Import:-490.97 MW Sask Import:0.00 MW MATL Import:-300.10 MW

MH Export: 22.21 MW

FIGURE A6-3-5 N-1: 463L (FORT MACLEOD 15S TO CHINOOK 181S) AFTER RAS#169

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021



P2300 RESC Enterprise MPC Solar

BC Import:-493.44 MW Sask Import:-0.00 MW MATL Import:-300.09 MW

MH Export: 22.21 MW

FIGURE A6-3-6 N-1: 674ST1 (BOWRON 674S TRANSFORMER T1) AFTER RAS#178

2023 SUMMER PEAK (POST-CONNECTION) - P2335

PRINTED ON APRIL 2021

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0% Rate A
1.100kV 0.900UV
kV: <=25.000 <=69.000<=138.000 <=240.000 <=500.000 >500.000

Attachment A7
Constraint Effective Factors Table

Contingency	Line	Power Plant														
		P2300	Stavely	Monarch	McBride	Lethbridge Coaldale	Chin Chute	Old Man River	Stirling Wind	P1831	Claresholm	Blackspring Ridge	P1851	Travers	P1870	P2335
2022 Summer Peak Post-Project																
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	0.8704	0.9088	-0.0043	-0.0094	-0.0026	-0.0148	-0.0045	-0.0173	0.8859	0.9245	-0.0038	-0.0043	-0.0069	0.8972	0.0000
853L (Queenstown 504S to West Brooks 28S)	463L (Fort MacLeod 15S to 463AL Tap)	0.4843	0.4994	-0.1265	0.4011	-0.0015	-0.0058	-0.0029	-0.0067	0.4918	0.5112	-0.0031	-0.1265	-0.0054	0.4954	0.0000
853L (Queenstown 504S to West Brooks 28S)	172L (North Lethbridge 370S to Chinook 181S)	0.5195	0.5202	0.7167	0.3887	-0.0021	-0.0091	-0.0039	-0.0106	0.5247	0.5403	-0.0039	0.7167	-0.0070	0.5221	0.0000
853L (Queenstown 504S to West Brooks 28S)	463L (Chinook 181S to 463AL Tap)	0.5133	0.5195	0.7506	0.3991	-0.0019	-0.0077	-0.0035	-0.0090	0.5194	0.5367	-0.0036	0.7506	-0.0063	0.5192	0.0000
725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	0.4687	0.5742	-0.0841	0.7422	-0.0311	-0.0416	-0.0198	-0.0434	0.4881	0.6692	-0.0109	-0.0841	-0.0140	0.5829	0.0000
725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	0.4692	0.5611	0.7433	0.7097	-0.0322	-0.0527	-0.0231	-0.0565	0.4864	0.6749	-0.0137	0.7433	-0.0193	0.5789	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	180L (Vulcan 255S to East Stavely 928S)	-0.1293	0.8191	-0.0016	-0.0017	-0.0015	-0.0023	-0.0011	-0.0025	-0.1154	0.7658	-0.0013	-0.0016	-0.0019	0.7970	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	161L (Vulcan 255S to 161AL Tap)	-0.2010	0.7336	-0.0025	-0.0026	-0.0023	-0.0036	-0.0018	-0.0038	0.8060	0.6607	-0.0021	-0.0025	-0.0030	0.7138	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	1.2067	1.1654	-0.0035	-0.0037	-0.0033	-0.0051	-0.0025	-0.0055	1.1857	1.1424	-0.0029	-0.0035	-0.0042	1.1340	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	853L (Queenstown 504S to 853AL Tap)	1.0110	0.9634	-0.0037	-0.0039	-0.0035	-0.0053	-0.0026	-0.0057	0.9967	0.9281	-0.0030	-0.0037	-0.0044	0.9374	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	161L (Queenstown 504S to 161AL Tap)	0.9302	0.8396	-0.0008	-0.0008	-0.0007	-0.0011	-0.0006	-0.0012	0.9286	0.7503	-0.0007	-0.0008	-0.0009	0.8170	0.0000
463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	0.4676	0.5719	0.0000	0.7728	-0.0308	-0.0430	-0.0197	-0.0452	0.4868	0.6650	-0.0106	0.0000	-0.0136	0.5803	0.0000
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	0.4751	0.5871	-0.0862	0.7622	-0.0316	-0.0408	-0.0196	-0.0422	0.4956	0.6739	-0.0106	-0.0862	-0.0134	0.5918	0.0000
674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	0.4776	0.5767	0.7833	0.7352	-0.0329	-0.0514	-0.0229	-0.0549	0.4959	0.6826	-0.0134	0.7833	-0.0185	0.5903	0.0000
674ST1 (Bowron 674S Transformer T1)	463L (Chinook 181S to 463AL Tap)	0.4785	0.5833	0.8127	0.7493	-0.0329	-0.0496	-0.0224	-0.0526	0.4978	0.6821	-0.0129	0.8127	-0.0176	0.5934	0.0000
2022 Summer Light Post-Project																
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	0.8886	0.9304	-0.0059	0.0083	-0.0015	-0.0084	-0.0019	-0.0093	0.9038	0.9431	-0.0012	-0.0059	-0.0039	0.9222	0.0000
853L (Queenstown 504S to West Brooks 28S)	172L (North Lethbridge 370S to Chinook 181S)	0.4900	0.5060	0.8242	0.4002	-0.0015	-0.0056	-0.0020	-0.0057	0.4964	0.5149	-0.0018	0.8242	-0.0053	0.5039	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	0.9752	0.9371	-0.0036	-0.0029	-0.0030	-0.0048	-0.0021	-0.0050	0.9728	0.9023	-0.0018	-0.0036	-0.0036	0.9280	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	853L (Queenstown 504S to 853AL Tap)	0.9038	0.8655	-0.0032	-0.0026	-0.0027	-0.0043	-0.0019	-0.0045	0.9031	0.8278	-0.0017	-0.0032	-0.0033	0.8552	0.0000
15ST1 (Fort MacLeod 15S Transformer T1)	161L (Queenstown 504S to 161AL Tap)	0.9485	0.8967	-0.0007	-0.0006	-0.0006	-0.0010	-0.0004	-0.0010	0.9540	0.8352	-0.0004	-0.0007	-0.0007	0.8782	0.0000
2022 Summer Peak Post-Project P2335 Sensitivity																
853L (Queenstown 504S to West Brooks 28S)	180L (Fort MacLeod 15S to 180AL Tap)	-0.0015	0.0009	-0.0010	-0.0012	-0.0006	-0.0014	-0.0006	-0.0015	1.0040	-0.0047	-0.0005	-0.0010	-0.0007	-0.0017	0.9832
853L (Queenstown 504S to West Brooks 28S)	463L (Fort MacLeod 15S to 463AL Tap)	0.8548	0.8973	-0.0044	-0.0096	-0.0025	-0.0140	-0.0043	-0.0163	0.8670	0.9179	-0.0036	-0.0044	-0.0065	0.8871	0.8491
853L (Queenstown 504S to West Brooks 28S)	172L (North Lethbridge 370S to Chinook 181S)	0.4786	0.4945	-0.1282	0.4051	-0.0015	-0.0052	-0.0027	-0.0061	0.4847	0.5094	-0.0030	-0.1282	-0.0051	0.4918	0.4746
853L (Queenstown 504S to West Brooks 28S)	463L (Chinook 181S to 463AL Tap)	0.5176	0.5154	0.7292	0.3933	-0.0021	-0.0085	-0.0037	-0.0098	0.5222	0.5398	-0.0038	0.7292	-0.0067	0.5199	0.5114
725L (Bowron 674S to Coalbanks 111S)	463L (Fort MacLeod 15S to 463AL Tap)	0.5089	0.5133	0.7595	0.4019	-0.0019	-0.0072	-0.0033	-0.0083	0.5141	0.5345	-0.0035	0.7595	-0.0061	0.5152	0.5034
725L (Bowron 674S to Coalbanks 111S)	172L (North Lethbridge 370S to Chinook 181S)	0.4709	0.5822	-0.0867	0.7545	-0.0321	-0.0422	-0.0202	-0.0438	0.4909	0.6664	-0.0111	-0.0867	-0.0142	0.5857	0.4807
725L (Bowron 674S to Coalbanks 111S)	463L (Chinook 181S to 463AL Tap)	0.4726	0.5705	0.7680	0.7224	-0.0334	-0.0533	-0.0236	-0.0570	0.4914	0.6707	-0.0140	0.7680	-0.0195	0.5819	0.4811
15ST1 (Fort MacLeod 15S Transformer T1)	255ST1 (Vulcan 255S Transformer T1)	0.4749	0.5796	0.8027	0.7419	-0.0335	-0.0512	-0.0231	-0.0545	0.4944	0.6735	-0.0135	0.8027	-0.0185	0.5876	0.4840
15ST1 (Fort MacLeod 15S Transformer T1)	161L (Vulcan 255S to 161AL Tap)	0.0291	0.0345	0.0004	0.0004	0.0003	0.0005	0.0003	0.0006	0.9369	0.0443	0.0003	0.0004	0.0004	0.0377	0.9174
15ST1 (Fort MacLeod 15S Transformer T1)	853L (West Brooks 28S to 853AL Tap)	-0.0795	0.8641	-0.0010	-0.0010	-0.0009	-0.0014	-0.0007	-0.0015	0.9255	0.8059	-0.0008	-0.0010	-0.0012	0.8464	0.9063
15ST1 (Fort MacLeod 15S Transformer T1)	853L (Queenstown 504S to 853AL Tap)	1.1018	1.0409	-0.0049	-0.0052	-0.0046	-0.0071	-0.0035	-0.0076	1.0993	0.9948	-0.0040	-0.0049	-0.0059	1.0273	1.0765
15ST1 (Fort MacLeod 15S Transformer T1)	161L (Queenstown 504S to 161AL Tap)	0.9251	0.8655	-0.0047	-0.0049	-0.0044	-0.0068	-0.0034	-0.0072	0.9215	0.8158	-0.0039	-0.0047	-0.0056	0.8505	0.9023
463L (Fort MacLeod 15S to Chinook 181S)	725L (Bowron 674S to 725BL Tap)	0.9388	0.8481	-0.0006	-0.0006	-0.0005	-0.0008	-0.0004	-0.0009	0.9298	0.7585	-0.0005	-0.0006	-0.0007	0.8202	0.9105
674ST1 (Bowron 674S Transformer T1)	463L (Fort MacLeod 15S to 463AL Tap)	0.4637	0.5711	0.0000	0.7751	-0.0314	-0.0435	-0.0200	-0.0456	0.4831	0.6534	-0.0108	0.0000	-0.0138	0.5748	0.4730
674ST1 (Bowron 674S Transformer T1)	172L (North Lethbridge 370S to Chinook 181S)	0.4747	0.5913	-0.0883	0.7692	-0.0325	-0.0417	-0.0201	-0.0431	0.4953	0.6687	-0.0109	-0.0883	-0.0137	0.5916	0.4849
674ST1 (Bowron 674S Transformer T1)	463L (Chinook 181S to 463AL Tap)	0.4771	0.5808	0.8003	0.7405	-0.0339	-0.0528	-0.0235	-0.0565	0.4965	0.6743	-0.0137	0.8003	-0.0189	0.5889	0.4861

Engineering Connection Assessment: Study Scope

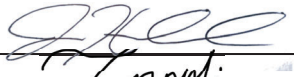
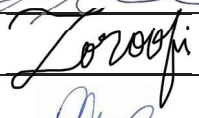
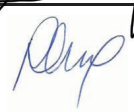
P2300 Enterprise Solar Project Connection

Renewable Energy Systems Canada Inc.

Date: March 15, 2021

Version: V1

Classification: Public

Company Name	Name and Credentials	Date	Signature
Hardline Engineering Ltd.	James R Howland, P.Eng	2021-03-23	
AESO	Siavash Zoroofi, P. Eng	03/24/2021	
Renewable Energy Systems Canada Inc. (Market Participant)	Rebecca Crump	2021-03-23	

Contents

Tables

Figures

Attachments

1 Introduction

This Study Scope provides an overview of the engineering studies to be completed by Hardline Engineering Ltd. (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

Enterprise Solar GP Inc. (Enterprise Solar), on behalf of Enterprise Solar LP, owned by Renewable Energy Systems Canada Inc. (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Enterprise Solar Project (Facility) to the AIES.

The Market Participant's request includes: a request for a new system access service in the area of Stavely, with a Rate STS, *Supply Transmission Service*, contract capacity of 65 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 3 MW; and a request for transmission development (collectively, the Project).

The Project in-service date (ISD) used for the purpose of the studies is August 31, 2022.

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	1 MW
	Type	Station service
	Motors (number and size)	Not Applicable
	Power factor	0.9 pf
	Future load expansion plans	No
Generation	Generation type	Solar
	Existing Rate STS, *Supply Transmission Service,* contract capacity	0 MW
	Requested Rate STS	65 MW
	Number and size of generating units	TBD
	Maximum authorized real power (MARP)	65 MW
	Maximum capability (MC)	65 MW
	Reactive power capability	(0.95 pf absorbing)

Project Component		Description
		(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 Stavely (Area 49).

The Study Area for the Project consists of the AESO planning areas of Brooks (Area 47), Fort Macleod (Area 53), Lethbridge (Area 54), and Stavely (Area 49), 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

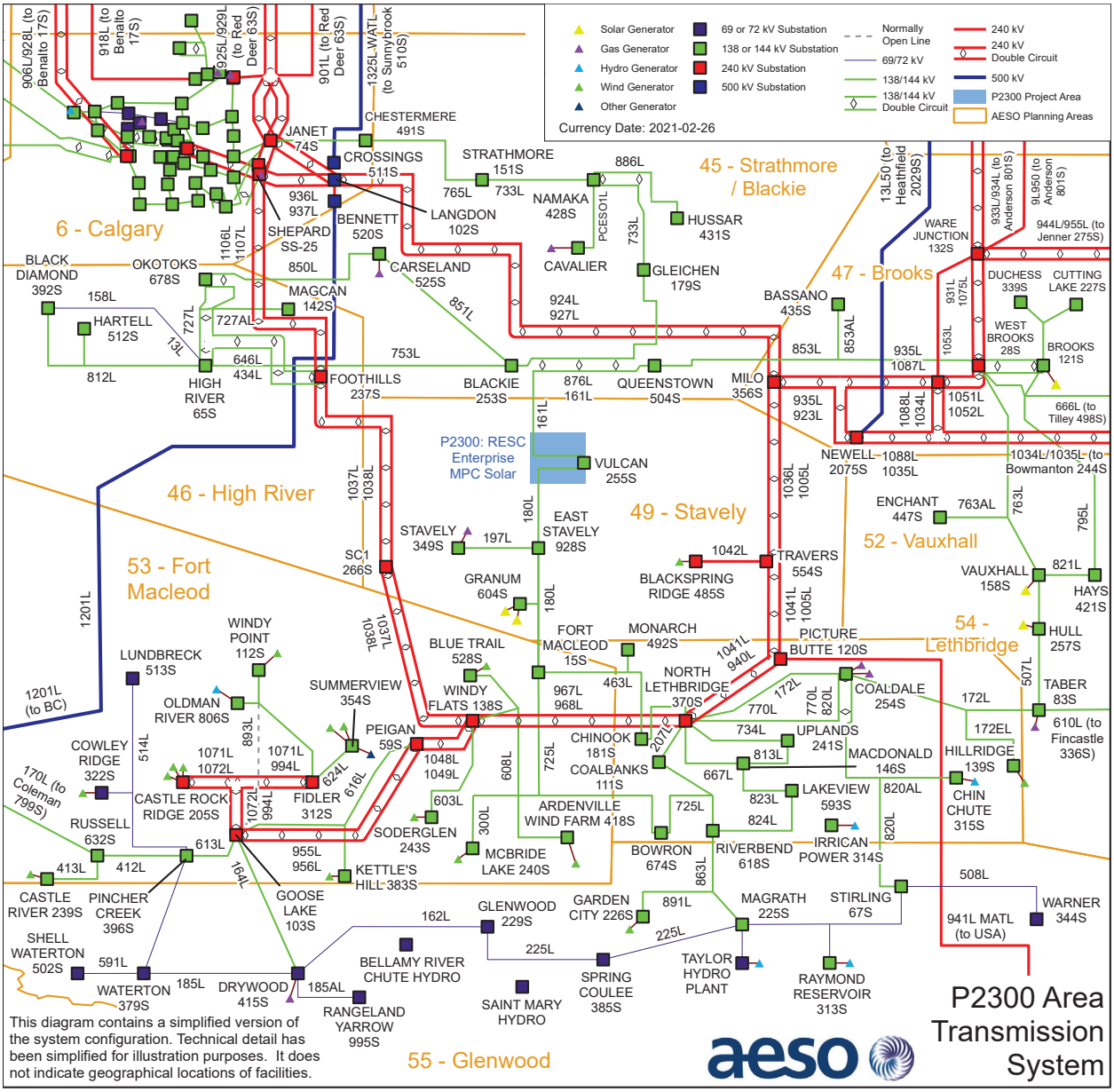
Existing constraints in the Study Area are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (TCM Rule).

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 36: Garden City 226S WAGF Trip Scheme
- RAS 37: Peigan 59S - 616L Overload Mitigation Scheme
- RAS 40: Coleman 799S - 786L Overload Mitigation Scheme
- RAS 129: Goose Lake 103S 613L Overload Mitigation Scheme
- RAS 136: Direct Transfer Trip to MATL on Loss of 1201L
- RAS 137: MATL Local Detection Scheme
- RAS 141: 498S Voltage Instability Mitigation
- RAS 149: EATL HVDC
- RAS 150: WATL HVDC
- RAS 604: Windy Point/Oldman River Tripping Scheme
- RAS 605: Summerview Tripping 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 7 – T-tap connection to the existing 138 kV transmission line 161L

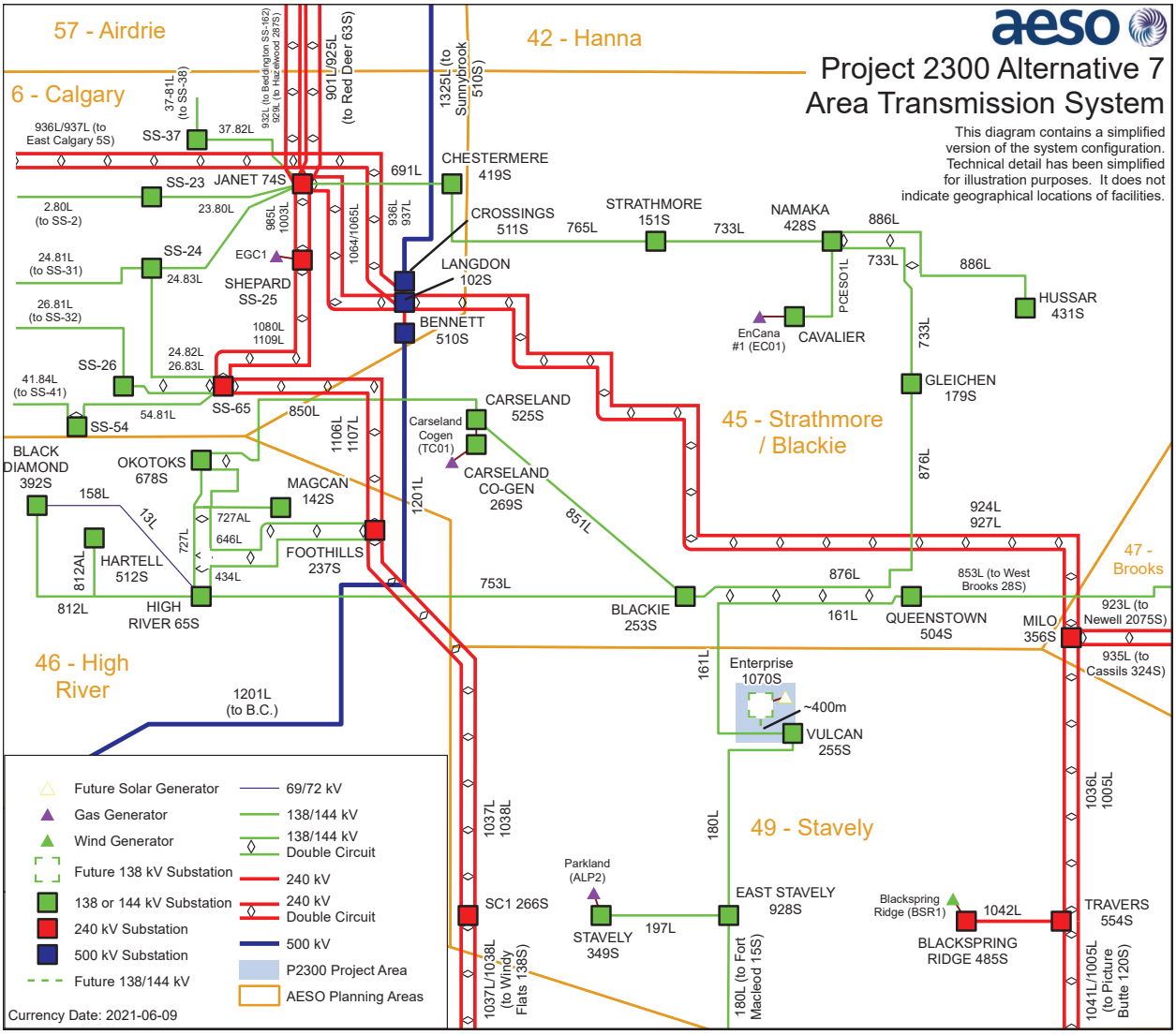
This alternative includes the following developments:

- Add one 138 kV transmission circuit, approximately 400 meters in length[1], to connect the proposed Facility to the existing 138 kV transmission line 161L (between the existing Vulcan 255S and Queenstown 504S substations) 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.

[1] The exact line length to be determined by the Market Participant under the Market Participant Choice process.

Figure 2-1: Connection Alternative 7



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 vents. 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 502.7 of the ISO rules, *Load Facility Technical 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*;
- Section 502.5 of the ISO rules *Generating Unit Technical Requirements*; and
- Section 502.6 of the ISO rules *Generating Unit 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 Peak (SP)	High Solar (HS)	2022 SP HS Pre-Project	0	0
2	2022 Summer Light (SL)	HS	2022 SL HS Pre-Project	0	0
Post-Project					
3	2022 SP	HS	2022 SP HS Post-Project	1	65
4	2022 SL	HS	2022 SL HS Post-Project	1	65
5	2029 SP	HS	2029 SP HS Post-Project	1	65
Pre-Project Sensitivity- Fortis Vulcan 255S DER Solar					
6	2022 SP	HS	2022 SP HS Pre-Project P2335 Sensitivity	0	0
Post-Project Sensitivity- Fortis Vulcan 255S DER Solar					
7	2022 SP	HS	2022 SP HS Post-Project P2335 Sensitivity	1	65

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.

4.2.2 Connection Project Assumptions

Table 4-2 summarizes the connection projects in the Study Area that will be included as part of sensitivity studies in addition to those listed in subsection 4.2.4.

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

AESO Project No.	AESO Project Name	AESO Planning Area No.	Generation (MW)	Load (MW)	Scheduled ISD
P2335	Fortis Vulcan 255S DER Solar	49	13	0	June 2021

Note:

MARP value for this facility is 15 MW.

4.2.3 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 *2019 Long-term Outlook* (2019 LTO)[2] with modifications to incorporate the latest forecast intelligence. For the post-Project studies, when the Study Area loads are modified to align with the regional load forecast, the active power to reactive power ratio in the base case scenarios shall be maintained.

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]	923	1,513

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), Vauxhall (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.

4.2.4 Generation Assumptions

The generation forecast to be used for the studies is based on the 2019 LTO with modifications to incorporate the latest forecast intelligence. The generation assumptions for the studies will assume high solar dispatch 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
Irrican Hydro (ICP1)	450	7	54	6.9	6.6
Lethbridge Coaldale (ME04)	4690	6	54	0	6
Altagas Parkland (ALP2)	4235	10	49	0	9.9

[2] The 2019 LTO is available on the AESO website.

Facility Name	Bus No.	MC (MW)	AESO Planning Area No	Unit Net Generation[a] (MW) by Scenario	
				2022 SL	2022 SP
Oldman River (OMRH)	2230	32	53	31.6	31.7
Chin Chute (CHIN)	407	15	54	9.9	11.3
AltaGas Bantry (ALP1)	4275	7	47	0	6.5

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

Pre-Project dispatch levels for the [existing, under-construction and contracted] 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)	
				2022 SL	2022 SP
Ardenville Wind (ARD1)	4735, 4740	68	53	13.6	40.8
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 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	16.2	48.6
Kettles Hill (KHW1)	2402, 3402	63	53	12.6	37.8
McBride Lake Windfarm (AKE1)	2901, 3901, 4901	73	53	14.6	43.8
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	53	6.0	18.0
Suncor Wintering Hills (SCR4)	60789, 60791, 60793, 60846, 60848, 60850	88	43	17.6	52.8
Old Man River (OWF1)	61543	46	53	9.2	27.6
Blackspring Ridge (BSR1)	61736, 61737	300	49	60.0	180.0
Castle Rock Ridge 2 (CRR2)	567221	30.6	53	6.1	18.4
Enel Riverview Wind Farm (RIV1)	69221	115	53	23.0	69.0

Capital Power Whitla Wind Power Facility (WHT1)	60990	201.6	4	40.3	121.0
Subtotal (Southern Alberta)				**306.2**	**918.7**
Ghost Pine (NEP1)	2621, 2622, 2623, 2624, 2625	82	42	16.4	49.2
Halkirk (HAL1)	66435, 67435	150	42	30.0	90.0
Fortis Bull Creek Phases 1 and 2(BUL1 & BUL2)	550003, 550004	29	37	5.8	17.4
Subtotal (Central Alberta)				**52.2**	**156.6**
Total				**358.4**	**1075.3**

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 Generations (MW)	
				2022 SL	2022 SP
Brooks Solar (BSC1)	553257	15	47	10.5	14.3
Hull DER Solar (HUL1)	552402	24.5	52	17.2	23.3
Vauxhall Solar (VXH1)	554273	22	52	15.4	20.9
Claresholm 1 (CLR1)	60894	58	49	40.6	55.1
Claresholm 2 (CLR2)	61894	75	49	52.5	71.3
Suffield (SUF1)	557270	23	52	16.1	21.9
Burdett(BRD1)	992692	10.5	52	7.4	10.0
Burdett (BUR1)	558269	20	52	14.0	19.0
Westfield Yellow Lake (WEF1)	557277	19	52	13.3	18.1
Subtotal (Southern Alberta)				**186.9**	**253.7**
Innisfail Solar (INF1)	557120	22	39	15.4	20.9
Subtotal (Central Alberta)				**15.4**	**20.9**
Total				**202.3**	**274.6**

Table 4-7 and Table 4-8 list 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 4-7: 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 (MW)	
						2022 SL	2022 SP
P1892	Fortis Buffalo Atlee Cluster 3 WAGF (REP #2)	Sept. 1, 2020	552260	17.25	47	3.5	10.4
P1853	Fortis Buffalo Atlee Cluster 1 WAGF (REP #2)	Sept. 1, 2020	553260	17.25	47	3.5	10.4
P2199	Buffalo Atlee Wind Farm 2 (REP #2)	Sept. 1, 2020	557261	13.8	47	2.8	8.3

P1719	Stirling WAGF Project	21-May-21	61630	113	54	22.6	67.8
P2122	EDF Cypress Wind (REP #2)	Nov. 1, 2021	560003	201.6	4	40.3	121.0
P1533	Joss MPC WAGF (REP #3)	31-May-21	60798, 60799	122.4	47	24.5	73.4
P1698	Joss Jenner WAGF - Phase 2 (REP #3)	31-May-21	61798, 61799	71.4	47	14.3	42.8
P2041	TransAlta Windrise MPC Wind (REP #3)	Dec. 17, 2020	56703	207	53	41.4	124.2
P1812	Suncor Forty Mile Granlea WAGF	Nov. 16, 2020	61994, 62994	200	4	40.0	120.0
P1800	Capital Power Whitla Wind Power Facility	Dec. 1, 2020	61990	97.2	4	19.4	58.3
P2212	RESC Rattlesnake Ridge MPC Wind	30-Jul-21	60873	115.9	4	23.2	69.5
P1718	Wheatland WAGF	30-Sep-22	61632, 60632	120	43	24.0	72.0
Subtotal (Southern Alberta)						**259.4**	**778.1**
P1567	EDPR Sharp Hills Wind Farm (REP #1)	Nov. 15, 2020	60831, 60832	248.4	42	49.7	149.0
Subtotal (Central Alberta)						**49.7**	**149.0**
Total Planned						**309.0**	**927.1**

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)	
						2022 SL	2022SP
P2009	Greengate Travers MPC Solar	Dec. 1, 2020	560026, 561026, 562026	400	49	280.0	380.0
P1839	Fortis 421S Hays DG PV	Feb. 15, 2021	554401	23	52	16.1	21.9
P1831	Fortis 255S Vulcan Faribault Farms DG PV	24-May-21	4244	22	49	15.4	20.9
P1850	Fortis Coaldale 254S DER Solar 3	24-May-21	554691	22	54	15.4	20.9
P1851	Fortis Monarch 492S DER Solar	24-May-21	2005	23.6	54	16.5	22.4
P1862	Fortis Spring Coulee 385S Solar DG	Oct. 15, 2021	553246, 554246	29.5	55	20.7	28.0
P1870	Fortis Stavely 349S DER Solar	24-May-21	2004	16.5	49	11.6	15.7
P1918	FortisAlberta Conrad DER Solar 1	Aug. 15, 2021	554291	23.4	52	16.4	22.2
P1959	FortisAlberta Conrad DER Solar 2	Aug. 15, 2021	553291	22.5	52	15.8	21.4

P2029	FortisAlberta Strathmore 151S DER Solar 1	Aug. 15, 2021	557259	18	45	12.6	17.1
P2030	FortisAlberta Strathmore 151S DER Solar 2	Aug. 15, 2021	558259	22.5	45	15.8	21.4
P2341	Travers Solar Phase 2	1-Apr-22	560026, 561026, 562026	65	49	45.5	61.8
Subtotal (Southern Alberta)						**481.6**	**653.6**
Subtotal (Central Alberta)							

The post-Project scenario wind and solar generation dispatch levels were identical to the pre-Project scenario dispatch levels shown in Table 4-5, Table 4-6, Table 4-7, and Table 4-8. The Facility was dispatched to 65 MW in all post-Project scenarios.

4.2.5 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 2029 SP 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 (+) (MW) by Intertie		
		AB-BC	AB-SK	MATL
1, 3, 6, 7	2022 SP HS Pre (Post)-Project / 2022 SP HS Pre (Post)-Project P2335 Sensitivity	-509	0	-300
2, 4	2022 SL HS Pre (Post)-Project / 2022 SL HS Pre (Post)-Project P2335 Sensitivity	-305	0	-300

4.2.6 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 2029 SP 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, 7	2022 SP HS Pre (Post)-Project / 2022 SP HS Pre (Post)-Project P2335 Sensitivity	325 *S → N*	875 *S → N*

Scenario Number	Scenario Name	WATL (MW)*	EATL (MW)*
2, 4	2022 SL HS Pre (Post)-Project / 2022 SL HS Pre (Post)-Project P2335 Sensitivity	475 *S → N*	475 *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

4.2.7 Transmission Facility Ratings

The legal owners of transmission facilities (TFOs) 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 Rating (MVA)	
			Normal	Emergency
820L	Stirling 67S - 820L Tap - Coaldale 254S	138	120	132
820AL	Chin Chute 315S - 820L Tap	138	120	132
1041L	North Lethbridge 370S - Travers 554S	240	481	553
940L	North Lethbridge 370S - Picture Butte 120S	240	481	577
1036L	Travers 554S - Milo 356S	240	481	577
1005L	Picture Butte 120S - Milo 356S	240	481	577
863L	Magrath 225S - Riverbend 618S	138	120	132
725AL	Riverbend 618S- 725L	138	120	132
725L	Bowron 674S- 725AL tap	138	122	134
725L	725AL tap - Coalbanks 111S	138	116	128
207L	Coalbanks 111S - North Lethbridge 370S	138	120	132
734L	Uplands 241S - North Lethbridge 370S	138	167	184

Line ID	Line Description	Voltage Class (kV)	Summer Rating (MVA)	
			Normal	Emergency
172L	North Lethbridge 370S - Coaldale 254S	138	119	131
172L	Chinook 181S - North Lethbridge 370S	138	85	94
172L	Coaldale 254S - Taber 83S	138	119	131
180L	East Stavely 928S-Vulcan 255S	138	118	130
180L	East Stavely 928S-Fort Macleod 15S	138	120	132
161L	Vulcan 255S - Queenstown 504S	138	117	129
463L	Fort MacLeod 15S-Chinook L181S	138	107	118
823L	Macdonald 146S t-Lakeview 593S	138	142	142
824L	Lakeview 593S - Riverbend 618S	138	142	142
667L	Macdonald 146S - North Lethbridge 370S	138	175	175
853L	Queenstown 504S-Westbrooks 28S	138	121	133

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)
North Lethbridge 370S	T3	240/138	193.6
	T5	240/138	200
	T6	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		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
Hillridge 139S	138	1 x 1.8 MVAr	1.8	-	-
Windy Flats 138S	240	-	-	2x75 MVAr	150

4.2.8 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
180L (Vulcan 255S – Fort Macleod 15S)	Vulcan 255S	9	60
180L (Vulcan 255S – Fort Macleod 15S)	Fort Macleod 15S	9	60
463L (Fort MacLeod 15S-Chinook 181S)	Chinook L181S	9	60
463L (Fort MacLeod 15S-Chinook 181S)	Fort Macleod 15S	9	60
725L (Bowron 674S - Fort Macleod 15S)	Bowron 674S	9	60
725L (Bowron 674S - Fort Macleod 15S)	Fort Macleod 15S	9	60
853L (Queenstown 504S-Westbrooks 28S)	Queenstown 504S	9	60
853L (Queenstown 504S-Westbrooks 28S)	Westbrooks 28S	9	60
172L (Chinook 181S – North Lethbridge 370S)	Chinook 181S	9	30
172L (Chinook 181S – North Lethbridge 370S)	North Lethbridge 370S	9	30
1041L (North Lethbridge 370S - Travers 554S)	North Lethbridge 370S	5	6
1041L (North Lethbridge 370S - Travers 554S)	Travers 554S	5	6
161L (Vulcan 255S – Queenstown 504S)	Vulcan 255S	9	60
161L (Vulcan 255S – Queenstown 504S)	Queenstown 504S	9	60

4.2.9 Project Dynamic Data

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

4.2.10 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		Motor Starting		Short Circuit
		Category		Category		Category		Category		Category A
		A	B	A	B	A	B	A	B	
Pre-Project										
1	2022 SP HS Pre-Project	X	X							X
2	2022 SL HS Pre-Project	X	X							
Post-Project										
3	2022 SP HS Post-Project	X	X			X	X			X
4	2022 SL HS Post-Project	X	X			X	X			
5	2029 SP HS Post-Project									X
Pre-Project Sensitivity- Fortis Vulcan 255S DER Solar										
6	2022 SP HS Pre-Project P2335 Sensitivity	X	X							X
Post-Project Sensitivity- Fortis Vulcan 255S DER Solar										
7	2022 SP HS Post-Project P2335 Sensitivity	X	X			X	X			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 neighboring 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 AESO planning area of Wabamun (Area 40) will be used as the reference for the studies.

Response plots for angle, active and reactive power output, and terminal voltage for the proposed generation facility and generators listed below will be provided:

- Sheerness#3 Power Plant
- Altagas Parkland
- Lethbridge Coaldale

The transient response voltages shall be monitored at the following key 240 kV and 138 kV buses:

- Lethbridge 370S substation 240 kV bus and 138kV bus
- West Brooks 28S substation 240kV bus and 138kV bus
- Queenstown 504S substation 138kV bus
- Vulcan 255S substation 138kV bus
- East Stavely 928S substation 138kV bus
- Fort Macleod 15S substation 138kV bus

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.

Summer peak scenarios will be used for the short-circuit studies.

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

- North Lethbridge 370S substation
- West Brooks 28S substation
- East Stavely 928S substation
- Queenstown 504S substation
- Vulcan 256S substation
- Fort Macleod 15S substation
- Enterprise 1070S substation (including in post-Project studies only)

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[3] 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 B conditions.

[3] 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 (2019 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

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 these standards are given in: AESO. *Alberta Reliability Standards*. Available from http://www.aeso.ca/rulesprocedures/17004.html

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 or 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

Performance Level	Disturbance (1)(2)(3)(4) Initiated by: Fault or No fault DC Disturbance	MW Margin (P-V method) (5)(6)(7)	MVAr Margin (V-Q method) (6)(7)
			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. i.e.: 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	Near End	Far End
kV	Cycles	Cycles
500	4	5
240	5	6
144/138	6	8

with telecommunications		
144/138	6	30
without telecommunications		

Table 2-4: Stuck Breaker Clearing Times for Lines

Fault Clearing Time			Fault Clearing Time			Fault Clearing Time		
138/144 kV			240 kV			500 kV		
Near End	Far End	2nd Ckt (for C5 and C7 Only)	Near End	Far End	2nd Ckt (for C5 and C7 Only)	Near End	Far End	2nd Ckt (for C5 and C7 Only)
15	24	24	12	6	14	9	5	11

Table 2-5: Stuck Breaker Clearing Times for Transformers

Fault Clearing Time (Cycles)						Fault Clearing Time (Cycles)					
240/138 kV						500/240 kV					
Fault on 240 kV Side			Fault on 138 kV Side			Fault on 500 kV Side			Fault on 240 kV Side		
240 kV Side	138 kV Side	2nd Ckt (for Breaker Fail)	138 kV Side	240 kV Side	2nd Ckt (for Breaker Fail)	500 kV Side	240 kV Side	2nd Ckt (for Breaker Fail)	240 kV Side	500 kV Side	2nd Ckt (for Breaker Fail)
12	6	14	15	5	24	9	5	11	12	4	14