APPENDIX A AESO PLANNING STUDIES

Engineering Study Report

P1784 Addition of Voltage Support at Rycroft 730S Substation

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Executive Summary

The Alberta Electric System Operator (AESO) *2015 Long-term Transmission Plan* (2015 LTP) identifies reliability standards violations, such as voltage and thermal criteria violations, in the Peace River and Grande Prairie Planning Area (Area 19 and 20) due to load growth. As further described in this report, the AESO has since conducted need assessment studies for the local 144 kV and 72 kV transmission networks in the Rycroft area (Study Area) and determined the need for transmission system reinforcement. Planning study results demonstrate that the existing transmission network in the Study Area does not have sufficient capacity to reliably supply the near-term forecast load growth and is prone to voltage violations under single contingency conditions. This is primarily due to the length of the 144 kV transmission lines radially feeding the load in the area following contingency conditions. Based on the study results, timing of the need will depend on the pace of load growth in the Study Area from the existing 68 MW to the current system capability limit of 75 MW, which is the point at which voltage performance will be impacted.

Three options were considered to meet the identified need:

- **Option 1:** Dynamic reactive power support of approximately 50 MVAr at the existing Rycroft 730S substation
- **Option 2:** A new 144 kV transmission circuit between Rycroft 730S and Clairmont Lake 811S plus additional VAr support in the form of switched capacitor banks as required
- **Option 3:** A new 144 kV transmission circuit between Saddle Hills 865S and Mowat 2033S plus additional VAr support in the form of switched capacitor banks as required

Without any wire reinforcement in the Study Area, dynamic reactive power support is required to meet the transmission reliability requirements under contingency conditions. The locations of the reactive power support devices are normally close to the load center, and the placement of the dynamic VAr support needs to address the voltage violations under the two worst contingencies in the Study Area: 7L75 and 7L68. Adding a large amount of reactive power device at a single substation with a radial feed such as Ksituan River 754S is not recommended due to incurred losses and constraints on availability of the reactive power support under certain system operating conditions. Therefore, Rycroft 730S is recommended for the addition of the 50 MVAr dynamic reactive power device as per Option 1.

Option 2 and Option 3 are wire solutions proposed to meet the forecasted area peak load for the next 20 years. Both options would also require reactive power support (capacitor banks) in addition to new circuits in the Study Area.

Voltage stability analysis was completed using the winter peak scenarios to determine the VAr support required for each option as they represent a higher loading level compared to summer peak scenarios. Load flow analysis was performed for the 2026 and 2036 summer peak (SP) and winter peak (WP) scenarios for the Study Area. Contingency analysis was conducted for all transmission elements in the Study Area and critical elements in the adjacent areas, and transmission facilities within the Study Area were monitored. Transient stability analysis was performed for the preferred option to ensure that the transmission system in the Rycroft area will have acceptable voltage recovery performance. Winter peak load scenarios were used for transient voltage recovery studies. Options 1, 2 and 3 listed above can meet the transmission Reliability Criteria.

Option 1 is the preferred transmission development option for the following reasons:

- It has a lower estimated capital cost.
- It has a lower environmental and land use impact because it does not involve any new line construction.
- It has better voltage performance and requires less voltage support from the rest of the system.
- It has better thermal performance than Option 3, and similar thermal performance to Option 2.

The preferred transmission development option includes the following system component:

- a 144 kV 50 MVAr Dynamic reactive power support at the Rycroft 730S substation.

Based on the study results, the AESO recommends increasing the load serving capability of the Rycroft area by adding a 50 MVAr dynamic reactive power device at the existing Rycroft 730S substation to alleviate the identified voltage criteria violations. This transmission development is the minimum development required to address the identified need in the 10-year planning horizon which enables about 35% of the forecast load growth in the area. It also offers the flexibility and expandability needed to meet the AESO's 20-year load forecast by adding additional voltage support equipment of a 4.8 MVAr capacitor bank at Ksituan River 754S when the need arises.

The studies also demonstrate that the identified constraints arise as early as winter 2017 under N-1 conditions based on the latest load and generation forecast. However, the forecast load growth in the Study Area is driven by a number of connection projects and demand transmission service increases. While the AESO is reasonably certain that the preferred development option is needed in the future, the timing of the in-service date for the development will rely on new load and pace of the existing load growth, as well as new load project ISDs, which are beyond the AESO's control. Therefore, the AESO has determined it is most appropriate to specify a milestone.

A load growth milestone is proposed for the Preferred Development Option when the coincident winter aggregate peak load for Rycroft area of 75 MW is reached, as measured at Rycroft 730S, Eureka River 861S, Ksituan River 754S, Boucher Creek 829S, Hines Creek 724S, Friedenstal 800S, and Mowat 2033S substations.

Finally, the AESO will use operational measures, as necessary, including connection remedial action schemes, should constraints arise in the area prior to the implementation of the Preferred Development Option.

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Abbreviations

AESO	Alberta Electric System Operator
CT	current transformer
DFO	Legal owner of distribution facilities
Rate DTS	Demand Transmission Service
ID	Information Document
ISD	in-service date
ISO	Independent System Operator
kV	Kilovolt
LTO	Long-term Outlook
LTP	Long-term Transmission Plan
MVA	megavolt ampere
MVAr	megavolt ampere reactive
MW	megawatt
NID	Needs Identification Document
SASR	System Access Service Request
Study Area	Portion of the system studied to determine technical performance of options to address the need in the Rycroft area
SVC	static VAr compensator
TFO	Legal owner of transmission facilities
TPL standards	Transmission Planning Standards
VAr	volt ampere reactive

1 Introduction

The Alberta Electric System Operator (AESO) *2015 Long-term Transmission Plan* (2015 LTP) identifies reliability standards violations, such as voltage and thermal criteria violations, in the Peace River and Grande Prairie Planning Area (Area 19 and 20) due to forecasted load growth. As further described in this report, the AESO has since conducted need assessment studies for the local 144 kV and 72 kV transmission networks in the Rycroft area (Study Area). Due to the nature of local constraints, the need for transmission system reinforcement in the Study Area will not be materially impacted by changes and developments in the broader Peace River and Grande Prairie areas. The AESO has used the most up-to-date forecast, based on the *AESO 2017 Long-term Outlook* (2017 LTO) and additional system access project specific information and system topology assumptions in these studies and confirmed that reliability criteria violations are expected to arise in the near-term under certain system conditions.

The area of focus in the planning studies described herein is limited to the local 144 kV and 72 kV networks between Peace River (Area 19) and Grande Prairie (Area 20), and is referred to as the Study Area. The Study Area is connected to the Northwest transmission network of the Alberta Interconnected Electric System (AIES) through two existing 144 kV transmission lines. To the south, the Study Area connects to Clairmont Lake 811S substation through 7L68, and to the north it connects to West Peace River 793S substation through 7L75 (Figure 1-1). These two lines supply the Study Area load. Under a contingency that takes either one of these transmission lines out of service, the local area load will be radially supplied entirely by the remaining line. The Study Area could experience low voltage criteria violations and eventually voltage collapse under certain contingency conditions and as load continues to grow in the area. There is no existing generation in the Study Area and the generation outside of the Study Area has no material impact.

The broader Peace River and Grande Prairie Planning Areas are presented in Figure 1-2.

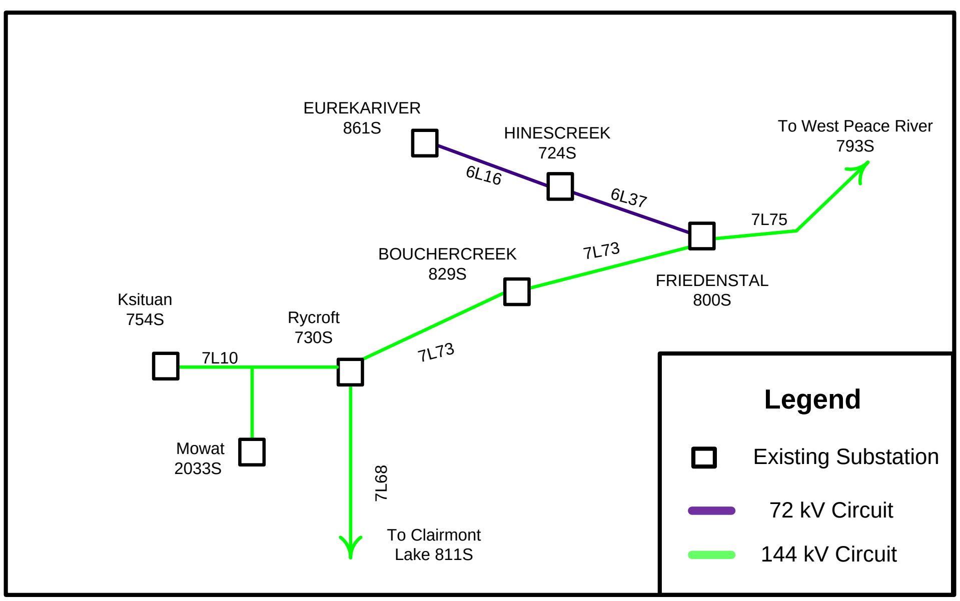
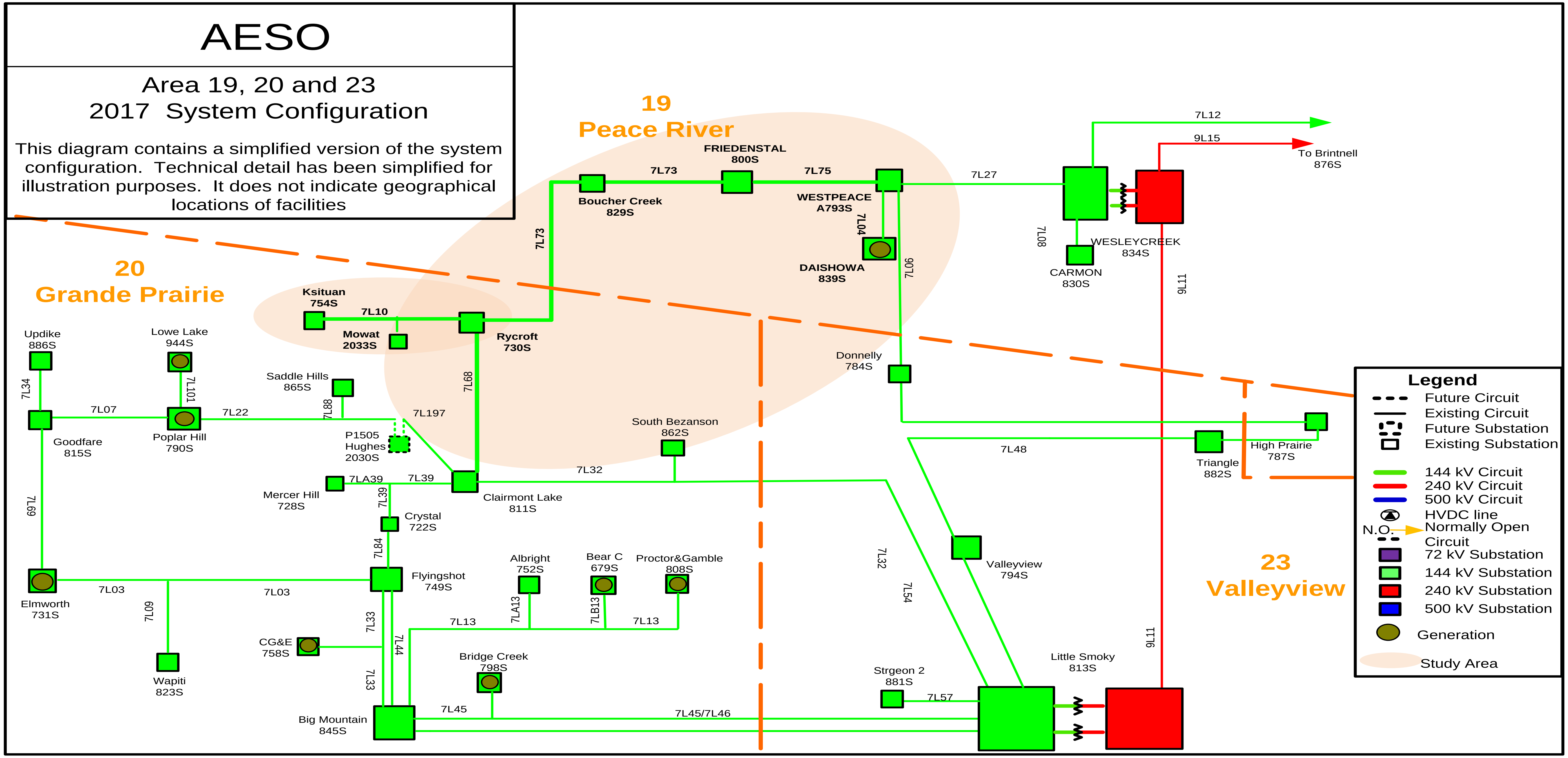


Figure 1-1. Transmission System in the Study Area

Figure 1-2. Transmission System in the Peace River and Grande Prairie Planning Areas



1.1 Study Objectives

Study objectives are summarized below:

- Assess the need for, and timing of, transmission reinforcement in the Study Area.
- Develop options to address the need for transmission system reinforcement and compare technical performance of these options over the 20-year planning horizon.
- Select the preferred transmission development option based on technical merits.

1.2 Study Scope

The following steps were followed and planning studies were conducted using the latest load and generation forecast available to the AESO.

- Need Assessment – Power flow studies were completed for Category A (all transmission elements in service) and Category B (a single transmission element out of service) system conditions in the near term. The system performance was compared against the requirements of the Transmission Planning (TPL) standards to identify any thermal and/or voltage criteria violations under various stressed system conditions.
- Development of transmission reinforcement options – Several different 144 kV transmission reinforcement options were developed to address the criteria violations identified during the Need Assessment studies.
- Technical assessment of the transmission reinforcement options – The performance of each transmission reinforcement option was assessed through power flow, voltage and transient stability studies under Category A and Category B system conditions over the 20-year planning horizon.
- Short-circuit analyses – Short-circuit current levels were calculated for the transmission network before and after implementation of the preferred transmission reinforcement option in the near term.

2 Reliability Standards, Criteria, Study Assumptions, and System Model

This section discusses the applicable Reliability Standards, criteria, study assumptions, and system model applied in the Rycroft area planning studies. The information used to create the study cases, such as load and generation assumptions and system configuration, reflects the most current information available to the AESO. While the AESO makes assumptions based on the latest available information, it is acknowledged that assumptions are subject to change over time. The AESO addresses the possible impact of changes in assumptions by monitoring active system projects and performing regular system planning studies as part of the long-term plans.

2.1 Transmission Reliability Standards and Criteria

Alberta Reliability Standards[1] and Criteria

When developing long-term plans, the AESO applies the Transmission Planning (TPL) standards, which are part of the Alberta Reliability Standards, to ensure the transmission system is planned to meet the applicable performance requirements under a defined set of system conditions and contingencies. A brief description of each of the standards relevant to this study is given below. Considering the size and scope of this project, some of the Alberta Reliability Standards may not require assessment.

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 ranges, 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.

TPL-002-AB-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, 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. No cascading outages can occur.

The TPL Standards have referenced thermal and voltage limits within the applicable rating when specifying the required system performance. For the purpose of applying the TPL Standards to the planning studies documented in this report, applicable ratings are defined as follows, in accordance with the AESO's *Transmission Planning Criteria – Basis and Assumptions:*

- Applicable thermal limits are 100% of continuous summer and winter ratings.
- Voltage range under normal operating condition per AESO Information Document (ID) #2010-007RS, *General Operating Practices – Voltage Control*, which relates to Section 304.4 of the

[1] A complete description of these standards are given in http://www.aeso.ca/rulesprocedures/17004.html

ISO rules, *Maintaining Network Voltage*. For the busses not listed in ID #2010-007RS, Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions* applies.

- Desired post-contingency voltage change limits for three defined post event timeframes as provided in Table 2-2 below.

Table 2-1. Acceptable Range of Steady State Voltage

Nominal Voltage (kV)	Extreme Minimum (kV)	Normal Minimum (kV)	Normal Maximum (kV)	Extreme Maximum (kV)
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	152
72	65	68.5	75.5	79
69	62	65.5	72.5	76

Table 2-2. Post-Contingency Voltage Deviations 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 low voltage bus	±10%	±7%	±5%

2.2 Load Forecast

The AESO forecast for this project, *Addition of Voltage Support at Rycroft 730S Substation Load and Generation Forecasts (see* Appendix B of the NID Application), includes details of the load and generation forecast used for these studies. For ease of reference, relevant information is summarized below:

- Studies presented in this report are based on the latest load and generation forecast available to the AESO for the Study Area.
- Study Area peak load has historically occurred in the winter season and this is forecast to be the case in the future. The 2016 recorded seasonal winter peak (WP) load was 68 MW. The 2016 recorded seasonal summer peak load was 58 MW.[2]

[2] For the purpose of the AESO's forecast, winter season starts on November 1 and ends on April 30 of the following year. Summer season is from May 1 to October 31 of the calendar year.

- Load is forecast to grow significantly in the near-term due to three transmission system access service requests submitted by ATCO Electric, the distribution facility owner (DFO). As a result:
  - Summer peak load is forecast to increase from 58 MW in 2016 to 78 MW in 2026
  - Winter peak load is forecast to increase from 68 MW in 2016 to 89 MW in 2026

2.3 Generation Assumptions

As shown in the AESO forecast for this project (*see* Appendix B of the NID Application), there are currently no existing generation nor applied for generation connection requests on the 144 kV and 72 kV transmission systems in the Study Area. There is the potential for hydroelectric resource development in the vicinity of the Study Area; however, due to long lead times associated with these types of developments, some hydroelectric developments were included in these studies at the end of the 20-year planning horizon. Specifically, a 350 MW hydro facility was included on the 240 kV bus at Wesley Creek 834S, as there is not enough transmission capacity within the Study Area.

2.4 System Development Assumptions

Currently there are no system development projects approved or under construction in the Northwest Planning Region.

2.5 Customer Connection Assumptions

Table 2-3 outlines the customer connection projects in the Study Area that have been considered in the study cases. Their inclusion represents system topology following completion of the system development described herein. Since 2015, ATCO DFO has submitted three system access service requests (SASRs) to collectively serve 36 MW of new load in the Rycroft area. These connection projects have scheduled in-service dates (ISDs) between 2017 and 2019, and they are based on information currently available to the AESO.

Two applications are for Rate DTS increases at existing Ksituan River 754S (project 1658) and Eureka River 861S (project 1646) substations and one is for serving load at the new Mowat 2033S (project 1618) substation. Projects 1618 and 1646 were energized in Q2 2017 with a total of 24.5 MW Rate DTS increase in the area.

Table 2-3. Customer Projects in the Study Area

Project No.	Project Name	Area	Existing Rate DTS (MW)	Requested Rate DTS (MW)	ISD	Change in MW
1618	ATCO Spirit River New POD	20	0	21	June 2017 (energized)	+21
1646	ATCO Eureka River 861S Capacity Increase	19	2.9	6.4	June 2017 (energized)	+3.5
1658	ATCO Ksituan River 754S Capacity Increase	20	26.3	38.0	February 2019	+11.7

2.6 Voltage Profile Assumptions

Voltages at major buses will be maintained at normal levels within the voltage requirement set out in Table 2-1 above. The AESO ID *General Operating Practice - Voltage Control (ID #2010-007RS)* will be used as a reference to establish normal voltage levels. To be focused on the Study Area, the following voltage levels are assumed to be maintained at the two key source buses that supply the Study Area under system normal conditions in all study cases: West Peace River 793S at 148 kV or above; Clairmont Lake 811S at 144 kV or above.

2.7 Facility Ratings and Shunt Elements

Table 2-4 summarizes the facility ratings in the Study Area and its vicinity. Table 2-5 summarizes the existing capacitive shunt elements in the Study Area and its vicinity. There are no existing reactors or SVCs in the Study Area.

Table 2-4. Existing Facility Ratings in the Study Area and its Vicinity

Facility	From	To	Voltage (kV)	MVA (Currently de-rated)	
				Summer	Winter
7L68	Clairmont Lake 811S	Rycroft 730S	144	114	146 (132)
7L73*	Rycroft 730S	Friedenstal 800S	144	114 (99)	146 (99)
7L75**	Friedenstal 800S	West Peace River 793S	144	146	196 (149)
7L10***	Rycroft 730S	Ksituan River 754S	144	114 (85)	146 (134)

* 7L73 is limited to 99 MVA by current transformer (CT) and clearance limitations. ATOC Electric Ltd. the TFO in the area has a capital maintenance project which included this line restoration to 113/145 MVA normal summer/winter ratings on a 144 kV base with an estimated ISD of 2020.

** 7L75 was limited to 99 MVA by current transformer (CT) and clearance limitations. A recent TFO capital maintenance project restored the ratings of 7L75 to 146/149 MVA normal summer/winter ratings on a 144 kV base (completed in November 2017).

***7L10 was limited to 49 MVA, the area TFO increased the 7L10 ratings between Rycroft 730S and Mowat 2033S to 85/134 MVA normal summer/winter ratings on a 144 kV base as part of project 1618 (completed in October 2017).

Table 2-5. Shunt Elements in the Study Area

Substation Name and Number	Nominal Bus Voltage (kV)	Capacitors	
		Number of Switched Shunt Blocks	Each at Nominal Voltage (MVAr)
Ksituan 754S	144	1	15
Mowat 2033S	144	1	15
		1	10
Eureka River 861S	72	1	5
Friedenstal 800S	144	1	15
	25	1	4.8

2.8 Protection Fault Clearing Times

Fault clearing times for existing facilities were provided by the area TFO and are listed in Table 2-6.

Table 2-6. Transient Category B Contingency List and Fault Clearing Times

Contingency	Fault Location (first substation is near end, second substation is far end)	Clearing Time (Cycles)	
		Near end	Far end
7L68 (Rycroft 730S to Clairmont Lake 811S)	Rycroft 730S	5	--
	Clairmont Lake 811S	--	7*
7L68 (Rycroft 730S to Clairmont Lake 811S)	Clairmont Lake 811S	5	--
	Rycroft 730S	--	7*
7L75 (West Peace River 793S to Friedenstal 800S)	Friedenstal 800S	6	--
	West Peace River 793S	--	8**
7L75 (West Peace River 793S to Friedenstal 800S)	West Peace River 793S	6	--
	Friedenstal 800S	--	8**
7L73 (Rycroft 730S to Friedenstal 800S)	Rycroft 730S	6	--
	Friedenstal 800S	--	8**
7L73 (Rycroft 730S to Friedenstal 800S)	Friedenstal 800S	6	--
	Rycroft 730S	--	8**
9L11 (Little Smoky 813S to Wesley Creek 834S)	Little Smoky 813S	5	--
	Wesley Creek 834S	--	6

* 7 cycles of teleprotection clearing time is required on 7L68 as part of project 1658 Ksituan River 754S Capacity Increase.

**As part of project 1658 Ksituan River 754S Capacity Increase, teleprotection is being installed on both 7L73 and 7L75 to ensure a total fault clearing times of 8 cycles at the far end.

3 Planning Methodology

The methodology used to conduct the planning studies in the Study Area included the following:

- Use summer and winter peak load conditions to create a variety of credible stressed scenarios for the planning studies.
- Conduct need assessment studies in the near-term to identify potential transmission system constraints to serving load under Category A (N-0) and Category B (N-1) system conditions.
- Determine the load serving capability of the existing transmission system supplying the Study Area.
- Determine the timing of the need to reinforce the transmission system for the Study Area by comparing its load serving capability against the forecast load.
- Develop transmission reinforcement options to address the identified near-term constraints and that considered the 20-year planning horizon.
- Evaluate the relative performance of the transmission reinforcement options in the medium-term (2026), and long-term (2036).
- Select the preferred transmission reinforcement option based on technical performance, economics, and social, environmental and land impacts.
- Develop a milestone and staged approach (if appropriate) to trigger the construction of the preferred transmission option.
- Perform short-circuit analysis for the substations in the Study Area and its vicinity before and after implementation of the transmission reinforcement options.

3.1 Study Scenarios

Study scenarios represent combinations of key factors including forecast peak load and generation dispatches that would result in credible stressed system conditions. The scenarios created for these planning studies are summarized in Table 3-1.

Load supply adequacy studies – Scenario 1 was created to identify the potential year the transmission reinforcement option is needed to alleviate any voltage violations or thermal overloads that could constrain the transmission systems ability to supply load. Winter peak loading conditions were used in this scenario to identify potential voltage violations considering the worse voltage impact during the winter season.

System configuration – Planning study results were dependent on a number of key assumptions, including load and generation forecasts, customer connection projects and system configuration.

Medium-term and long-term performance assessments – To test the performance of each transmission reinforcement option in the medium-term (2026) for the 10-year planning horizon and long-term (2036) for the 20-year planning horizon, study scenarios for the 2026 summer peak load, 2026 winter peak load, 2036 summer peak load, and 2036 winter peak load were created to represent credible stressed system conditions.

Generation dispatches – No generation is connected within the Study Area. Generation dispatch outside of the Study Area will not have material impact on load serving capability in the Rycroft area. Low Northwest region generation scenarios under 2017 LTO Reference Case were used as the overall credible stressed system conditions for planning studies.

Table 3-1. Study Scenarios

Study Scenario	Year	Season	Study Area Peak Load (MW)	Study Area Generation (MW)
1	2017	Winter	78	NA
2	2026	Summer	78	NA
3	2026	Winter	89	NA
4	2036	Summer	84	NA
5	2036	Winter	96	NA

3.2 Power Flow Analysis

Power flow analyses were performed to assess the need prior to any new transmission reinforcement in the Study Area. The objective of these studies was to identify system constrains due to violations of the TPL standards. Based on study results, the load serving capability of the transmission system in the Study Area was determined for the existing transmission system. The maximum load that can be reliably supplied by the transmission system in the Study Area without causing a performance violation following a Category B contingency is defined as the area's load serving capability.

Table 3-2 below shows the list of contingencies considered in the studies. Transmission facilities within the Study Area were monitored and reported with any thermal or voltage criteria violations. Each of the transmission reinforcement options considered was analyzed and compared using the study scenarios listed in Table 3-1.

Table 3-2. Category B Contingency List

Contingency	Elements Removed
9L11	9L11 (Little Smoky 813S – Wesley Creek 834S)
7L75	7L75 (West Peace River A793S – Friedenstal 800S)
7L73	7L73 (Friedenstal 800S - Rycroft 730S)
7L68	7L68 (Clairmont Lake 811S – Rycroft 730S)
7L10	7L10 (Rycroft 730S- Ksituan River 754S)
7L32	7L32 (Little Smoky 813S – Clairmont Lake 811S)
7L46	7L46 (Little Smoky 813S – Big Mountain 845S)
7L39	7L39 (Clairmont Lake 811S – Crystal Lake 722S)
7L03	7L03 (Flyingshot 749S – Elmworth 731S)
7L69	7L69 (Goodfare 815S – Elmworth 731S)

Contingency	Elements Removed
New 144 kV line *	New Line (Mowat 2033S – Saddle Hills 865S)
Capacitor Banks**	Capacitor banks at Friedenstal, Mowat, and Ksituan River

*New 144 kV line between Mowat 2033S and Saddle Hills 865S was only tested for Option 3. The assumption is that the new line will be terminated at designated substations with two dedicated breakers while the existing system network configurations remain as is.

**Single element contingencies were tested based on substation breaker configurations.

3.3 Voltage Stability Analysis

The objective of the power-voltage (PV) analysis was to determine the ability of the network to maintain voltage stability margin at all the busses in the system under normal and abnormal system conditions. The PV curve represents voltage change as a result of increased power transfer between two systems. The reported incremental transfers were to the collapse point.

The voltage stability criteria are included in Appendix G of the NID document.

Voltage stability analysis was carried out using the winter peak scenarios due to the higher area loading in winter compared to the summer for the same year. The voltage stability analysis was performed by increasing load on the Study Area busses only and increasing the generation in the South Region (Areas 53, 54 and 55). Also for this analysis, no limits were selected for the generation sources, non-negative active power constant MVA loads were enforced, and the existing power factor for the reference was maintained.

Voltage stability analysis was performed for Category A condition and all Category B contingencies listed in Table 3-2.

Voltage-reactive power (VQ) analysis was performed to identify the approximate amount of reactive power required for Category A and all Category B contingencies listed in Table 3-2.

3.4 Transient Voltage Recovery Analysis

Transient stability analysis was performed with the alternative VAr support included for the faults indicated in Table 2-6. Fault clearing times provided by the area TFO were used in these studies. Three phase faults were applied.

For the transient stability analysis, the motor model (CLOD) within the Study Area assumed 70% of the load with a motor split of 40% large and 30% small motors, which is typically used for studies in the Northwest and Northeast areas.

3.5 Short-circuit Analysis

The objective of short-circuit analysis was to assess whether the maximum fault currents exceed the capability for the circuit breakers to clear faults and to ensure equipment in the area is capable of carrying the anticipated short-circuit flow. Short-circuit levels were analyzed under three-phase-to-ground faults and single-line-to-ground faults with all the generators in and around the Study Area dispatched.

4 Need Assessment

The main objective of the Need Assessment studies was to determine the load serving capability of the existing transmission supplying the Study Area. Accordingly, the constraints limiting the load serving capability were identified together with the limiting contingencies. The load serving capability of the existing transmission system was determined using the planning methodology described in Section 3.

Once the load serving capability of the system was determined, the timing of the need for system reinforcement was identified by matching the system capability to the forecast load for the Study Area.

4.1 Load Serving Capability of the Existing System

During 2016 the winter peak load level in the Study Area was approximately 68 MW and the peak load level up to date (2017) was approximately 72 MW. The Need Assessment shows that the existing system load serving capability is approximately 75 MW. The load serving capability is limited by low transmission voltage and voltage deviation at various substations in the Study Area following a 7L75 or 7L73 contingency. The load serving capability following 7L68 contingency is very similar to, but slightly better than, that of 7L75. The results of the Need Assessment also show that, when the area load reaches approximately 80 MW following a 7L68 contingency, the power flow solution did not converge under this study scenario (voltage collapse or voltage instability). Study Scenario 1A assumed a Study Area load of 75 MW and Scenario 1B assumed a Study Area load of 80 MW. Both were created from Scenario 1 with the load scaling methodology applied. The power flow diagrams for these two new scenarios are provided in Attachment A (Scenario 2017WP-1A and 1B).

With the loss of 7L73 (between Rycroft 730S and Friedenstal 800S) a marginally high transmission voltage on the 144 kV bus at Friedenstal 800S of 156 kV was noted. The high transmission voltage in the Friedenstal area is currently managed through TFO overvoltage protection schemes that trip the Friedenstal 800S capacitor. (This, and similar issues will not be mentioned again in the report if they are not related to the proposed transmission reinforcement options.)

4.2 Timing of Need

Based on the study results, timing of the need will depend on when load in the Study Area increases from the existing 72 MW to approximately 75 MW, which would cause voltage violations in this area and represents a loading level close to the voltage stability margin (an 80 MW limit).

The load forecast indicates the Study Area load might increase to a peak of 78 MW in winter 2017 if load materializes according to current connection project applications; therefore, the need for additional reinforcement in the Study Area is anticipated to arise as early as winter 2017. However, the forecast load growth in the area is currently driven by specific connection projects. While the AESO is reasonably certain that the transmission development is needed in the Rycroft area in the future, the timing of transmission development depends on external factors such as the load project in-service dates (ISDs) which are beyond the AESO's control. The AESO has therefore determined that milestones are appropriate to manage this uncertainty.

Considering the Need Assessment, Section 5 describes the transmission reinforcement options considered to address the identified constraints in the Study Area.

5 Development of Transmission Reinforcement Options

Three transmission reinforcement options were identified and assessed with the components outlined in Sections 5.1 through 5.3, based on the need to reliably supply the load in the Rycroft area. All three options would address the voltage violations identified during the Need Assessment.

In order to meet the forecasted area peak load of 96 MW for the next 20 years, additional voltage support was considered in the Study Area as proposed under Option 1. The study shows that, without any wire reinforcement in the Study Area, dynamic reactive power support is required. This is mainly due to the large amount of reactive power requirement, approximately 50 MVAr, to meet the transmission reliability criteria under certain contingency conditions. If this reactive power support is entirely provided by capacitor banks at the Rycroft load center, which is supplied by Ksituan River 754S, Mowat 2033S and Rycroft 730S substations, it would cause normal maximum voltage violations within and adjacent to the Study Area under system normal conditions. It would also cause emergency maximum voltage violations throughout the entire Study Area under the contingency of 7L68.

Wire solutions were also considered to meet the forecasted area peak load for the next 20 years. Both Option 2 and Option 3 would require additional reactive power support (e.g., capacitor banks) in addition to new circuits in the Study Area.

As part of the selection of the preferred option, construction staging opportunities will be considered. See Figure 5-1, Figure 5-2 and Figure 5-3 for single line diagrams of the three options.

5.1 Option 1: Dynamic Reactive Power Support of 50 MVAr

- Provide dynamic reactive power support with 144 kV 50 MVAr at the existing Rycroft 730S to ensure reliability for the 10 year planning horizon.
- Add a 25 kV 4.8 MVAr capacitor bank at Ksituan River 754S in the long term.

5.2 Option 2: New 144 kV Circuit from Rycroft 730S to Clairmont Lake 811S plus Reactive Power Support

- Build a new 144 kV circuit between Rycroft 730S and Clairmont Lake 811S (approximately 60 km in length) for the 10 year planning horizon.
- Approximately 20 MVAr reactive power support would be required in addition to the new circuit, as follows:
    - A 144 kV 10 MVAr capacitor bank at Ksituan 754S for the 10 year planning horizon;
    - A 25 kV 7.2 MVAr capacitor bank at Ksituan River 754S and a 25 kV 2.4 MVAr capacitor bank at Eureka River 861S in the long term.

5.3 Option 3: New 144 kV Circuit from Mowat 2033S to Saddle Hills 865S plus Reactive Power Support

- Build a new 144 kV transmission circuit connecting the Mowat 2033S substation to Saddle Hills 865S (approximately 45 km in length) for the 10 year planning horizon.
- Approximately 30 MVAr reactive power support would be required in addition to the new circuit, as follows:
  - a 144 kV 10 MVAr capacitor bank at Rycroft 730S in the 10 year planning horizon
  - a 144 kV 10 MVAr capacitor bank and a 25 kV 7.2 MVAr capacitor bank both at Ksituan River 754S in the 10 year planning horizon
  - a 25 kV 2.4 MVAr capacitor bank at Eureka River 861S in the long term.

5.4 Alignment with the AESO's Long-Term Plans

The AESO's 2015 LTP proposed additional voltage support at the Rycroft 730S substation to meet the load forecast for the Rycroft area. The transmission reinforcement options presented and considered in this report are aligned with the AESO's long-term plans for transmission development for the Rycroft area.

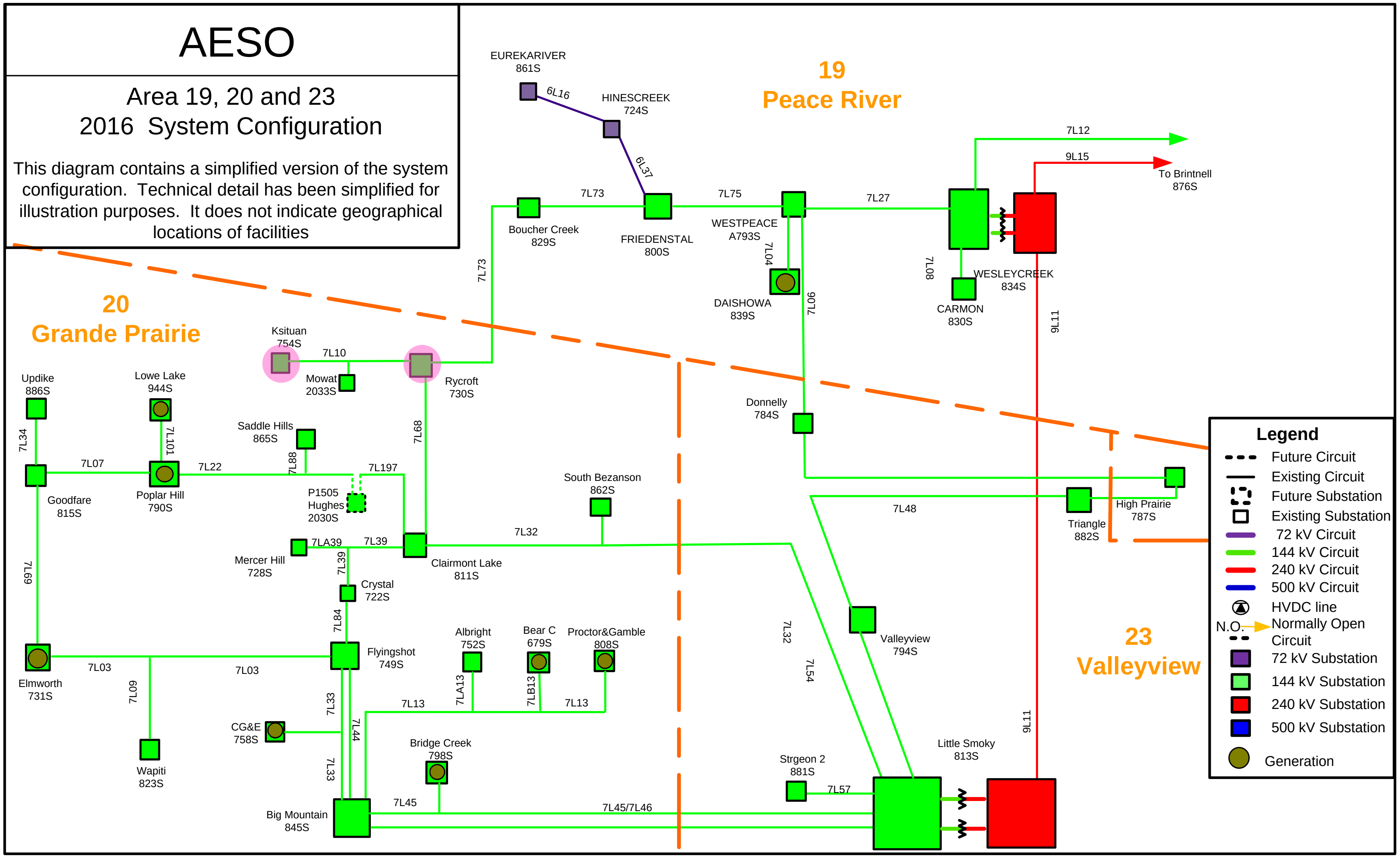


Figure 5-1. Option 1 – Dynamic Reactive Power Support in Study Area

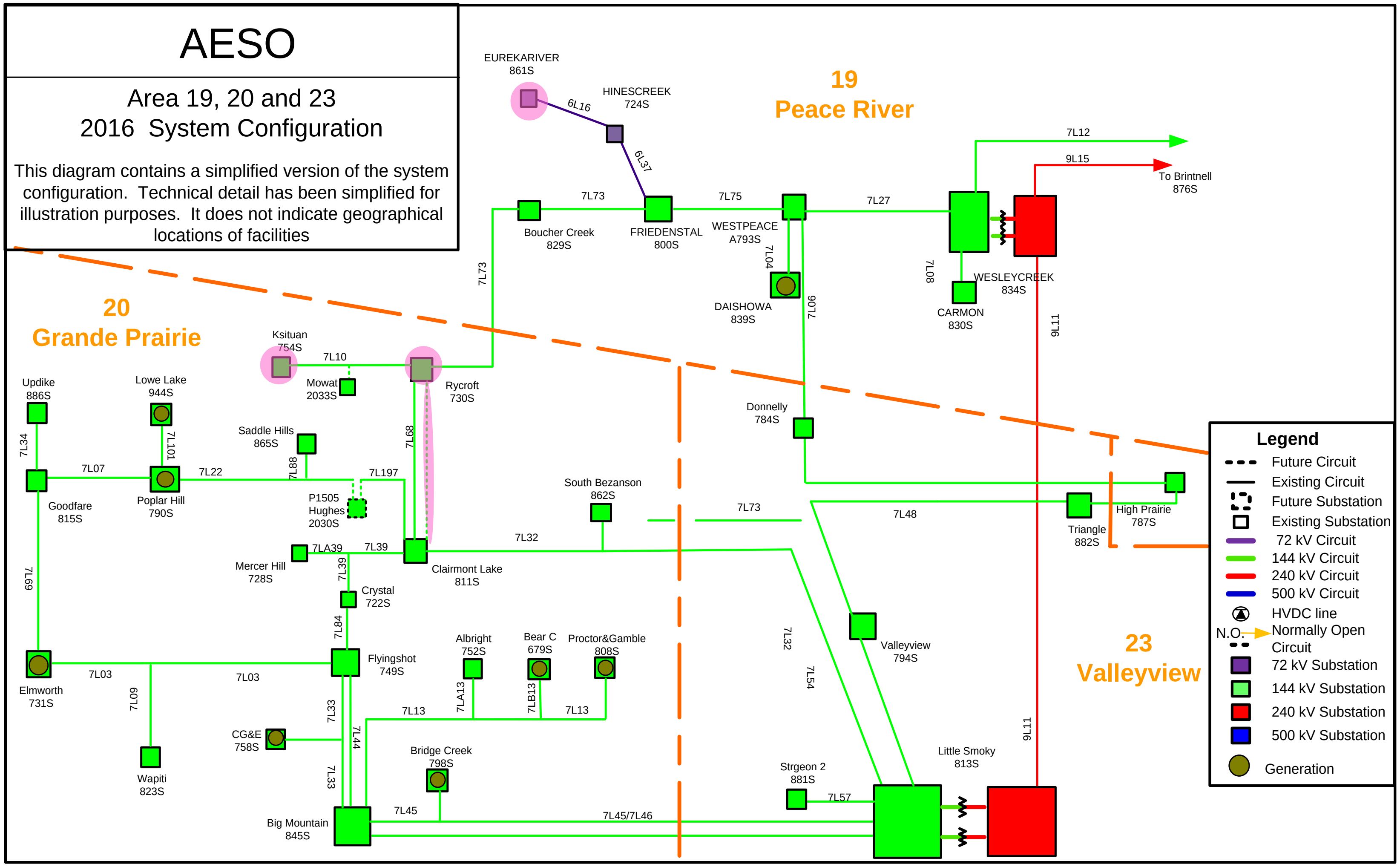


Figure 5-2. Option 2 – New 144 kV line from Rycroft 730S to Clairmont Lake 811S Plus Reactive Power Support in Study Area

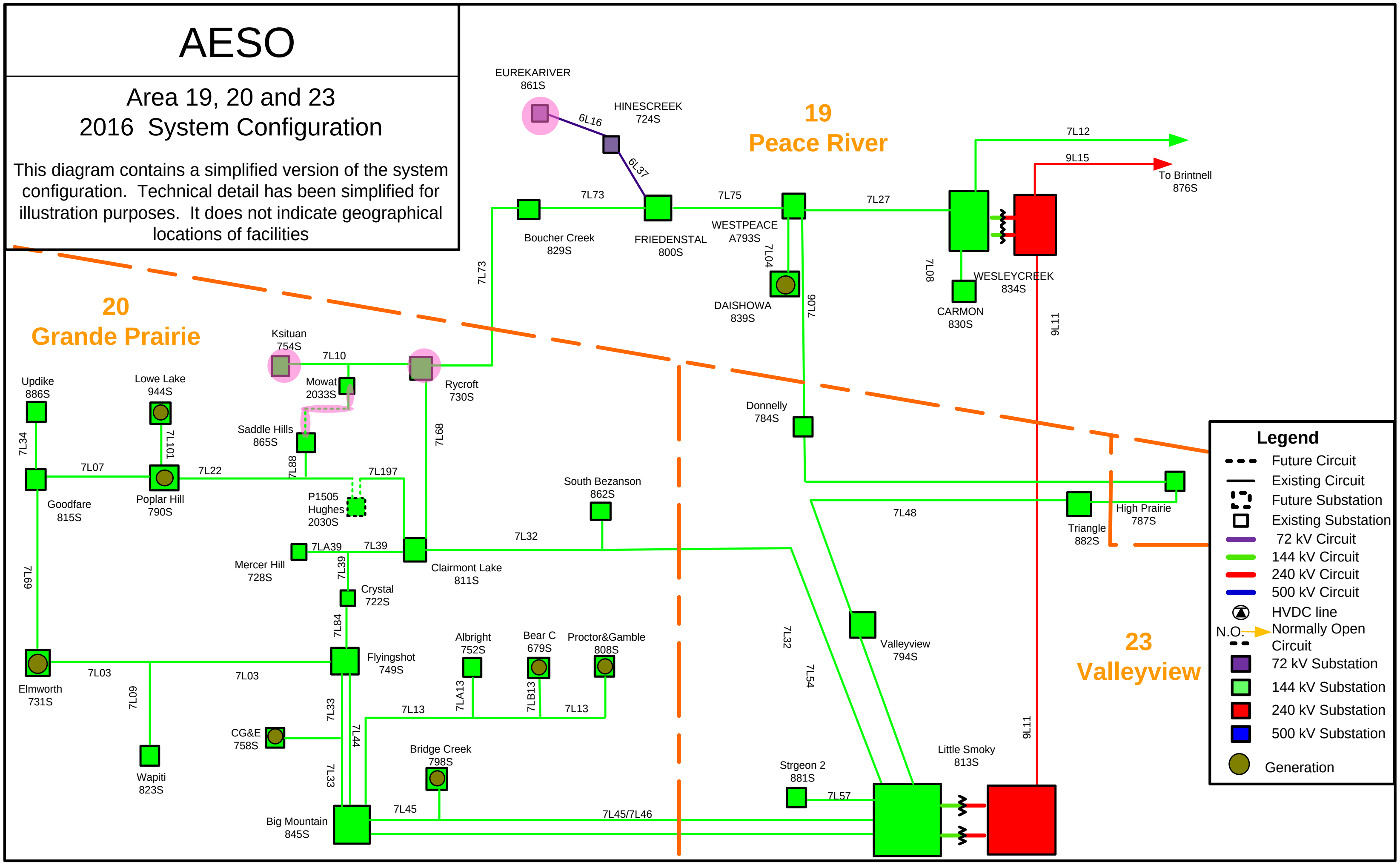


Figure 5-3. Option 3 – New 144 kV line from Mowat 2033S to Saddle Hills 865S Plus Reactive Power Support in Study Area

6 Technical Assessment of the Options

Studies were carried out to evaluate the performance of the three options considered. The load serving capability of each option was assessed and compared against the long-term forecast to ensure that it can reliably serve the forecasted area load. When additional reactive power devices were assessed to meet the load serving capability requirement, the AESO consulted the area TFO and standard equipment sizing was considered in this study, specifically:

- 144 kV dynamic reactive power devices of 50 MVAr or 40 MVAr (SVC or STATCOM)
- 144 kV capacitor banks of 15 MVAr, 10 MVAr or units of 25 kV capacitor banks coming in standard blocks of 2.4 MVAr each

For these studies, 144 kV and 72 kV bases are used for transmission facility/equipment ratings unless noted otherwise.

6.1 Option 1: Dynamic Reactive Power Support of 50 MVAr

6.1.1 Load Serving Capability

With VAr support added in the Rycroft area under Option 1, the transmission system load serving capability increases from the existing 75 MW to approximately 100 MW which would then be only limited by the summer seasonal thermal capacity of line 7L68 under the contingency of line 7L75 (Table 6-1). The new load serving capability would be able to meet the area need for up to 20 years. Power flow diagrams are provided in Attachment B (Scenario 1C).

Table 6-1. Load Serving Capability of Option 1

System Configuration	Load Serving Capability (Summer)	Limiting Contingency	Limiting Element (Summer Rating)	Limit Type
Option 1	100 MW	7L75	7L68 (114 MVA)	Thermal

6.1.2 Reactive Power Support Requirement

The existing system load serving capability in Study Area is approximately 75 MW. This limit is due to low transmission voltages and voltage deviation violations at various substations following a 7L75 or 7L73 contingency. The results for Option 1 show that the power flow solution might not converge (voltage collapse or voltage instability) under N-1 conditions when the Study Area load is over 80 MW. There will also be N-0 voltage violations at Ksituan River 754S when the Rycroft area load reaches approximately 92 MW and above. The power flow diagram for this scenario is provided in Attachment B (Scenario 4A).

In order to meet the forecasted area peak load of 96 MW for the next 20 years, while utilizing the existing transmission network thermal capability, additional voltage support is required in the Study Area.

Voltage collapse, voltage profile (pre- and post-contingency conditions) and voltage recovery are factors considered when identifying the need for dynamic VAr support devices. Dynamic reactive support is required in the Study Area due to the large reactive power required, approximately 50 MVAr, to meet the transmission reliability criteria under contingency conditions. If all of this is provided by capacitor banks at the Rycroft load center supplied by Ksituan River 754S, Mowat 2033S and Rycroft 730S, it would cause normal maximum voltage violations in the Study Area under system normal conditions (N-0). It would also cause emergency maximum voltage violations throughout the entire Study Area under the contingency of 7L68, as shown in Attachment B (Scenario 4B). Dynamic reactive support in the area would address these issues.

This study assessed the technical performance of the system using an SVC for Option 1. Detailed devices and technologies will be proposed by the TFO in later stages of the project.

The locations of the reactive power support devices are normally close to the load center, and the placement of the dynamic VAr support needs to address the voltage violations under the two worst contingencies in the Study Area: 7L75 and 7L68. Therefore, Rycroft 730S and Ksituan River 754S were considered for the placement of reactive power support device(s) in this study. Adding a large reactive power device at a single substation with a radial feed is not recommended due to incurred losses and constraints on the availability of the reactive power support under certain system operating conditions. Therefore, Ksituan River 754S was screened out and Rycroft 730S substation was selected for further analysis under Option 1.

First, VQ analyses were performed to determine the amount of reactive power support required at Rycroft 730S. Then, PV analyses for load margins and power flow analysis on 2026 and 2036 winter peak and summer peak scenarios for voltage and thermal line flows were assessed to ensure the recommended reactive power support meets the transmission reliability requirement.

VQ Analysis for Additional VAr Support

As the voltage constraints are caused by high area load requirements and that the winter load forecast is higher than the summer load forecast, the size(s) and location(s) of the reactive power support devices were determined using winter peak load conditions. In order to determine the amount of VAr required in Study Area for the next 20 years, VQ analysis was conducted with a 5% increase over the 2036 WP scenario reference load level of 96 MW. For this scenario, all existing Study Area capacitors were assumed to be on with no new area VAr support. Approximately 54 MVAr at Rycroft 730S will be required to maintain area voltages above the minimum voltage requirement of 130 kV (0.94 p.u.) under critical contingencies (Figure 6-1).

The 54 MVAr reactive support could be entirely dynamic (SVC or STATCOM) or could be a combination of dynamic and capacitor banks in the Study Area that would be sufficient to meet the pre- and post-contingency performance requirements. Either a standard size 50 MVAr SVC alone or a 40 MVAr SVC with additional capacitor banks could provide this support, and both sizes and types of equipment have been considered for Option 1.

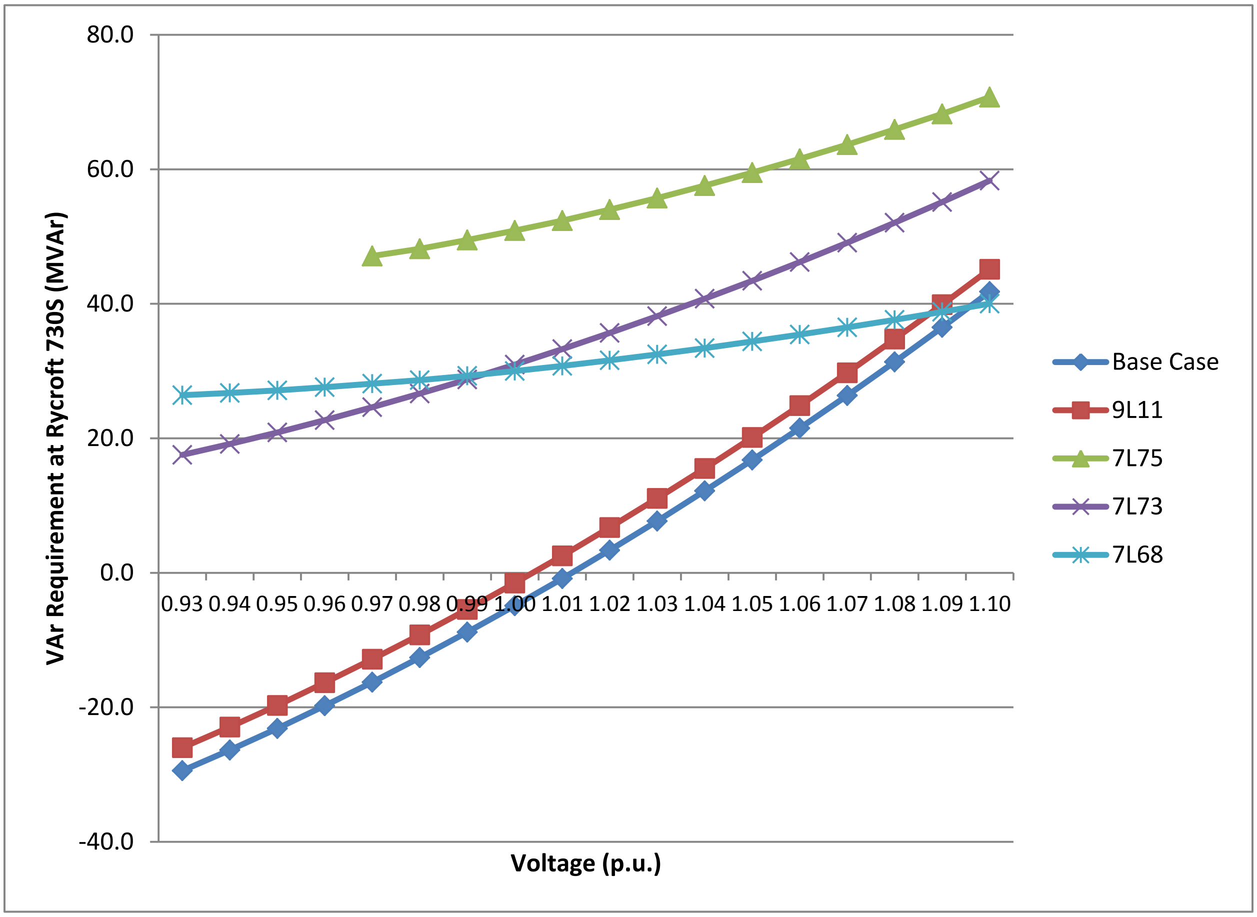


Figure 6-1. 20-year VQ Analysis at Rycroft 730S – Option 1

PV Analysis for Additional VAr Support

PV analyses were performed for 50 MVAr and 40 MVAr SVCs on the 144 kV bus at Rycroft 730S under the 2026 WP and 2036 WP scenarios. The winter peak load for the Study Area is 89 MW in 2026 and 96 MW in 2036.

The PV analysis results for the 2026 WP scenario are provided for 50 MVAr SVC and for 40 MVAr SVC on 144 kV bus at Rycroft 730S (see Table 6-2 and Table 6-3, respectively). The 50 MVAr SVC meets the voltage stability requirement for 10-year planning horizon. The 40 MVAr SVC does not meet the voltage stability requirement; therefore additional capacitor banks will be required. However an SVC of 40 MVAr or lower with additional capacitor banks would rank lower than the 50 MVAr SVC in terms of economic merit. Therefore, the 50 MVAr SVC is preferred because of its technical performance and economic merit.

Table 6-2. Voltage Stability – 2026 WP: 50 MVAr SVC at Rycroft 730S (min. PV margin = 4.43 MW)

Contingency	From	To	2026 WP (min. PV margin is 4.43 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		45.63	Yes	*134.13*	0.81 @ Ksituan River
9L11	Little Smoky 813S	Wesley Creek 834S	43.52		*132.02*	0.83 @ Ksituan River
7L75	West Peace River 793S	Friedenstal 800S	5.63		*94.13*	0.97 @ Ksituan River 144kV
7L73	Friedenstal 800S	Rycroft 730S	15.63		*104.13*	0.90 @ Ksituan River 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	16.88		*105.38*	0.99 @ Ksituan River 144 kV
7L46	Little Smoky 813S	Big Mountain 845S	22.50		*111.0*	0.91 @ Ksituan River 144 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	23.75		*112.25*	0.93 @ Ksituan River 144 kV

Table 6-3. Voltage Stability – 2026 WP: 40 MVAr SVC at Rycroft 730S (min. PV margin = 4.43 MW)

Contingency	From	To	2026 WP (Min PV margin is 4.43 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		43.13	Yes	131.63	0.78 @ Ksituan River 144 kV
9L11	Little Smoky 813S	Wesley Creek 834S	41.56	Yes	130.06	0.79 @ Ksituan River 144 kV
7L75	West Peace River 793S	Friedenstal 800S	3.13	No	91.63	0.91 @ Ksituan River 144 kV
7L73	Friedenstal 800S	Rycroft 730S	13.13	Yes	101.63	0.84 @ Ksituan River 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	11.25	Yes	99.75	0.99 @ Ksituan River 144 kV
7L46	Little Smoky 813S	Big Mountain 845S	19.38	Yes	107.88	0.88 @ Ksituan River 144 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	21.25	Yes	109.75	0.89 @ Ksituan River 144 kV

The PV analysis results for 2036 WP scenario are provided in Table 6-4 with a 50 MVAr SVC at Rycroft 730S substation. The results show that a 50 MVAr SVC alone is not able to meet the voltage stability requirements for the next 20 years even assuming the voltage in the southern Grande Prairie system will be reinforced and maintained at 138 kV and above by a future development (SVC or similar) at or near Clairmont Lake 811S, which will be addressed by separate Need Assessment in the future. Therefore, further testing was completed with an additional 4.8 MVAr capacitor bank on 25 kV bus at Ksituan River 754S, as this substation was identified with N-0 voltage violations toward the end of the 20-year planning horizon. This combination of voltage support passed the voltage stability requirement. The results of this analysis are shown in Table 6-5.

Table 6-4. Voltage Stability – 2036 WP: 50 MVAr SVC at Rycroft 730S (min. PV margin = 4.8 MW)

Contingency	From	To	2036 WP (min. PV margin is 4.8 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		50	Yes	145.8	0.73 @ Eureka River 72 kV
9L11	Little Smoky 813S	Wesley Creek 834S	49.38	Yes	145.18	0.70 @ Eureka River 72 kV
7L75	West Peace River 793S	Friedenstal 800S	4.38	No	100.18	0.91 @ Eureka River 72 kV
7L73	Friedenstal 800S	Rycroft 730S	19.38	Yes	115.18	0.90 @ Ksituan River 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	12.50	Yes	108.3	0.99 @ Ksituan River 144 kV
7L46	Little Smoky 813S	Big Mountain 845S	41.88	Yes	132.68	0.76 @ Eureka River 72 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	37.50	Yes	137.68	0.79 @ Eureka River 72 kV

Table 6-5. Voltage Stability – 2036 WP: 50 MVAr SVC at Rycroft 730S and a 4.8 MVAr capacitor bank (25 kV) at Ksituan River (min. PV margin = 4.8 MW)

Contingency	From	To	2036 WP (min. PV margin is 4.8 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		51.25	Yes	147.05	0.73 @ Eureka River 72 kV
9L11	Little Smoky 813S	Wesley Creek 834S	50.63		146.43	0.70 @ Eureka River 72 kV
7L75	West Peace River	Friedenstal 800S	16.25	Yes	112.05	0.79 @ Eureka

Contingency	From	To	2036 WP (min. PV margin is 4.8 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
	793S					River 72 kV
7L73	Friedenstal 800S	Rycroft 730S	40.63		136.43	0.80 @ Ksituan River 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	15.63		111.43	0.99 @ Eureka River 72 kV
7L46	Little Smoky 813S	Big Mountain 845S	43.75		139.55	0.75 @ Eureka River 72 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	26.25		122.05	0.89 @ Eureka River 72 kV

Power Flow Analysis for additional VAR support

2026 Timeframe

Power flow analyses were performed to test the Study Area performance with Option 1, a 144 kV 50 MVAr SVC at Rycroft 730S, using the 2026 SP and 2026 WP study scenarios. Attachment B provides the power flow results (Opt1-2026SP Scenario 2 and Opt1-2026WP Scenario 3).

Category A:

No voltage or thermal Reliability Criteria violations were observed under 2026SP or 2026WP study scenarios.

Category B:

No thermal or voltage Reliability Criteria violations were identified under 2026 SP or 2026 WP study scenarios.

2036 Timeframe

Power flow analyses were performed with a 144 kV 50 MVAr SVC at Rycroft 730S with a 25 kV 4.8 MVAr capacitor bank at Ksituan River 754S under the 2036 SP and 2036 WP study scenarios. Clairmont Lake 811S voltage was maintained at 138 kV and above in 2036WP scenarios under category B conditions to ensure the Grande Prairie area VAr requirements do not influence the options investigated for the Rycroft area VAr support. Power flow results are provided in Attachment B (Opt1-2036SP Scenario 4 and Opt1-2036WP Scenario 5).

Category A:

No voltage or thermal Reliability Criteria violations were observed under 2036SP or 2036WP study scenarios.

Category B:

No voltage violations were identified under 2036 SP or 2036 WP study scenarios. The thermal performance study results on 2036 SP and 2036 WP study scenarios are listed in Table 6-6 and Table 6-7. No other thermal violations were identified.

Table 6-6. Category B Thermal Performance – 2036 SP: 50 MVAr SVC at Rycroft 730S and a 4.8 MVAr capacitor bank at Ksituan River 754S

Contingency	Overloaded Element	Rating* (Summer MVA)	Flow* (MVA)	% of Loading
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L73 (Rycroft 730S to Friedenstal 800S)	95	104	105

* MVA on a 138 kV base

Table 6-7. Category B Thermal Performance – 2036 WP: 50 MVAr SVC at Rycroft 730S and a 4.8 MVAr capacitor bank at Ksituan River 754S

Contingency	Overloaded Element	Rating*(Winter MVA)	Flow* (MVA)	% of Loading
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L73 (Rycroft 730S to Friedenstal 800S)	95	109	110
7L46 (Little Smoky 813S – Big Mountain 845S)			102	103

* MVA on a 138 kV base

Line 7L73 ratings are currently CT limited, and the line shows thermal overloads under the contingencies of 7L32 or 7L46 over the long term (i.e., between years 2027 and 2036). As the identified thermal overload occurs post-2026, the 7L73 line restoration will be further investigated as load continues to grow in the area.

6.1.3 Summary

To meet the forecast load over the 20-year planning horizon, a technical assessment was performed with additional voltage support in the Study Area. The assessment shows that, without any wire reinforcement in the Study Area, dynamic reactive power support is required to meet the transmission reliability requirements under contingency conditions.

The locations of the reactive power support devices are normally close to the load center, and the placement of the dynamic VAr support needs to address the voltage violations under the two worst contingencies in the Study Area: 7L75 and 7L68. Therefore, Rycroft 730S and Ksituan River 754S were considered for the placement of reactive power support device(s) in this study. However, adding a large amount of reactive power device at a single substation with a radial feed such as Ksituan River 754S is not recommended due to incurred losses and constraints on the availability of the reactive power support under certain system operating conditions. Therefore, Rycroft 730S is selected for further analysis.

Dynamic reactive power support of 50 MVAr at Rycroft 730S substation can meet the reliability requirements for pre and post voltage performance and voltage stability limit in the Study Area while supplying the local Rycroft area load up to approximately 90 MW (about 35% growth), which is sufficient to address the need for the 10-year planning horizon. A 50 MVAr SVC shows economic merits over the combination of an SVC of smaller size (40 MVAr) with capacitor bank(s). For the dynamic reactive power device, this study assumed an SVC for technical assessment purposes. Detailed devices and technologies will be proposed by the TFO in later stages of the project.

An additional capacitor bank would be required when the load increases up to the 20-year planning horizon.

The transmission development for Option 1 comprises the following system components:

- Dynamic reactive power support of 50 MVAr at Rycroft 730S 144 kV within 10 years; and
- A 25 kV 4.8 MVAr capacitor bank at Ksituan River 754S in the long term (i.e., between year 2027 and 2036).

6.2 Option 2: New 144 kV Circuit from Rycroft 730S to Clairmont Lake 811S plus Reactive Power Support

6.2.1 Load Serving Capability

Table 6-8 summarizes the load serving capability of adding the new 144 kV line between Rycroft 730S and Clairmont Lake 811S. The load serving capability is approximately 85 MW due to the under-voltage violations at Ksituan River 754S under the contingency of 7L75, which is not sufficient to meet area needs within the first 10 years. Additional voltage support will therefore be needed in addition to this proposed line as the area load continues to increase. The rating of the new 144 kV line is assumed to be 114 MVA, similar to the existing 144 kV line 7L68. Clairmont Lake 811S voltage was maintained at 138 kV or above under Category B contingency conditions. Power flow diagrams are provided in Attachment B (Scenario 1E).

Table 6-8. Load Serving Capability of a new line from Rycroft 730S to Clairmont Lake 811S

System Configuration	Load Serving Capability	Limiting Contingency	Limiting Element	Limit Type
Option 2-new line only	85 MW	7L75	Low voltage and voltage deviation at Eureka River 861S	Voltage limit

6.2.2 Reactive Power Support Requirement

In order to meet the forecast area load requirement of 96 MW for the 20-year planning horizon, an additional reactive power device would be required for Option 2. As this is a voltage limit, the size of reactive power device was determined under winter peak load conditions, which are higher than summer peak load conditions.

VQ and Step Change Analysis for additional VAR support with the new line

In order to determine the amount of VAr required for Option 2 in Study Area for the next 20 years, VQ analysis was conducted. Study were done for Ksituan River 754S with a 5% increase over the 2026 WP and 2036 WP scenario reference load levels of 89 MW and 96 MW respectively. Ksituan River 754S substation was assessed as it was identified as showing N-0 voltage violations in the long term. For the

VQ analysis, all existing capacitors in the Study Area were assumed to be on with no new area VAr support.

For the 20-year scenario, the VQ curve hits the nose first for 7L75 contingency compared to other contingencies and would require approximately 24 MVAr at Ksituan River 754S to prevent area voltage collapse under critical contingencies in 2036 WP (Figure 6-2). For the 10-year scenario, the 7L75 contingency would require approximately 14 MVAr at Ksituan River 754S to maintain the area voltage above 130 kV (0.94 p.u.) for post-contingency conditions (Figure 6-3).

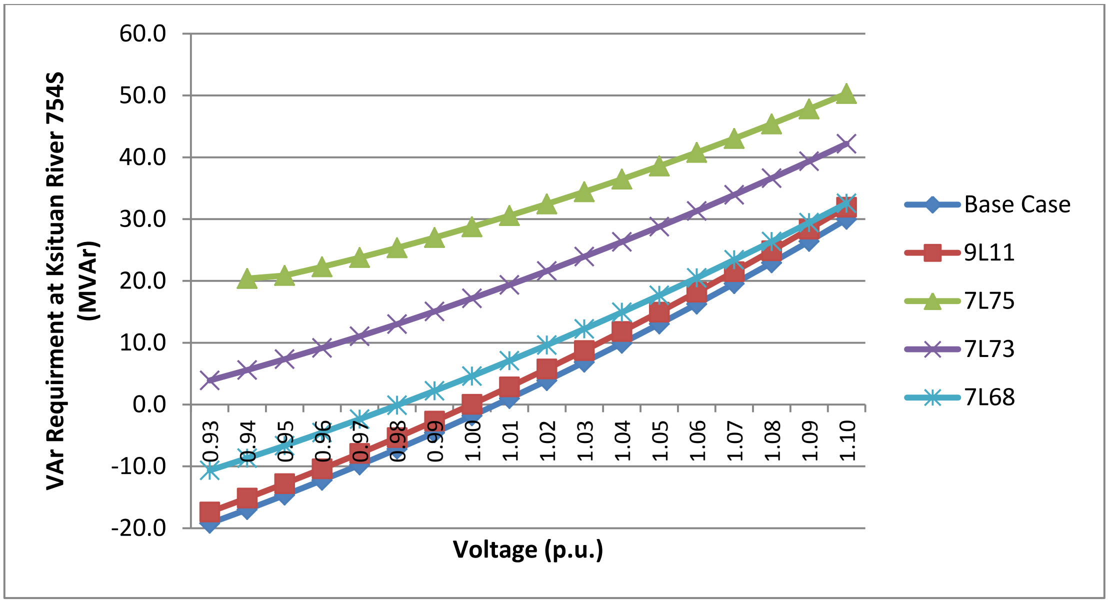


Figure 6-2. 20-year VQ Analysis at Ksituan River 754S with a new 144 kV line – Option 2

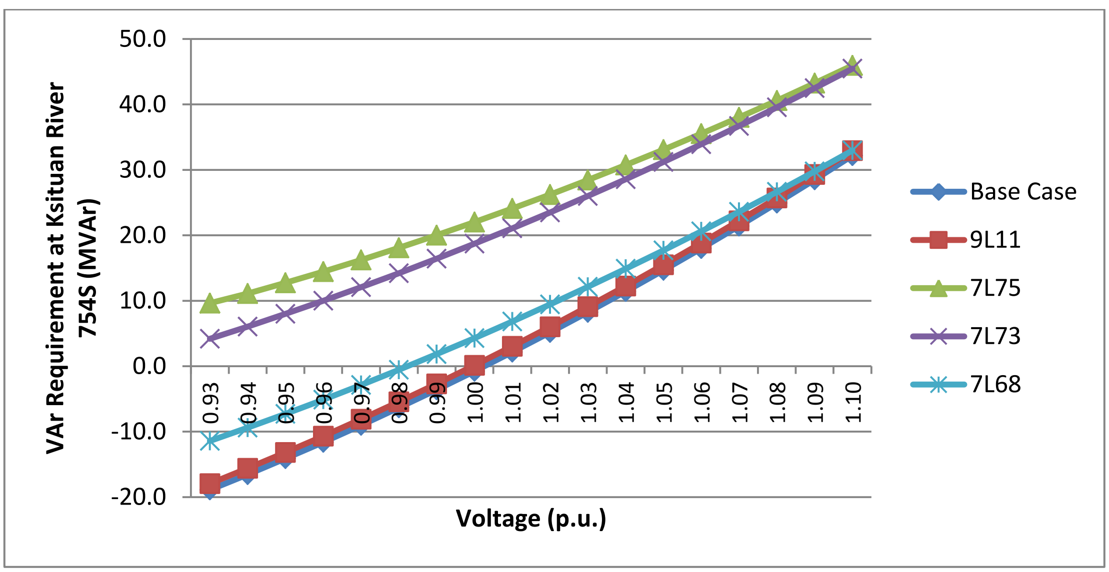


Figure 6-3. 10-year VQ Analysis at Ksituan River 754S with a new 144 kV Line – Option 2

Further analysis was conducted to determine the voltage step change as a result of switching different size capacitor banks at Ksituan River 754S both at the 144 kV and 25 kV voltage levels: a 15 MVAr and a 10 MVAr at 144 kV and a 7.2 MVAr at 25 kV under the 2036 WP study scenario. In all cases, existing Ksituan River 754S capacitor as well as all area capacitors were on and the proposed 144 kV line was put in service prior to switching the capacitor of interest at Ksituan River 754S. To keep the voltage step change at or below 3%, the maximum size of the capacitor at Ksituan River 754S was identified to be a 10 MVAr. Therefore, to meet the VAr requirement for Ksituan River 754S, a 144 kV 10 MVAr capacitor bank and a 25 kV 7.2 MVAr capacitor bank were selected for further testing.

Table 6-9. Voltage Step Change – 2036 WP: Ksituan River 754S

Substation	Bus No.	Nominal kV	Pre-Voltage (no new Cap) (p.u.)	Voltage Post 15 MVAr cap Switch (p.u.)	Step Change (%)	Voltage Post 10 MVAr cap Switch (p.u.)	Step Change (%)	Voltage Post 7.2 MVAr cap Switch (p.u.)	Step Change (%)
Ksituan River 754S	1104	144	1.000	1.039	3.9%	1.025	2.5%	1.022	2.2%
Rycroft 730S	1100	144	1.029	1.050	2.0%	1.043	1.4%	1.041	1.2%
Mowat 2033S	1116	144	1.016	1.046	3.0%	1.035	1.9%	1.033	1.7%
Boucher Creek 829S	1102	144	1.045	1.060	1.4%	1.055	1.0%	1.053	0.8%
Clairmont Lake 811S	1117	144	1.044	1.050	0.6%	1.054	1.0%	1.052	0.8%

PV Analysis for additional VAr Support with the new line

Voltage stability analysis was performed under the 2026 WP and 2036 WP scenarios based on the VQ analysis results for Option 2. With the new 144 kV line from Rycroft 730S to Clairmont Lake 811S in service, a 144 kV 10 MVAr capacitor bank at Ksituan River 754S was tested under the 2026 WP scenario and an additional 25 kV 7.2 MVAr capacitor bank at Ksituan River 754S was tested under the 2036 WP scenario as a starting point. The study results show that this combination of voltage support meets the voltage stability requirement for both 10-year and 20-year planning horizons.

In the PV analysis provided, Clairmont Lake 811S voltage was maintained at 138 kV or above under category B conditions to ensure the Grande Prairie area VAr requirements do not influence the options investigated for the Rycroft area VAr support.

Table 6-10. Voltage Stability – 2026 WP: 144 kV line and 10 MVAr capacitor bank at Ksituan River 754S (min. PV margin = 4.43 MW)

Contingency	From	To	Rycroft 89 MW (min. PV margin is 4.43 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		50.0	Yes	139	0.85 @ Eureka 72 kV

Contingency	From	To	Rycroft 89 MW (min. PV margin is 4.43 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
9L11	Little Smoky 813S	Wesley Creek 834S	43.13		132.13	0.87 @ Eureka 72 kV
7L75	West Peace River 793S	Friedenstal 800S	11.25		100.25	0.90 @ Eureka 72 kV
7L73	Friedenstal 800S	Rycroft 730S	26.25		115.25	0.90 @ Ksituan River 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	41.88		130.88	0.78 @ Ksituan River 144 kV
7L46	Little Smoky 813S	Big Mountain 845S	23.75		112.75	0.92 @ Ksituan River 144 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	5.0		94	0.97 @ Eureka 72 kV

Table 6-11. Voltage Stability – 2036 WP: 144 kV line and 10 MVAr and 7.2 MVAr capacitor banks at Ksituan River 754S (min. PV margin = 4.8 MW)

Contingency	From	To	Rycroft 96 MW (min. PV margin is 4.8 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		63.13	Yes	158.93	0.68 @ Eureka 72 kV
9L11	Little Smoky 813S	Wesley Creek 834S	57.50		153.3	0.70 @ Eureka 72 kV
7L75	West Peace River 793S	Friedenstal 800S	19.38		115.18	0.82 @ Eureka 72 kV
7L73	Friedenstal 800S	Rycroft 730S	44.38		140.18	0.87 @ Ksituan 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	50.63		146.43	0.65 @ Eureka 72 kV
7L46	Little Smoky 813S	Big Mountain 845S	40.00		135.80	0.82 @ Eureka 72 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	6.88		102.68	0.96 @ Eureka 72 kV

Power Flow Analysis for additional VAR support with the new line

In the power flow analysis the critical bus voltages at Clairmont Lake 811S was maintained at 138 kV and above under Category B conditions to ensure the Grande Prairie area VAr requirements did not influence the options investigated for VAr support in the Study Area.

2026 Timeframe

Power flow analyses were performed on a new 144 kV line between Rycroft 730S and Clairmont Lake 811S and a 10 MVAr capacitor bank at Ksituan River 754S under the 2026 SP and 2026 WP study scenarios. Power flow diagrams are provided in Attachment B (Opt2-Scenario 2 and Opt2-Scenario 3).

Category A:

No voltage or thermal Reliability Criteria violations were observed under 2026 SP or 2026 WP study scenarios.

Category B:

No voltage or thermal Reliability Criteria violations were observed under 2026 SP or 2026 WP study scenarios.

2036 Timeframe

Power flow analyses were performed first on a new 144 kV line between Rycroft 730S and Clairmont Lake 811S with 10 MVAr and 7.2 MVAr capacitor banks at Ksituan River 754S under the 2036 WP study scenarios. Power flow diagrams are provided in Attachment B (Opt2-Scenario 5A).

Category A:

No voltage or thermal Reliability Criteria violations were observed under 2036 SP or 2036 WP study scenarios.

Category B:

The study results show under-voltage and post-transient point of delivery (POD) bus deviation violations at Eureka River 861S and Hines Creek 724S under 2036 WP scenarios (Table 6-12 and Table 6-13).

Table 6-12. Category B Voltage Range – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State (kV)
7L75 (W. Peace River 793S – Friedenstal 800S)	Eureka River 861S	1108	72	65	79	71.8	64.2

Table 6-13. Category B Voltage Deviation – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses Only					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
7L75 (W. Peace River 793S – Friedenstal 800S)	Eureka River 861S	19108	25	26	23.0	11.5	-	-	-	-
	Hines Creek 724S	19107	25	25.8	23.2	10.1	-	-	-	-

As shown above, the addition of 10 MVAr and 7.2 MVAr capacitors at Ksituan River 754S would be insufficient to meet the transmission reliability requirements due to the transmission under-voltage violations at Eureka River 861S and Hines Creek 724S. Additional VAr support of a 2.4 MVAr 25 kV capacitor was added at Eureka River 861S for further testing using 2036 SP and 2036 WP scenarios. The study results show that this combination of voltage support meets the transmission Reliability Criteria, as shown in the power flow diagrams provided in Attachment B (Opt2-2036SP Scenario 4 and Opt2-2036WP Scenario 5).

Voltage performance results for the 2036 WP scenario that included this additional 2.4 MVAr capacitor bank at Eureka River 861S are listed in Table 6-14 and Table 6-15.

Table 6-14. Category B Voltage Range – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S and 2.4 MVAr at Eureka River 861S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State (kV)
7L73 (Rycroft 730S - Friedenstal 800S)	Friedenstal 800S	1105	144	130	155	147.0	156.2
	Friedenstal 800S	1106	72	65	79	76.2	81.1
	Hines Creek 724S	1107	72	65	79	74.2	79.6
	Eureka River 861S	1108	72	65	79	74.1	79.9

Adding a 2.4 MVAr capacitor bank at Eureka River 861S could cause slightly higher voltages on 144 kV and 72 kV buses at Friedenstal area under the loss of line 7L73 (from Rycroft 730S to Friedenstal 800S). The high transmission voltage will be managed through TFO overvoltage protection schemes that trip the Friedenstal 800S capacitor.

Compared to Option 2, Option 1 does not have any adverse impact on the over-voltages at Friedenstal area under the loss of line 7L73 as it proposes the dynamic reactive power device at Rycroft area, which will be separated from Friedenstal area under the contingency of 7L73.

Table 6-15. Category B Voltage Deviation – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S and 2.4 MVAr at Eureka River 861S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses Only					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
7L75 (W. Peace River 793S – Friedenstal 800S)	Eureka River 861S	19108	25	26.2	23.3	11%	-	-	-	-

In the 2036 WP, for the loss of 7L75 (West Peace River 793S – Friedenstal 800S) marginal voltage deviation (post-transient only) was noted at Eureka River 861S. However, the voltage deviations decreased to below 7% and 5% once the automatic and manual adjustments (respectively) were made to the system.

Option 2 was further tested from a thermal perspective by adding the capacitor banks identified above for 2036 SP and 2036 WP scenarios. The study results are listed in Table 6-16 and Table 6-17.

Table 6-16. Category B Thermal Performance– 2036 SP: 10 MVAr and 7.2 MVAr at Ksituan River 754S and 2.4 MVAr at Eureka River 861S

Contingency	Overloaded Element	Rating* (Summer MVA)	Flow* (MVA)	% of Loading
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L73 (Rycroft 730S – Friedenstal 800S)	95	105	107

* MVA on a 138 kV base

Table 6-17. Category B Thermal Performance– 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S and 2.4 MVAr at Eureka River 861S

Contingency	Overloaded Element	Rating* (Winter MVA)	Flow* (MVA)	% of Loading
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L73 (Rycroft 730S – Friedenstal 800S)	95	107	112
7L46 (Little Smoky 813S – Big Mountain 845S)			100	103

* MVA on a 138 kV base

Line 7L73 ratings are currently CT limited, and the line shows thermal overloads under the contingencies of 7L32 or 7L46 in the long term. As the identified thermal overload would occur post-2026, the 7L73 line restoration will be further investigated as load continues to grow in the area. No other voltage or thermal Reliability Criteria violations were observed in the Study Area under the 2036 SP or 2036 WP scenario.

6.2.3 Summary

To meet the forecast load over the 20-year planning horizon, technical studies were performed to assess the performance of transmission wire reinforcement from Rycroft 730S to Clairmont Lake 811S with additional voltage support in the Study Area.

Transmission development for Option 2 comprises of the following system components:

- A new 144 kV circuit between Rycroft 730S and Clairmont Lake 811S within 10 years;
- A new 144 kV 10 MVAr capacitor bank at Rycroft 730S within 10 years;
- A new 25 kV 7.2 MVAr capacitor bank at Ksituan River 754S in the long term (i.e., between year 2027 and 2036);
- A new 25 kV 2.4 MVAr capacitor bank at Eureka River 861S to be installed concurrently with the Ksituan River 754S capacitor bank described above.

Overall, Option 1 shows relatively better voltage performance than Option 2 and it requires less voltage support from the rest of the system. The thermal performance is very similar between these two options. However, Option 1 is more economical and does not involve any new line construction. Option 1 should, therefore, result in less land impact.

6.3 Option 3: New 144 kV Circuit from Mowat 2033S to Saddle Hills 865S plus Reactive Power Support

6.3.1 Load Serving Capability

Table 6-18 summarizes the load serving capability of adding the new 144 kV line between Mowat 2033S and Saddle Hills 865S. The load serving capability is approximately 80 MW and is limited due to the under-voltage violations at Ksituan River 754S under the contingency of 7L73. This load serving capability of 80 MW is not sufficient to meet the area load needs within 10-year planning horizon. Therefore, additional voltage support will be needed as the area load approaches that limit. The rating of the new 144 kV line is assumed to be 114 MVA, similar to the existing 144 kV line 7L68. For the study scenarios, the critical bus voltage at Clairmont Lake 811S was maintained at 138 kV or above under Category B contingency conditions. Power flow diagrams are provided in Attachment B (Scenario 1F).

Table 6-18. Load Serving Capability of a new line from Mowat 2033S to Saddle Hills 865S

System Configuration	Load Serving Capability (MW)	Limiting Contingency	Limiting Element	Limit Type
Option 3: new line only	80	7L73	Under-voltage at Ksituan River 144 kV bus	Voltage

6.3.2 Reactive Power Support Requirement

Additional reactive power device(s) would be required for Option 3 in order to meet the forecast area load requirement of 96 MW for the 20-year planning horizon. As this is a voltage limit issue, the size of reactive power device was determined under winter peak load conditions, which are higher than summer peak load conditions.

VQ and Step Change Analysis for additional VAR Support with the new line

VQ analysis was conducted in order to determine the amount of VAr required in the Study Area for the next 20 years for Option 3. Study were done for Ksituan River 754S with a 5% increase over the 2026WP and 2036 WP scenario reference load levels of 89 MW and 96 MW respectively. All existing capacitors in the Study Area were assumed to be on with no new area VAr support.

For the 20-year scenario, the VQ curve hits the nose first for the 7L75 contingency, indicating that this contingency would require approximately 33 MVAr at Ksituan River 754S on a 144 kV base to prevent area voltage collapse (Figure 6-4). However, adding a large amount of capacitance at a single substation with a radial feed is not recommended due to over voltage concerns under certain system operating conditions.

For the 10-year scenario, the VQ curve shows that the 7L75 contingency would require approximately 24 MVAr at Ksituan River 754S on a 144 kV base to maintain the area voltage above 130 kV (0.94 p.u.) as shown on Figure 6-5.

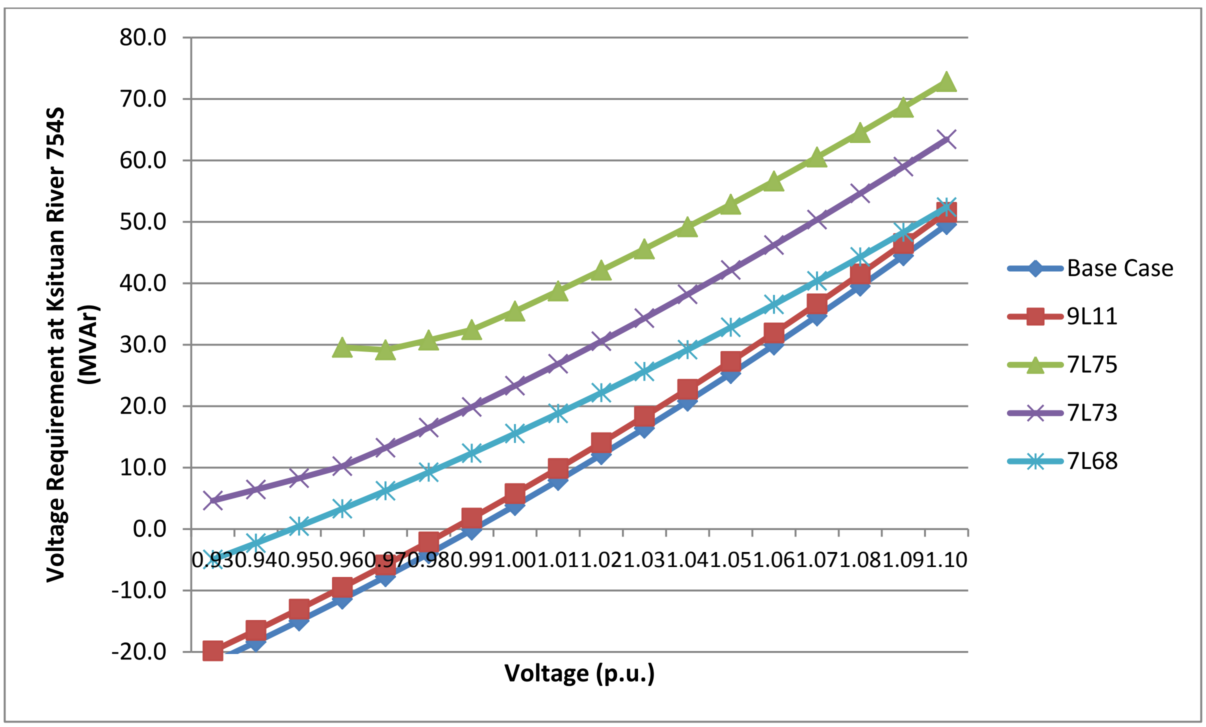


Figure 6-4. 20-year VQ Analysis at Ksituan River 754S with a new 144 kV line – Option 3

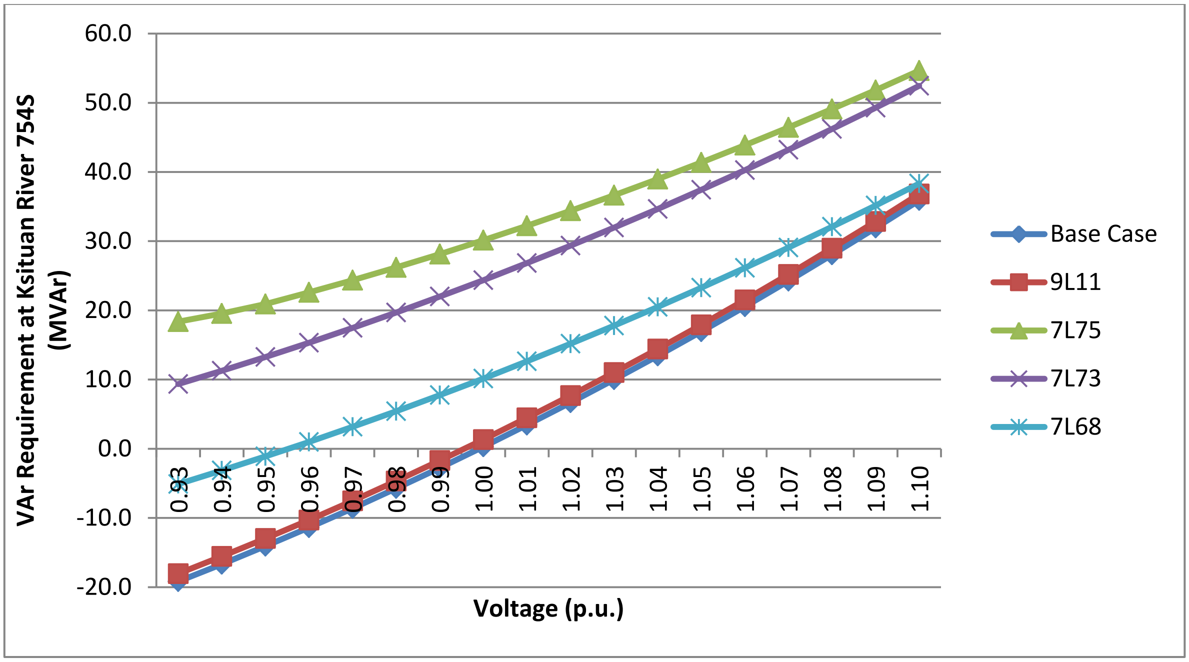


Figure 6-5. 10-year VQ Analysis at Ksituan River 754S with a new 144kV line – Option 3

Further analysis was conducted to determine the voltage step change as a result of switching different size capacitor banks at Ksituan River 754S: a 15 and a 10 MVAr capacitor bank at 144 kV and a 25 kV 7.2 MVAr capacitor bank at Ksituan River 754S using 2036 WP study scenario. In all cases, all existing capacitor banks in the Study Area, including Ksituan River 754S, were assumed to be switched on and the proposed 144 kV line was assumed to be in service prior to switching on the capacitor of interest. To keep the voltage step change at or below 3%, the maximum size of capacitor at Ksituan River 754S was determined to be 10 MVAr, as shown in Table 6-19. Therefore, to meet the VAr requirement for Ksituan River 754S, only the 144 kV 10 MVAr capacitor bank and the 25 kV 7.2 MVAr capacitor bank were selected for further testing.

Table 6-19. Voltage Step Change – 2036 WP: Ksituan River 754S

Substation	Bus No.	Nominal kV	Pre-Voltage (no new Cap) (p.u.)	Voltage Post 15 MVAr cap Switch (p.u.)	Step Change (%)	Voltage Post 10 MVAr cap Switch (p.u.)	Step Change (%)	Voltage Post 7.2 MVAr cap Switch (p.u.)	Step Change (%)
Ksituan River 754S	1104	144	0.990	1.024	3.4	1.013	2.3	1.009	1.9
Rycroft 730S	1100	144	1.018	1.037	1.9	1.031	1.3	1.028	1.0
Mowat 2030S	1116	144	1.007	1.032	2.5	1.024	1.7	1.021	1.4
Boucher Creek 929S	1102	144	1.035	1.049	1.4	1.045	1.0	1.043	0.8
Clairmont Lake 811S	1117	144	1.045	1.058	1.2	1.054	0.9	1.052	0.7

Again, further analysis was conducted to determine the voltage step change for 15 MVAr and 10 MVAr 144 kV capacitor banks at Rycroft 730S using the 2036 WP scenario. In all cases, all existing capacitor banks in the Study Area, including Ksituan River 754S were assumed to be switched on and the proposed 144 kV line was assumed to be in service prior to switching on the capacitor of interest. It was determined that switching on of either of the two capacitor banks at Rycroft 730S produced a voltage step change below 3% as shown in Table 6-20.

Table 6-20. Voltage Step Change – 2036 WP: Rycroft 730S

Substation	Bus No.	Nominal kV	Pre-Voltage (no new cap) (p.u.)	Voltage Post 15 MVAr cap Switch (p.u.)	Step Change (%)	Voltage Post 10 MVAr cap Switch (p.u.)	Step Change (%)
Ksituan River 754S	1104	144	0.990	1.012	2.2	1.005	1.5
Rycroft 730S	1100	144	1.018	1.041	2.3	1.033	1.5
Mowat 2030S	1116	144	1.007	1.029	2.2	1.021	1.4
Boucher Creek 929S	1102	144	1.035	1.052	1.6	1.046	1.1
Clairmont Lake 811S	1117	144	1.045	1.059	1.3	1.054	0.9

PV Analysis for additional VAr support with the new line

Voltage stability analysis was performed using the 2026 WP and 2036 WP scenarios based on the VQ analysis results. With a new 144 kV line from Mowat 2033S to Saddle Hills 865S in service, a 144 kV 10 MVAr, and a 25 kV 7.2 MVAr capacitor bank at Ksituan River 754S, as well as a 10 MVAr capacitor bank at Rycroft 730S were tested using the 2026 WP scenario as a starting point (Table 6-21 and Table 6-22). The study results show that this combination of voltage support meets the voltage stability requirement for both 10-year and 20-year planning horizons.

For this PV analysis, Clairmont Lake 811S voltage was maintained at 138 kV or above under Category B conditions to ensure that the Grande Prairie area VAr requirements did not influence the options investigated for VAr support in the Study Area.

Table 6-21. Voltage Stability – 2026 WP: 144 kV line plus 10 MVAr and 7.2 MVAr capacitor banks at Ksituan River 754S and 10 MVAr capacitor bank at Rycroft 730S (min. PV margin = 4.43 MW)

Contingency	From	To	Rycroft 89 MW (Min PV margin is 4.43 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		72.5	Yes	161.0	0.70 @ Eureka 72 kV
9L11	Little Smoky 813S	Wesley Creek 834S	70.63		159.13	0.70 @ Eureka 72 kV
7L75	West Peace River 793S	Friedenstal 800S	37.50		126.0	0.70 @ Eureka 72 kV

Contingency	From	To	Rycroft 89 MW (Min PV margin is 4.43 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
7L73	Friedenstal 800S	Rycroft 730S	58.75	Yes	147.25	0.81 @ Ksituan 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	36.88		125.38	0.74 @ Eureka 72 kV
7L46	Little Smoky 813S	Big Mountain 845S	58.75		147.25	0.76 @ Eureka 72 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	18.13		106.63	0.93 @ Eureka 72 kV

Table 6-22. Voltage Stability – 2036 WP: 144 kV line plus 10 MVAr and 7.2 MVAr capacitor banks at Ksituan River 754S and 10 MVAr capacitor bank at Rycroft 730S (min. PV margin = 4.6 MW)

Contingency	From	To	Rycroft 96 MW (Min PV margin is 4.6 MW) Maximum Incremental Transfer (MW)	Meets 105% Transfer Criteria?	Total Load Serving Capability (MW)	Minimum Voltage (p.u.)
N-0	System Normal		61.25	Yes	157.05	0.67 @ Eureka 72 kV
9L11	Little Smoky 813S	Wesley Creek 834S	55.00		150.80	0.69 @ Eureka 72 kV
7L75	West Peace River 793S	Friedenstal 800S	12.50		108.30	0.82 @ Eureka 72 kV
7L73	Friedenstal 800S	Rycroft 730S	37.50		133.30	0.87 @ Ksituan 144 kV
7L68	Rycroft 730S	Clairmont Lake 811S	40.63		136.43	0.56 @ Eureka 72 kV
7L46	Little Smoky 813S	Big Mountain 845S	38.13		133.93	0.81 @ Eureka 72 kV
7L32	Little Smoky 813S	Clairmont Lake 811S	6.88		102.68	0.95 @ Eureka 72 kV

Power Flow Analysis for additional VAr support with the new line

For power flow analysis, Clairmont Lake 811S voltage was maintained at 138 kV and above under Category B conditions to ensure the Grande Prairie area VAr requirements did not influence the options investigated for VAr support in the Study Area.

2026 Timeframe

Power flow analysis were performed using the 2026 SP and 2026 WP study scenarios, assuming a new 144 kV line was in service between Mowat 2033S and Saddle Hills 865S and that all three capacitor banks were switched on (i.e., 10 MVAr and 7.2 MVAr capacitor banks at Ksituan River 754S; 10 MVAr capacitor bank at Rycroft 730S). Power flow diagrams are provided in Attachment B (Opt3-Scenario 2 and Opt3-Scenario 3).

Category A:

No voltage or thermal Reliability Criteria violations were observed under 2026 SP or 2026 WP study scenarios.

Category B:

No voltage or thermal Reliability Criteria violations were observed under 2026 SP or 2026 WP study scenarios.

Power flow analysis shows that the addition of a new 144 kV line with 10 MVAr and 7.2 MVAr capacitors at Ksituan River 754S, as well as a 10 MVAr capacitor bank at Rycroft 730S would be sufficient to reliably serve the Study Area load for 10 years.

2036 Timeframe

As the Study Area is primarily voltage constrained, power flow analysis was performed to determine if the identified VAr support is sufficient to address voltage violations in the area for the 2036 WP scenario. For this scenario, the following components were assumed to be in service:

- new 144 kV line between Mowat 2033S and Saddle Hills 865S
- 10 MVAr and 7.2 MVAr capacitor banks at Ksituan River 754S
- 10 MVAr capacitor bank at Rycroft 730S

Power flow diagrams are provided in Attachment B (Opt3-Scenario 5A).

Category A:

No voltage Reliability Criteria violations were observed under 2036 SP or 2036 WP study scenarios.

Category B:

With the above specified VAr support, the study results show under-voltage and deviation violations at Eureka River 861S as listed in Table 6-23 and Table 6-24.

Table 6-23. Category B Voltage Range – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S with 10 MVAr at Rycroft 730S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State (kV)
7L75 (W. Peace River 793S – Friedenstal 800S)	Eureka River 861S	1108	72	65	79	71.5	62.6
	Hines Creek 724S	1107	72	65	79	72.4	64.0

Table 6-24. Category B Voltage Deviation – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S with 10 MVAr at Rycroft 730S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses Only					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
7L75 (W. Peace River 793S – Friedenstal 800S)	Eureka River 861S	19108	25	25.9	22.4	13.4	-	-	-	-
	Hines Creek 724S	19107	25	25.8	22.7	12.0	-	-	-	-
	Friedenstal 800S	19105	25	25.9	23.1	10.7	-	-	-	-

Under the loss of 7L75 (West Peace River 793S to Friedenstal 800S), low steady state transmission voltages were noted at Eureka River 861S and Hines Creek 724S substations. POD bus post-transient deviations were noted on 25 kV buses at Eureka River 861S, Hines Creek 724S and Friedenstal 800S, as 7L75 contingency causes the entire load in the Friedenstal area to be supported radially out of Rycroft 730S. These results indicate that additional voltage support would be required in the Friedenstal area for the loss of 7L75 (West Peace River 793S to Friedenstal 800S). Therefore, a 2.4 MVAr 25 kV capacitor was added at Eureka River 861S to support voltages in the area with the loss of line 7L75 in the long term. The study results show that this combination of voltage support can meet the transmission Reliability Criteria. Power flow diagrams are provided in Attachment B (Opt3-Scenario 4 and Opt3-Scenario 5). Voltage performance results for the 2036 WP scenario that includes this additional 2.4 MVAr capacitor bank at Eureka River 861S are listed in Table 6-25 and Table 6-26.

Table 6-25. Category B Voltage Range – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S with 10 MVAr at Rycroft 730S and 2.4 MVAr at Eureka River 861S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State (kV)
7L73 (Rycroft 730S - Friedenstal 800S)	Friedenstal 800S	1105	144	130	155	147.4	156.1
	Friedenstal 800S	1106	72	65	79	75.6	80.2

Adding a 2.4 MVAr capacitor bank at Eureka River 861S could cause slightly higher voltages on 144 kV and 72 kV at Friedenstal area under the loss of 7L73 (Rycroft 730S to Friedenstal 800S). The high transmission voltage will be managed through TFO overvoltage protection schemes that trip the Friedenstal 800S capacitor.

Compared to Option 3, Option 1 does not have any adverse impact on the over-voltages at Friedenstal area under the loss of line 7L73. The reason is that Option 1 proposes the dynamic reactive power device in the Rycroft area, which will be separated from the Friedenstal area under the contingency of 7L73.

Table 6-26. Category B Voltage Deviation – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S with 10 MVAr at Rycroft 730S and 2.4 MVAr at Eureka River 861S

Contingency	Substation Name and Number	Bus No.	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses Only					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
7L75 (W. Peace River 793S – Friedenstal 800S)	*Eureka River 861S*	*19108*	*25*	*26.2*	*23.0*	*12.2*	-	-	-	-
	Hines Creek 724S	*19107*	*25*	*26.0*	*23.2*	*10.9*	-	-	-	-

For the loss of 7L75 (West Peace River A793S to Friedenstal 800S), a marginal post-transient voltage deviation was noted on the 25 kV busses at Eureka River 861S and Hines Creek 724S. Voltage deviations decreased to below 7% and 5% once the automatic and manual adjustments (respectively) were made to the system.

Option 3 was further tested from a thermal perspective by adding the capacitor banks identified above for 2036 SP and 2036 WP scenarios. The study results are listed in Table 6-27 and Table 6-28.

Table 6-27. Category B Thermal Performance – 2036 SP: 10 MVAr and 7.2 MVAr at Ksituan River 754S with 10 MVAr at Rycroft 730S and 2.4 MVAr at Eureka River 861S

Contingency	Overloaded Element	Rating* (Summer MVA)	Flow* (MVA)	% Loading
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L10 (Rycroft 730S to Mowat 2033S T-tap)	81	81	101
7L46 (Little Smoky 813S – Big Mountain 845S)			84	104
7L45 (Little Smoky 813S – Big Mountain 845S)			83	102
7L69 (Goodfare 815S – Elmworth 731S)			91	108
7L03 (Flyingshot 749S – Elmworth 731S)			92	107
9L11 (Little Smoky 813S – Wesley Creek 834S)			85	100
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L73 (Rycroft 730S to Friedenstal 800S)	95	106	109
7L46 (Little Smoky 813S – Big Mountain 845S)			99	101
9L11 (Little Smoky 813S – Wesley Creek 834S)			101	100

*MVA on a 138 kV base

Table 6-28. Category B Thermal Performance – 2036 WP: 10 MVAr and 7.2 MVAr at Ksituan River 754S with 10 MVAr at Rycroft 730S and 2.4 MVAr at Eureka River 861S

Contingency	Overloaded Element	Rating* (Winter MVA)	Flow* (MVA)	% Loading
7L32 (Little Smoky 813S – Clairmont Lake 811S)	7L73 (Rycroft 730S to Friedenstal 800S)	95	109	113
7L46 (Little Smoky 813S – Big Mountain 845S)			102	106
7L45 (Little Smoky 813S – Big Mountain 845S)			99	103

*MVA on a 138 kV base

For 2036 SP scenario, N-1 thermal violations were identified on the 7L10 line segment between the Mowat 2033S T-tap and Rycroft 730S. No thermal violations were observed under N-1 conditions over the 20-year planning horizon with the line restored to its full thermal rating.

Line 7L73 ratings are currently constrained by the CT limit. Thermal overloads are observed on the line under the contingencies of 7L32 or 7L46 in the long term. The 7L73 line restoration will be further investigated when the load has materialized in the area and it is not included in this study scope.

No other voltage or thermal Reliability Criteria violations were observed in the Study Area under 2036 SP or 2036 WP scenarios.

6.3.3 Summary

To meet the forecast load over the 20-year planning horizon, technical studies were performed to assess the performance of a new line from Mowat 2033S to Saddle Hills 865S, with additional voltage support in the Study Area.

Transmission development for Option 3 comprises of the following system components:

- a new 144 kV transmission circuit between Mowat 2033S and Saddle Hills 865S within 10 years;
- a new 144 kV 10 MVAr capacitor bank and a new 25 kV 7.2 MVAr capacitor bank at Ksituan River 754S, added concurrently with the 144 kV line mentioned above;
- a new 144 kV 10 MVAr capacitor bank at Rycroft 730S, added concurrently with the capacitor banks at Ksituan 854S and the 144 kV line; and
- a new 25 kV 2.4 MVAr capacitor bank at Eureka River 861S in the long term (i.e., between years 2027 and 2036).

Overall, Option 1 shows relatively better voltage and thermal performance than Option 3 and it requires less voltage support from the rest of the system. Option 1 is also more economical and does not involve any new line construction. Option 1 should, therefore, result in less land impact.

6.4 Other Considered Options

A number of other transmission development options were considered with higher Rycroft load forecast levels, and requests were issued to the TFO to provide the NID cost estimates, as shown in Table 6-29. Later, the load forecast for the Study Area was reduced. The AESO then worked in collaboration with the DFO to revise the forecast for the Study Area and consequently these options were discarded.

Table 6-29. Other Transmission Development Options Considered

Option	Transmission Line	Rycroft 730S Dynamic Reactive Power Device (MVAr)	Rycroft 730S Capacitors (MVAr)	Ksituan 754S Capacitor(s) (MVAr)	Eureka River 861S Capacitors (MVAr)
1a	NA	60	N/A	10 / 144 kV	N/A
1b	NA	50	15 / 144 kV	2036: 4.8 / 25 kV	N/A
1e	NA	40	15 / 144 kV	7.2 / 25 kV + 4.8 / 25 kV	N/A
1f	NA	30	10 & 15 / 144 kV	7.2 / 25 kV 2036: 4.8 / 25 kV	N/A
2a	A new 144 kV circuit from Rycroft 730S to Clairmont Lake 811S	N/A	N/A	10 / 144 kV 7.2 / 25 kV	2.4 / 25 kV
3a	A new 144kV circuit from Saddle Hills 865S to Mowat 2033S	N/A	10 / 144 kV	10 / 144 kV 7.2 / 25 kV	2.4 / 25 kV

6.5 Technical Performance Comparison of Options

The Study Area is primarily constrained by voltage violations under N-1 conditions. This situation has arisen because of the length of the 144 kV transmission lines radially serving the area load. From voltage perspective, with the proposed VAr reinforcement devices, any of the three proposed options could provide the load serving capability to meet the forecast load in the Study Area for the 20-year planning horizon. Option 1 would provide the best system performance from a voltage perspective.

6.5.1 Voltage Performance

Overall, Option 1 shows relatively better voltage performance than the other two options (Table 6-30).

Table 6-30. Comparison of Options – Transmission Voltage and POD Bus Information

Option	Option Total Added Capacitive MVAr	Rycroft 730S Dynamic Reactive Power device Size (MVAr)	Rycroft 730S 144kV Capacitor Size (MVAr)	Ksituan River 754S Capacitor Size (MVAr)	Eureka River 861S Capacitor Size (MVAr)	Comments
1	54.8	50	N/A	2036: 4.8 MVAr	NA	No Transmission Criteria Violations No POD bus deviations identified
2	19.6	NA	NA	10 MVAr 144 kV 2036: 7.2 MVAr 25 kV	2036: 2.4 MVAr 25 kV	No Transmission Criteria Violations. In 2036 WP, marginal POD bus deviation (post-transient only) was noted at Eureka River 861S
3	29.6	NA	1x 10	10 MVAr 144 kV 7.2 MVAr 25 kV	2036: 2.4 MVAr 25 kV	No Transmission Criteria Violations. In 2036 WP, marginal POD bus deviation (post-transient only) was noted at Eureka River 861S Hines Creek 724S and Friedenstal 800S

6.5.2 Thermal Performance

- All options indicate that line 7L73 (Friedenstal 800S to Rycroft 730S) overloads due to clearance and CT limitations in the long term. This line restoration is not included in this study scope and will be further investigated when the load materializes.
- In the long term, Option 3 would require further clearance mitigation on line 7L10 (Rycroft 730S to Mowat 2033S T-tap) to increase the normal summer rating from 81 MVA to a minimum rating of 92 MVA on a 138 kV base.

Table 6-31. Comparison of Options – Thermal Flow

Option	Limiting Branch	
	7L10 (Rycroft 730S – Mowat tap)	**7L73 (Friedenstal 800S – Boucher Creek tap - Rycroft 730S)**
1	–	**2036 SP and 2036 WP** for N-1 of 7L46 and 7L32, max flow 109 MVA
2	–	**2036 SP and 2036 WP** for N-1 of 7L46 and 7L32, max flow 107 MVA
3	**2036 SP** for N-1 of 7L32, 7L45, 7L46, 7L69, 7L03 and 9L111, max flow 92 MVA	**2036 SP and 2036 WP** for N-1 of 7L45, 7L46 and 7L32, max flow 109 MVA

*MVA on 138 kV base

The study results also show thermal violations on lines 7L27 (Wesley Creek 834S – West Peace River 793S) and 7L32 (Little Smoky 813S – Clairmont Lake 811S) under various study scenarios. These constraints are out of this project scope and will be assessed by separate Need Assessment in the future.

6.6 Voltage Recovery Results

A voltage recovery test was conducted for the preferred option. Option 1 passed the voltage recovery test with the following assumptions:

- Studies using the 2026 WP scenario assumed no additional future enhancement outside the Study Area (future SVC or similar at or near Clairmont Lake 811S).
- Studies using the 2036 WP scenario with voltage at Clairmont Lake maintained at 138 kV and above for Category B contingencies.

Plots of the results are provided in Attachment C.

6.7 Short-circuit Analysis

Short-circuit analysis was performed using the 2017 base case to determine the maximum short-circuit fault levels prior to any transmission system reinforcements. Similar studies were also performed the preferred transmission development options. Three-phase and single-phase-to-ground fault currents were calculated. The results of the short-circuit study revealed that all fault levels are below the individual circuit breaker capabilities. For additional details, see Attachment D.

6.8 Summary of Study Results

The system in the Rycroft area is primarily comprises of a long 144 kV transmission path (approximately 210 km) between Clairmont Lake 811S and West Peace River 793S. This area is primarily constrained by voltage violations. The objective of this study was to evaluate options for increasing the load serving capability of the transmission system to reliably serve the forecast load for the Rycroft area over the 20-year planning horizon.

Option 1

Without any wire reinforcement in the Study Area, dynamic reactive power support in the area is required, and this is mainly due to the large amount of reactive power requirement of approximately 50 MVAr to meet the transmission reliability criteria under certain contingency conditions. However, this amount of reactive power all in forms of capacitor banks at the Rycroft load center will cause normal maximum voltage violations within and adjacent to the Study Area under system normal conditions. It will also cause emergency maximum voltage violations throughout the entire Study Area under the contingency of 7L68. The locations of the reactive power support devices are normally close to the load center, and the placement of the dynamic VAr support needs to address the voltage violations under the two worst contingencies in the Study Area: 7L75 and 7L68. With all the factors considered, Rycroft 730S is recommended to accommodate the 50 MVAr dynamic reactive power device.

Option 2 and 3

Wire solutions were also assessed to meet the forecasted area peak load for the next 20 years. Both options would also require reactive power support (capacitor banks) in addition to new circuits in the Study Area.

Comparison of Options

All options meet the objectives of the study and provide the same area reliability with the configurations tested. The power flow and voltage stability performance on three options were summarized in the previous sections. Option 1 is recommended as this option has better voltage performance over the other two options and it requires less voltage support from the rest of the system. This is due to the fact that even with the added transmission lines under Option 2 or Option 3, there will be a long radial path under contingency conditions and thus still voltage violations. Option 1 also has better thermal performance than Option 3. Option 1 is the most economic option and it is superior to other two options in terms of land impact since it does not involve any new line construction.

A 50 MVAr dynamic reactive power device is able to meet the forecast load for the local area with about 35% growth which is sufficient to address the need in medium term. It also provides the flexibility and expandability merits to meet the AESO’s 20-year load forecast. Therefore, this study recommends the transmission development of a 50 MVAr dynamic reactive power addition at Rycroft 730S substation.

7 Project Interdependencies

There are no other AESO system transmission development projects in flight in or around the Rycroft area that will impact the need and timing of the need identified in this study. No other AESO transmission project directly depends on this transmission reinforcement to proceed first. This project is specified by the load growth milestone of the coincident winter aggregate peak load for the Study Area reaching 75 MW. Once the aggregated peak load for Rycroft area exceeds the existing load serving capability, any new load connection project(s) in this area could be subject to the interim mitigation measures until the proposed transmission development option is in place.

8 Milestones

The studies demonstrate that the identified constraints arise as early as winter 2017 under N-1 conditions based on the latest load and generation forecast. However, the forecast load growth in the Study Area is driven by specific projects. While the AESO is reasonably certain that, the Preferred Development Option is needed in the future, the timing of the ISD for the development is dependent on the specific external factors (such as the load project ISDs) that are beyond the AESO's control. As such, the AESO has determined it is appropriate to specify milestones.

A load growth milestone is proposed for the Preferred Development Option when the coincident winter aggregate peak load for the Study Area of 75 MW is reached, as measured at Rycroft 730S, Eureka River 861S, Ksituan River 754S, Boucher Creek 829S, Hines Creek 724S, Friedenstal 800S, and Mowat 2033S substations.

Finally, the AESO will use operational measures, as necessary, including connection remedial action schemes, should constraints arise in the area prior to the implementation of the Preferred Development Option.

9 Conclusions and Recommendation

The AESO 2015 LTP identifies reliability standards violations, such as voltage and thermal criteria violations, in the Peace River (Area 19) and Grande Prairie (Area 20) planning areas due to load growth. As further described in this report, the AESO has since conducted need assessment studies for the local 144 kV and 72 kV transmission network called the Rycroft area and determined the need for transmission system reinforcement in this area. Planning study results demonstrate that the existing transmission network in the Study Area does not have sufficient capacity to reliably supply the forecast load growth in the near term and is prone to voltage violations under a single contingency. This is primarily due to the length of the 144 kV transmission lines radially feeding the load in the area. Therefore, there is a need for transmission development in the Study Area to alleviate the identified constraints. The driver of the need for transmission system development is the forecast load projects in the Study Area. Based on the study results, timing of the need will be dependent on the load growth in the Study Area reaching 75 MW that would impact voltage performance in the Rycroft area.

9.1 Options Assessed for the Project

Option 1: Dynamic Reactive Power Support of 50 MVAr

- Dynamic reactive power support of approximately 50 MVAr at the Rycroft 730S substation

Option 2: New 144 kV Circuit from Rycroft 730S to Clairmont Lake 811S Plus Reactive Power Support

- A new 144 kV transmission circuit between Rycroft 730S and Clairmont Lake 811S
- Additional VAr support in the form of switched capacitor banks as required

Option 3: New 144 kV Circuit from Mowat 2033S to Saddle Hills 865S Plus Reactive Power Support

- A new 144 kV line between Saddle Hills 865S and Mowat 2033S
- Additional VAR support of capacitor banks as required

Without any wire reinforcement in the Study Area, dynamic reactive power support is required to meet the transmission reliability requirements under contingency conditions. The locations of the reactive power support devices are normally close to the load center, and the placement of the dynamic VAr support needs to address the voltage violations under the two worst contingencies in the Study Area: 7L75 and 7L68. Adding a large amount of reactive power device at a single substation with a radial feed such as Ksituan River 754S is not recommended due to incurred losses and constraints on availability of the reactive power support under certain system operating conditions. Therefore, Rycroft 730S is recommended for the addition of the 50 MVAr dynamic reactive power device as per Option 1.

Option 2 and Option 3 are wire solutions proposed to meet the forecasted area peak load for the next 20 years. Both options would also require reactive power support (capacitor banks) in addition to new circuits in the Study Area.

The three short-listed options ensure the transmission Reliability Criteria are met in the Study Area. See Table 9-1 to compare the transmission reinforcements required for each option.

Table 9-1. System Reinforcement Options Summary

Option	Transmission Line	Rycroft 730S Dynamic Reactive Power Device (MVAf)	Rycroft 730S Capacitors (MVAr)	Ksituan 754S Capacitor(s) (MVAr)	Eureka River 861S Capacitors (MVAr)	Existing Line Requiring Rating Increase
1	NA	50	NA	2036: 1 x 4.8*	NA	Beyond 2026 timeframe: 7L73
2	A new 144 kV circuit from Rycroft 730S to Clairmont Lake 811S	NA	NA	1 x 10 2036: 1 x 7.2*	2036 : 1 x 2.4*	Beyond 2026 timeframe: 7L73
3	A new 144kV circuit from Saddle Hills 865S to Mowat 2033S	NA	1 x 10	1 x 10 1 x 7.2*	2036: 1 x 2.4*	Beyond 2026 timeframe: 7L10 and 7L73

* 25 kV capacitor located on low side of a local transformer.

9.2 Recommendation

Compared with other options, Option 1 is the Preferred Development Option for the following reasons:

- It has a lower estimated capital cost.
- It has a lower environmental and land use impact because it does not involve any new line construction.
- It has better voltage performance and requires less voltage support from the rest of the system.
- It has better thermal performance than Option 3, and similar thermal performance with Option 2.

The preferred transmission development option includes the following system component:

- a 144 kV 50 MVAr Dynamic reactive power support at the Rycroft 730S substation

Based on the study results, the AESO recommends increasing the load serving capability of Rycroft area by adding a 50 MVAr dynamic reactive power device at the existing Rycroft 730S substation to alleviate the identified voltage criteria violations. This transmission development is the minimum development required to address the identified need in the medium term which enables about 35% of the forecast load growth in the area. It also offers the flexibility and expandability needed to meet the AESO's 20-year load forecast by adding additional voltage support equipment of 4.8 MVAr capacitor bank at Ksituan River 754S when need arises.

The studies also demonstrate that the identified constraints arise as early as winter 2017 under N-1 conditions based on the latest load and generation forecast. However, the forecast load growth in the area is driven by a number of connection projects and demand transmission service increases. While the AESO is reasonably certain that the preferred development option is needed in the future, the timing of the in-service date for the development will rely on new load and pace of the existing load growth, as well as new load project ISDs, which are beyond the AESO's control. Therefore, the AESO has determined it is most appropriate to specify milestones.

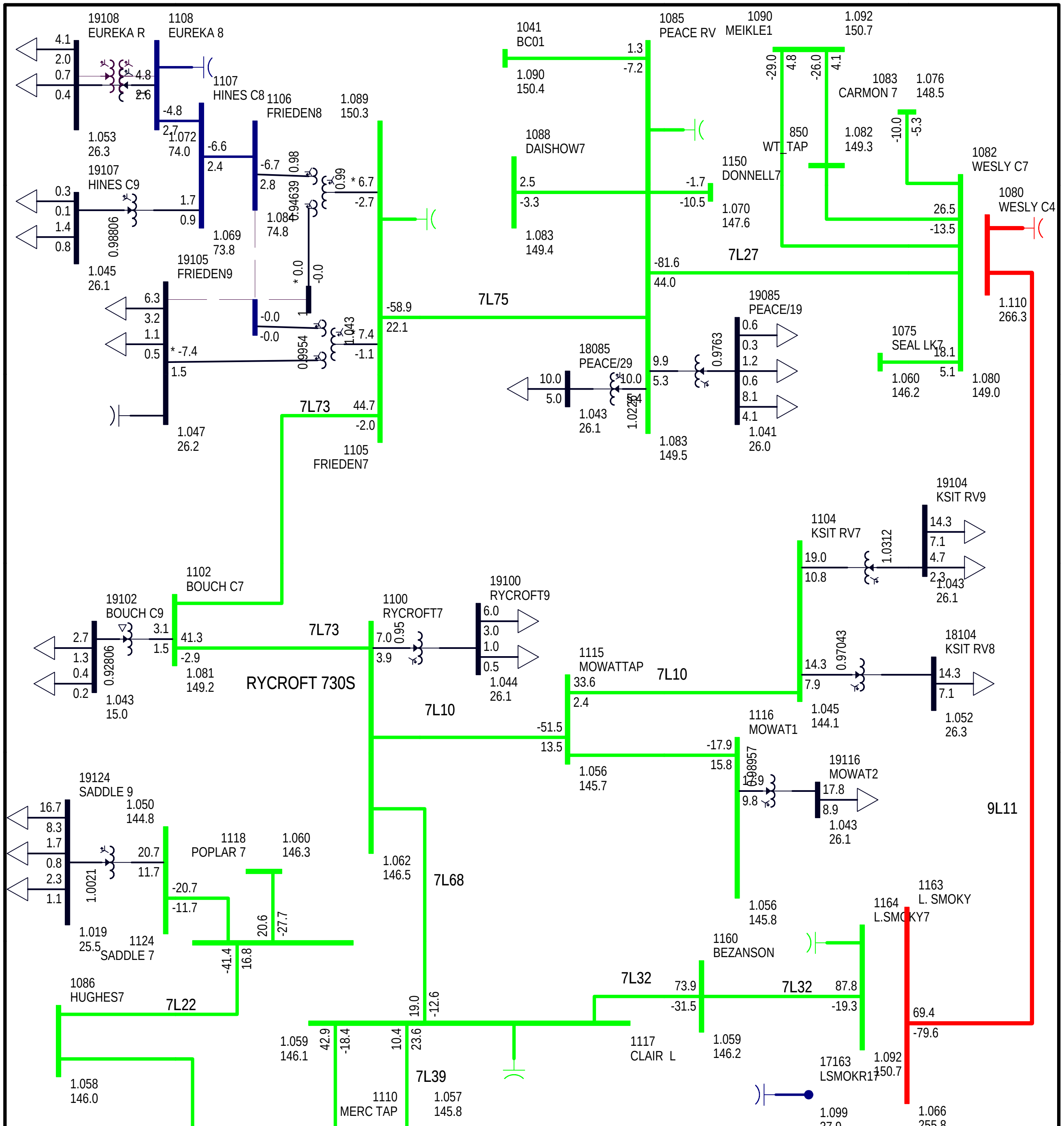
A load growth milestone is proposed for the Preferred Development Option when the coincident winter aggregate peak load for Rycroft area of 75 MW is reached, as measured at Rycroft 730S, Eureka River 861S, Ksituan River 754S, Boucher Creek 829S, Hines Creek 724S, Friedenstal 800S, and Mowat 2033S substations.

Finally, the AESO will use operational measures, as necessary, including connection remedial action schemes, should constraints arise in the area prior to the implementation of the Preferred Development Option.

Attachment A: Power Flow Plots – Need Assessment

Table A-1. Figure Numbers and Contingencies shown in the Plots from the Need Assessment

Figure	Study Scenario	Study Area Load (MW)	Contingency
A-1	1A	75	N-0
A-2	1A	75	9L11
A-3	1A	75	7L75
A-4	1A	75	7L73
A-5	1A	75	7L68
A-6	1A	75	7L10
A-7	1A	75	7L32
A-8	1A	75	7L22
A-9	1A	75	7L46
A-10	1A	75	7L45
A-11	1A	75	7L39
A-12	1A	75	7L84
A-13	1A	75	7L03
A-14	1A	75	7L69
A-15	1B	80	N-0
A-16	1B	80	9L11
A-17	1B	80	7L75
A-18	1B	80	7L73
A-19	1B	80	7L68
A-20	1B	80	7L10
A-21	1B	80	7L32
A-22	1B	80	7L22
A-23	1B	80	7L46
A-24	1B	80	7L45
A-25	1B	80	7L39
A-26	1B	80	7L84
A-27	1B	80	7L03
A-28	1B	80	7L69



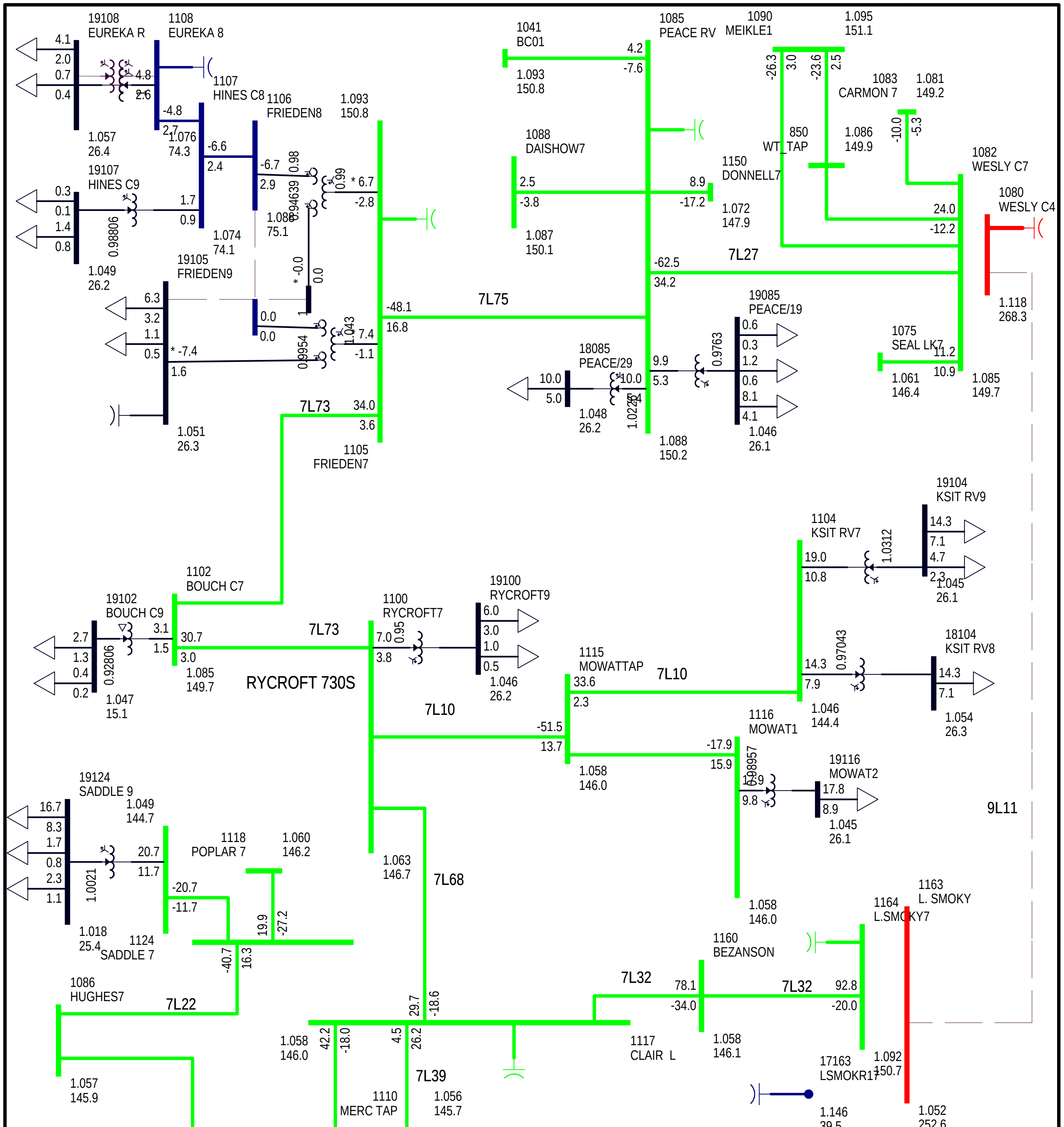
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
BASE CASE(N-0)
FIG A-1
THU, NOV 02 2017 17:52

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 80.1 MW



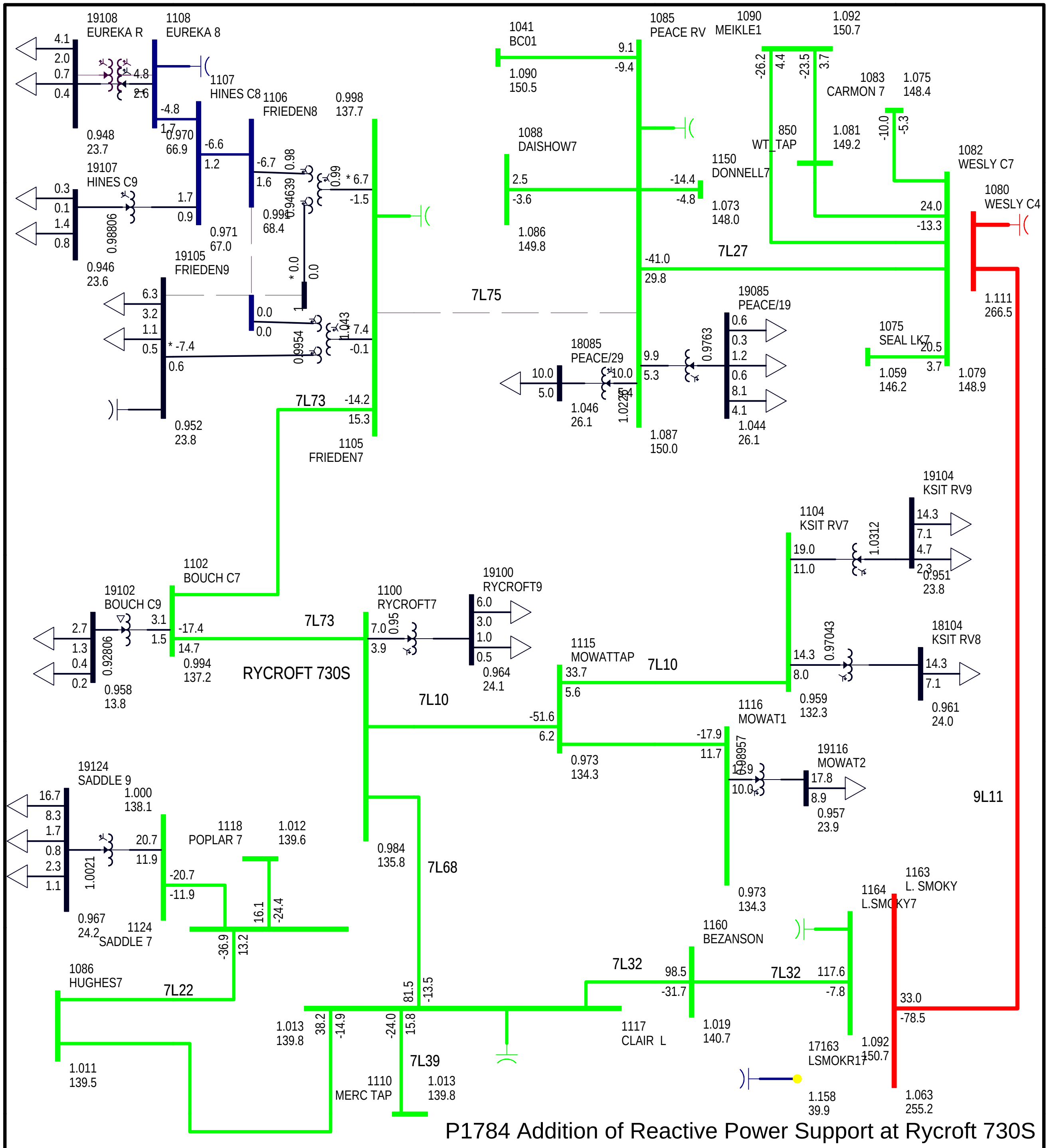
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
9L11 (N-1)
FIG A-2
THU, NOV 02 2017 17:52

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 79.2 MW

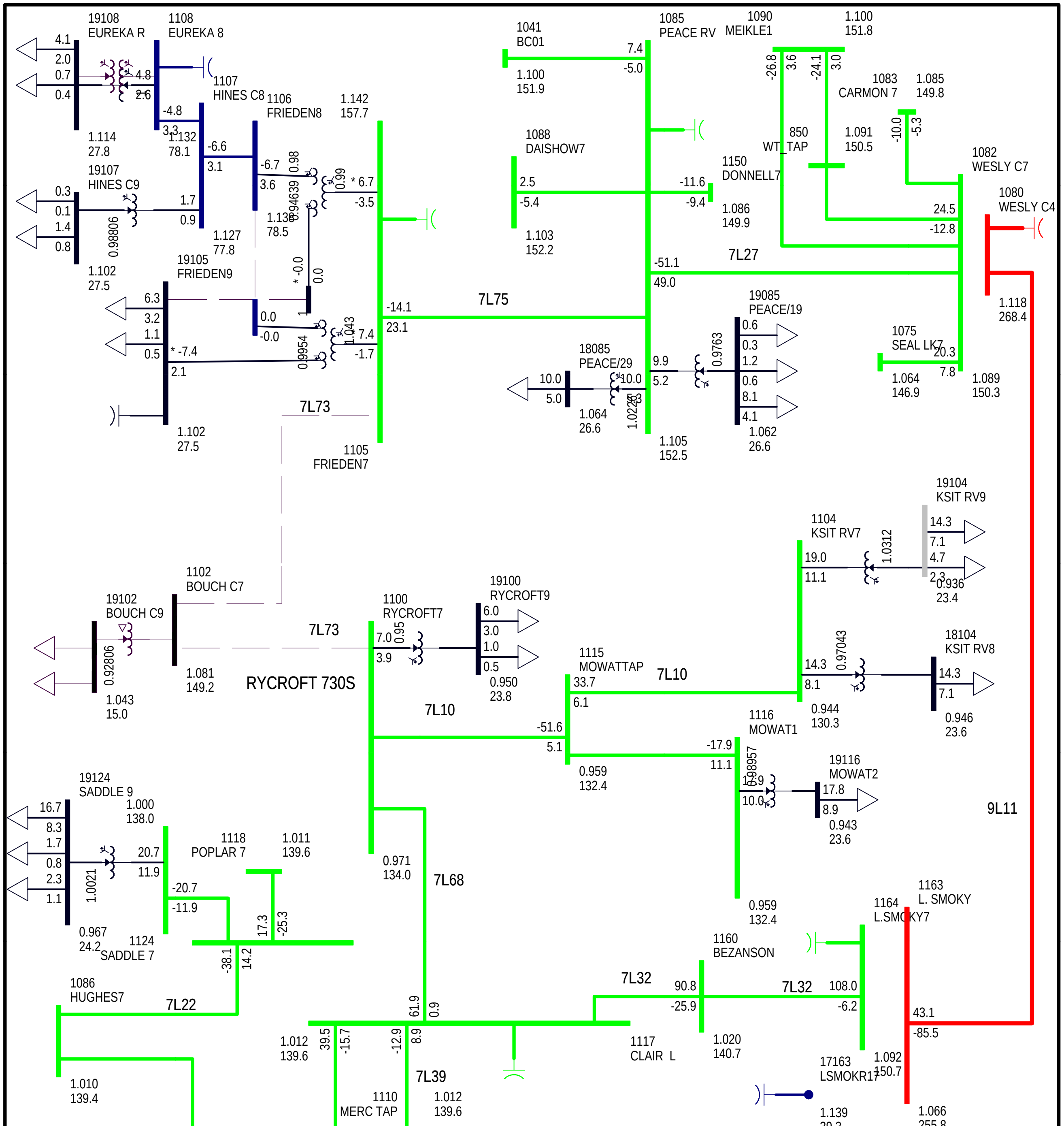


PROJECT 1784: SCENARIO 2017WP 1A
7L75 (N-1)
FIG A-3
THU, NOV 02 2017 17:52

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 81.5 MW



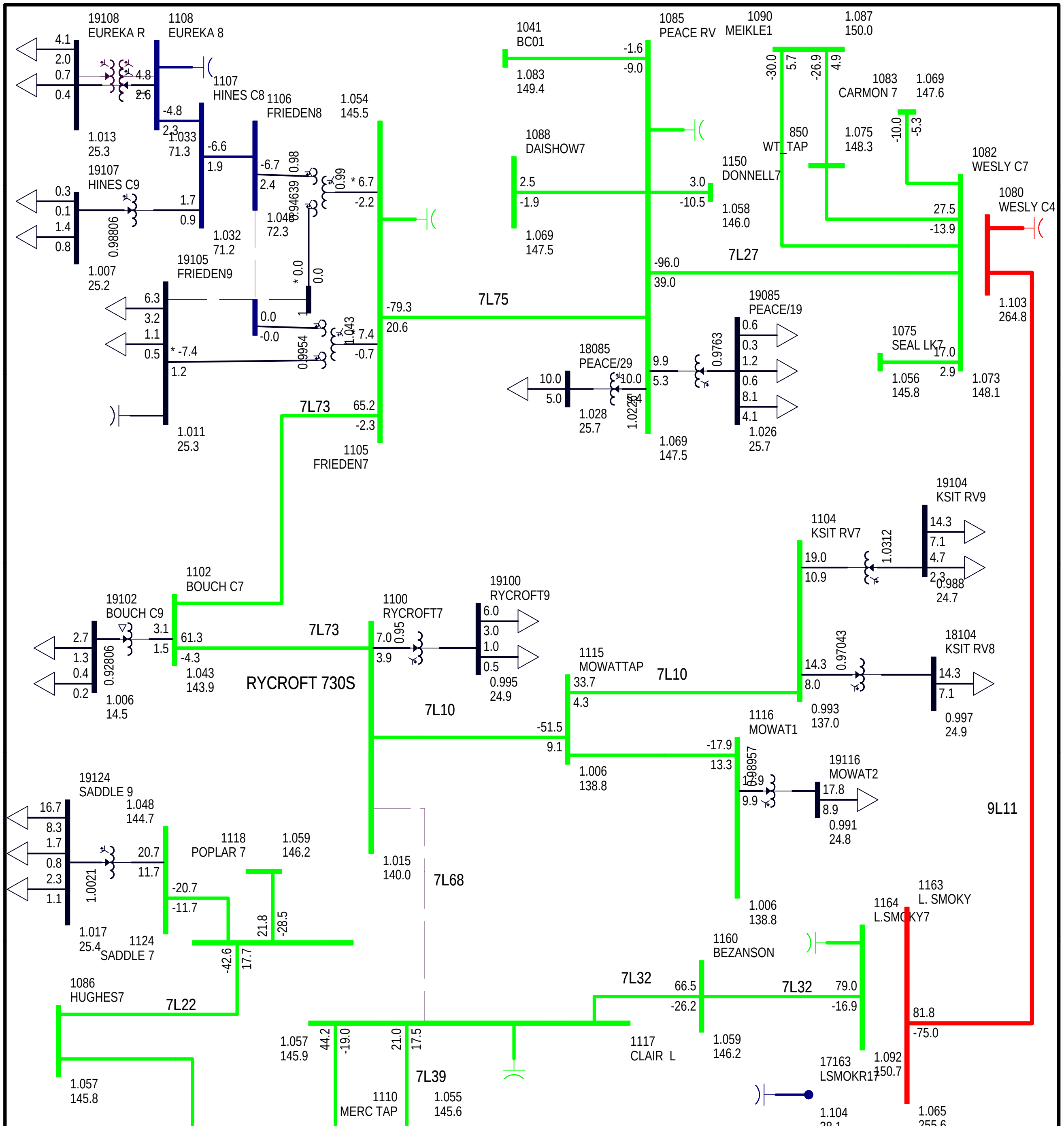
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L73 (N-1)
FIG A-4
THU, NOV 02 2017 17:52

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 71.9 MW

TOTAL FLOW INTO RYCROFT AREA: 76.5 MW



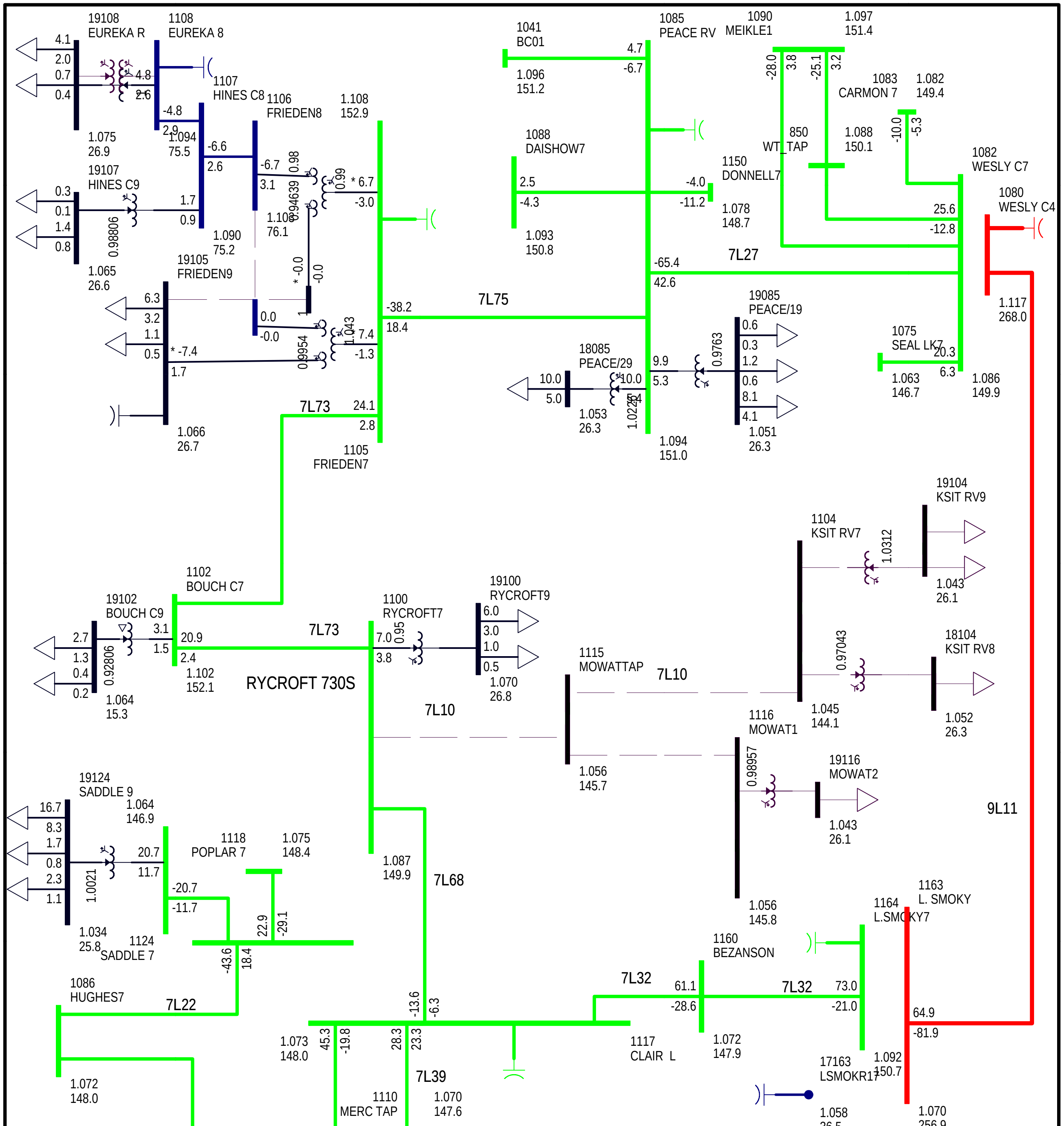
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L68 (N-1)
FIG A-5
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 83.1 MW



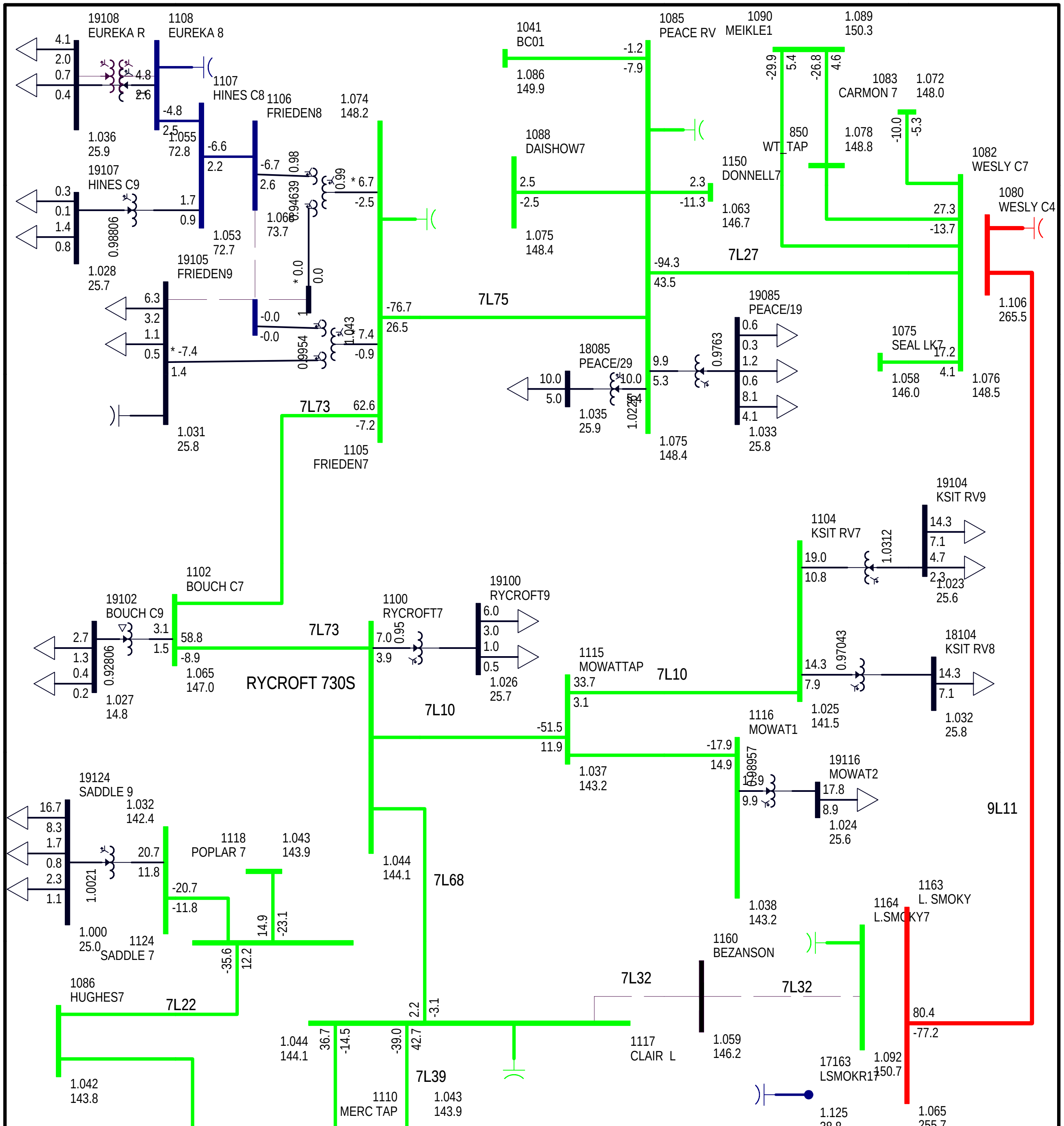
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L10 (N-1)
FIG A-6
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 23.9 MW

TOTAL FLOW INTO RYCROFT AREA: 25.6 MW



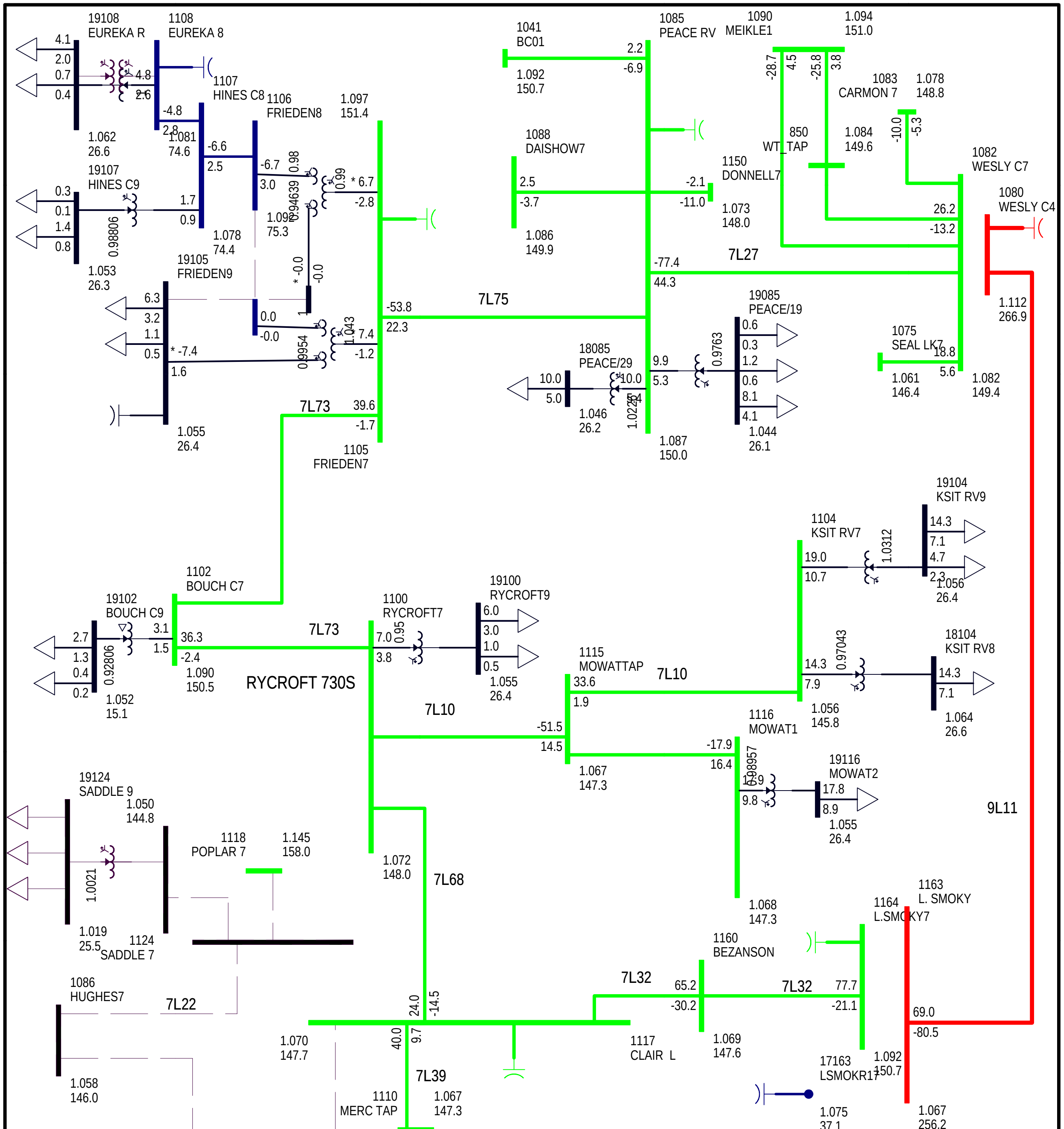
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L32 (N-1)
FIG A-7
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 82.6 MW



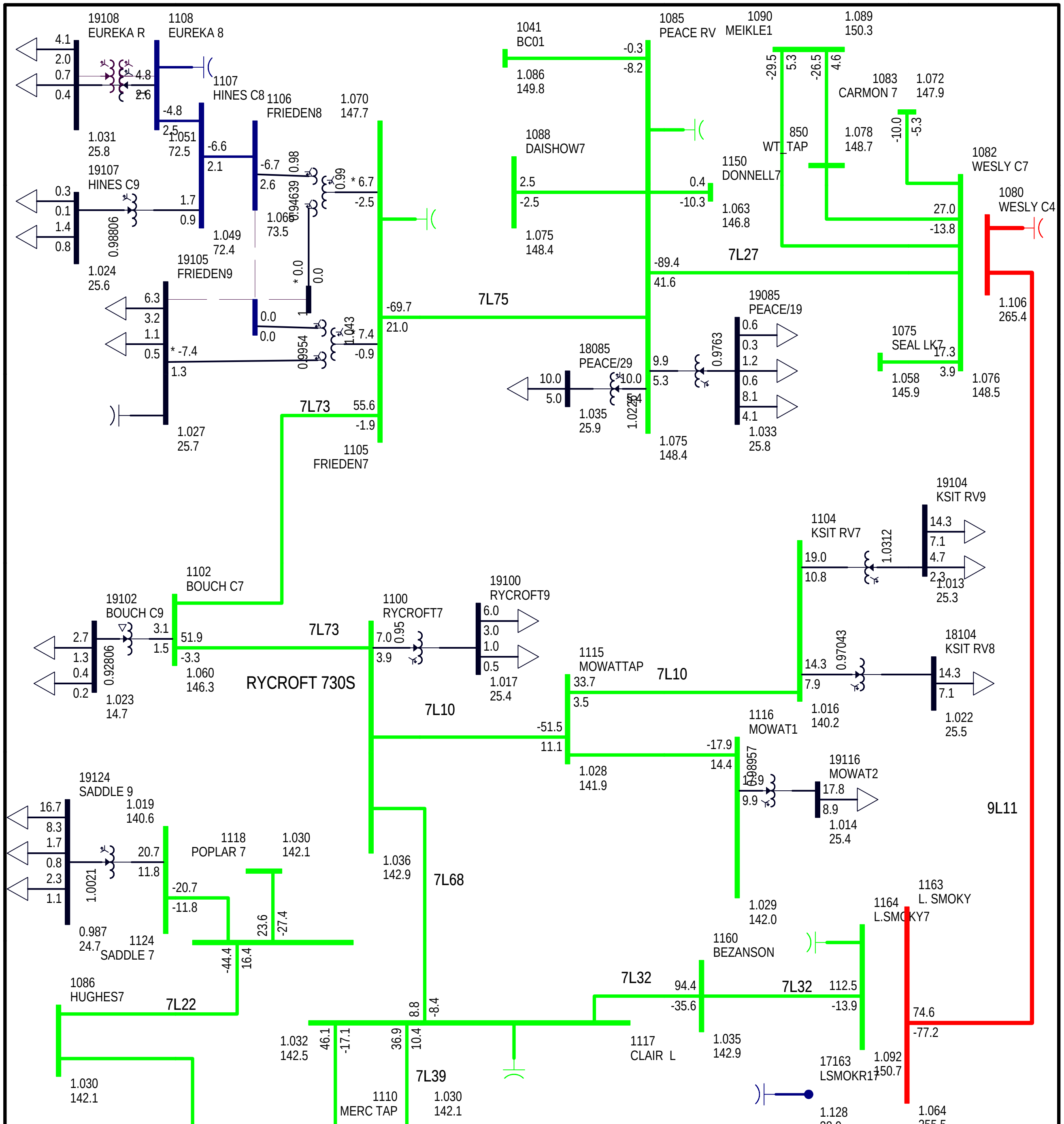
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L22 (N-1)
FIG A-8
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 79.6 MW



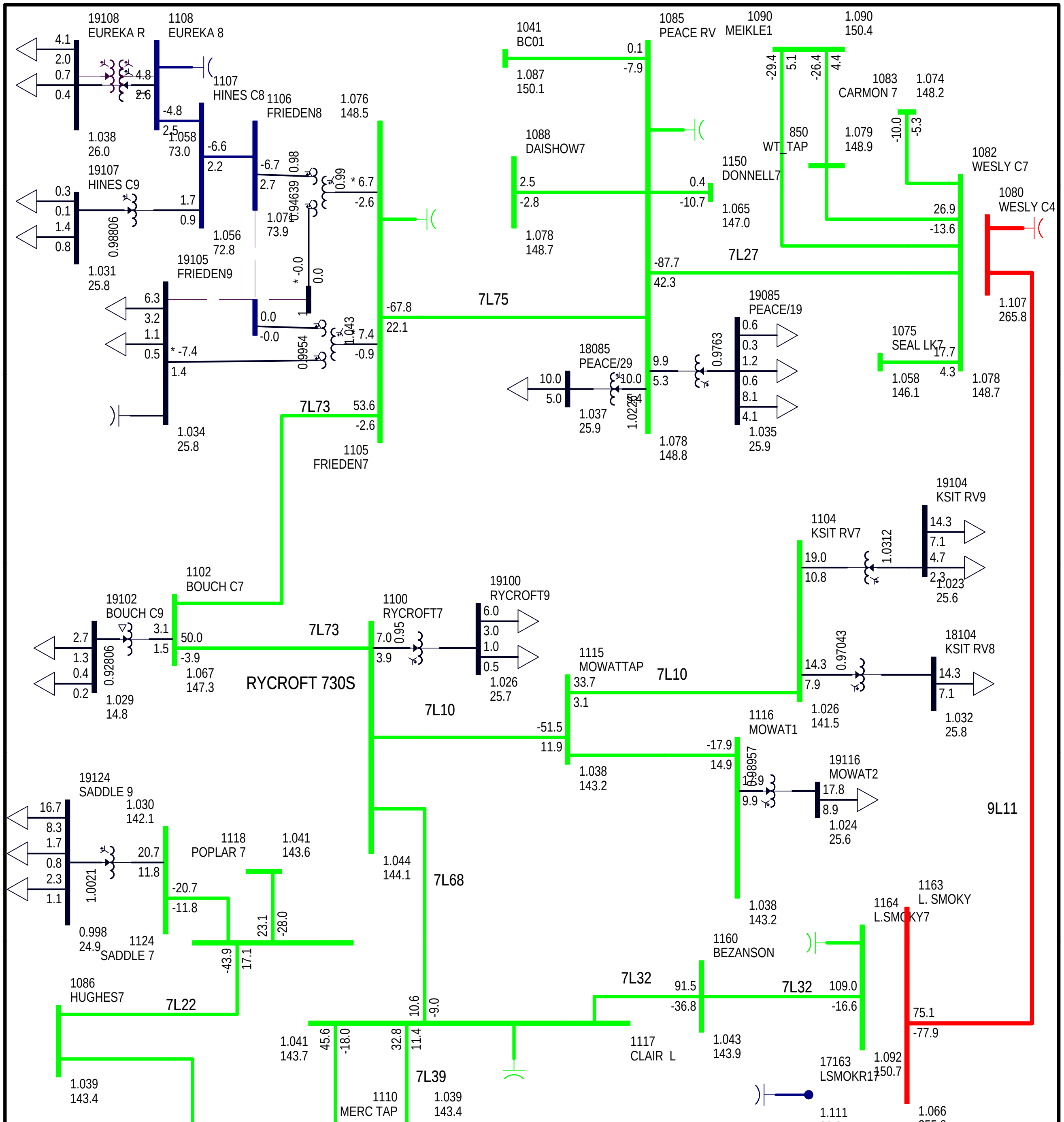
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L46 (N-1)
FIG A-9
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 81.4 MW



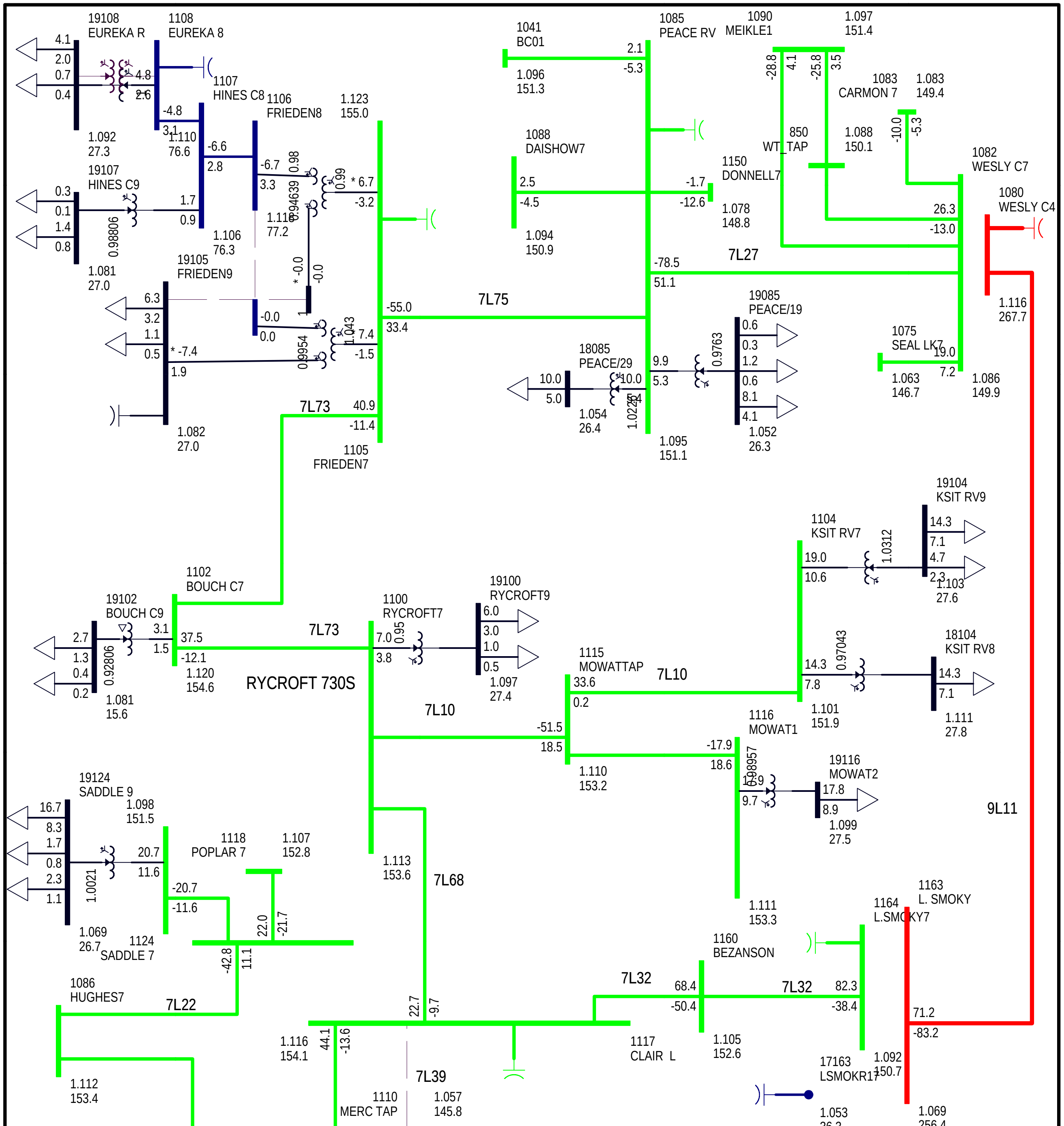
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L45 (N-1)
FIG A-10
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 81.1 MW



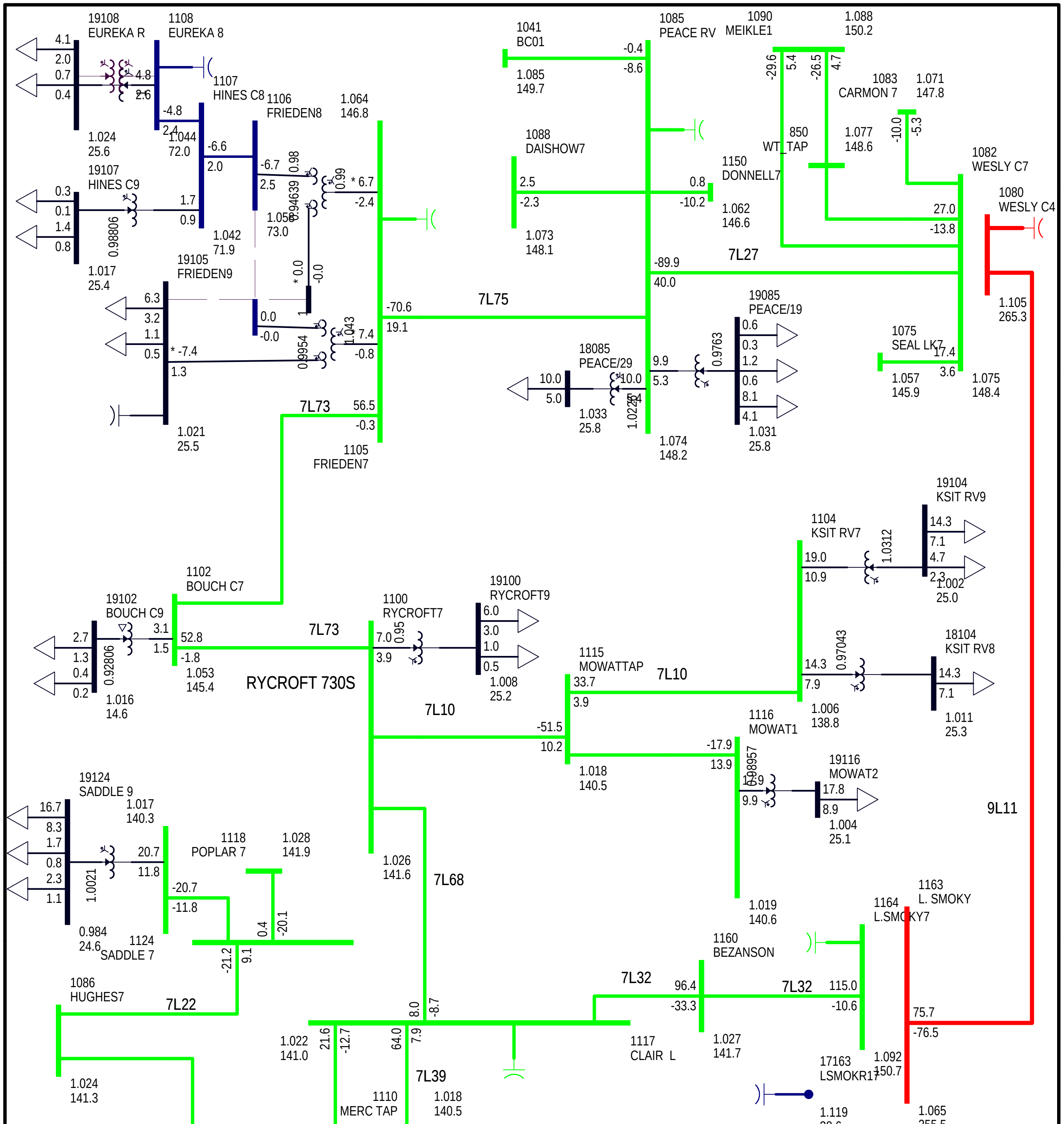
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L39 (N-1)
FIG A-11
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 79.8 MW



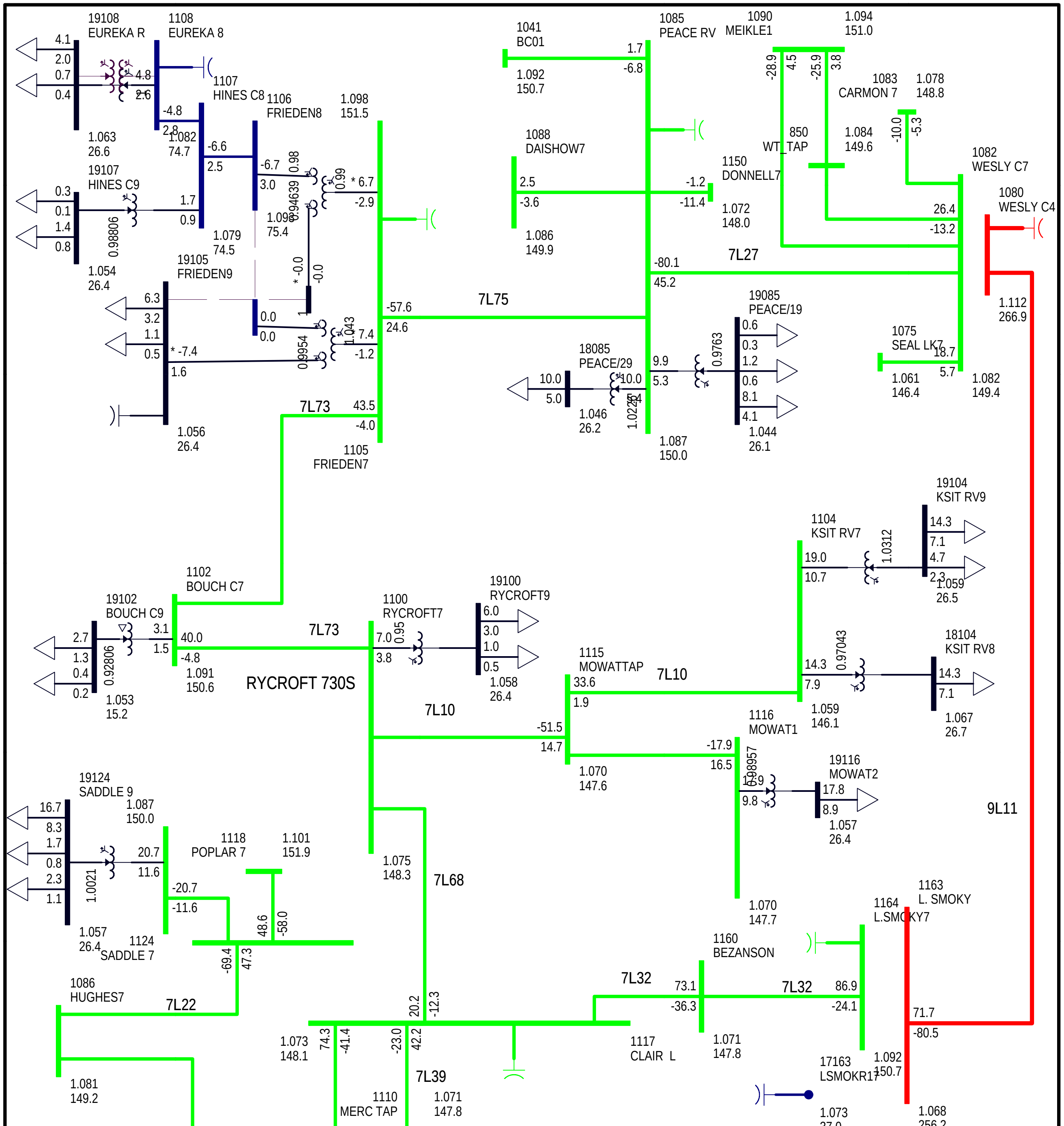
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L84 (N-1)
FIG A-12
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 81.6 MW



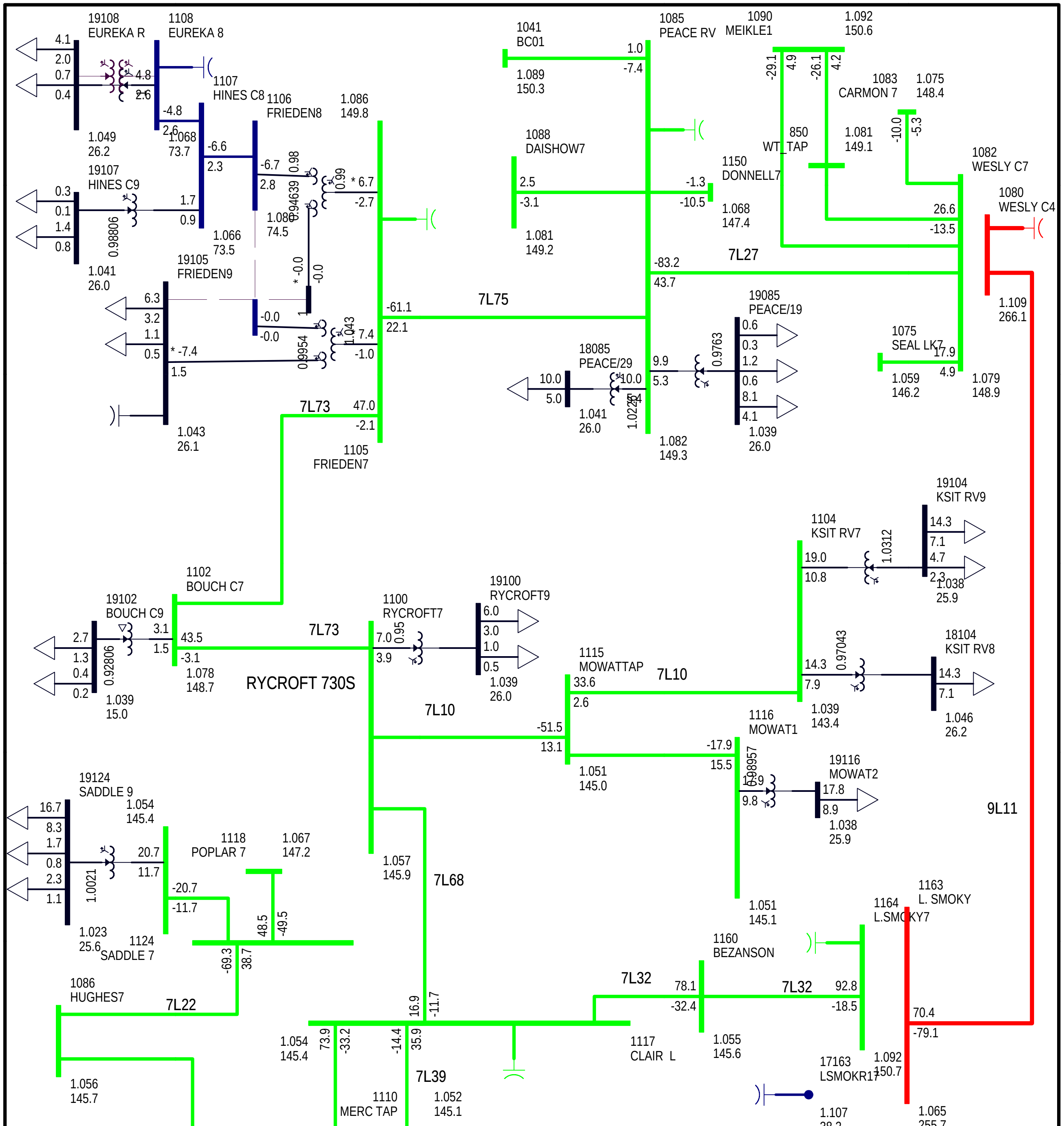
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L03 (N-1)
FIG A-13
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 79.9 MW



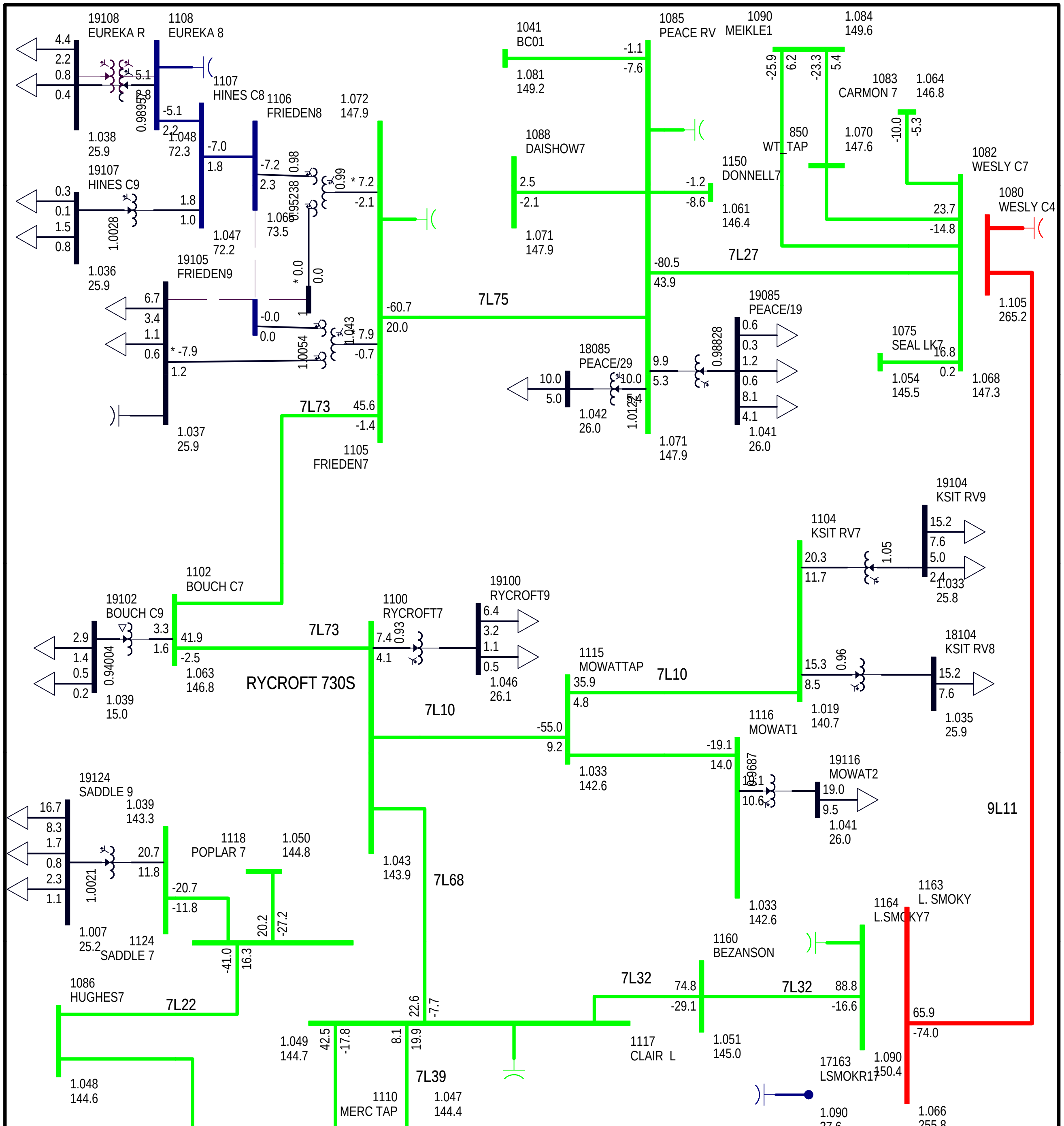
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1A
7L69 (N-1)
FIG A-14
THU, NOV 02 2017 17:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 75.0 MW

TOTAL FLOW INTO RYCROFT AREA: 80.3 MW



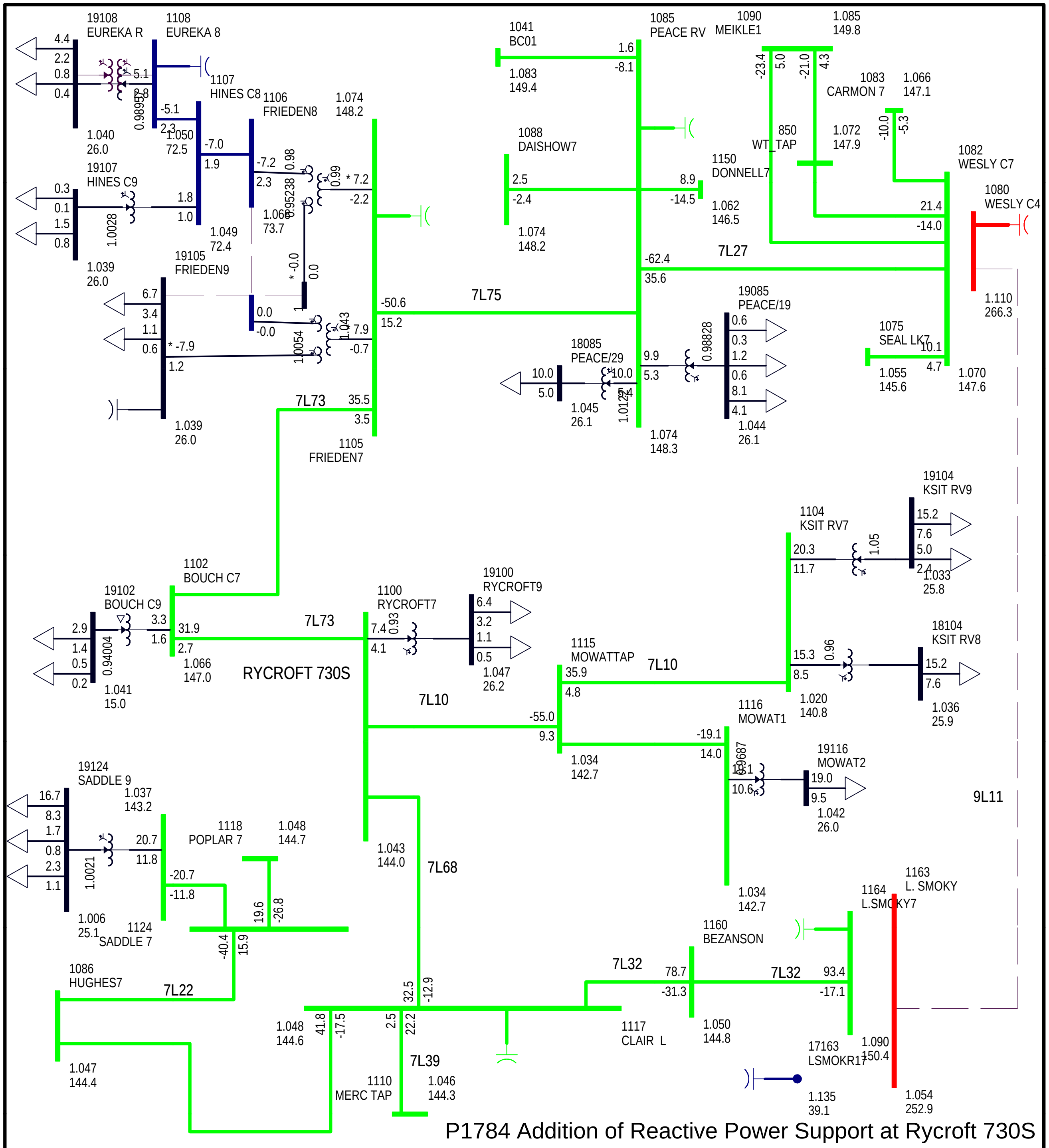
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
BASE CASE(N-0)
FIG A-15
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 85.5 MW



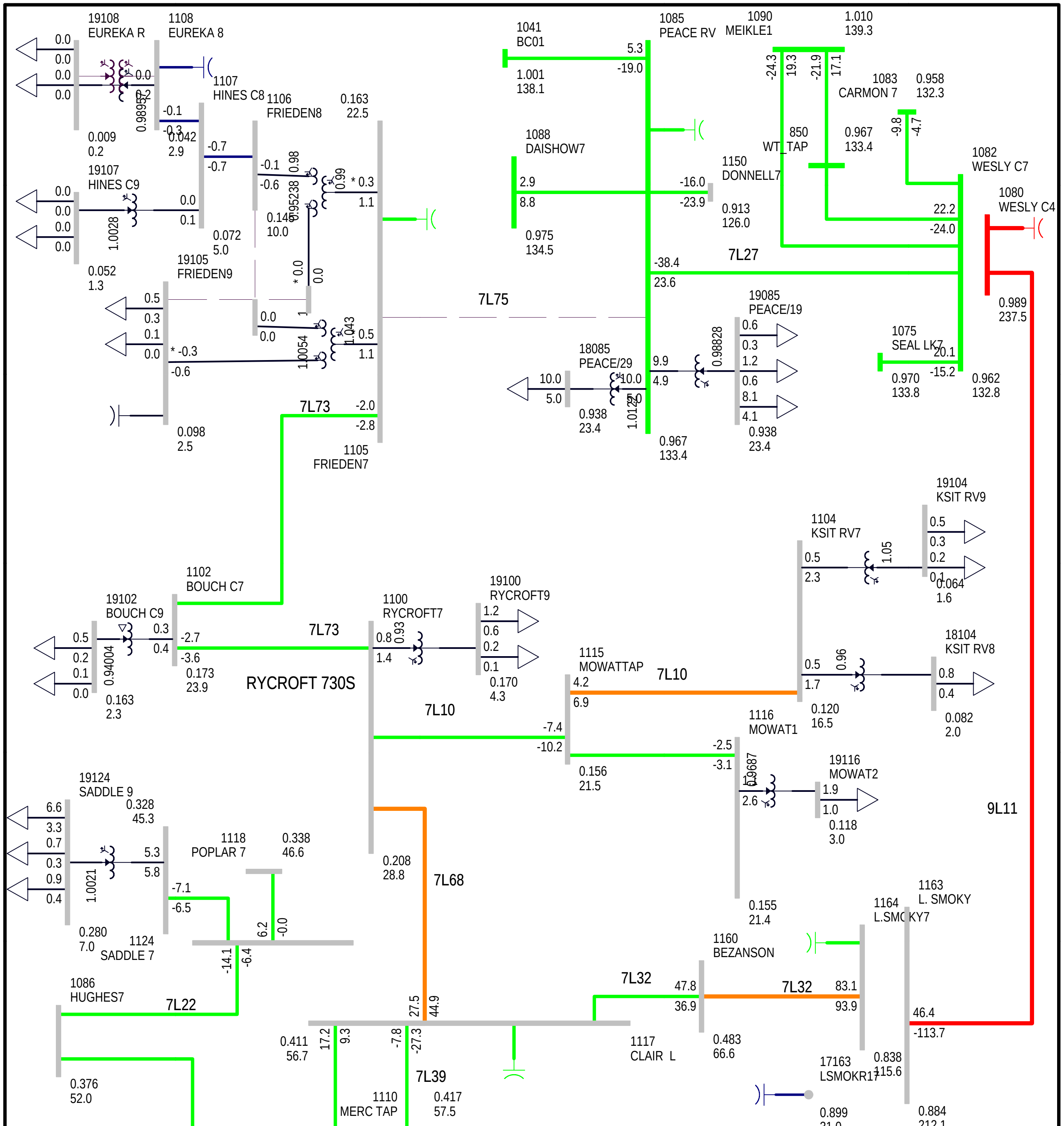
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
9L11 (N-1)
FIG A-16
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 84.7 MW



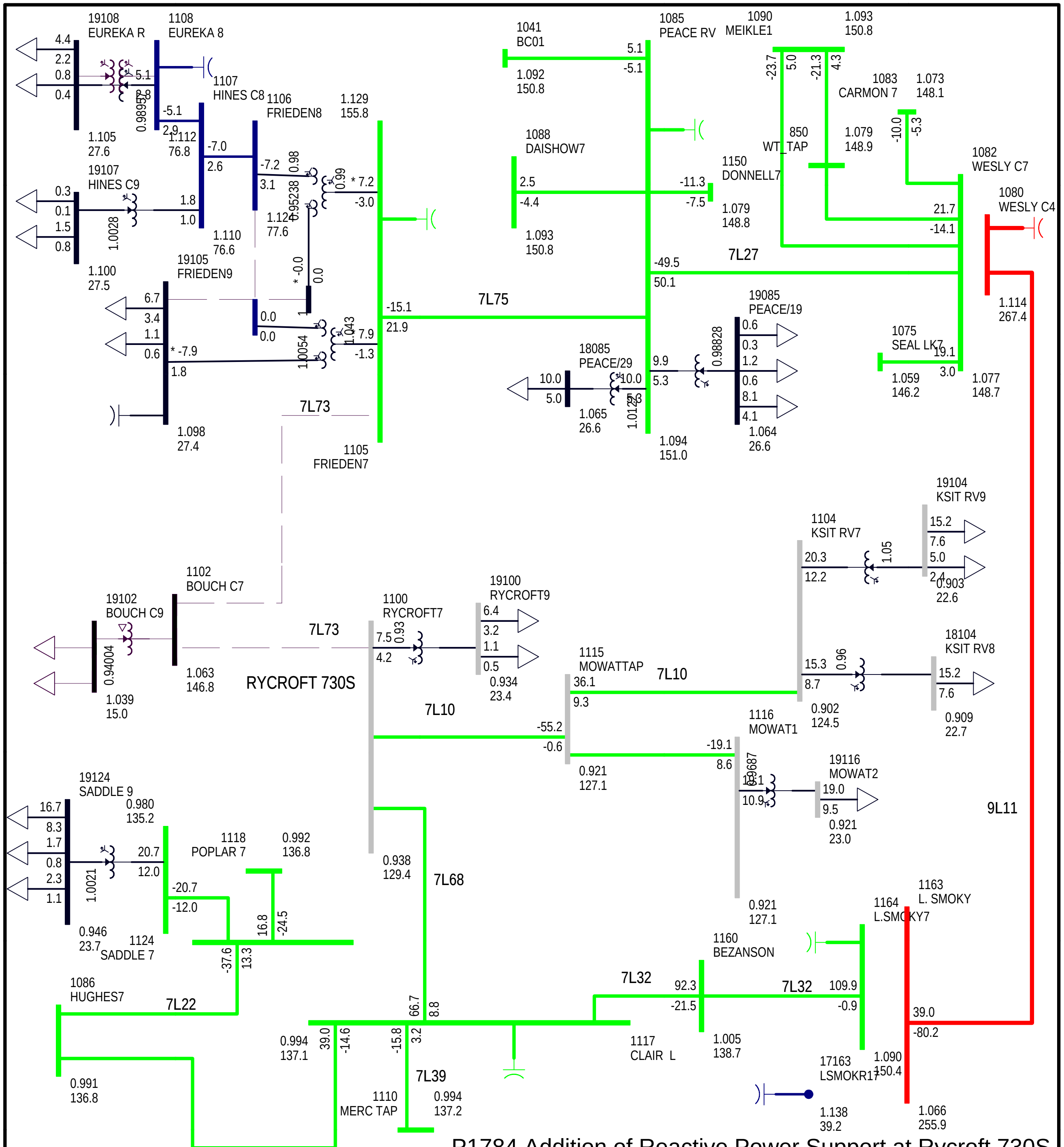
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L75 (N-1)
FIG A-17
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 6.1 MW

TOTAL FLOW INTO RYCROFT AREA: 27.5 MW



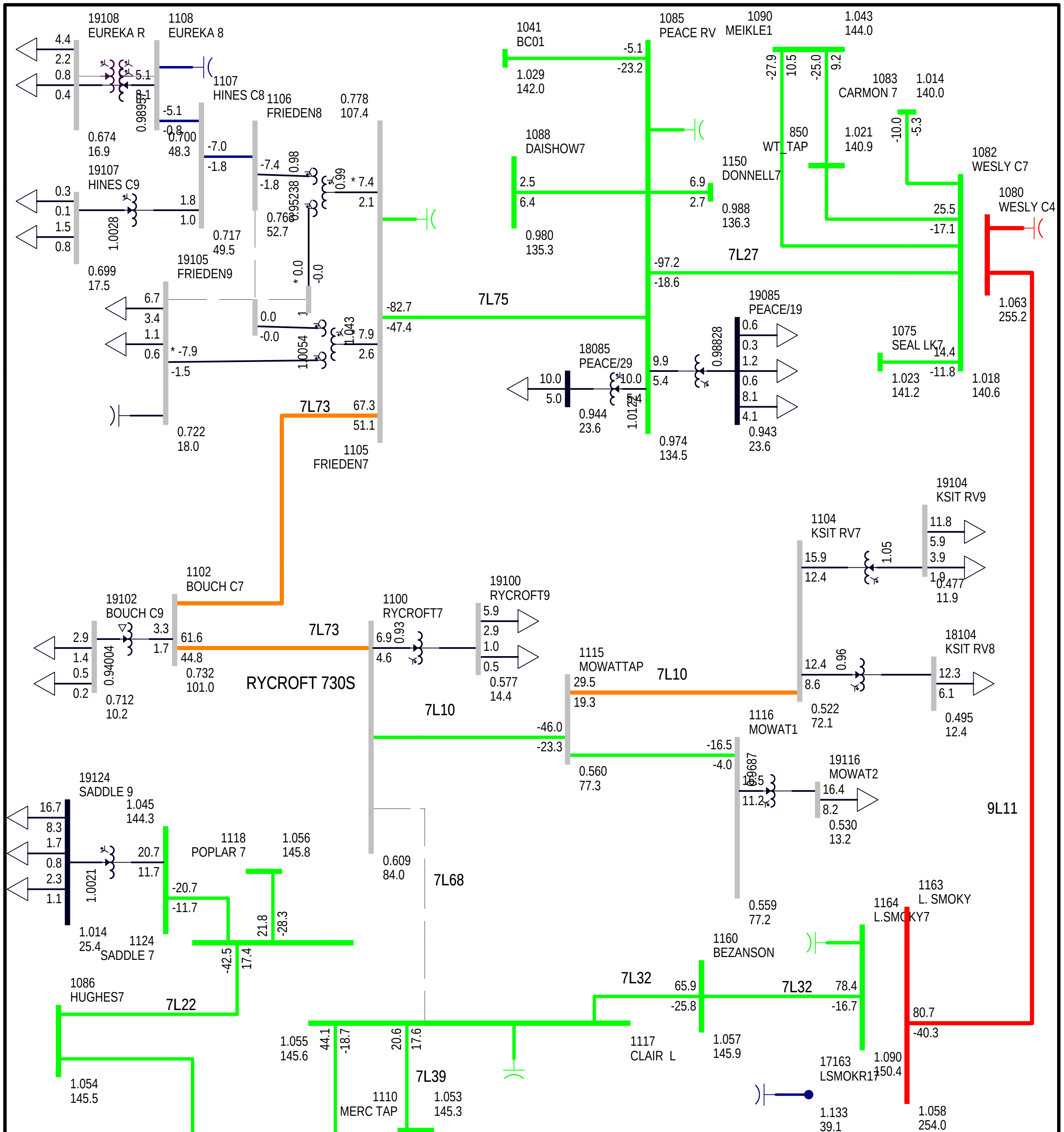
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L73 (N-1)
FIG A-18
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 76.7 MW

TOTAL FLOW INTO RYCROFT AREA: 82.2 MW



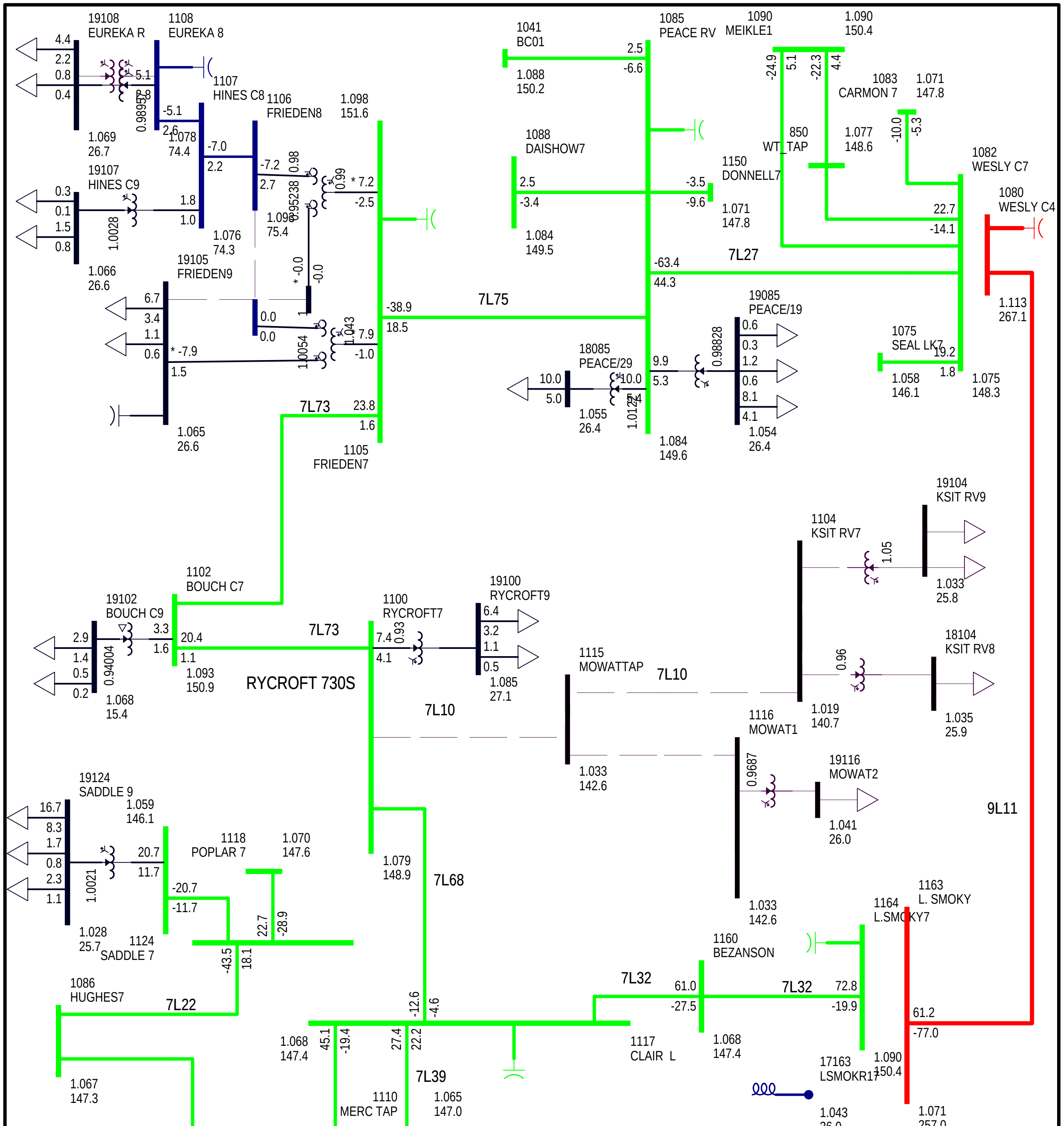
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L68 (N-1)
FIG A-19
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 69.3 MW

TOTAL FLOW INTO RYCROFT AREA: 91.8 MW



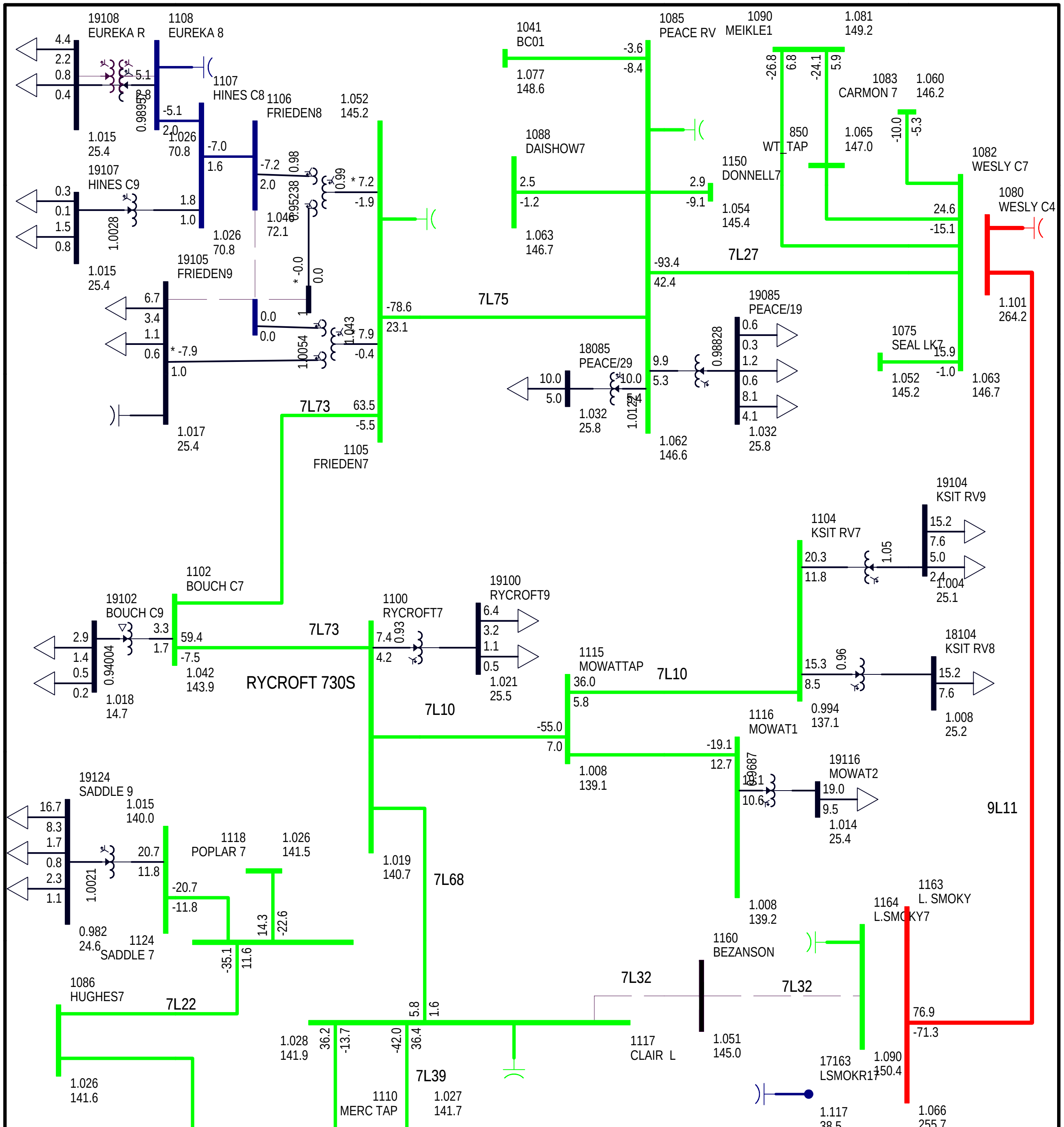
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L10 (N-1)
FIG A-20
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 25.5 MW

TOTAL FLOW INTO RYCROFT AREA: 27.3 MW



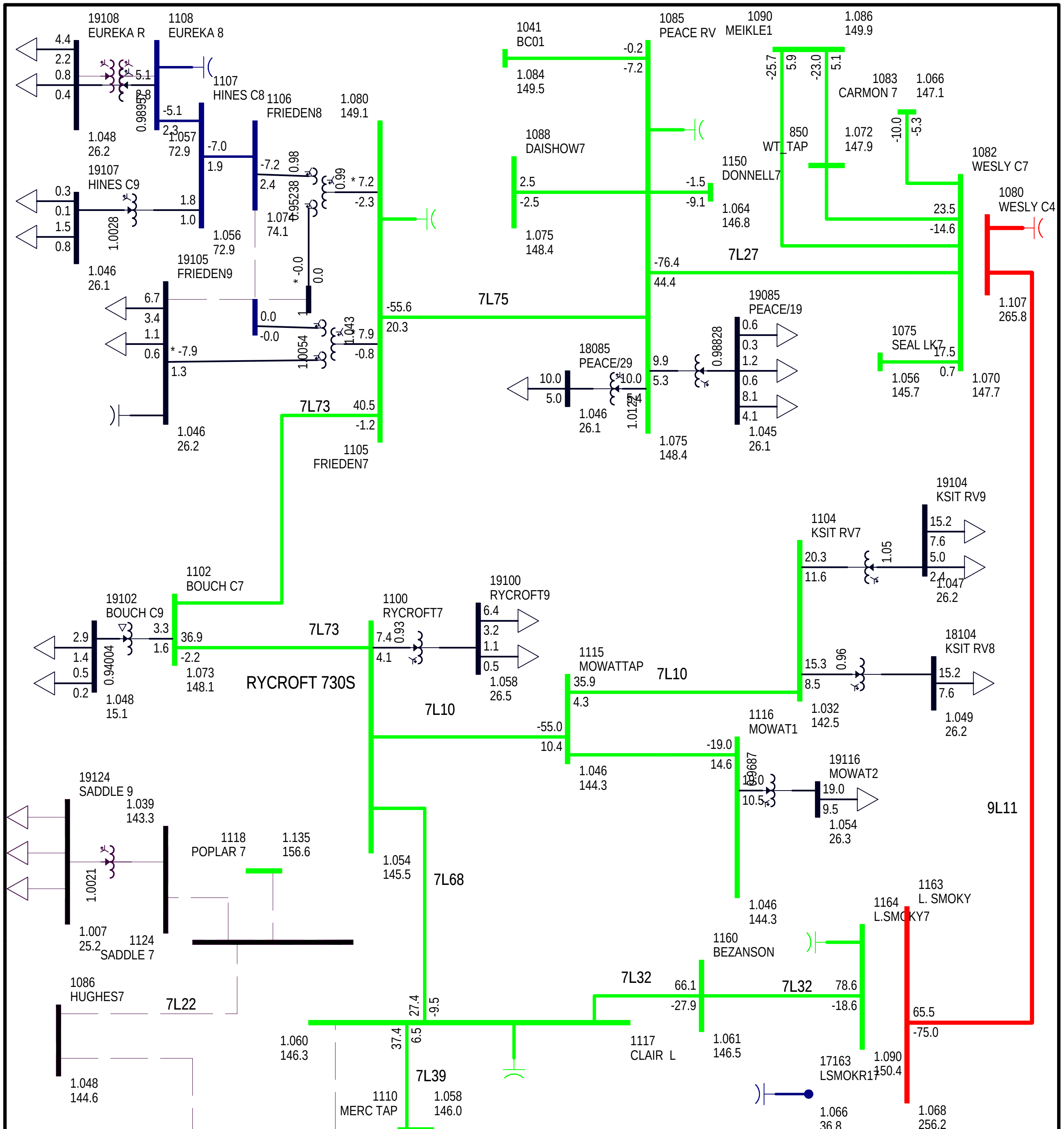
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L32 (N-1)
FIG A-21
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 88.2 MW



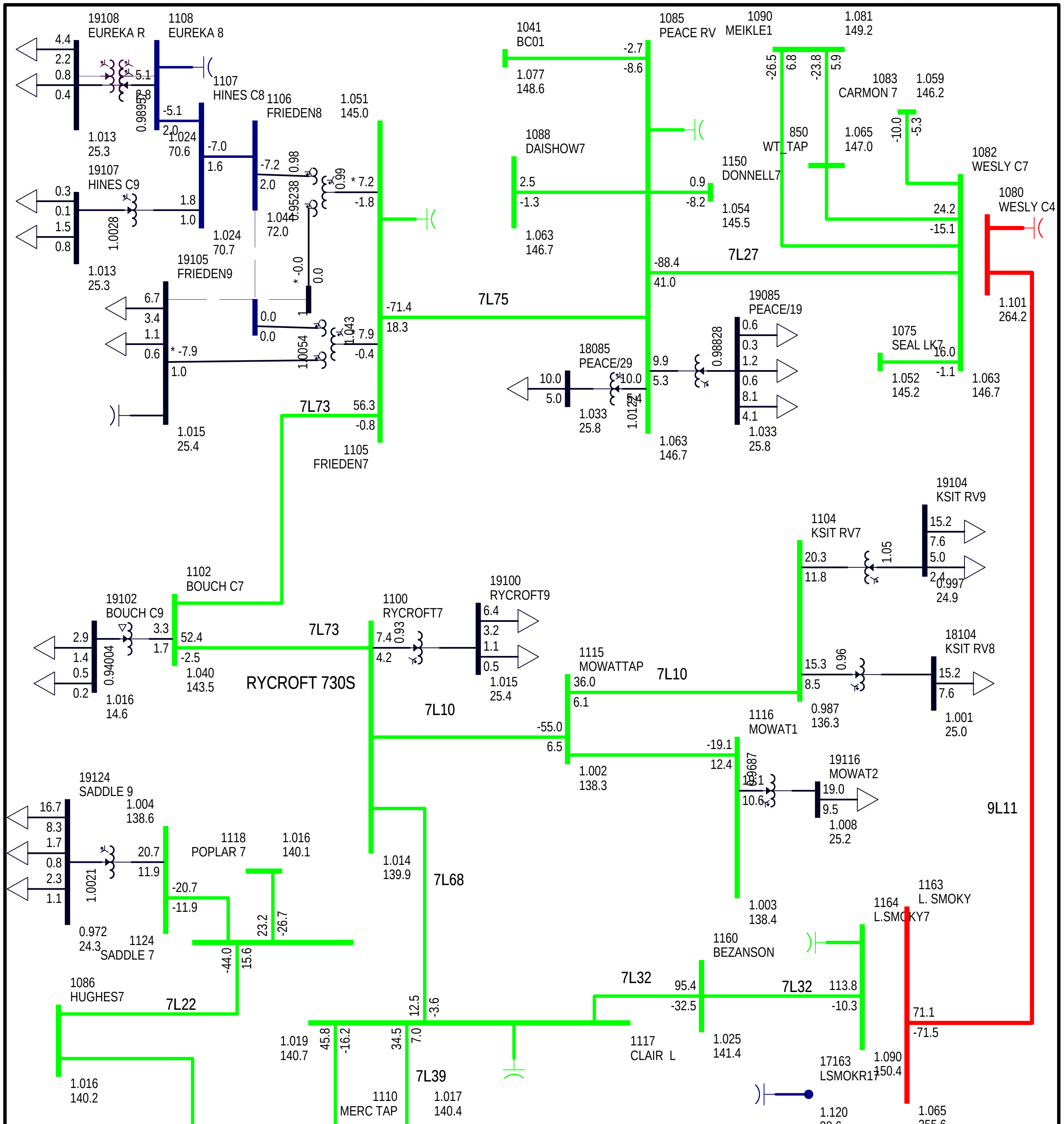
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L22 (N-1)
FIG A-22
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 85.0 MW



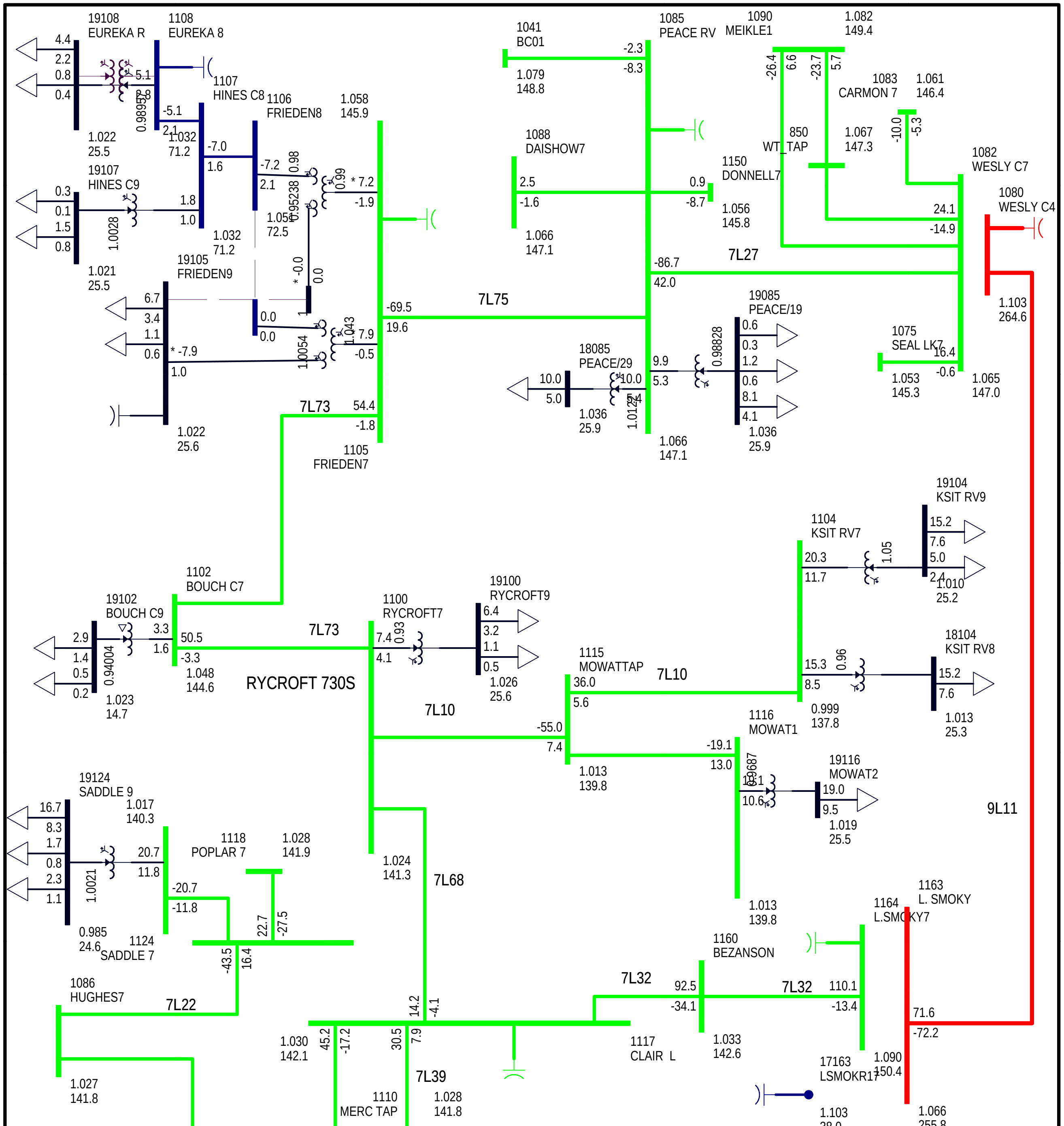
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L46 (N-1)
FIG A-23
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 87.0 MW



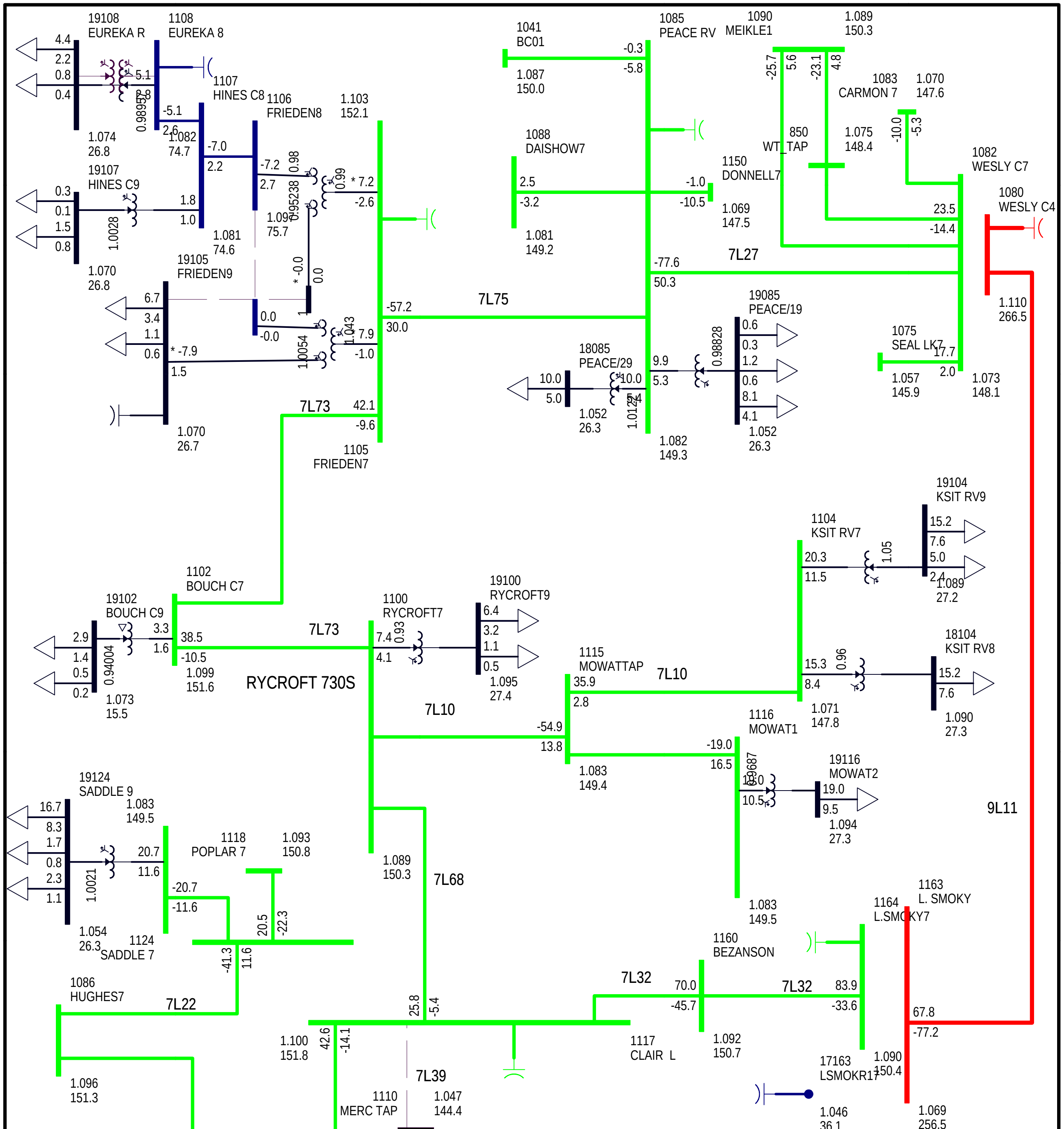
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L45 (N-1)
FIG A-24
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 86.7 MW



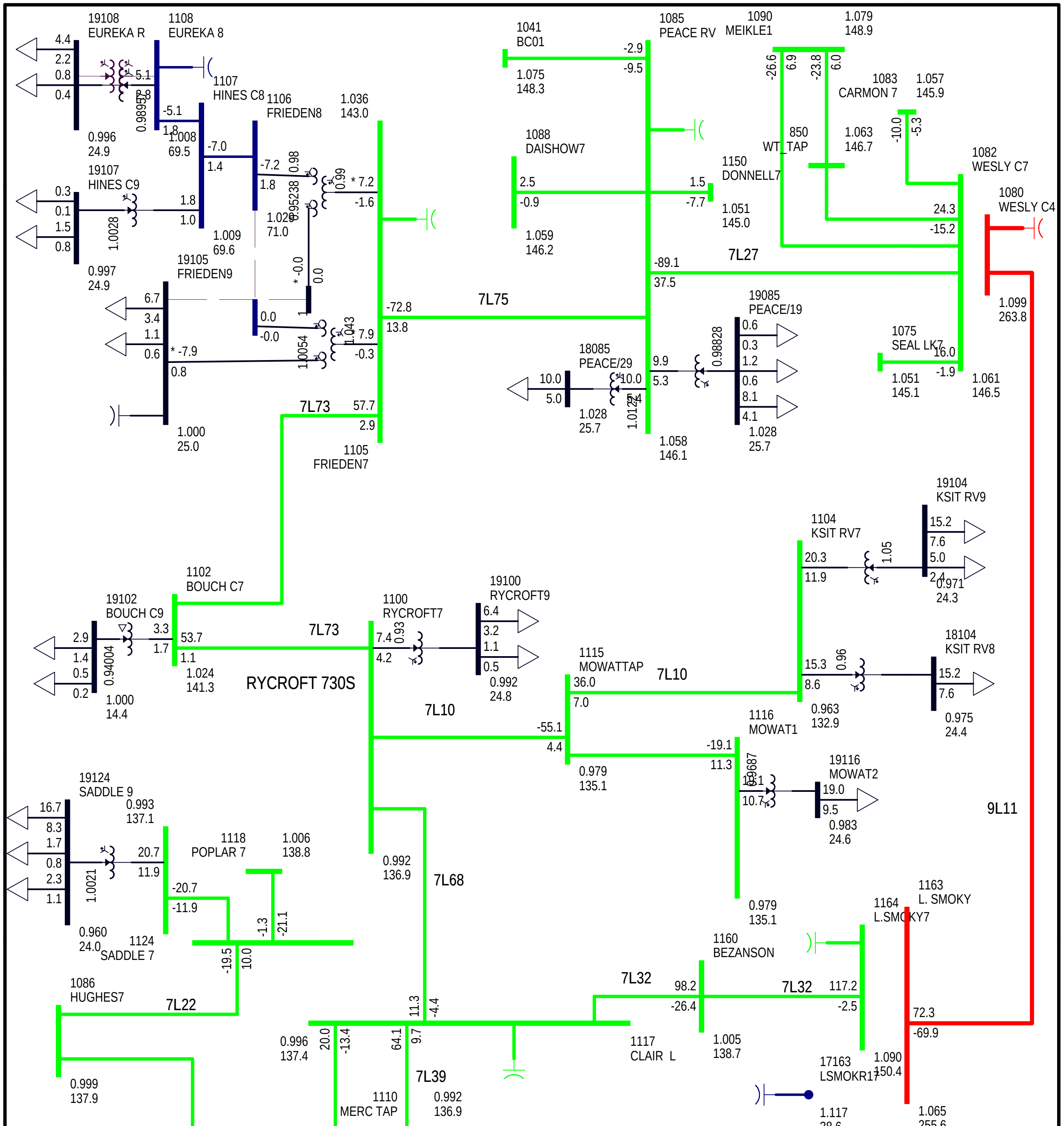
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L39 (N-1)
FIG A-25
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 85.2 MW



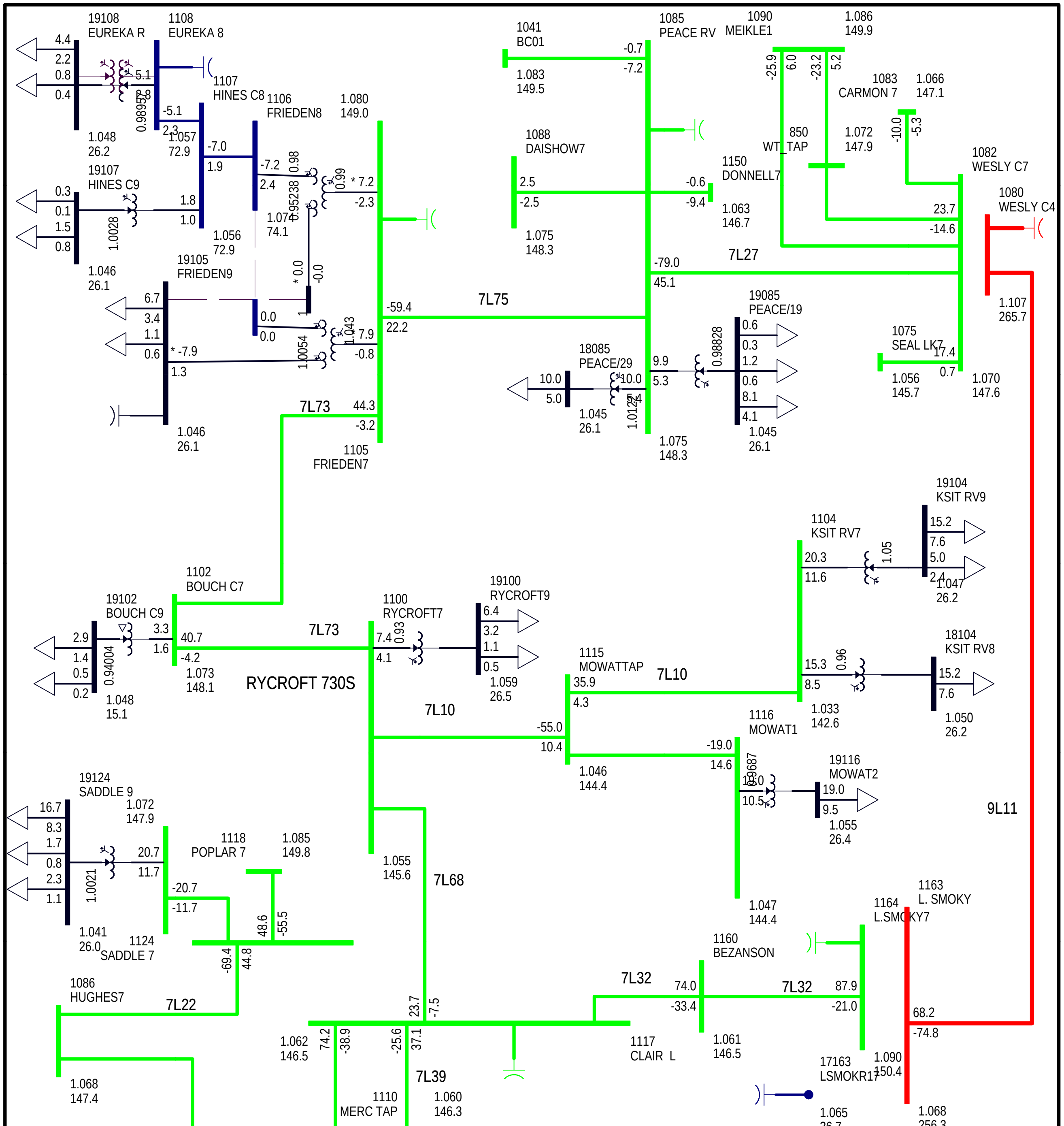
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L84 (N-1)
FIG A-26
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 87.4 MW



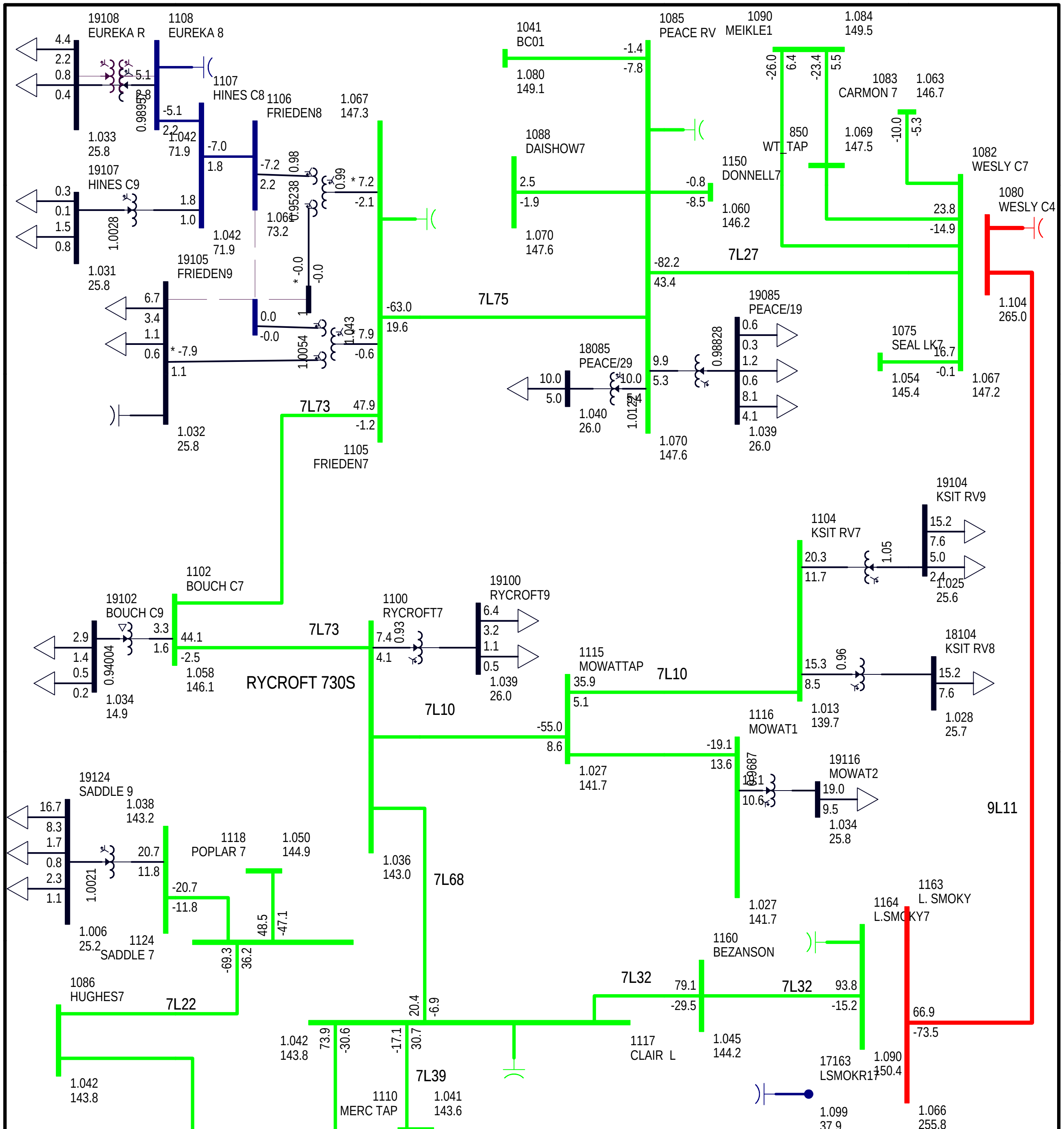
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L03 (N-1)
FIG A-27
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 85.4 MW



P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 2017WP 1B
7L69 (N-1)
FIG A-28
THU, NOV 02 2017 17:55

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 85.8 MW

Attachment B: Power Flow Plots – Options 1 through 3

Figure	Study Scenario	Study Area Load (MW)	Contingency
B-1	1C	100	N-0
B-2	1C	100	9L11
B-3	1C	100	7L75
B-4	1C	100	7L73
B-5	1C	100	7L68
B-6	4A	92	N-0
B-7	4B	96	Base
B-8	4B	96	9L11
B-9	4B	96	7L75
B-10	4B	96	7L73
B-11	4B	96	7L68

Figure	Transmission Option	Study Scenario	Study Area Load (MW)	Contingency
B-12	2	1E	85	N-0
B-13	2	1E	85	9L11
B-14	2	1E	85	7L75
B-15	2	1E	85	7L73
B-16	2	1E	85	7L68
B-134	3	1F	80	N-0
B-135	3	1F	80	9L11
B-136	3	1F	80	7L75
B-137	3	1F	80	7L73
B-138	3	1F	80	7L68

Figure	Transmission Option	Study Scenario	Contingency
B-17	1	2	N-0
B-18	1	2	9L11
B-19	1	2	7L75
B-20	1	2	7L73
B-21	1	2	7L68
B-22	1	2	7L10
B-23	1	2	7L32
B-24	1	2	7L22
B-25	1	2	7L46
B-26	1	2	7L45
B-27	1	2	7L39
B-28	1	2	7L84
B-29	1	2	7L03
B-30	1	2	7L69
B-31	1	3	N-0
B-32	1	3	9L11
B-33	1	3	7L75
B-34	1	3	7L73
B-35	1	3	7L68
B-36	1	3	7L10
B-37	1	3	7L32
B-38	1	3	7L22
B-39	1	3	7L46
B-40	1	3	7L45
B-41	1	3	7L39
B-42	1	3	7L84
B-43	1	3	7L03
B-44	1	3	7L69
B-45	1	4	N-0
B-46	1	4	9L11
B-47	1	4	7L75
B-48	1	4	7L73
B-49	1	4	7L68
B-50	1	4	7L10
B-51	1	4	7L32

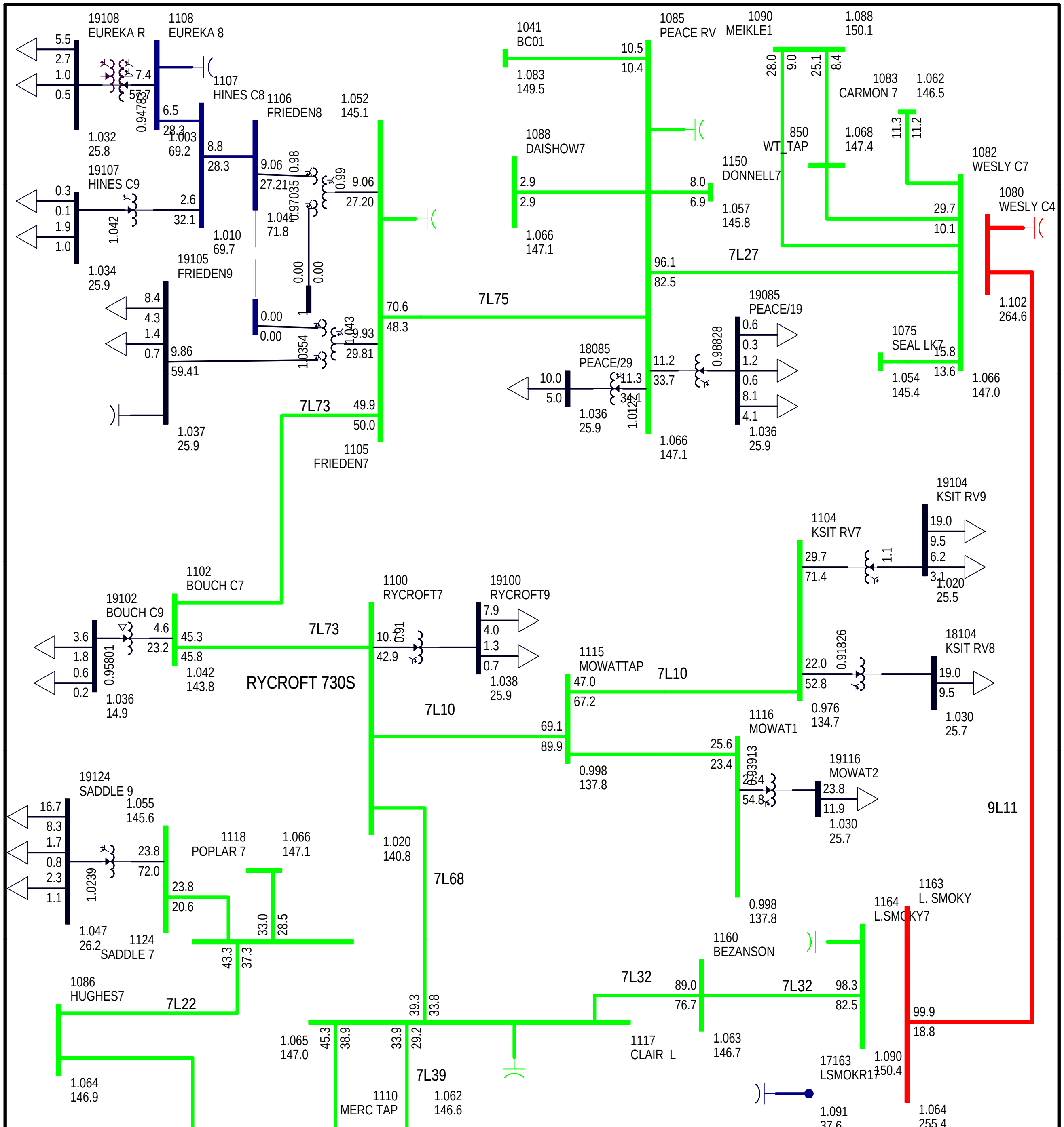
Figure	Transmission Option	Study Scenario	Contingency
B-52	1	4	7L22
B-53	1	4	7L46
B-54	1	4	7L45
B-55	1	4	7L39
B-56	1	4	7L84
B-57	1	4	7L03
B-58	1	4	7L69
B-59	1	5	N-0
B-60	1	5	9L11
B-61	1	5	7L75
B-62	1	5	7L73
B-63	1	5	7L68
B-64	1	5	7L10
B-65	1	5	7L32
B-66	1	5	7L22
B-67	1	5	7L46
B-68	1	5	7L45
B-69	1	5	7L39
B-70	1	5	7L84
B-71	1	5	7L03
B-72	1	5	7L69
B-73	2	2	N-0
B-74	2	2	9L11
B-75	2	2	7L75
B-76	2	2	7L73
B-77	2	2	7L68
B-78	2	2	7L10
B-79	2	2	7L32
B-80	2	2	7L22
B-81	2	2	7L46
B-82	2	2	7L45
B-83	2	2	7L39
B-84	2	2	7L84
B-85	2	2	7L03
B-86	2	2	7L69

Figure	Transmission Option	Study Scenario	Contingency
B-87	2	3	N-0
B-88	2	3	9L11
B-89	2	3	7L75
B-90	2	3	7L73
B-91	2	3	7L68
B-92	2	3	7L10
B-93	2	3	7L32
B-94	2	3	7L22
B-95	2	3	7L46
B-96	2	3	7L45
B-97	2	3	7L39
B-98	2	3	7L84
B-99	2	3	7L03
B-100	2	3	7L69
B-101	2	5A	N-0
B-102	2	5A	9L11
B-103	2	5A	7L75
B-104	2	5A	7L73
B-105	2	5A	7L68
B-106	2	4	N-0
B-107	2	4	9L11
B-108	2	4	7L75
B-109	2	4	7L73
B-110	2	4	7L68
B-111	2	4	7L10
B-112	2	4	7L32
B-113	2	4	7L22
B-114	2	4	7L46
B-115	2	4	7L45
B-116	2	4	7L39
B-117	2	4	7L84
B-118	2	4	7L03
B-119	2	4	7L69
B-120	2	5	N-0
B-121	2	5	9L11

Figure	Transmission Option	Study Scenario	Contingency
B-122	2	5	7L75
B-123	2	5	7L73
B-124	2	5	7L68
B-125	2	5	7L10
B-126	2	5	7L32
B-127	2	5	7L22
B-128	2	5	7L46
B-129	2	5	7L45
B-130	2	5	7L39
B-131	2	5	7L84
B-132	2	5	7L03
B-133	2	5	7L69
B-139	3	2	N-0
B-140	3	2	9L11
B-141	3	2	7L75
B-142	3	2	7L73
B-143	3	2	7L68
B-144	3	2	7L32
B-145	3	2	7L22
B-146	3	2	7L46
B-147	3	2	7L45
B-148	3	2	7L39
B-149	3	2	7L84
B-150	3	2	7L03
B-151	3	2	7L69
B-152	3	2	NewLine_Opt3
B-153	3	2	7L10_Opt3
B-154	3	3	N-0
B-155	3	3	9L11
B-156	3	3	7L75
B-157	3	3	7L73
B-158	3	3	7L68
B-159	3	3	7L32
B-160	3	3	7L22
B-161	3	3	7L46

Figure	Transmission Option	Study Scenario	Contingency
B-162	3	3	7L45
B-163	3	3	7L39
B-164	3	3	7L84
B-165	3	3	7L03
B-166	3	3	7L69
B-167	3	3	NewLine_Opt3
B-168	3	3	7L10_Opt3
B-169	3	5A	N-0
B-170	3	5A	9L11
B-171	3	5A	7L75
B-172	3	5A	7L73
B-173	3	5A	7L68
B-174	3	4	N-0
B-175	3	4	9L11
B-176	3	4	7L75
B-177	3	4	7L73
B-178	3	4	7L68
B-179	3	4	7L32
B-180	3	4	7L22
B-181	3	4	7L46
B-182	3	4	7L45
B-183	3	4	7L39
B-184	3	4	7L84
B-185	3	4	7L03
B-186	3	4	7L69
B-187	3	4	NewLine_Opt3
B-188	3	4	7L10_Opt3
B-189	3	5	N-0
B-190	3	5	9L11
B-191	3	5	7L75
B-192	3	5	7L73
B-193	3	5	7L68
B-194	3	5	7L32
B-195	3	5	7L22
B-196	3	5	7L46

Figure	Transmission Option	Study Scenario	Contingency
B-197	3	5	7L45
B-198	3	5	7L39
B-199	3	5	7L84
B-200	3	5	7L03
B-201	3	5	7L69
B-202	3	5	NewLine_Opt3
B-203	3	5	7L10_Opt3



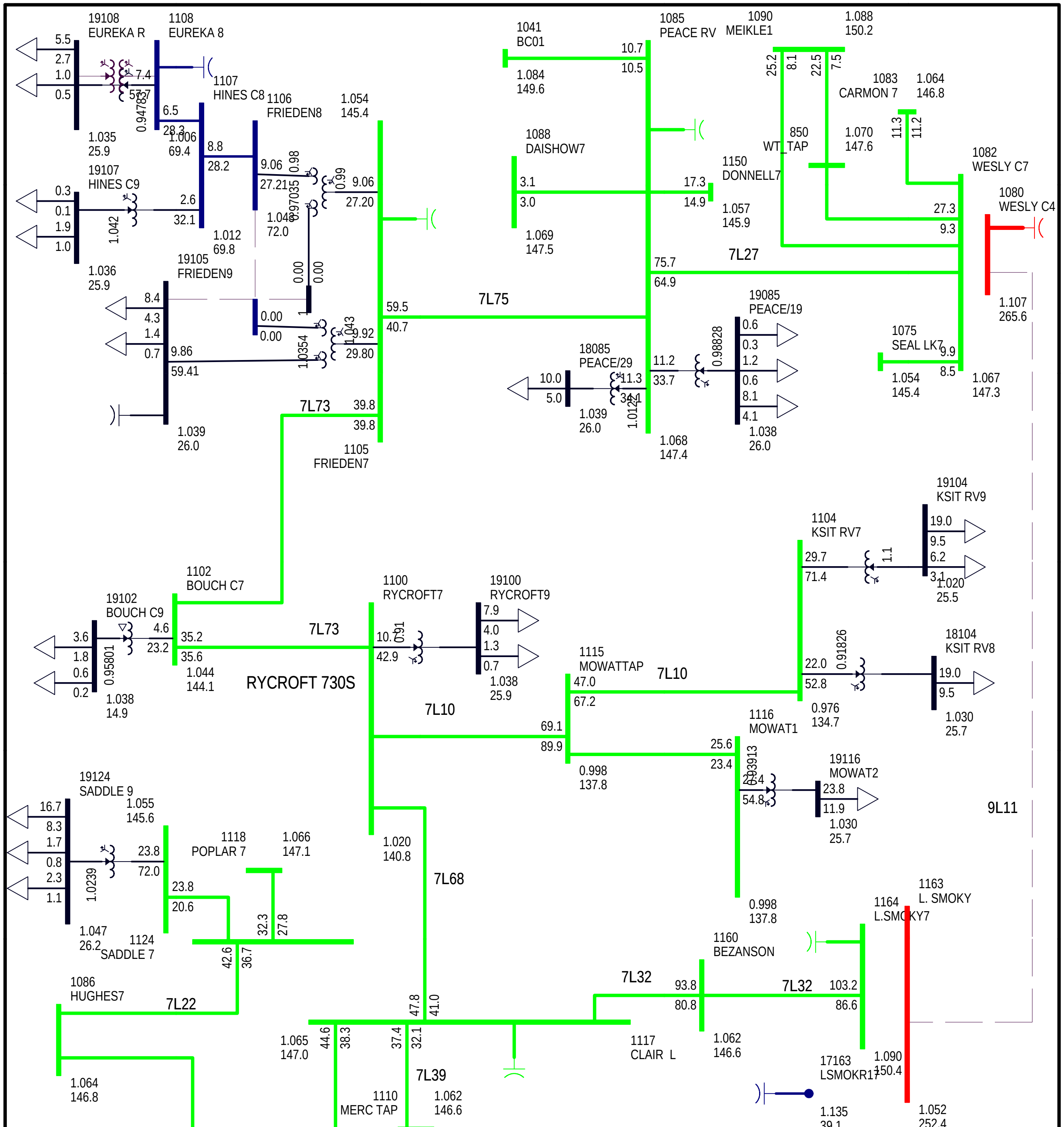
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 1C
BASE CASE(N-0)
FIG B-1
FRI, NOV 03 2017 10:59

Bus - Voltage (kV/pu)
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 100.0 MW

TOTAL FLOW INTO RYCROFT AREA: 108.1 MW



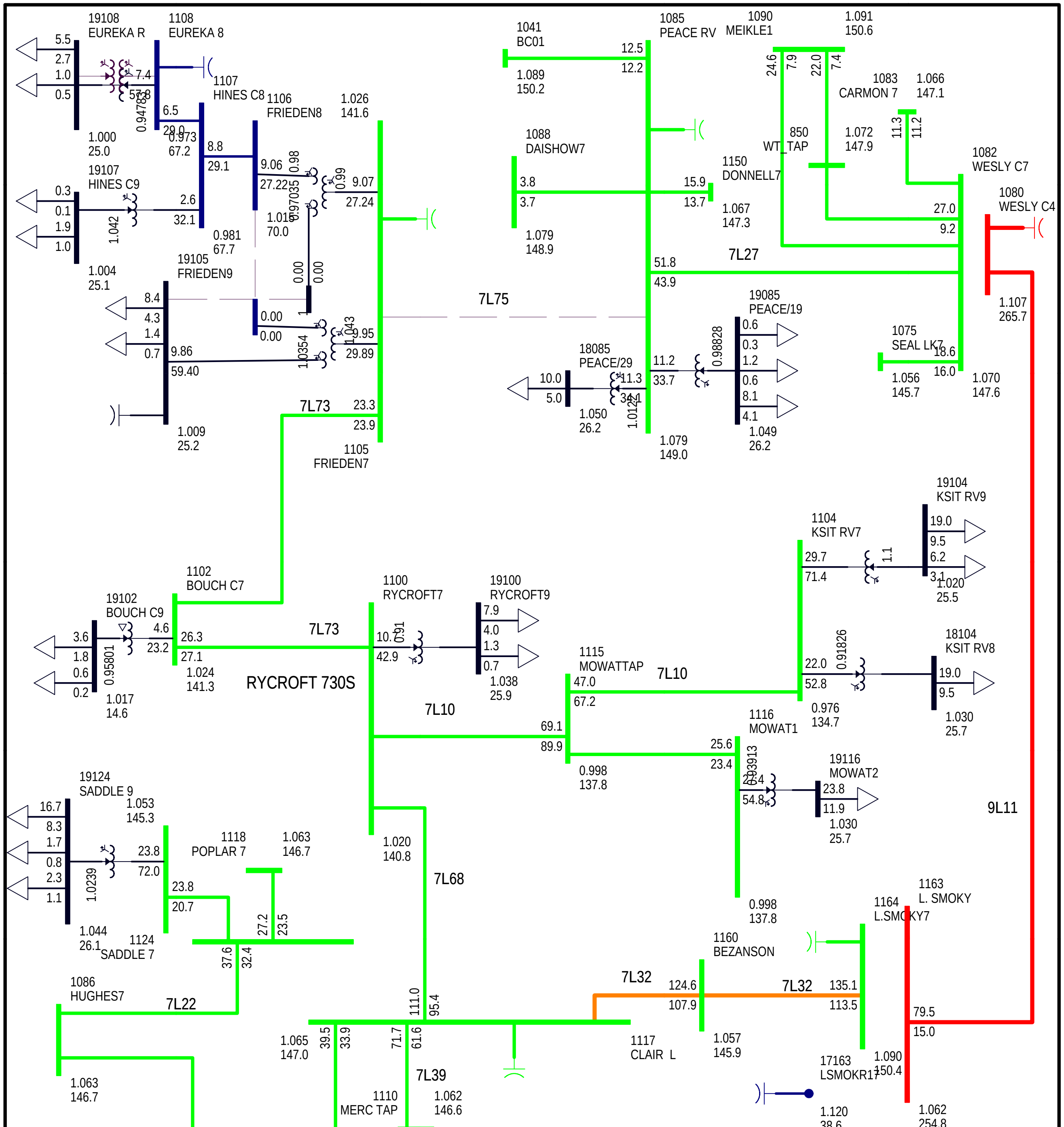
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 1C
9L11 (N-1)
FIG B-2
FRI, NOV 03 2017 10:59

Bus - Voltage (kV/pu)
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 100.0 MW

TOTAL FLOW INTO RYCROFT AREA: 107.1 MW



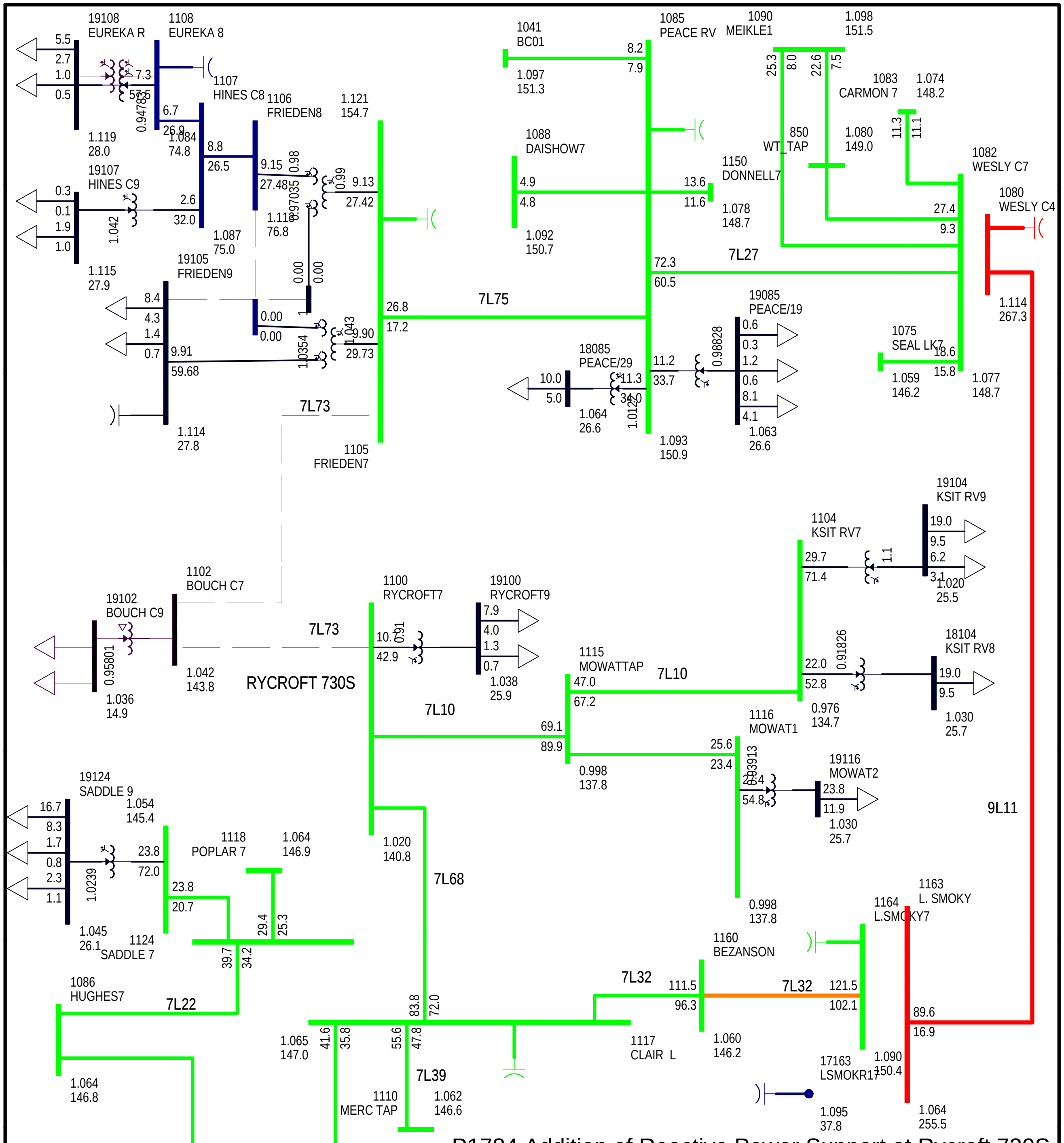
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 1C
7L75 (N-1)
FIG B-3
FRI, NOV 03 2017 10:59

Bus - Voltage (kV/pu)
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 100.0 MW

TOTAL FLOW INTO RYCROFT AREA: 110.5 MW



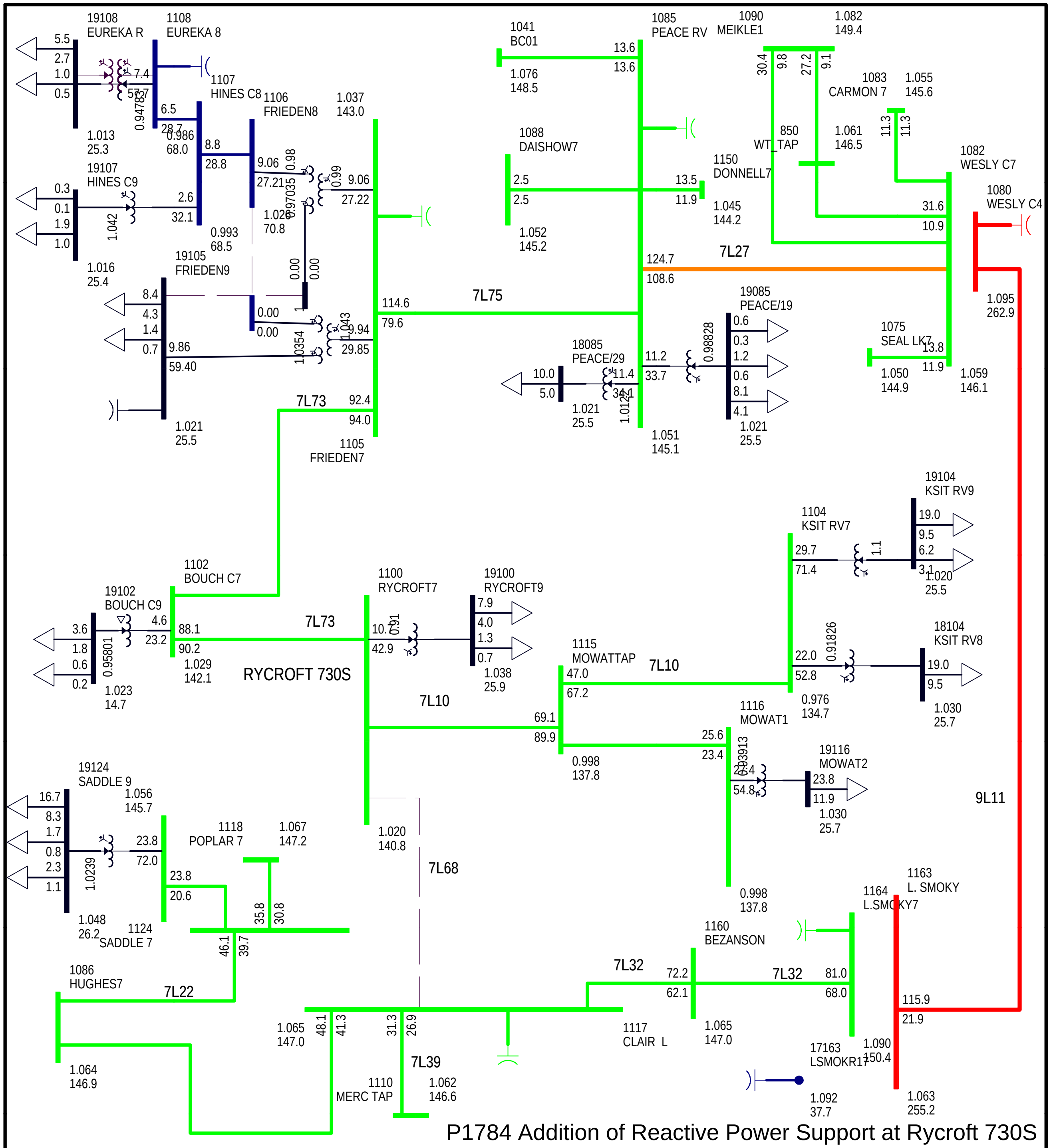
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 1C
7L73 (N-1)
FIG B-4
FRI, NOV 03 2017 10:59

Bus - Voltage (kV/pu)
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 95.8 MW

TOTAL FLOW INTO RYCROFT AREA: 103.1 MW



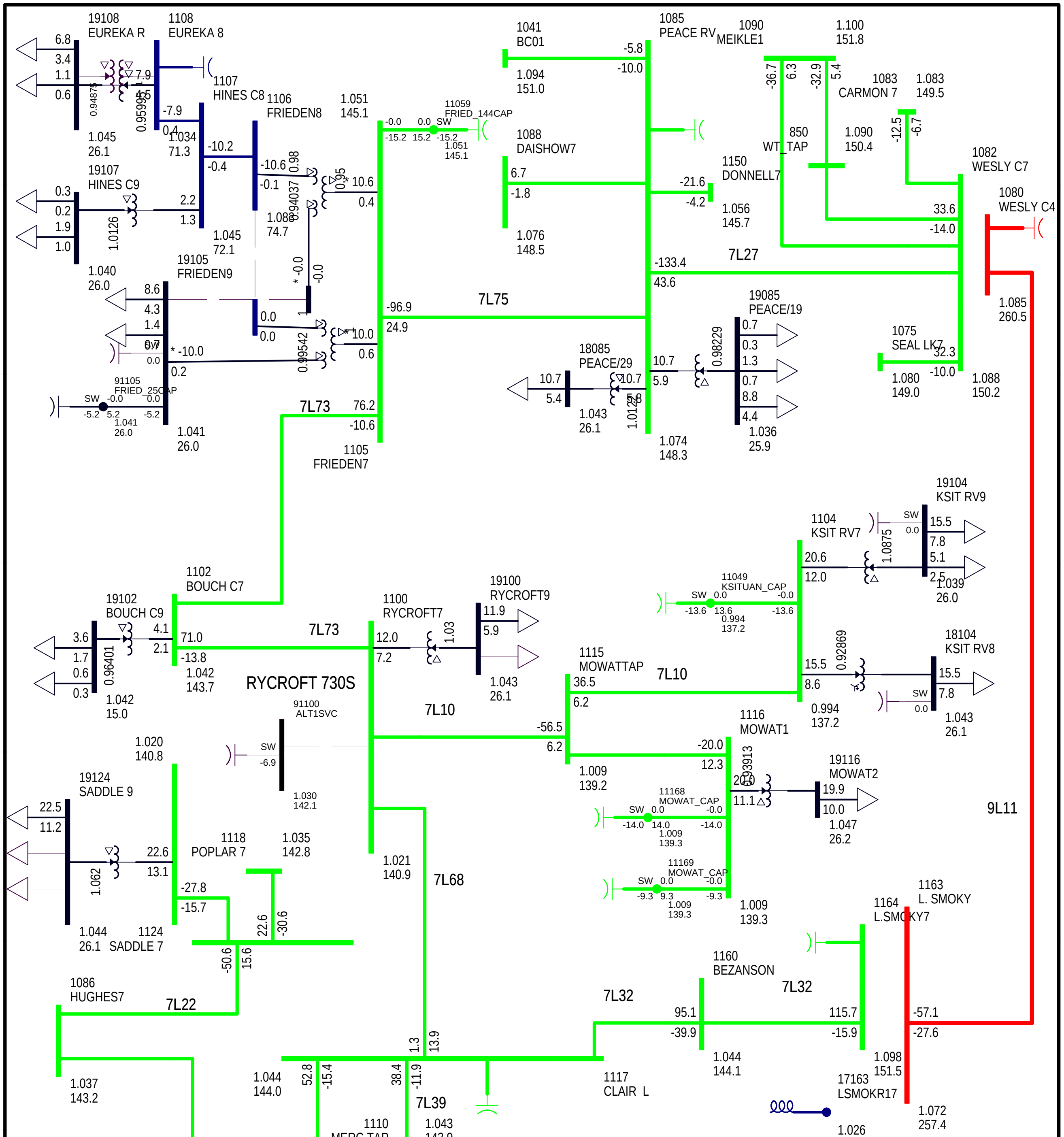
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 1C
7L68 (N-1)
FIG B-5
FRI, NOV 03 2017 10:59

Bus - Voltage (kV/pu)
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 100.0 MW

TOTAL FLOW INTO RYCROFT AREA: 116.2 MW



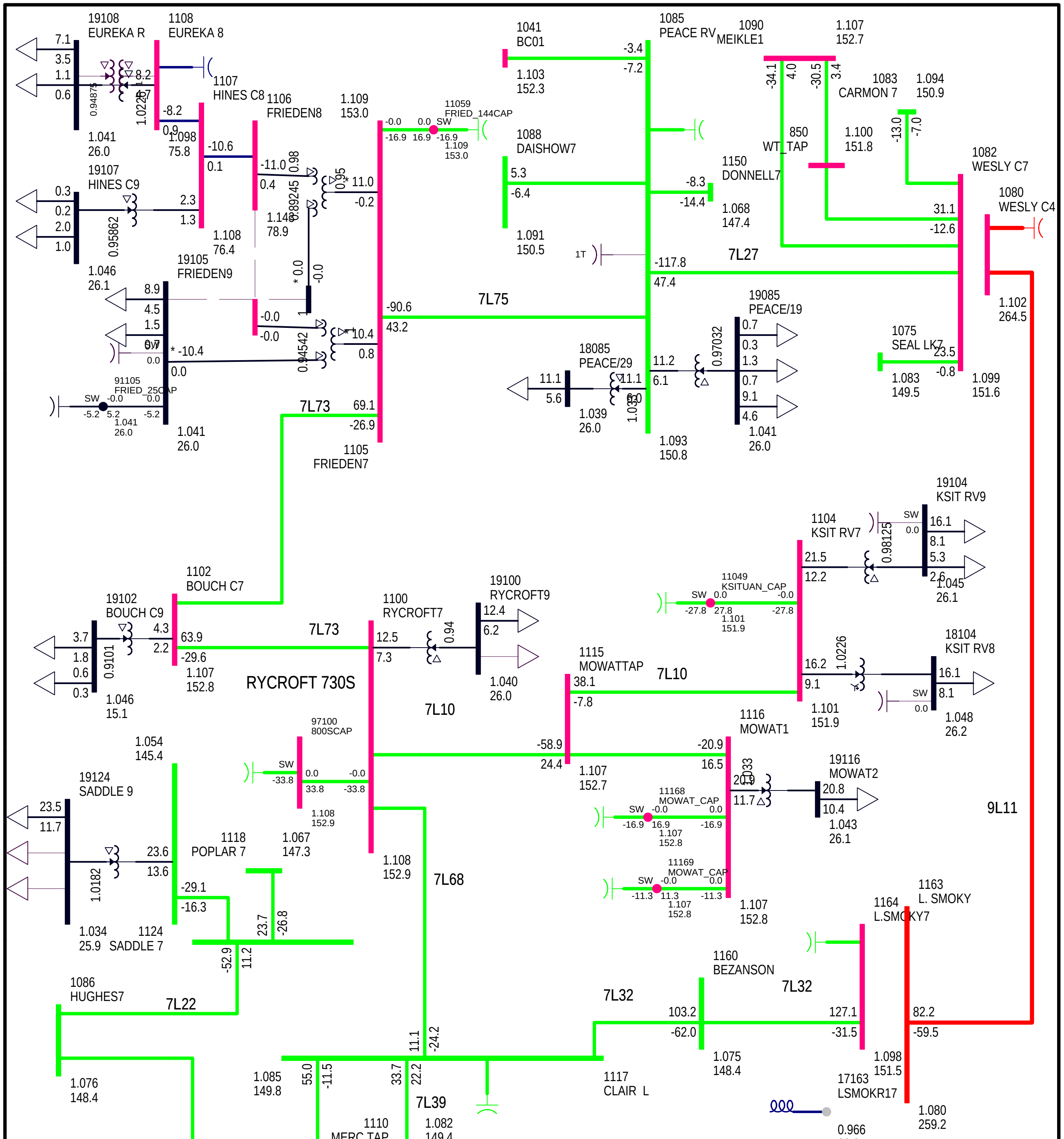
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 4A
BASE CASE(N-0)
FIG B-6
FRI, NOV 03 2017 11:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 92.0 MW

TOTAL FLOW INTO RYCROFT AREA: 103.8 MW



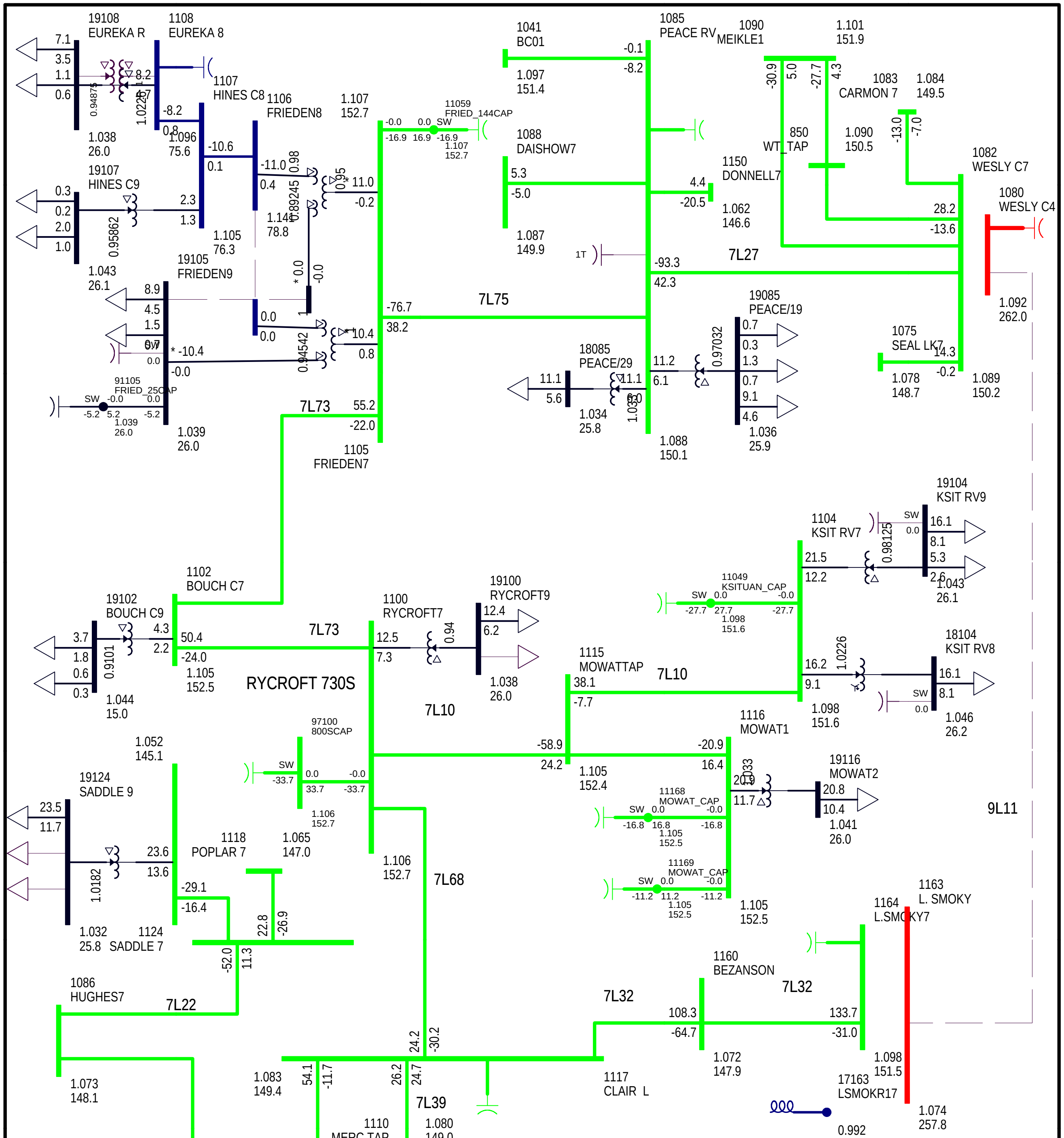
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 4B
BASE CASE(N-0)
FIG B-7
FRI, NOV 03 2017 11:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.094OV 0.992UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 106.8 MW



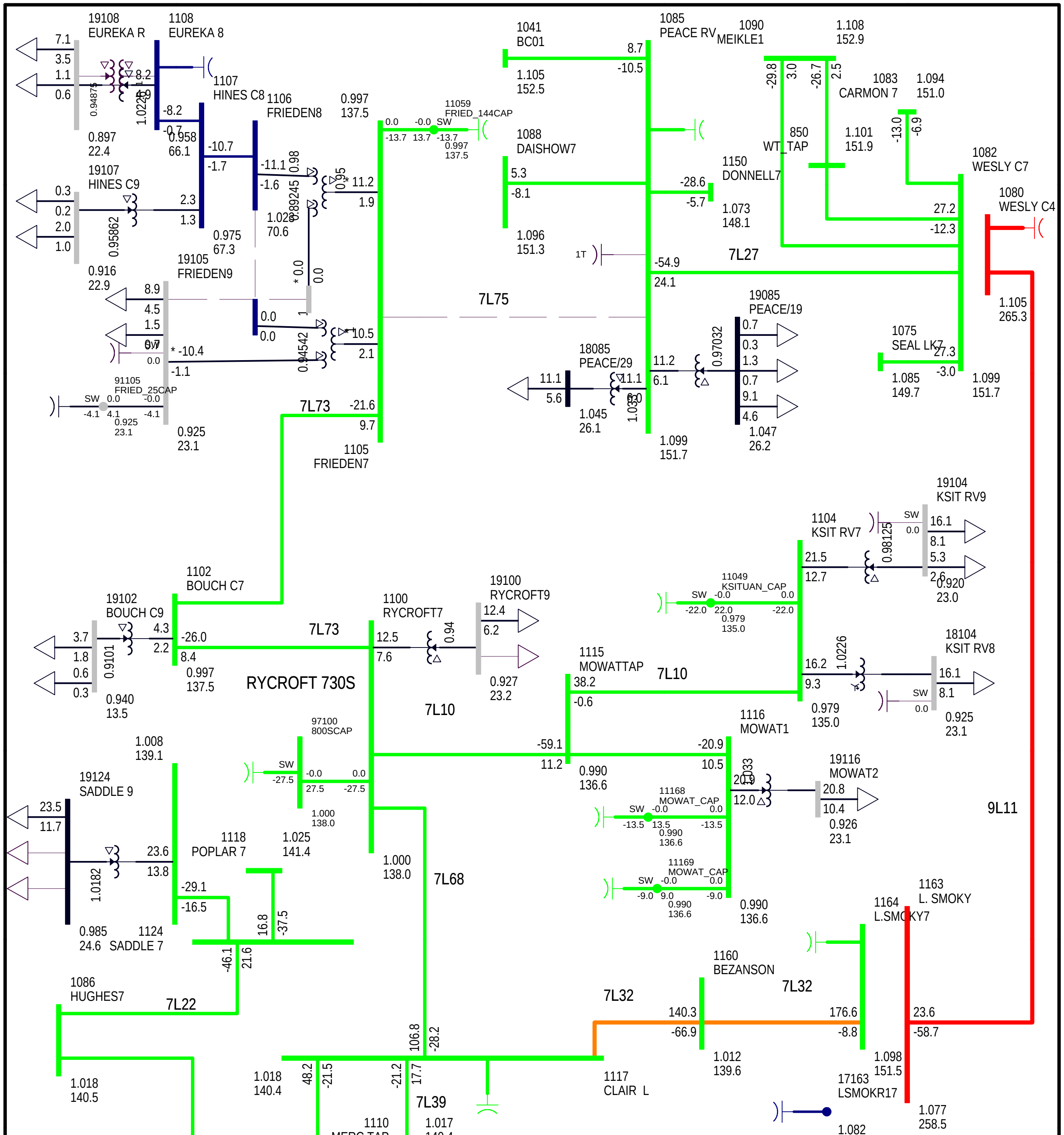
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 4B
9L11 (N-1)
FIG B-8
FRI, NOV 03 2017 11:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 104.7 MW



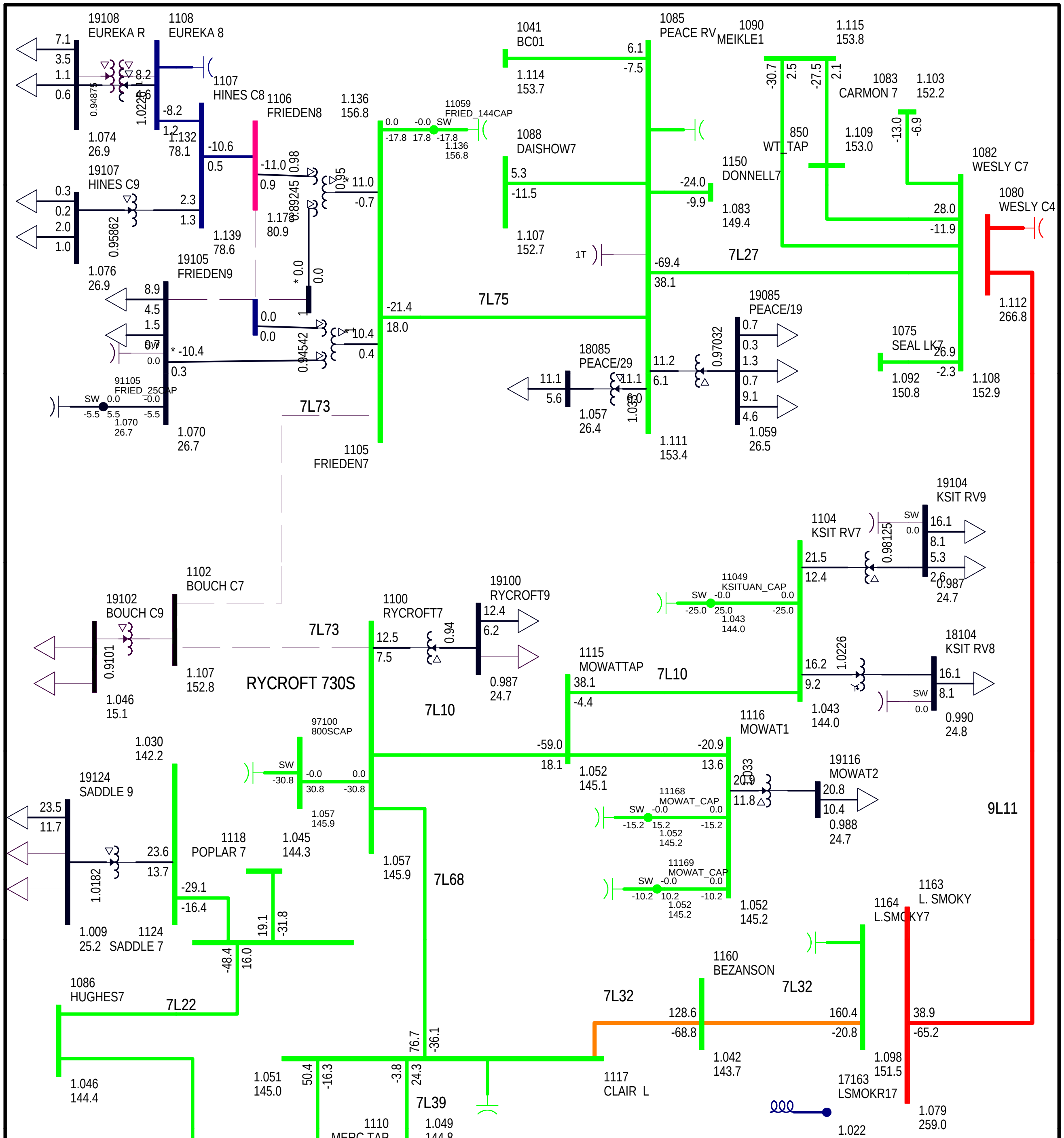
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 4B
7L75 (N-1)
FIG B-9
FRI, NOV 03 2017 11:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 106.8 MW



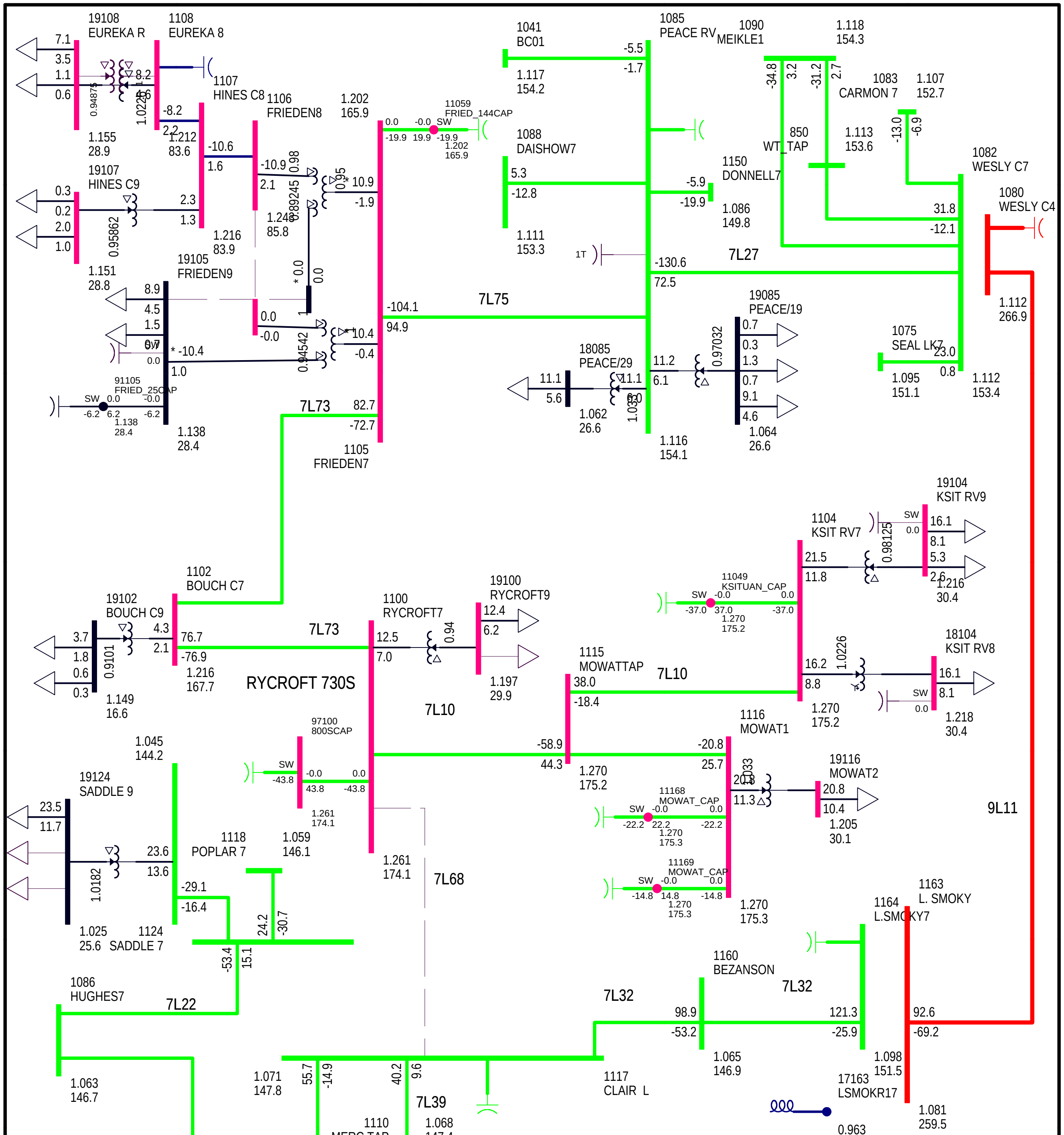
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 4B
7L73 (N-1)
FIG B-10
FRI, NOV 03 2017 11:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 91.7 MW

TOTAL FLOW INTO RYCROFT AREA: 98.5 MW



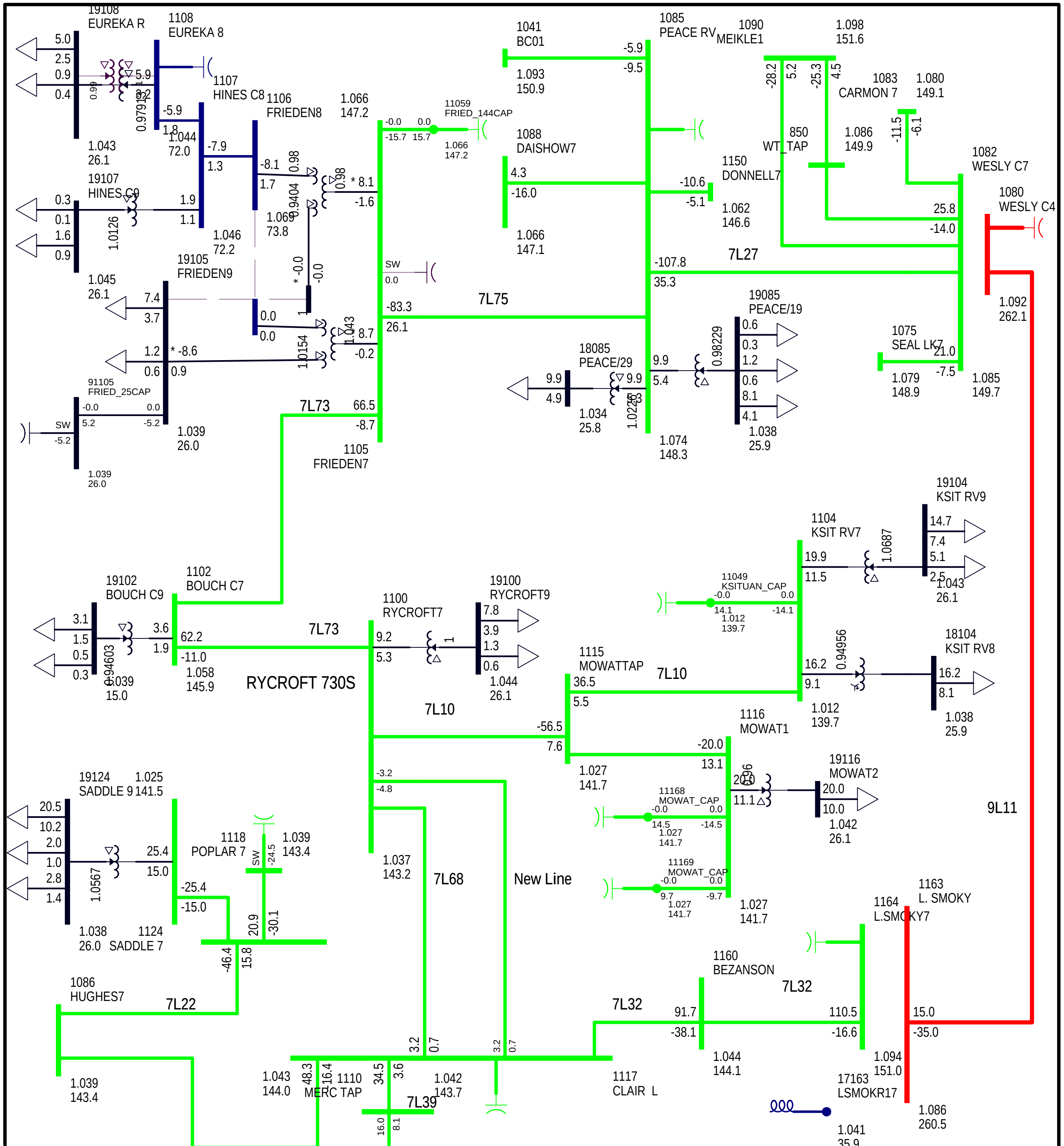
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784: SCENARIO 4B
7L68 (N-1)
FIG B-11
FRI, NOV 03 2017 11:53

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 112.9 MW



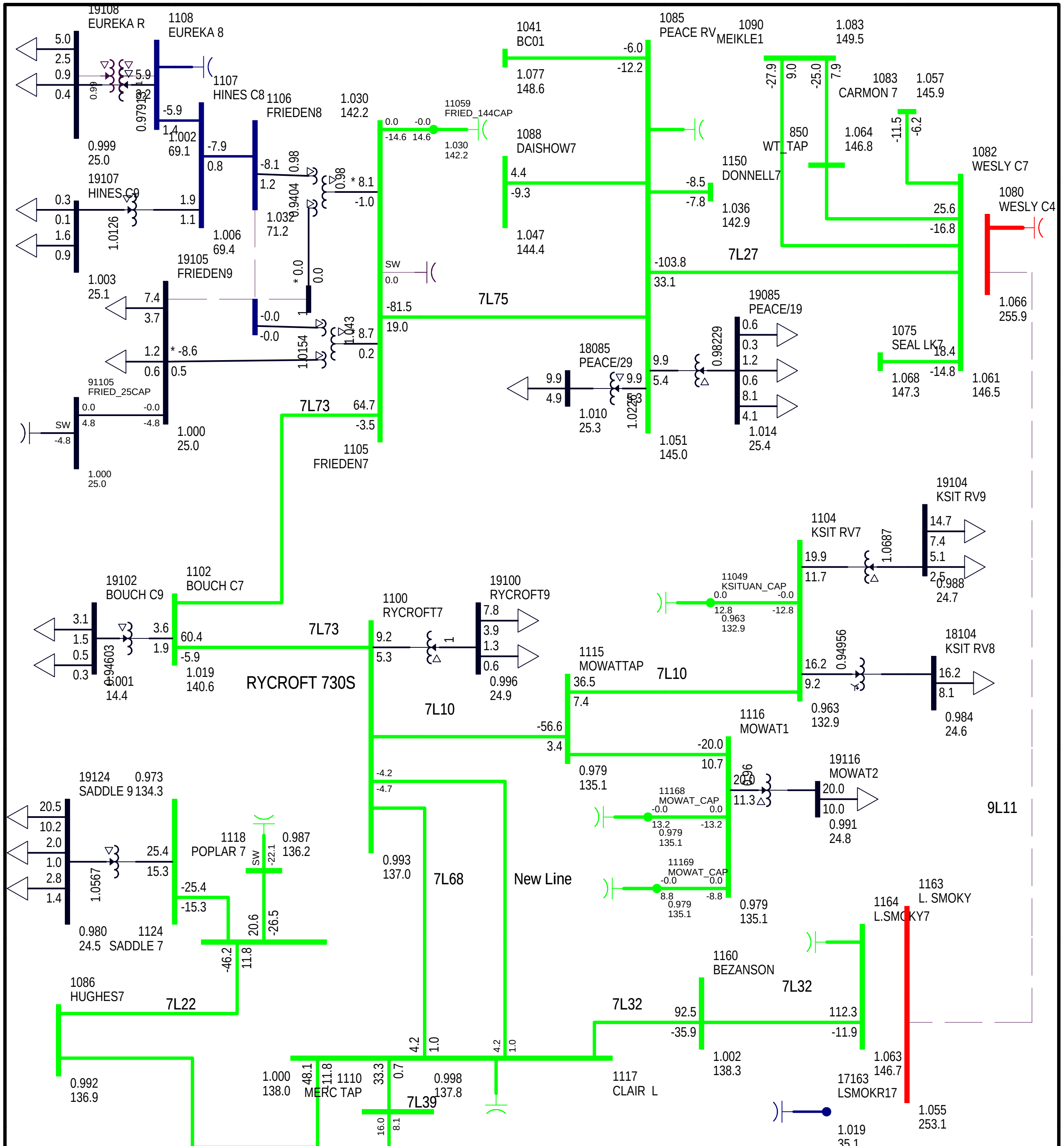
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 1E
BASE CASE(N-0)
FIG B-12
TUE, NOV 07 2017 10:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 85.0 MW

TOTAL FLOW INTO RYCROFT AREA: 90.7 MW



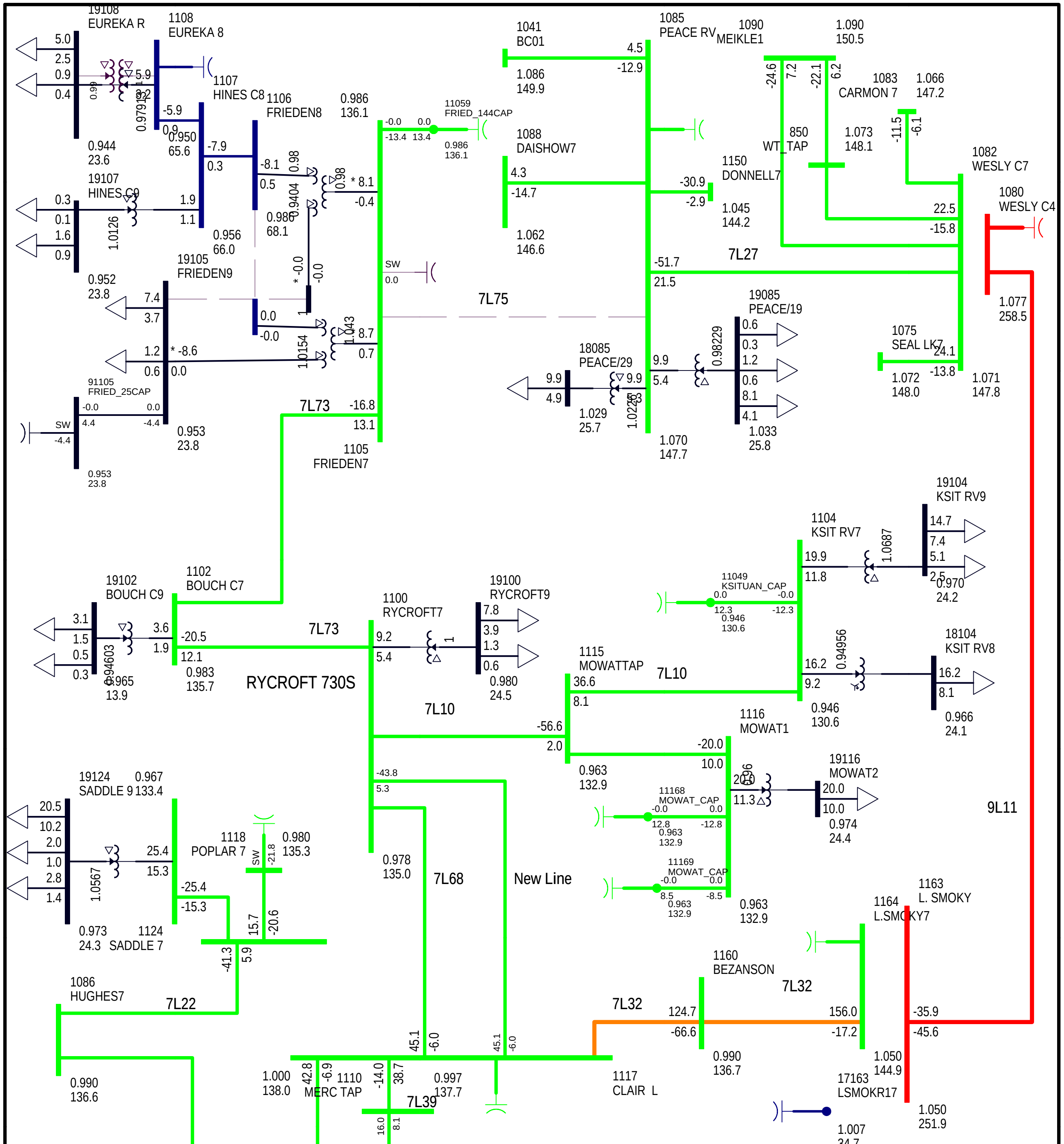
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 1E
9L11 (N-1)
FIG B-13
TUE, NOV 07 2017 10:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 85.0 MW

TOTAL FLOW INTO RYCROFT AREA: 89.8 MW



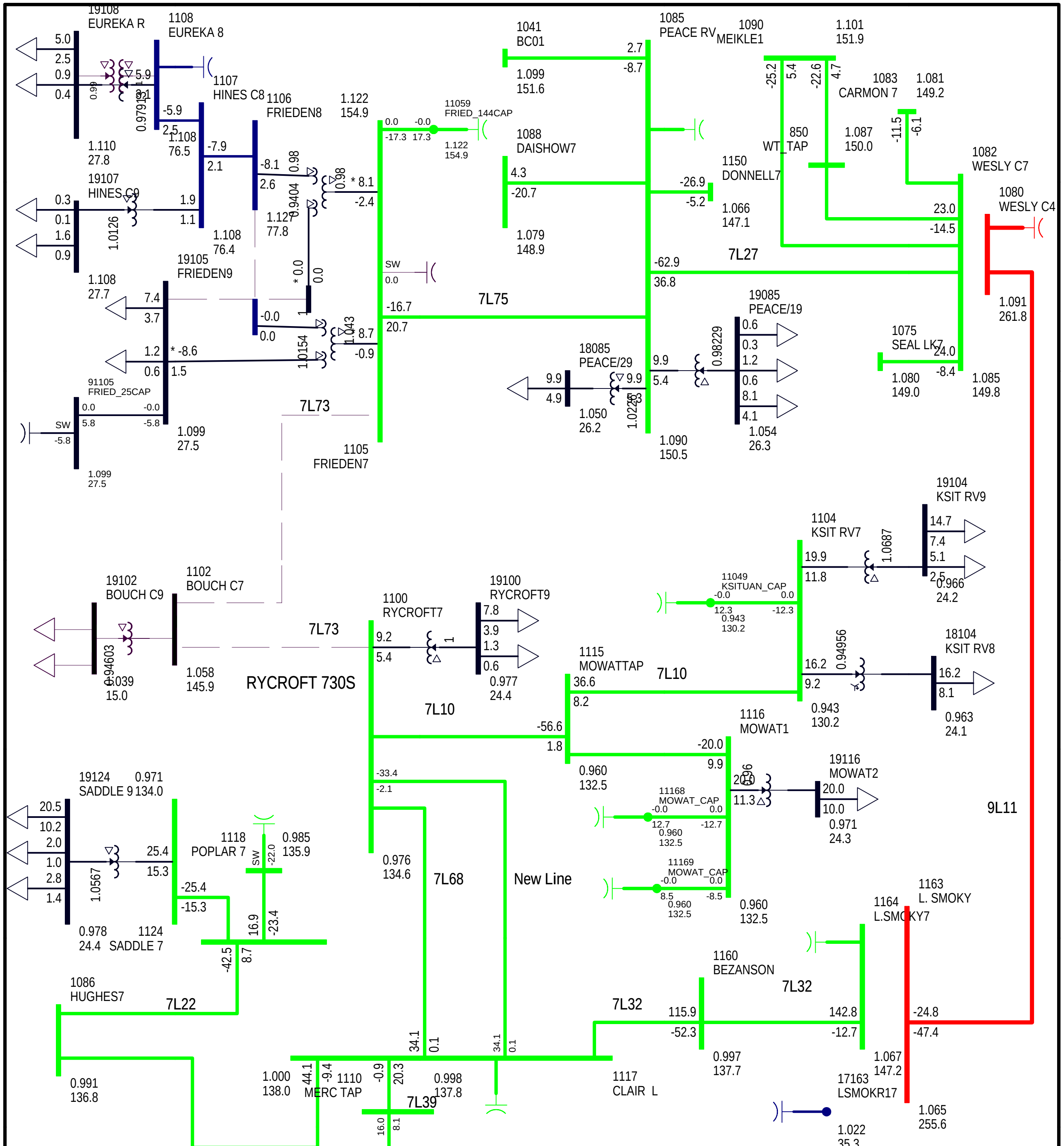
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 1E
7L75 (N-1)
FIG B-14
TUE, NOV 07 2017 10:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 85.0 MW

TOTAL FLOW INTO RYCROFT AREA: 45.1 MW



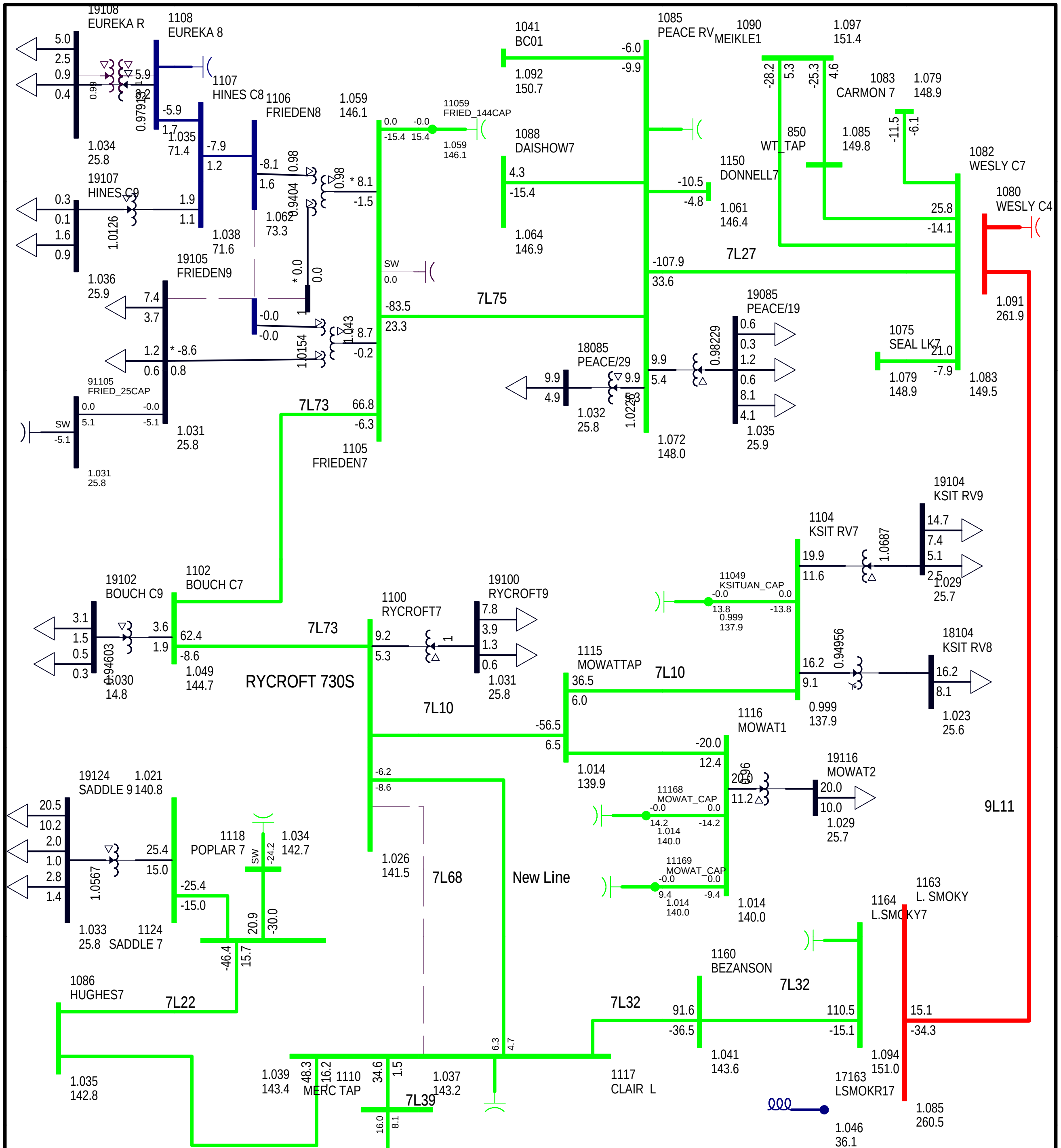
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 1E
7L73 (N-1)
FIG B-15
TUE, NOV 07 2017 10:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 81.5 MW

TOTAL FLOW INTO RYCROFT AREA: 51.3 MW



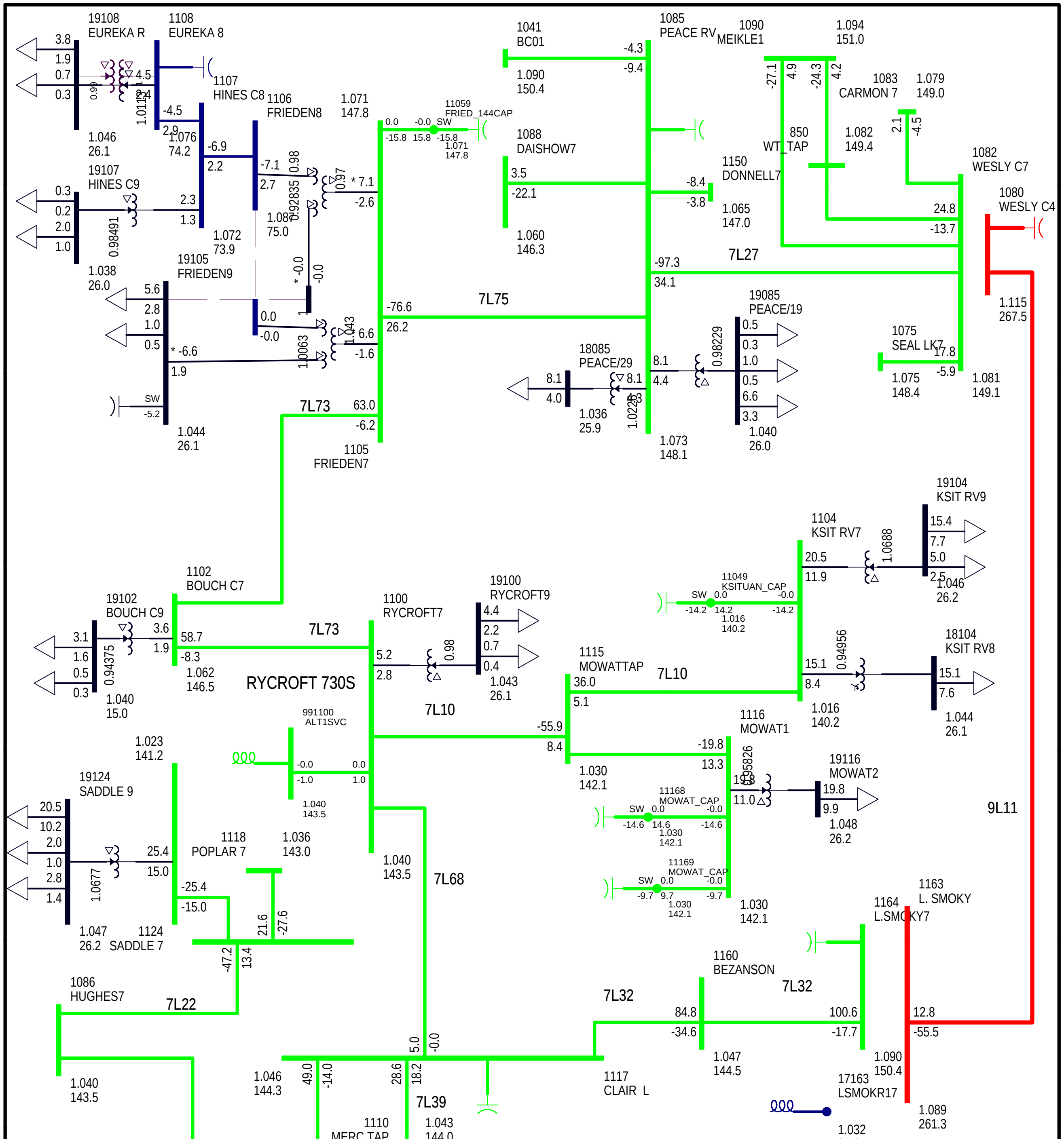
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 1E
7L68 (N-1)
FIG B-16
TUE, NOV 07 2017 10:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 85.0 MW

TOTAL FLOW INTO RYCROFT AREA: 87.7 MW



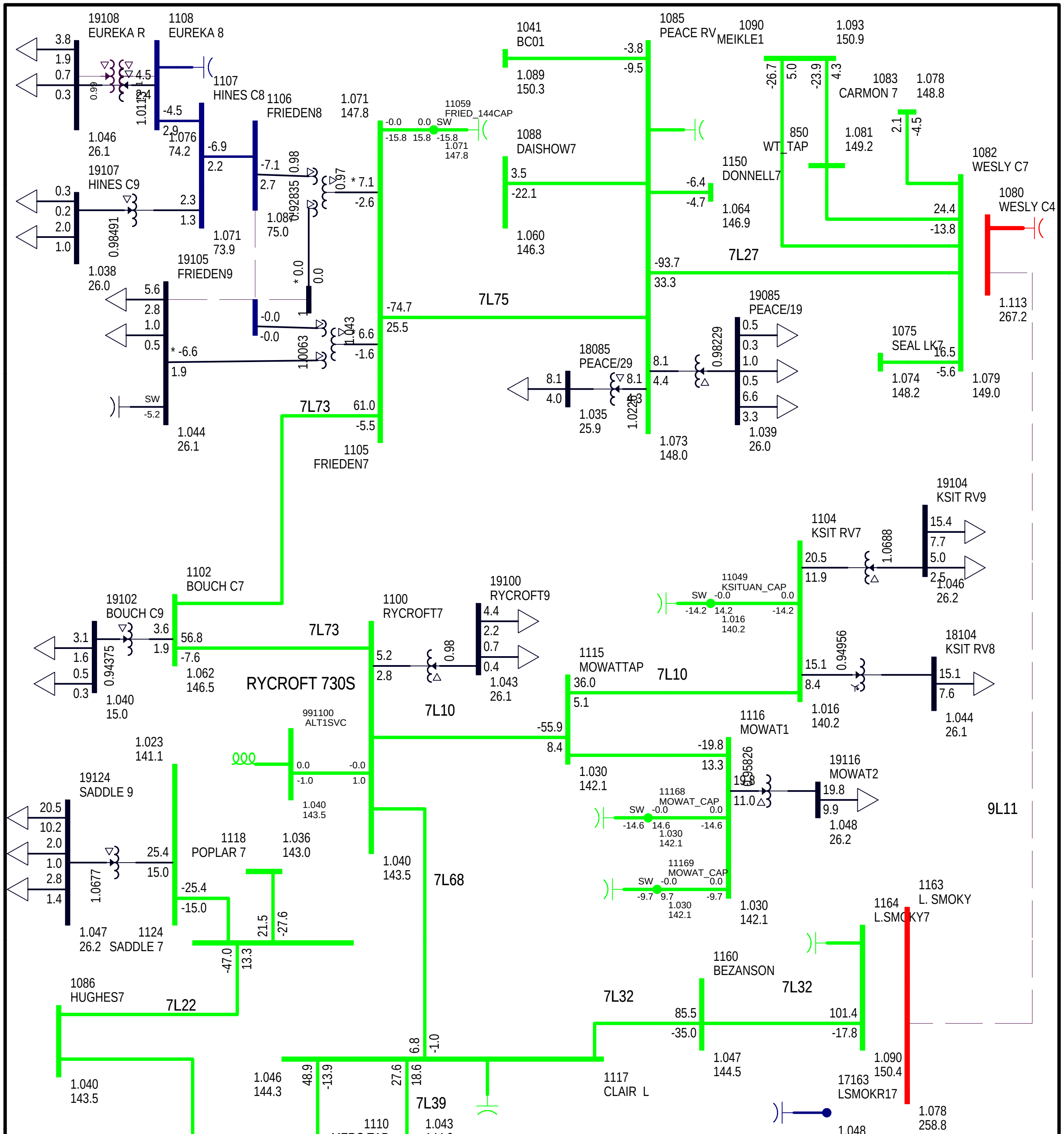
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
BASE CASE(N-0)
FIG B-17
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.3 MW



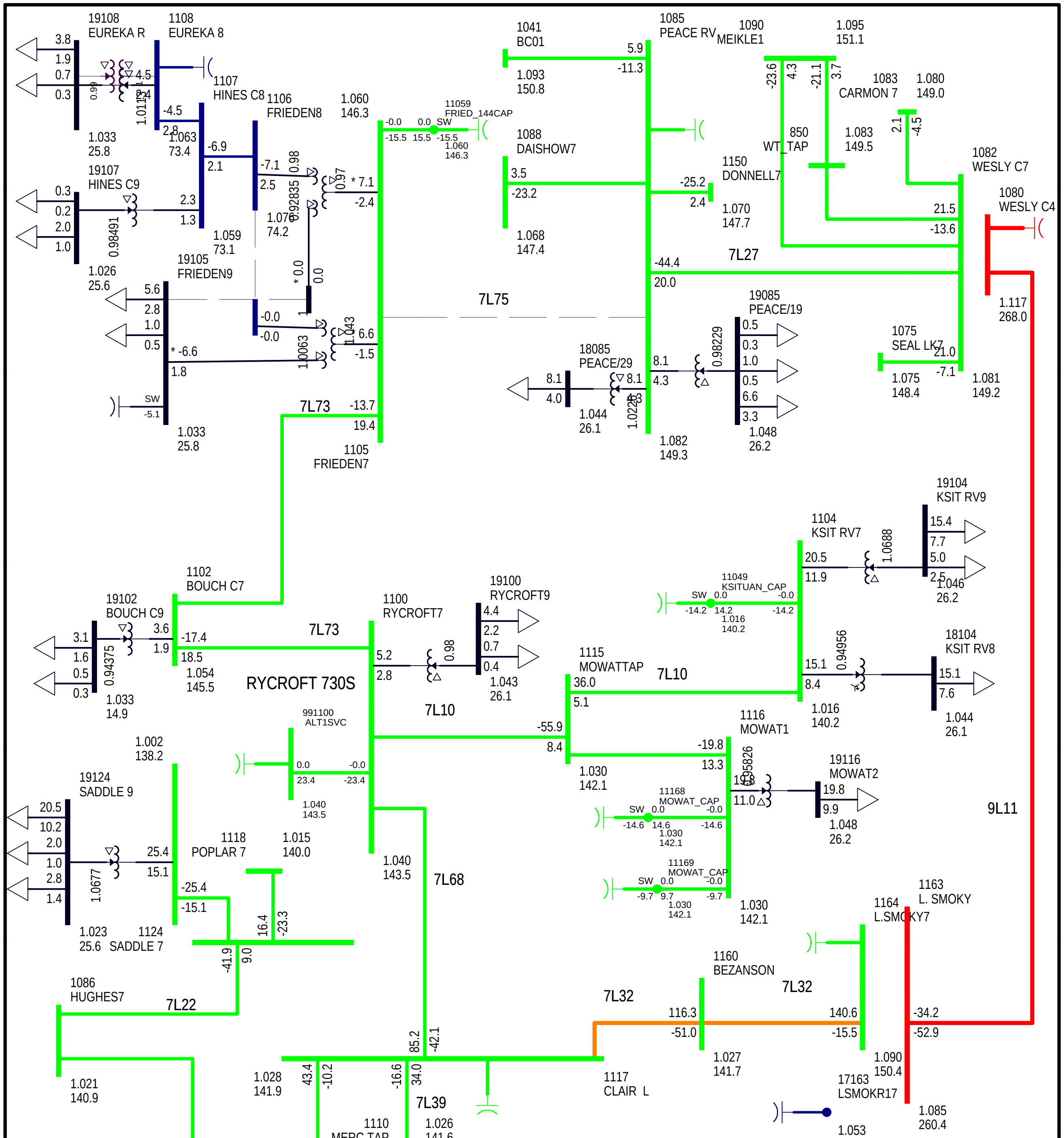
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
9L11 (N-1)
FIG B-18
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 84.9 MW



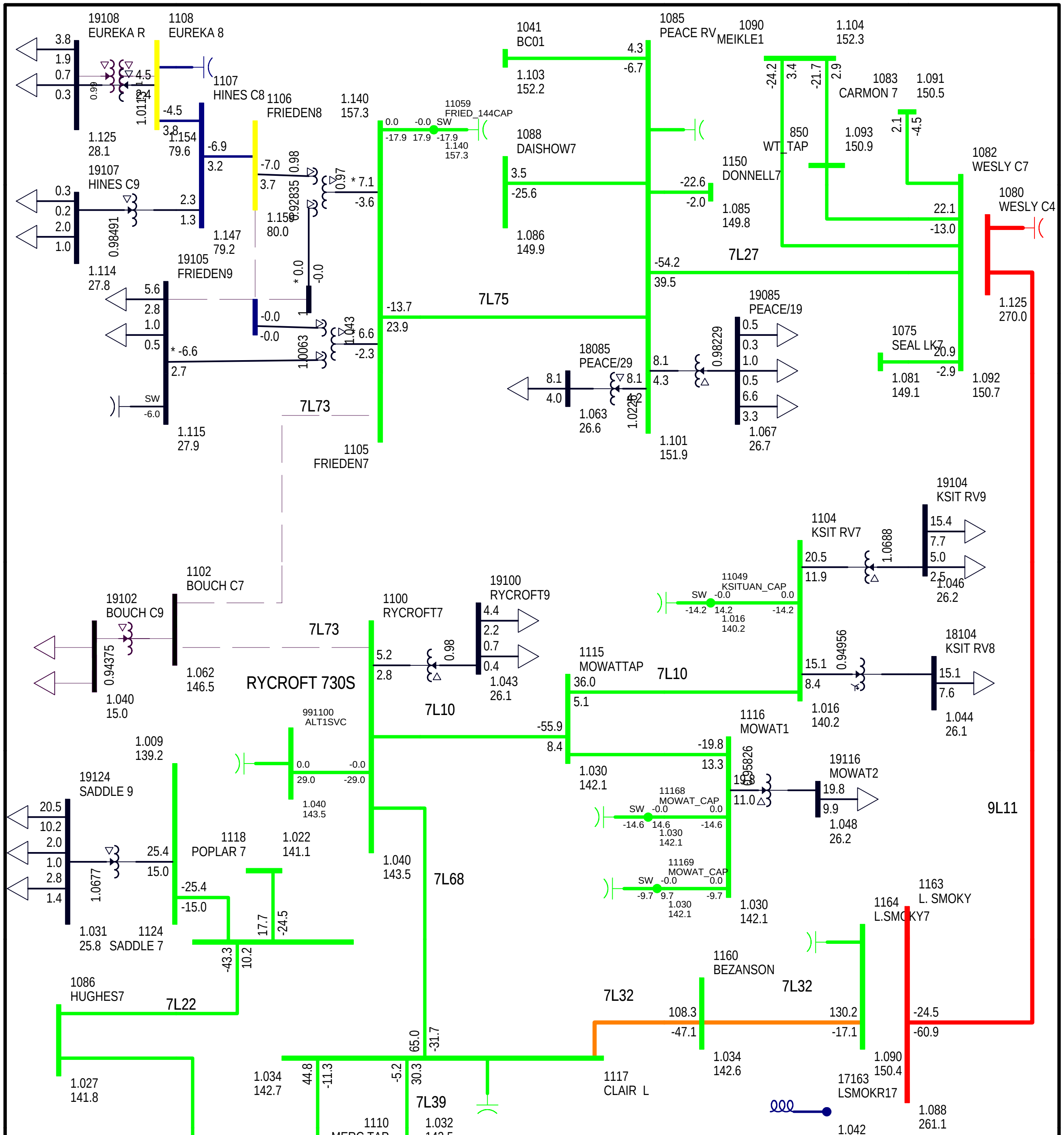
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L75 (N-1)
FIG B-19
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.2 MW



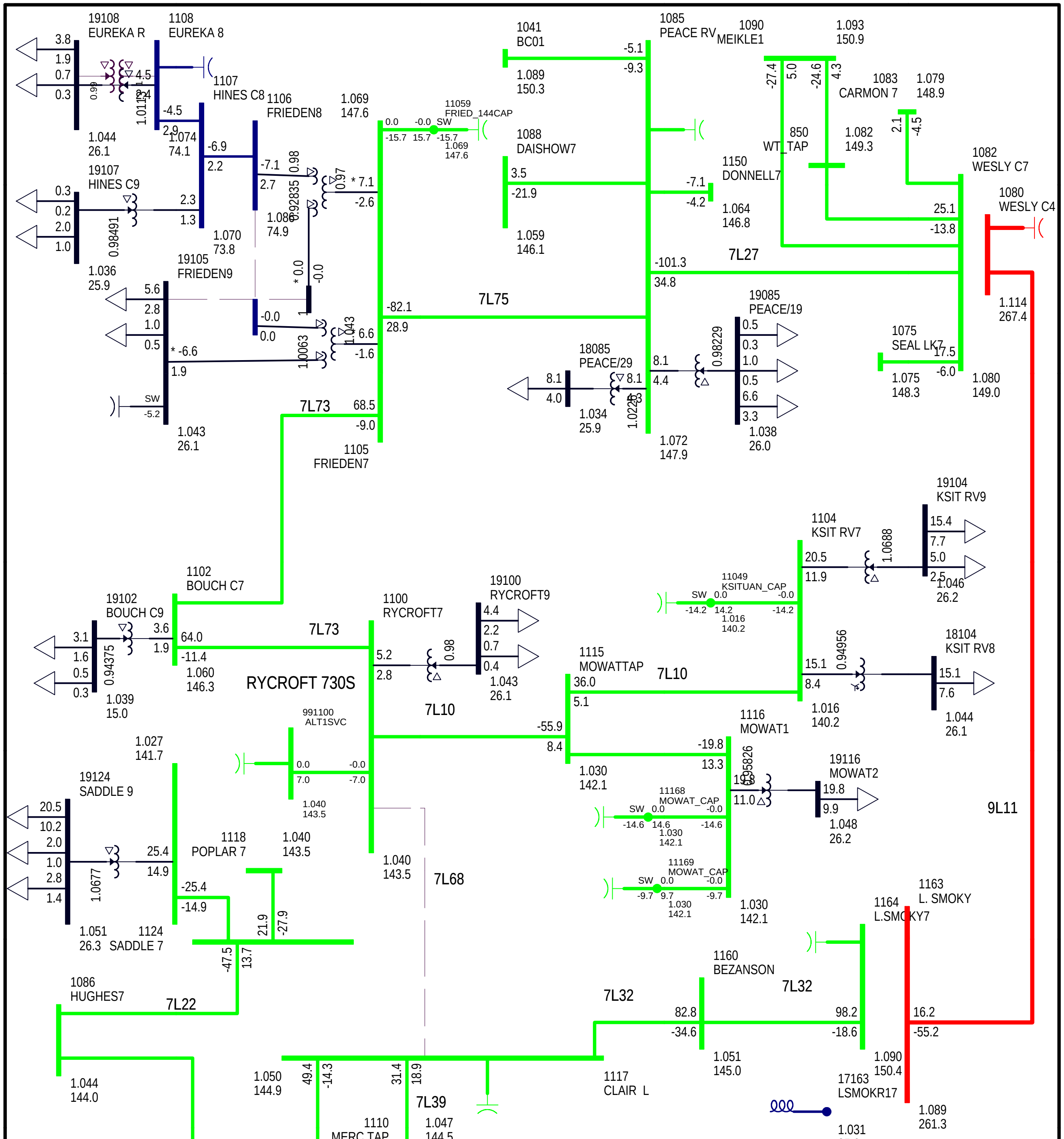
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L73 (N-1)
FIG B-20
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 73.9 MW

TOTAL FLOW INTO RYCROFT AREA: 79.1 MW



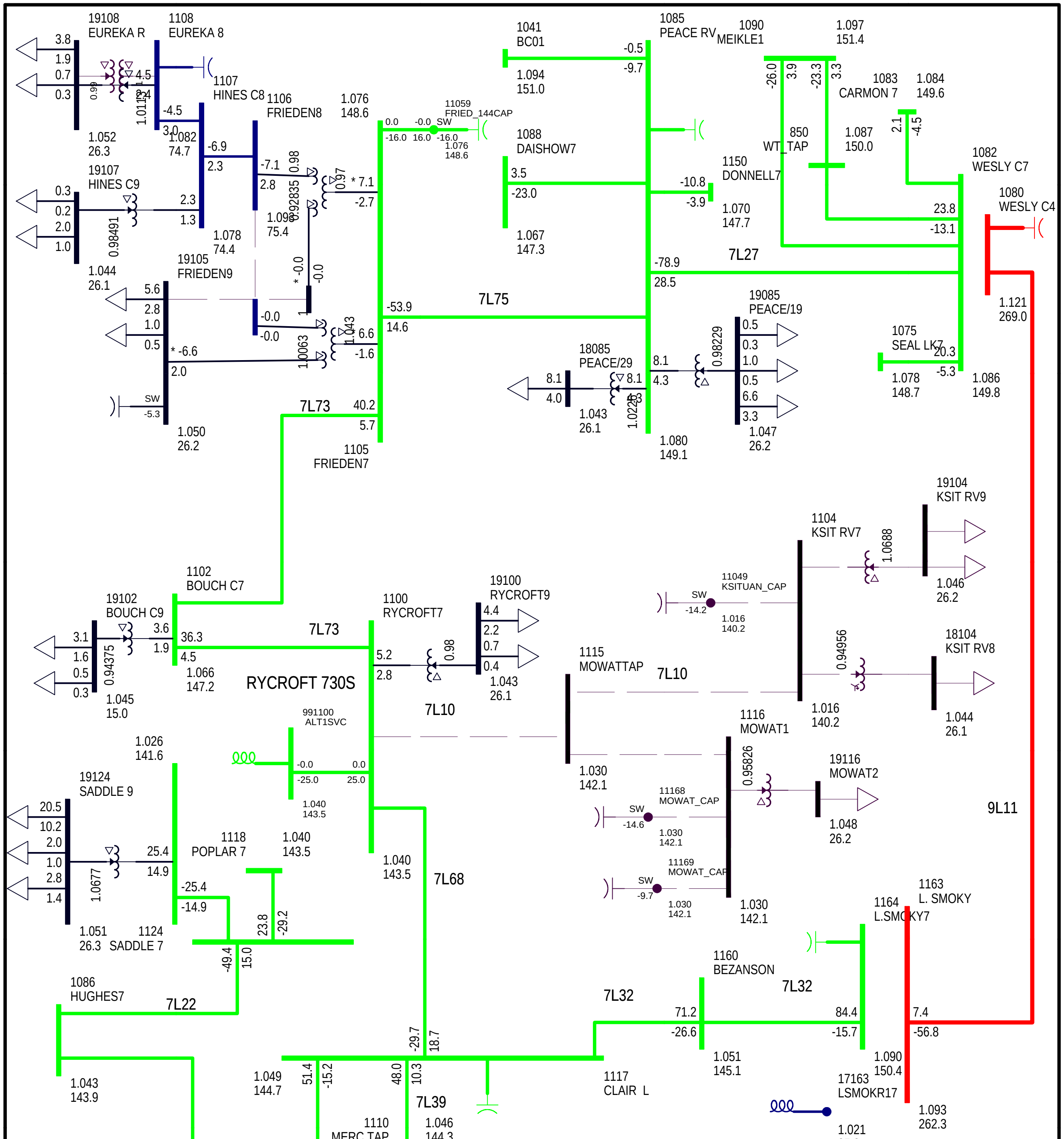
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L68 (N-1)
FIG B-21
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 86.3 MW



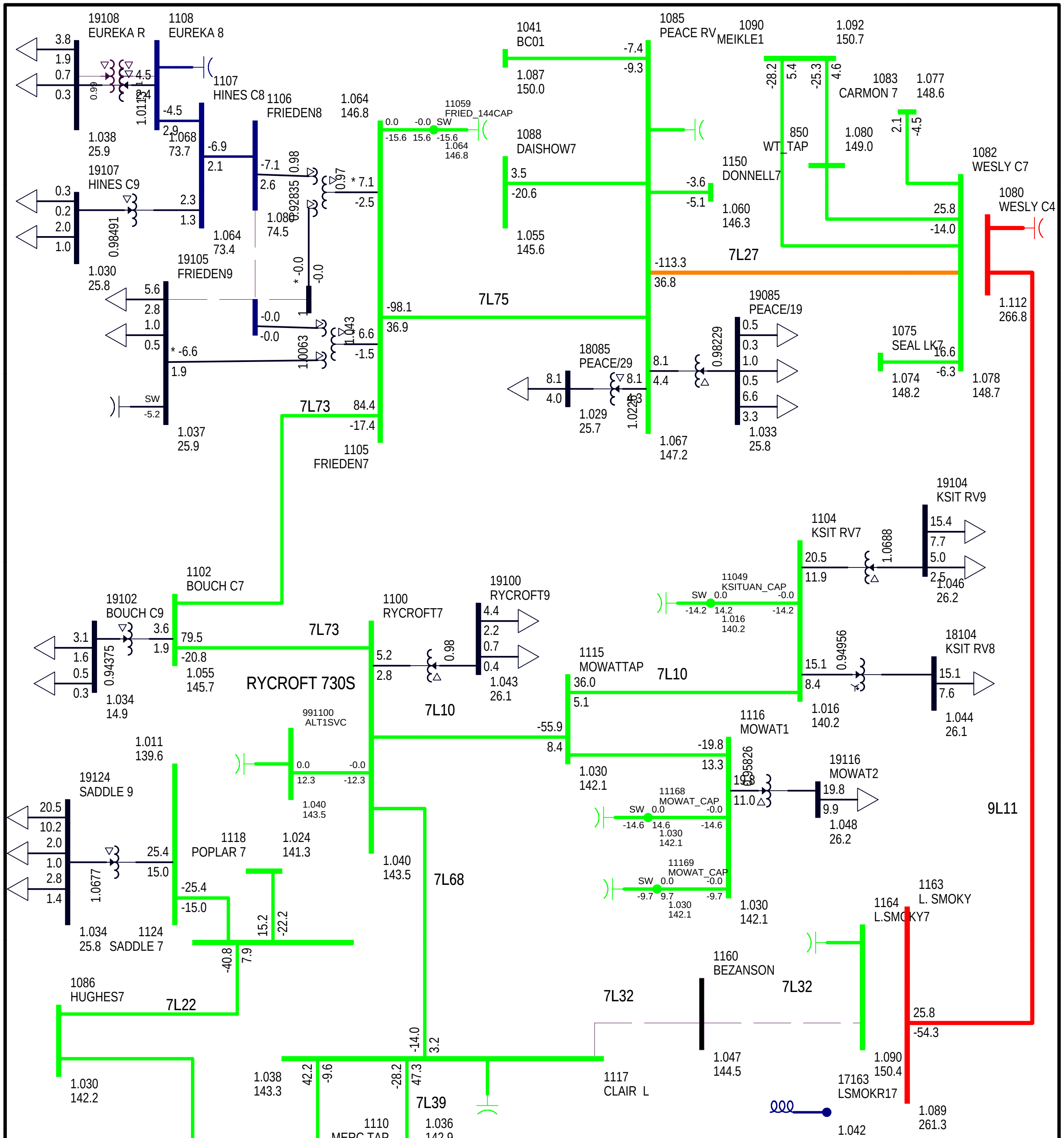
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L10 (N-1)
FIG B-22
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 22.2 MW

TOTAL FLOW INTO RYCROFT AREA: 25.9 MW



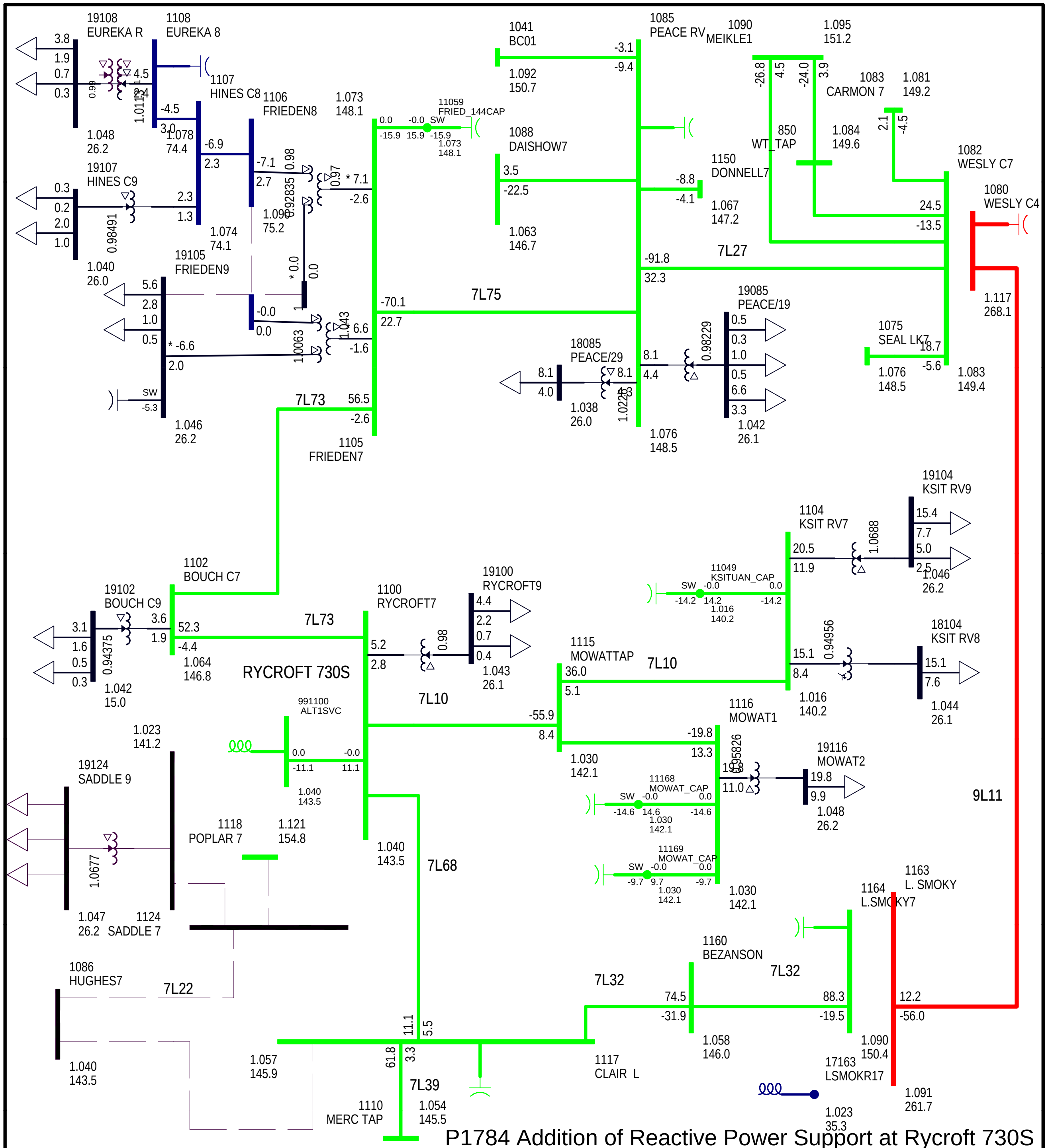
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L32 (N-1)
FIG B-23
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 90.2 MW

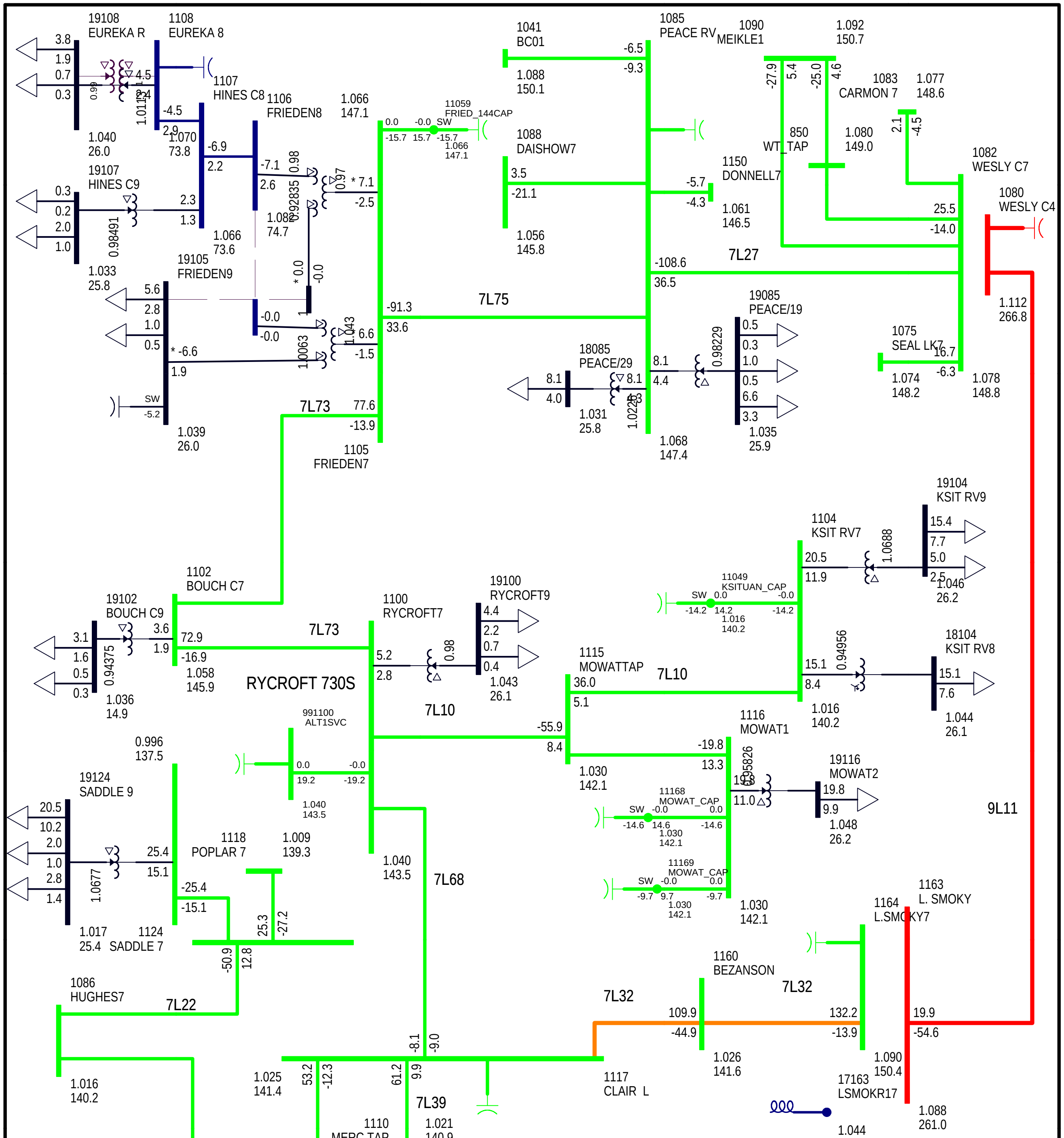


PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L22 (N-1)
FIG B-24
FRI, NOV 03 2017 16:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 84.2 MW



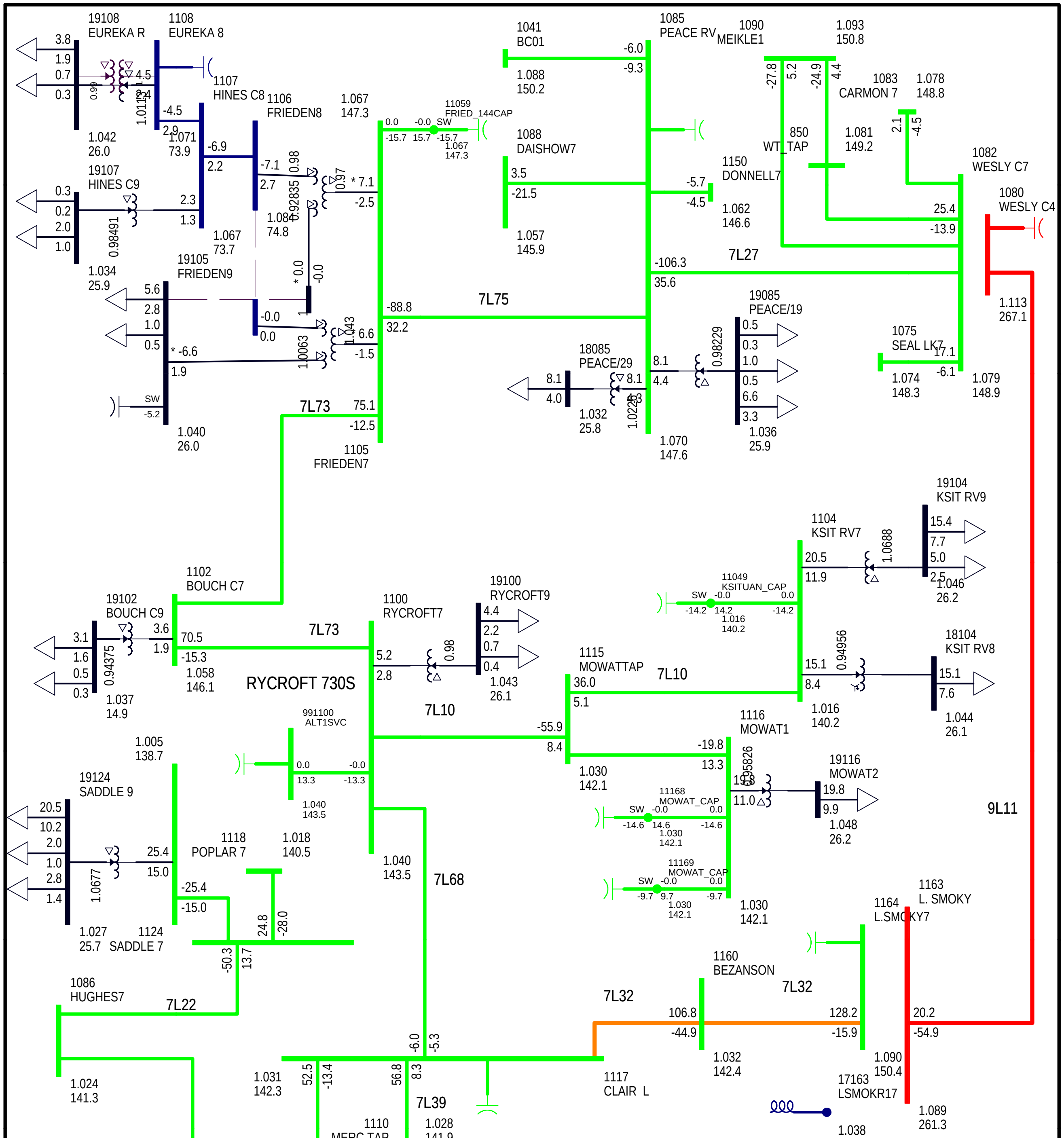
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L46 (N-1)
FIG B-25
FRI, NOV 03 2017 16:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 88.4 MW



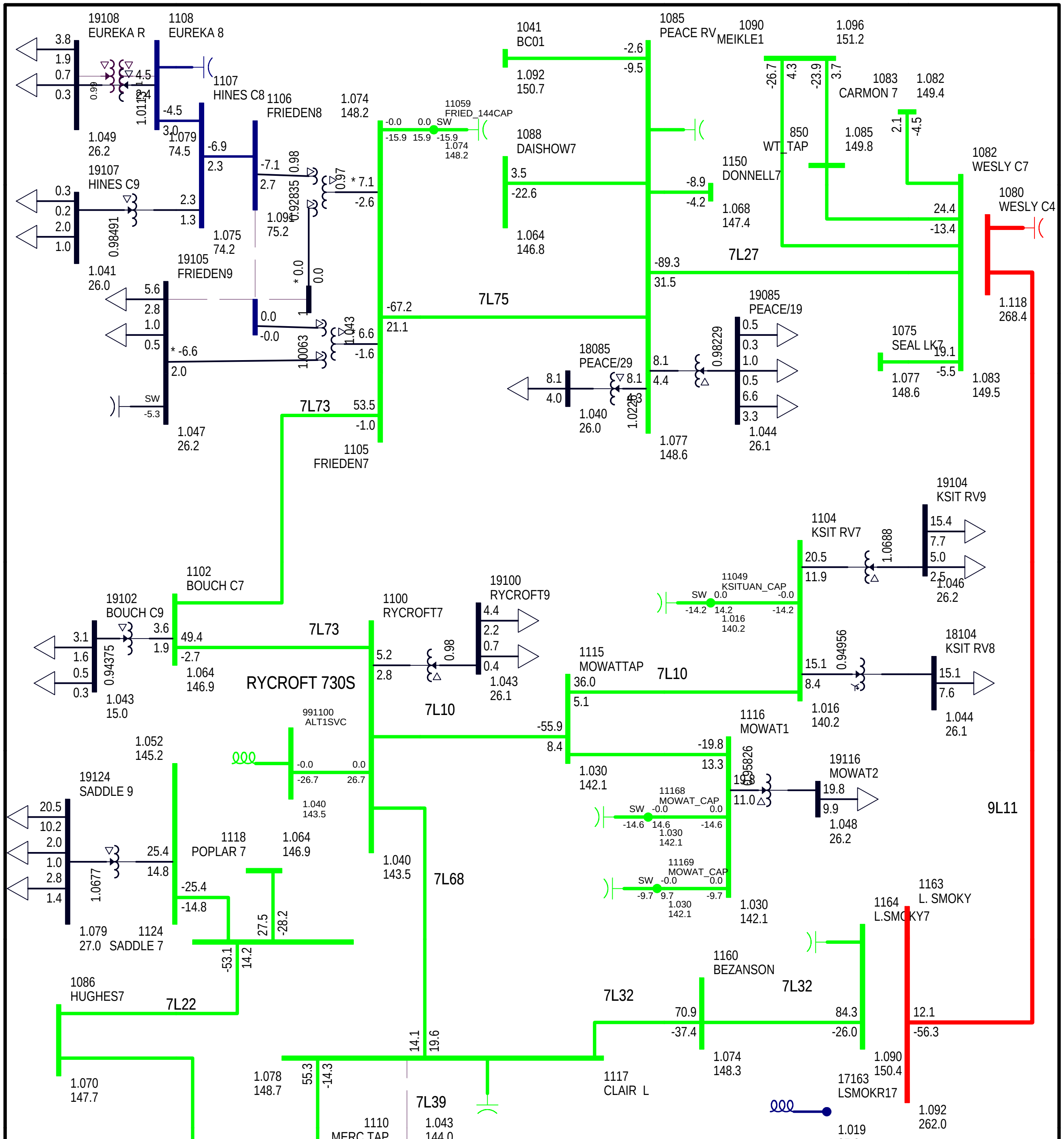
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L45 (N-1)
FIG B-26
FRI, NOV 03 2017 16:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 87.8 MW



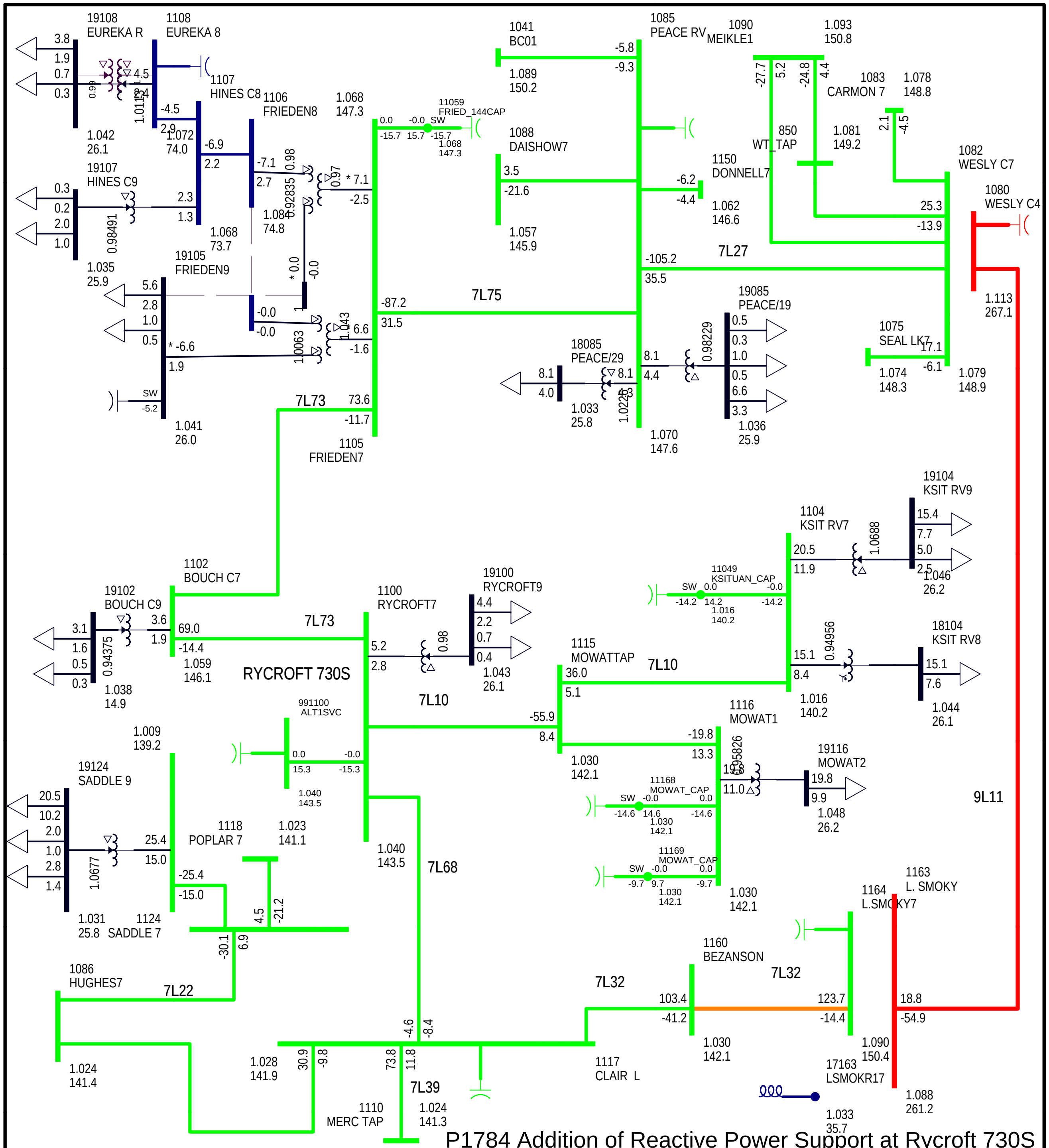
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L39 (N-1)
FIG B-27
FRI, NOV 03 2017 16:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 84.0 MW

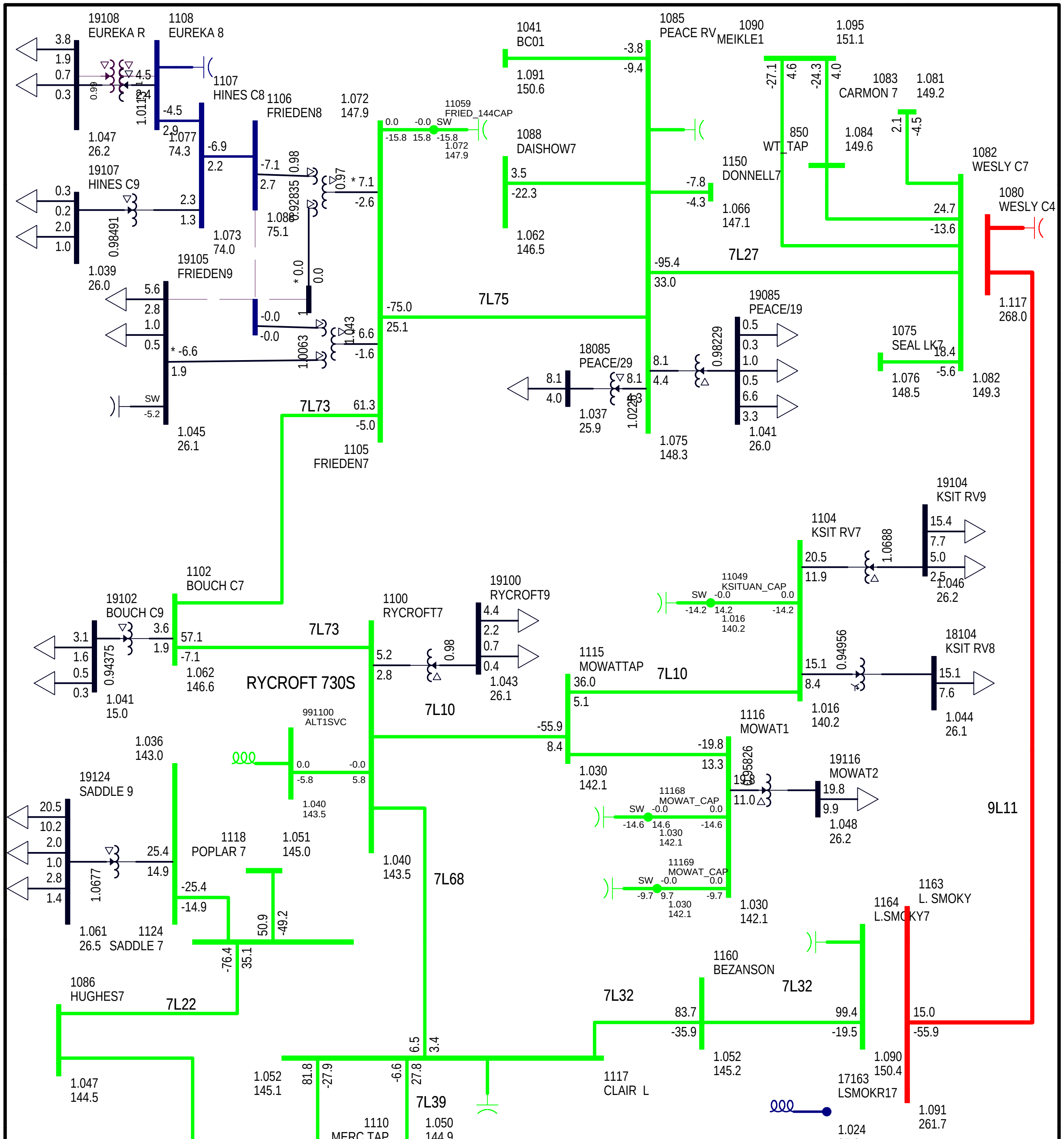


PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L84 (N-1)
FIG B-28
FRI, NOV 03 2017 16:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 87.4 MW



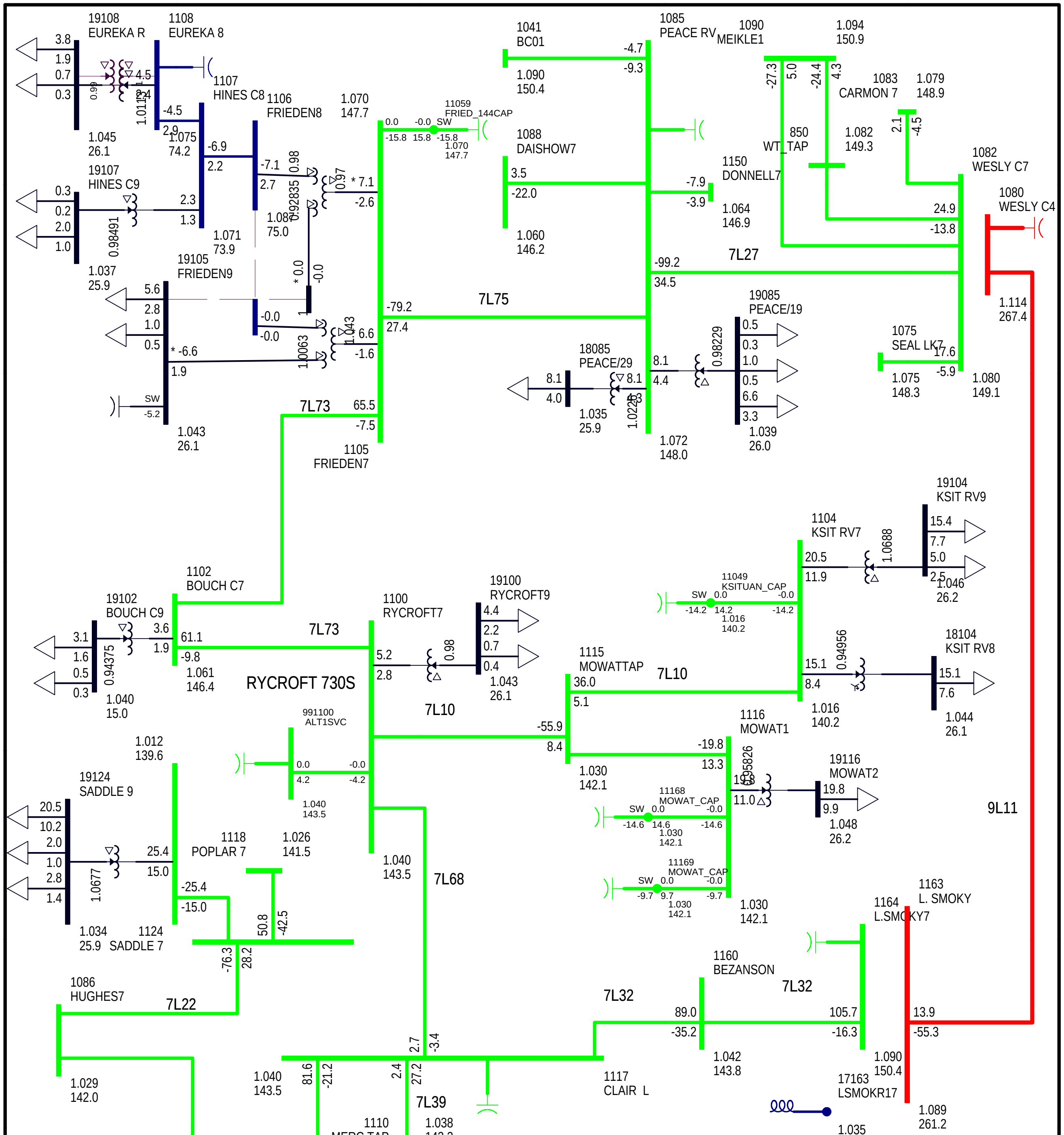
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L03 (N-1)
FIG B-29
FRI, NOV 03 2017 16:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.0 MW



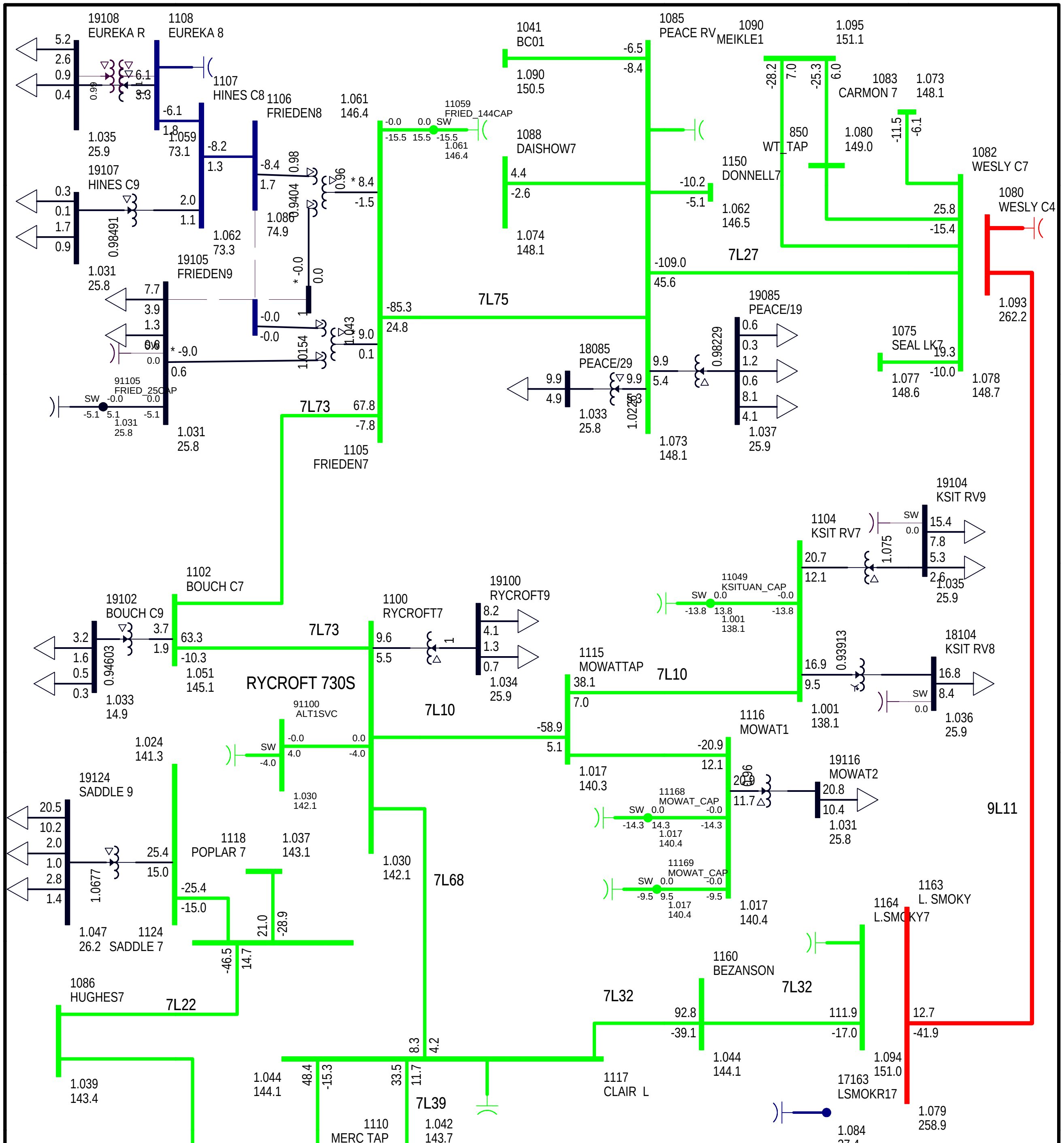
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: 2026SP SCENARIO 2
7L69 (N-1)
FIG B-30
FRI, NOV 03 2017 16:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.7 MW



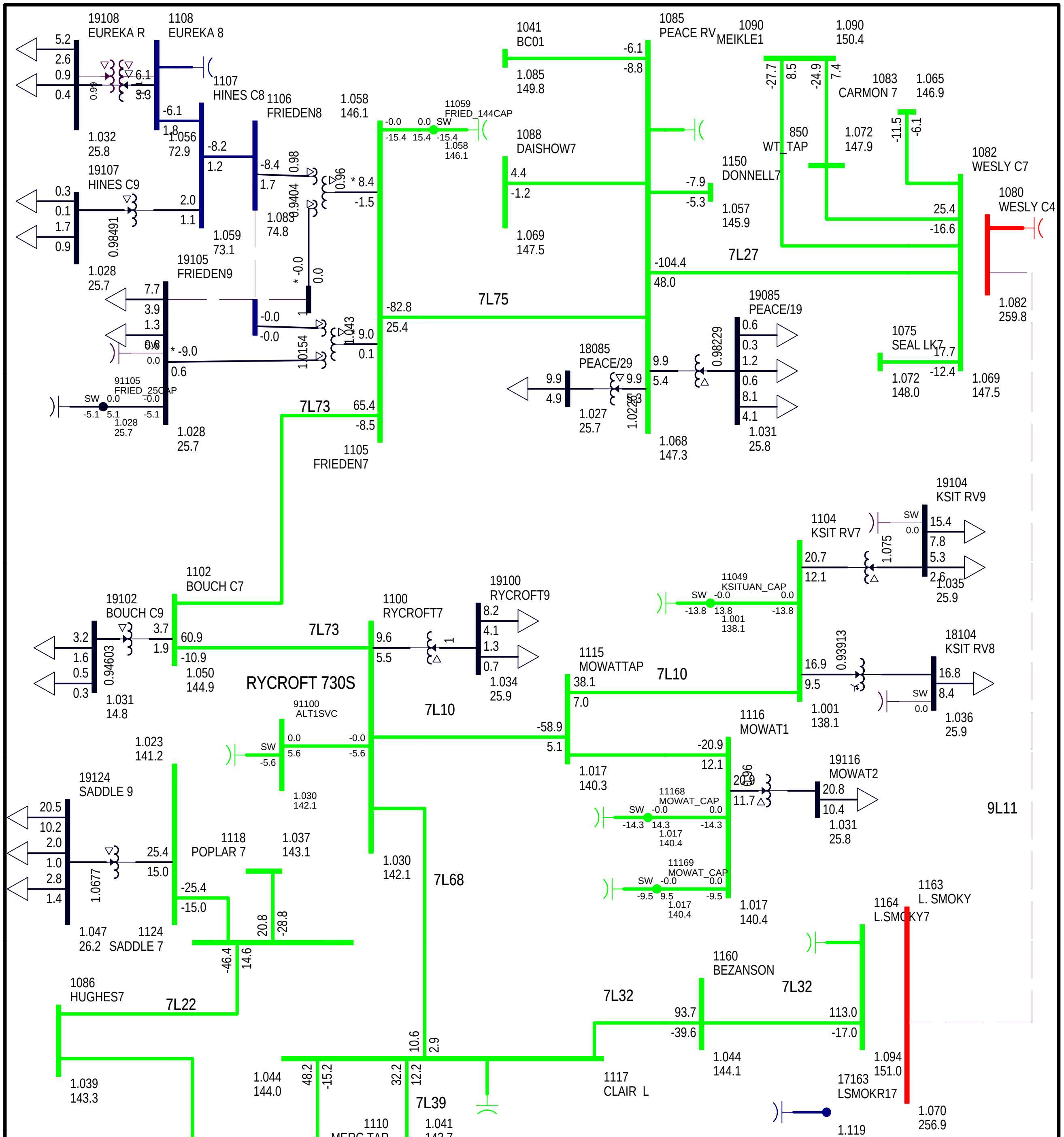
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
BASE CASE(N-0)
FIG B-31
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 98.0 MW



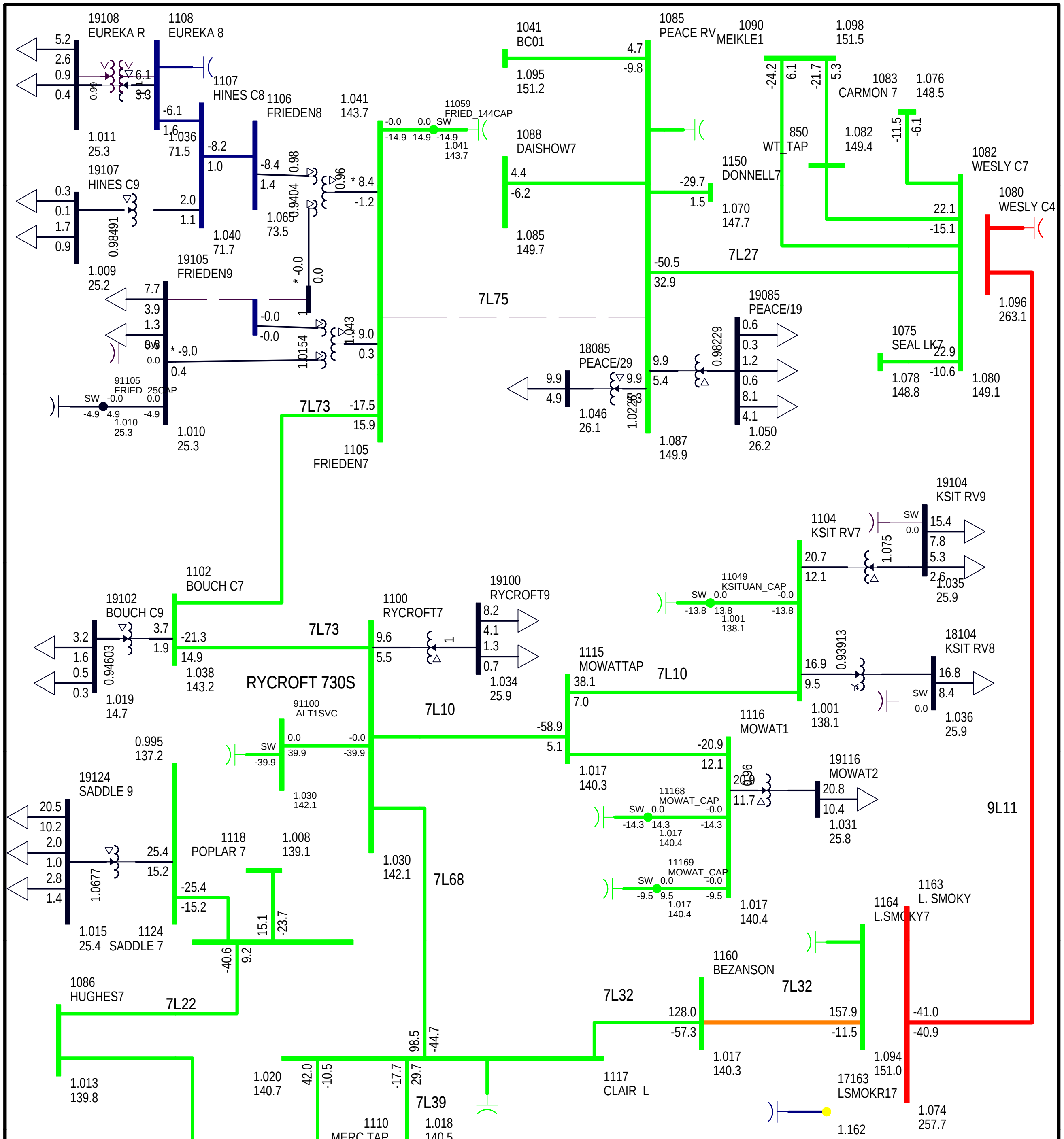
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
9L11 (N-1)
FIG B-32
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 97.7 MW



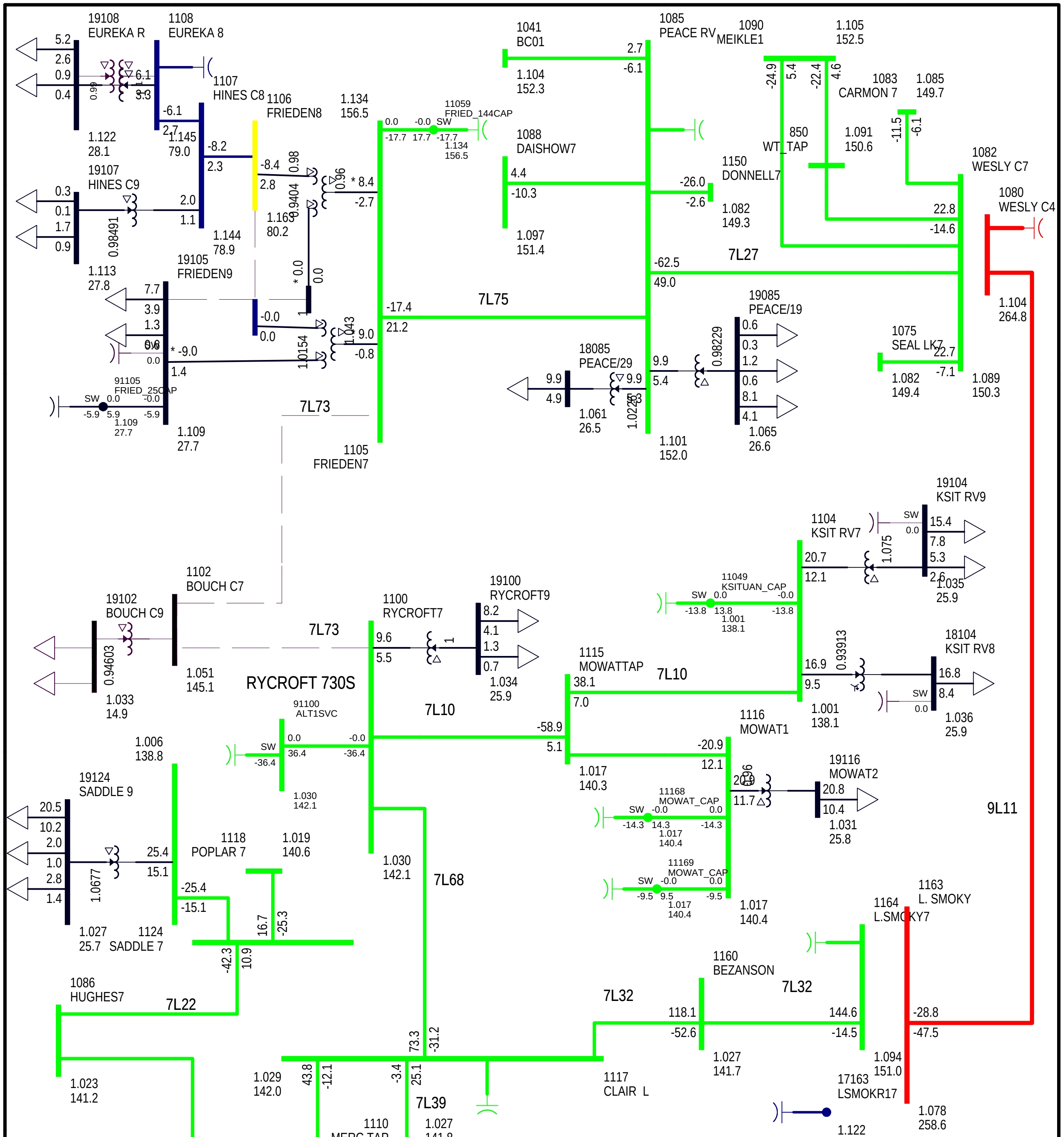
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L75 (N-1)
FIG B-33
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 98.5 MW



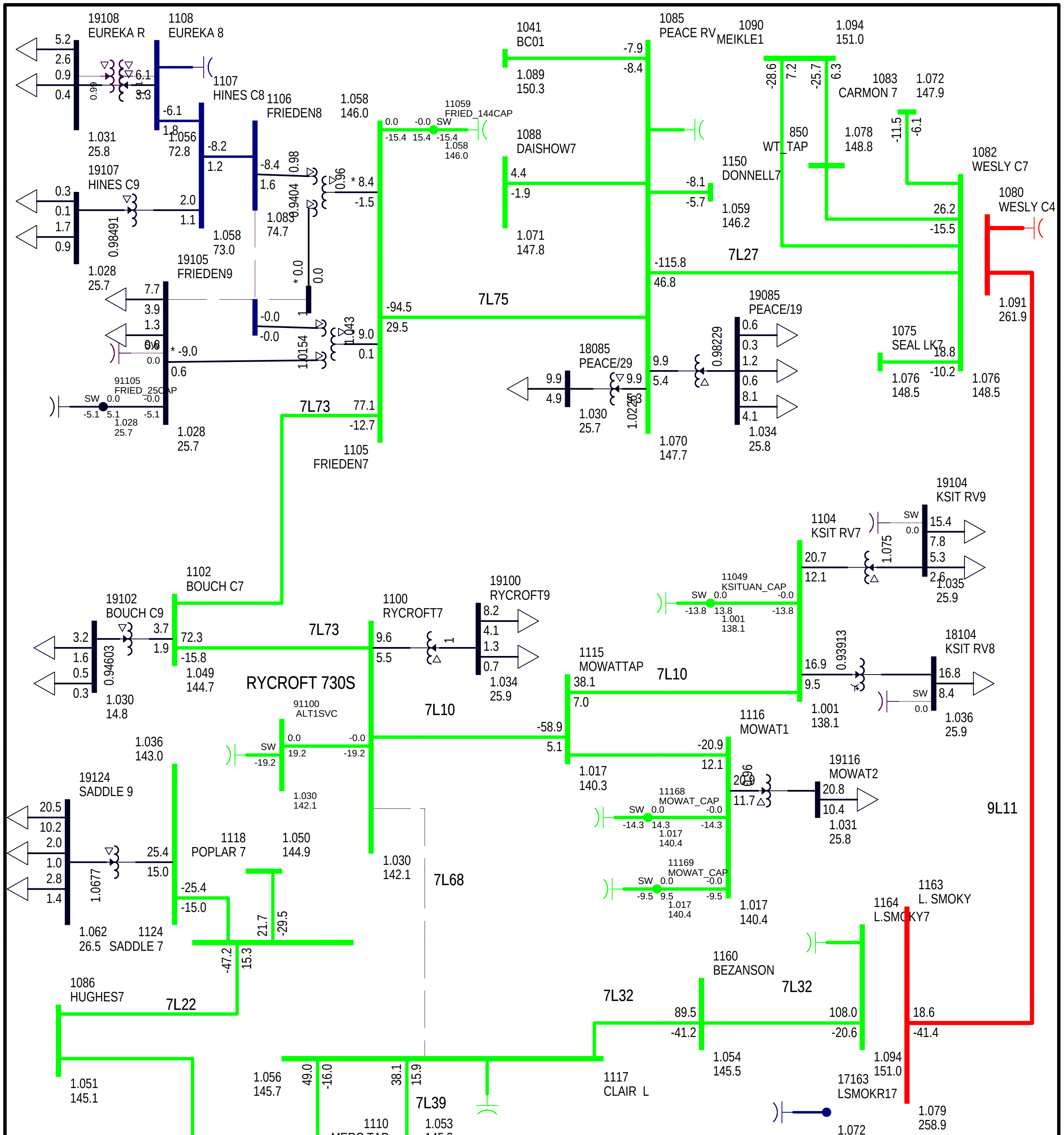
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L73 (N-1)
FIG B-34
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 84.9 MW

TOTAL FLOW INTO RYCROFT AREA: 91.2 MW



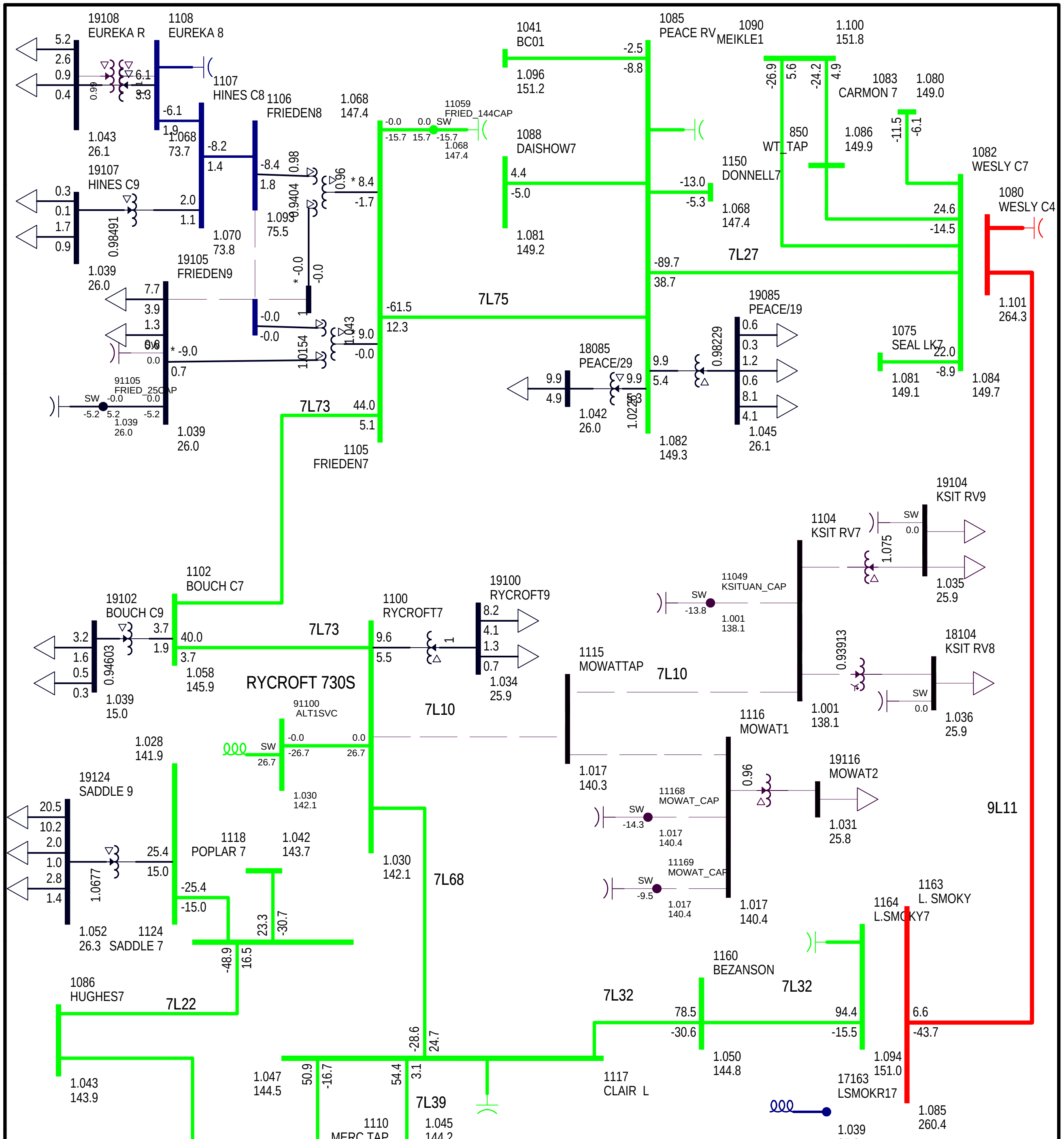
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L68 (N-1)
FIG B-35
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 100.0 MW



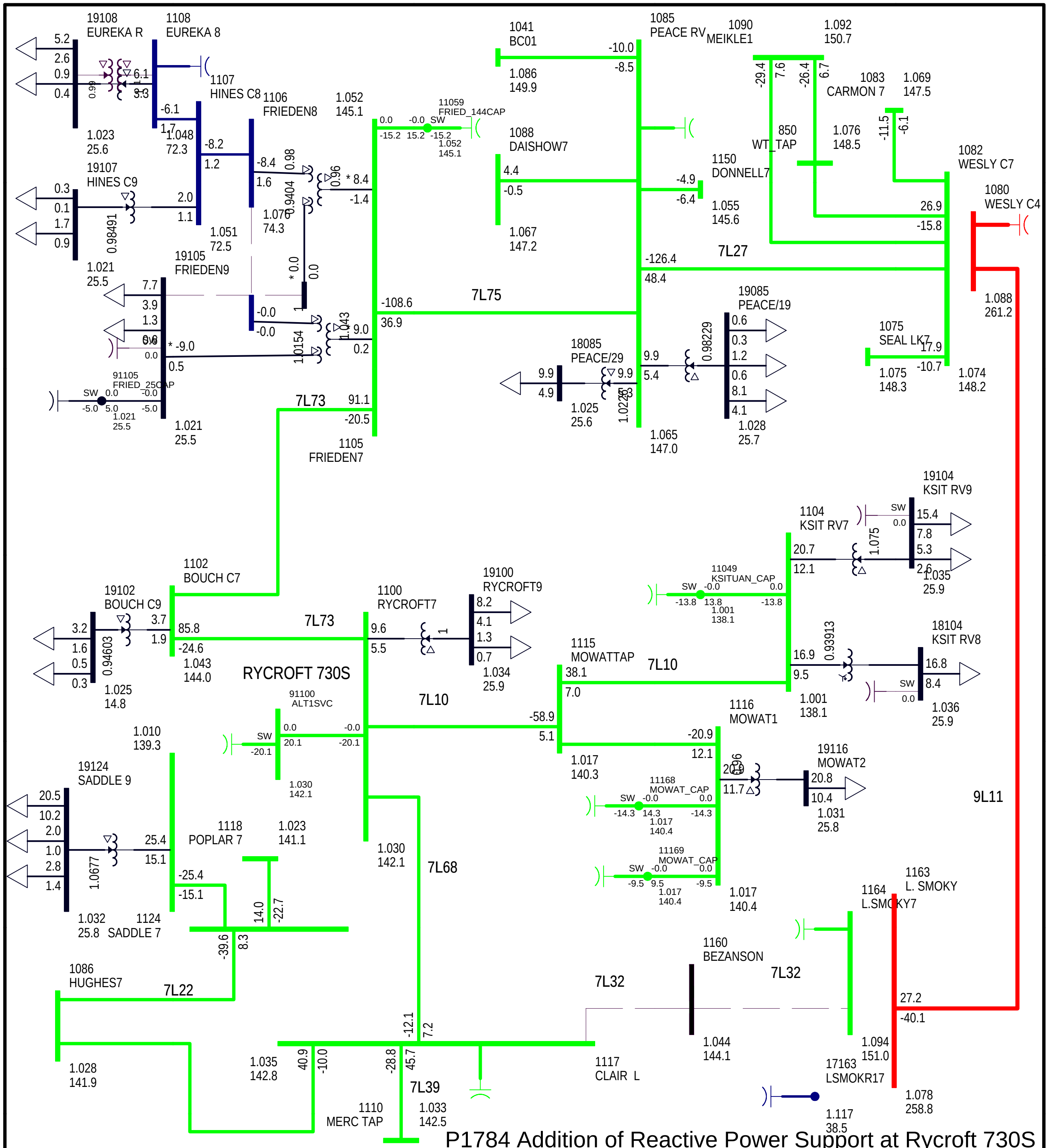
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L10 (N-1)
FIG B-36
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 30.3 MW

TOTAL FLOW INTO RYCROFT AREA: 35.0 MW

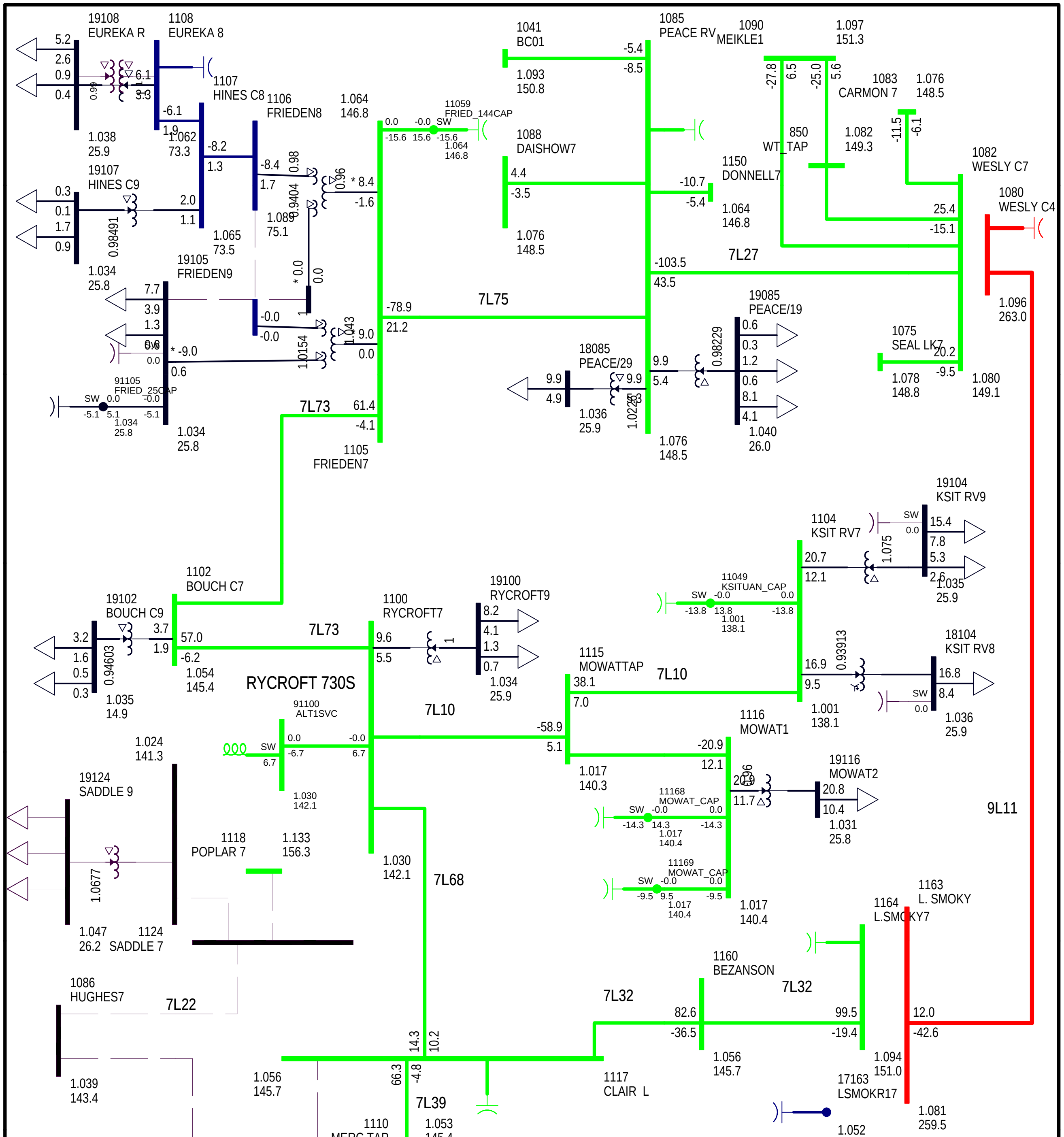


PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L32 (N-1)
FIG B-37
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 104.0 MW



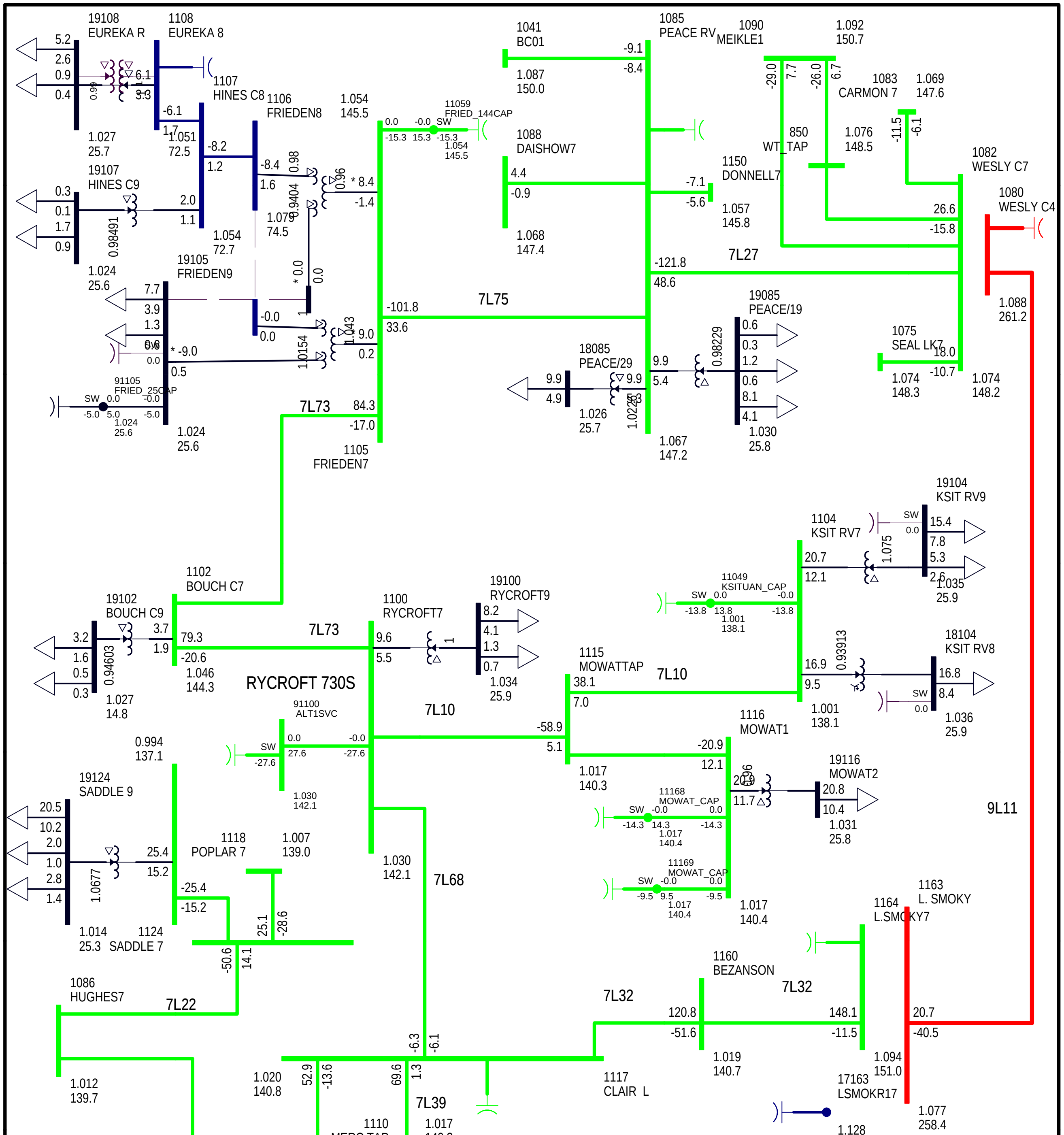
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L22 (N-1)
FIG B-38
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 96.9 MW



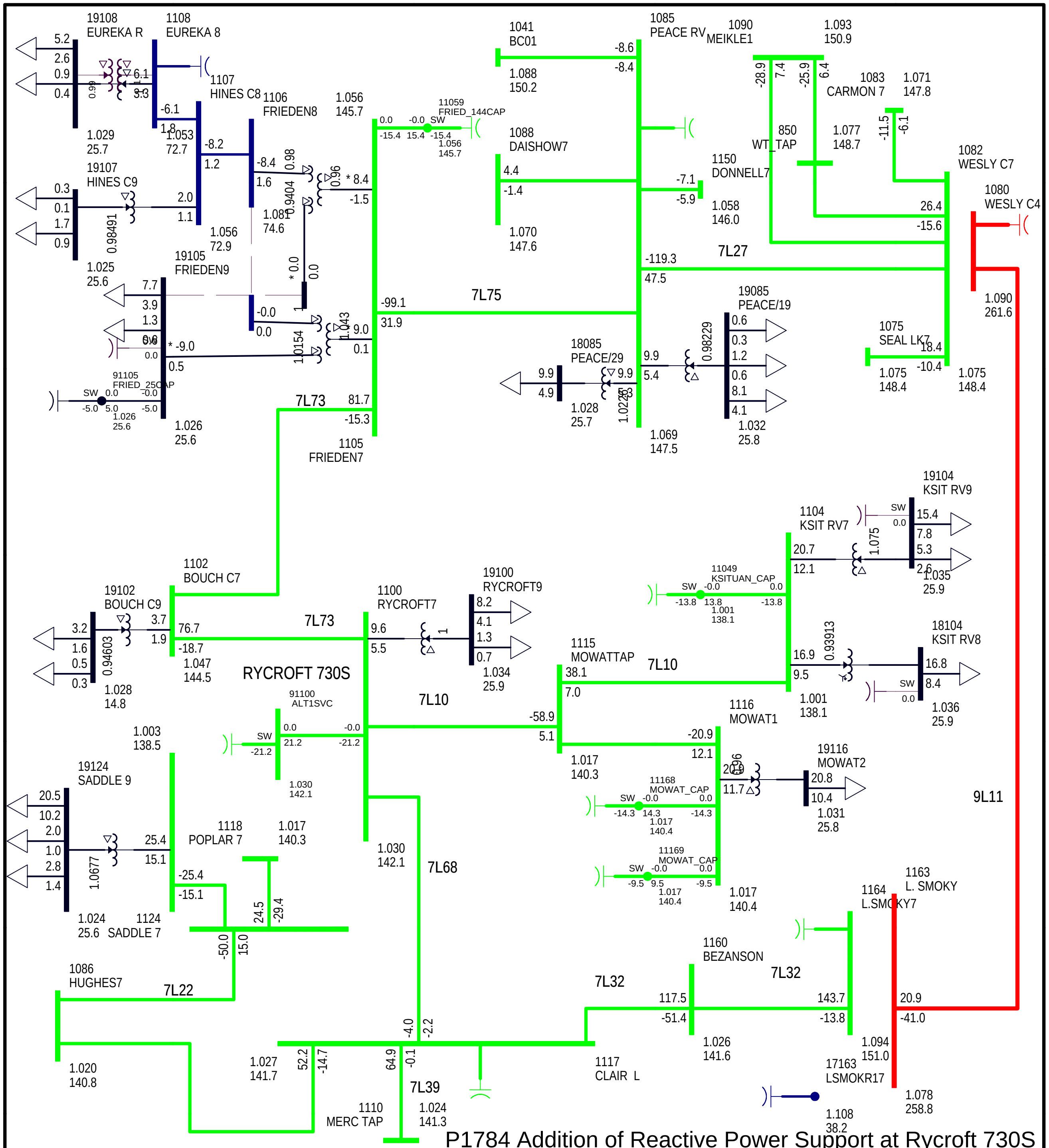
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L46 (N-1)
FIG B-39
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 102.0 MW

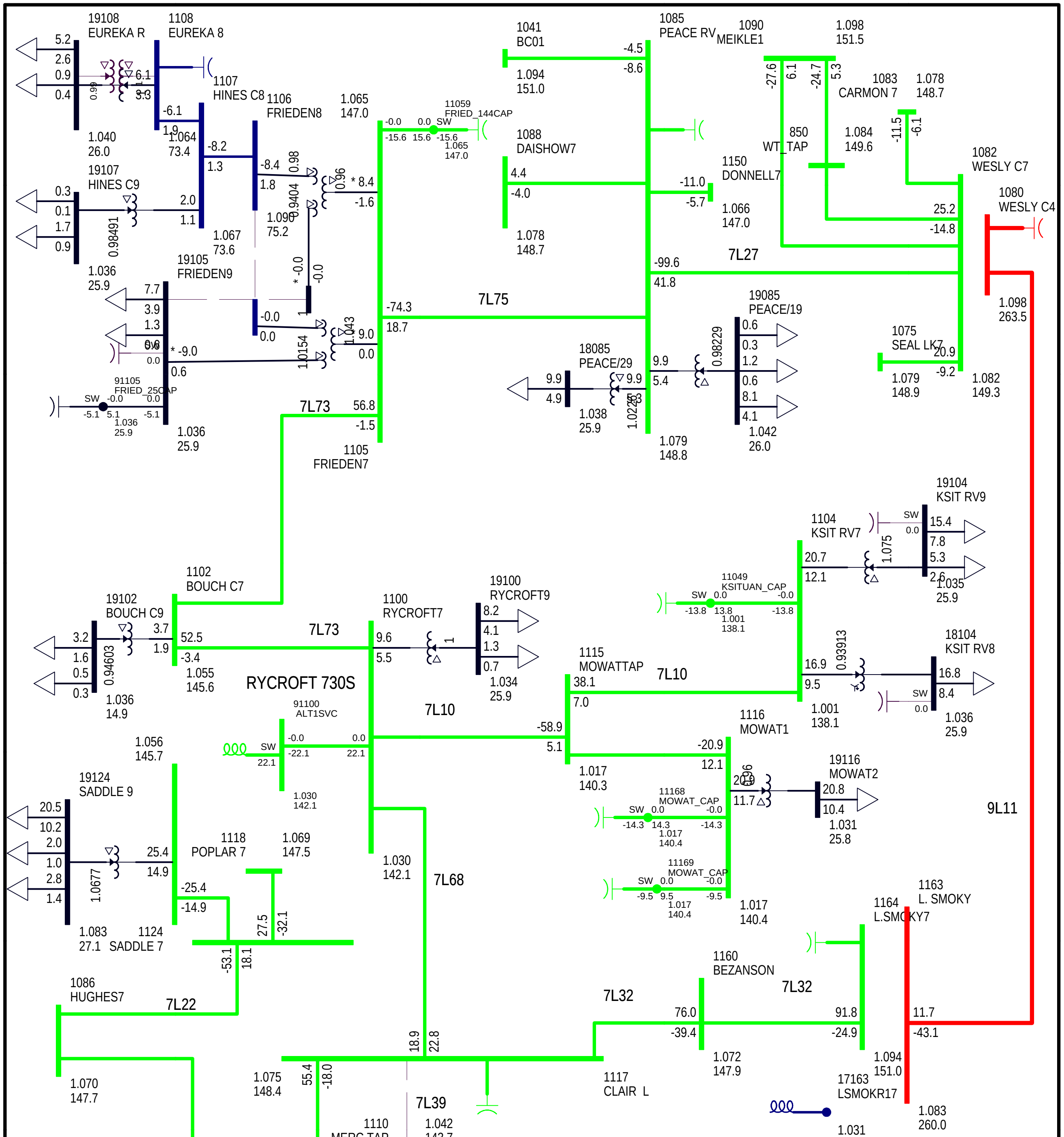


PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L45 (N-1)
FIG B-40
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 101.2 MW



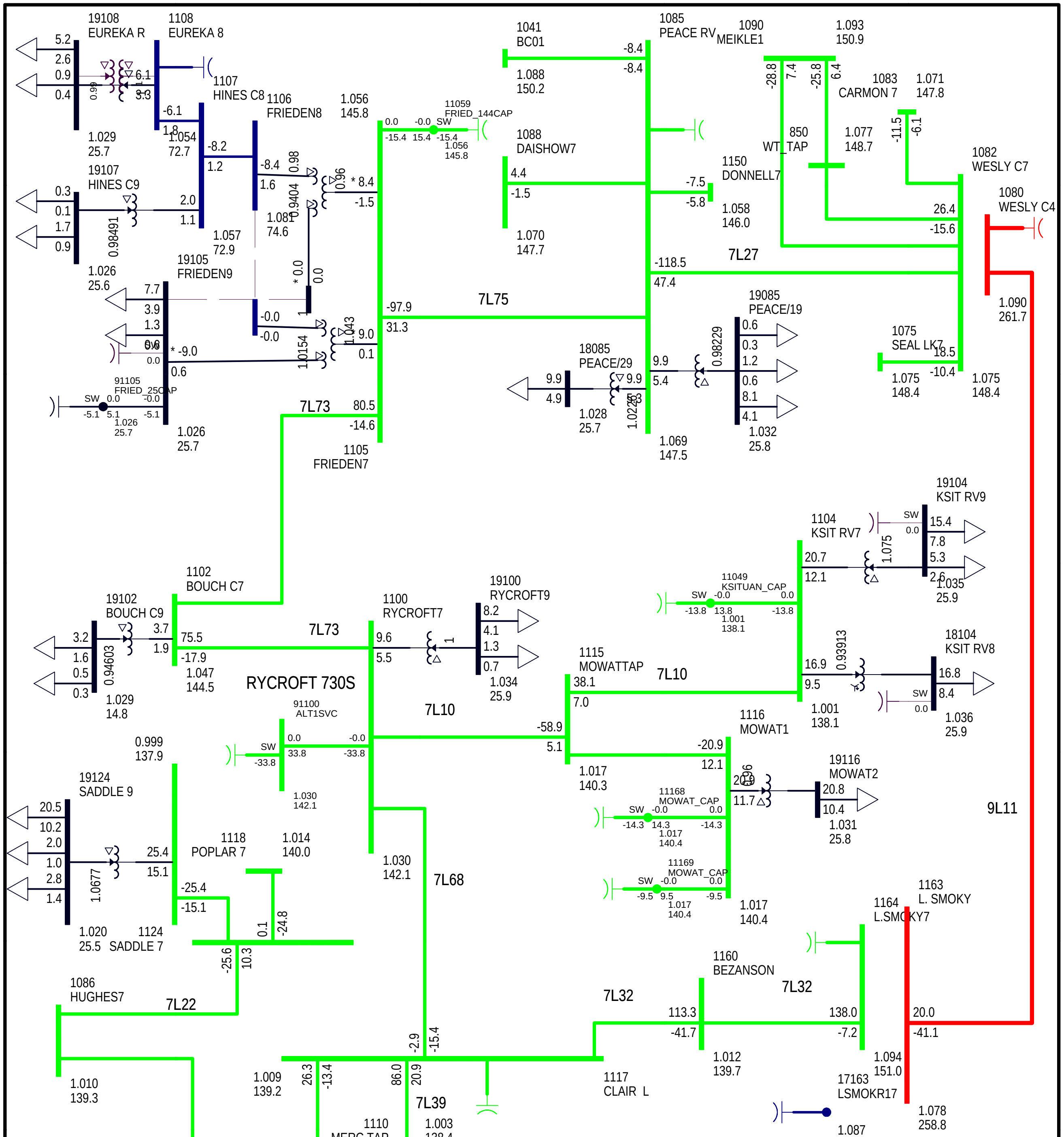
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L39 (N-1)
FIG B-41
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 96.4 MW



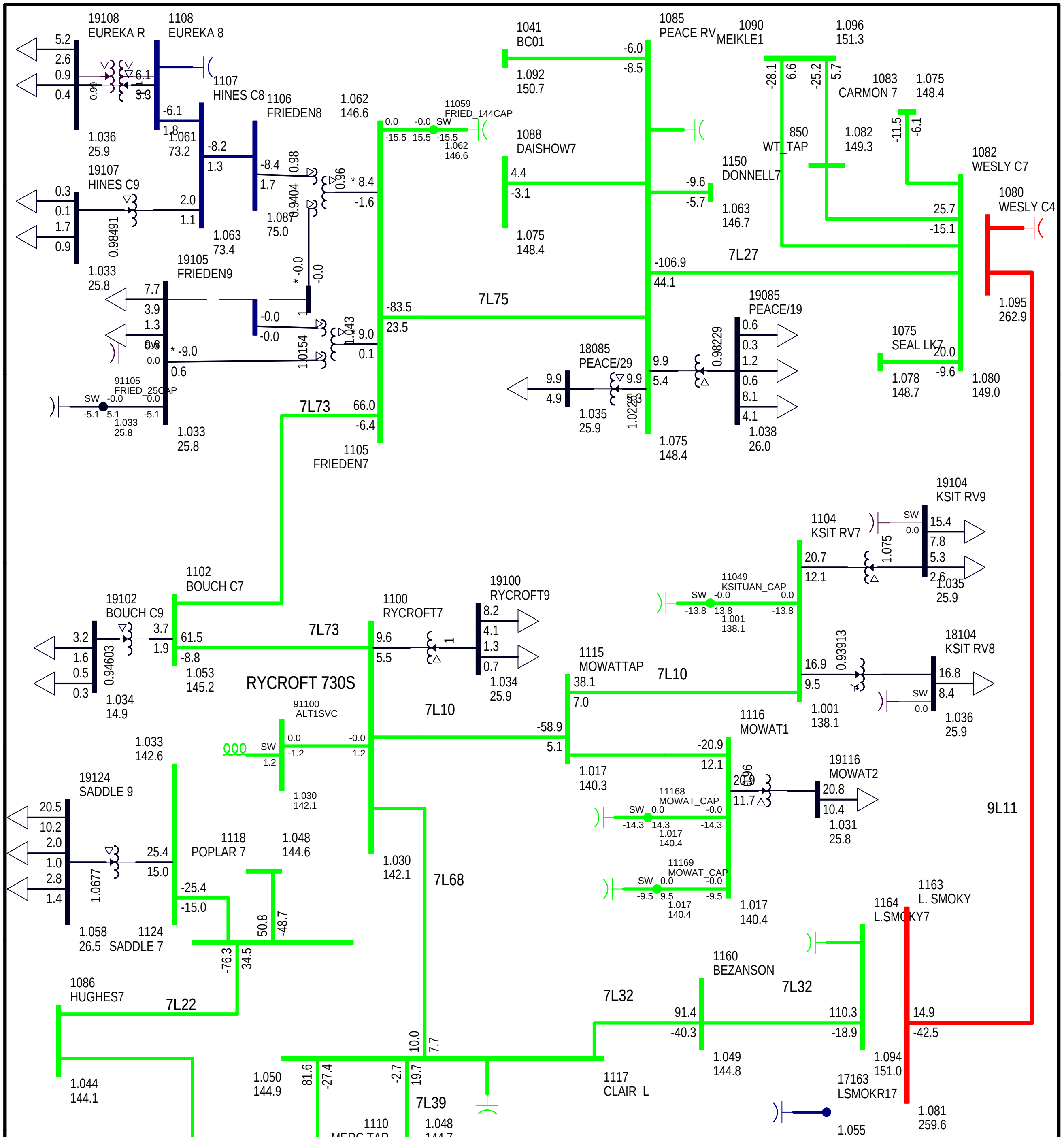
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L84 (N-1)
FIG B-42
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 101.0 MW



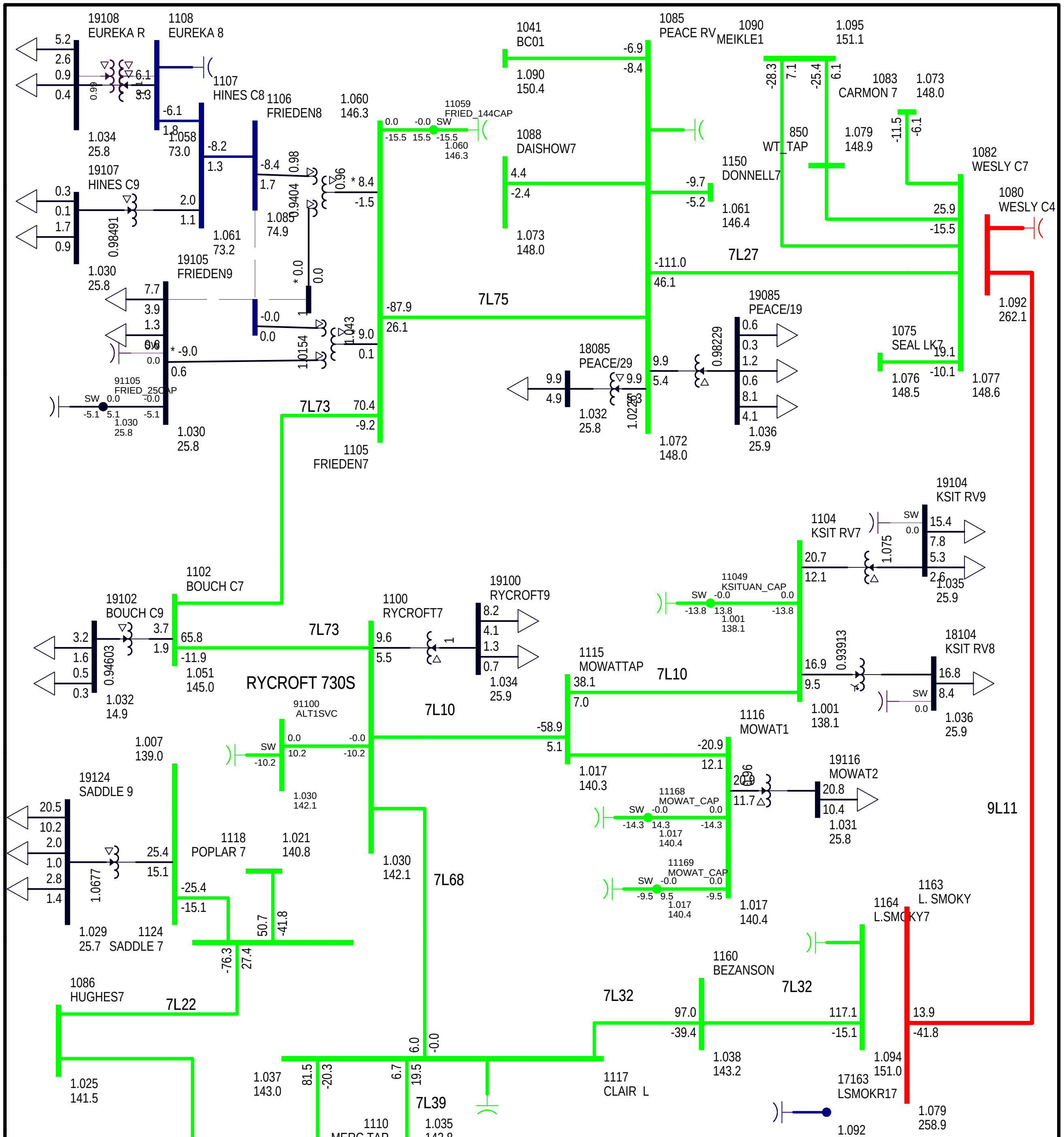
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L03 (N-1)
FIG B-43
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 97.7 MW



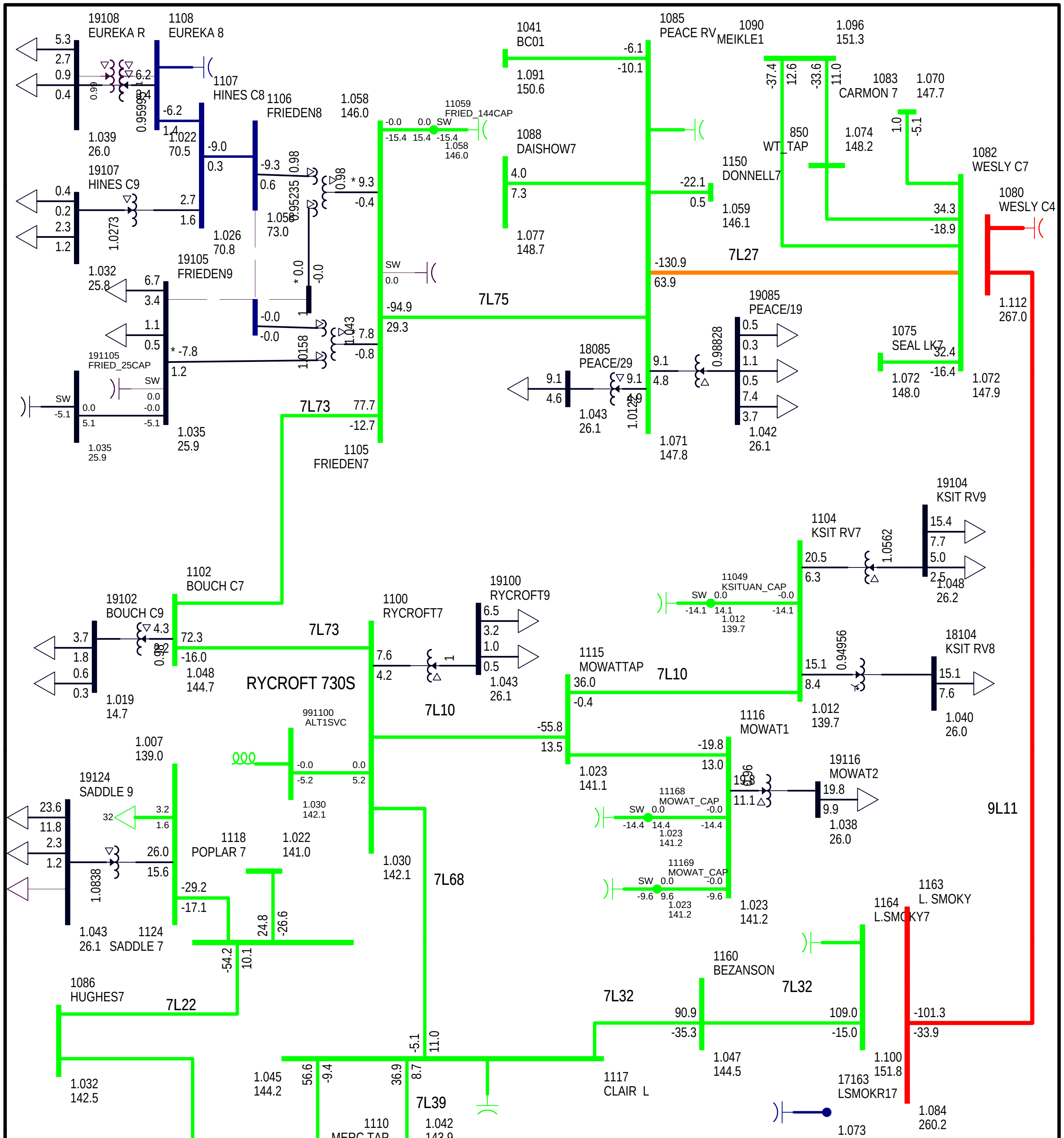
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 3 2026WP
7L69 (N-1)
FIG B-44
FRI, NOV 03 2017 16:05

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 98.6 MW



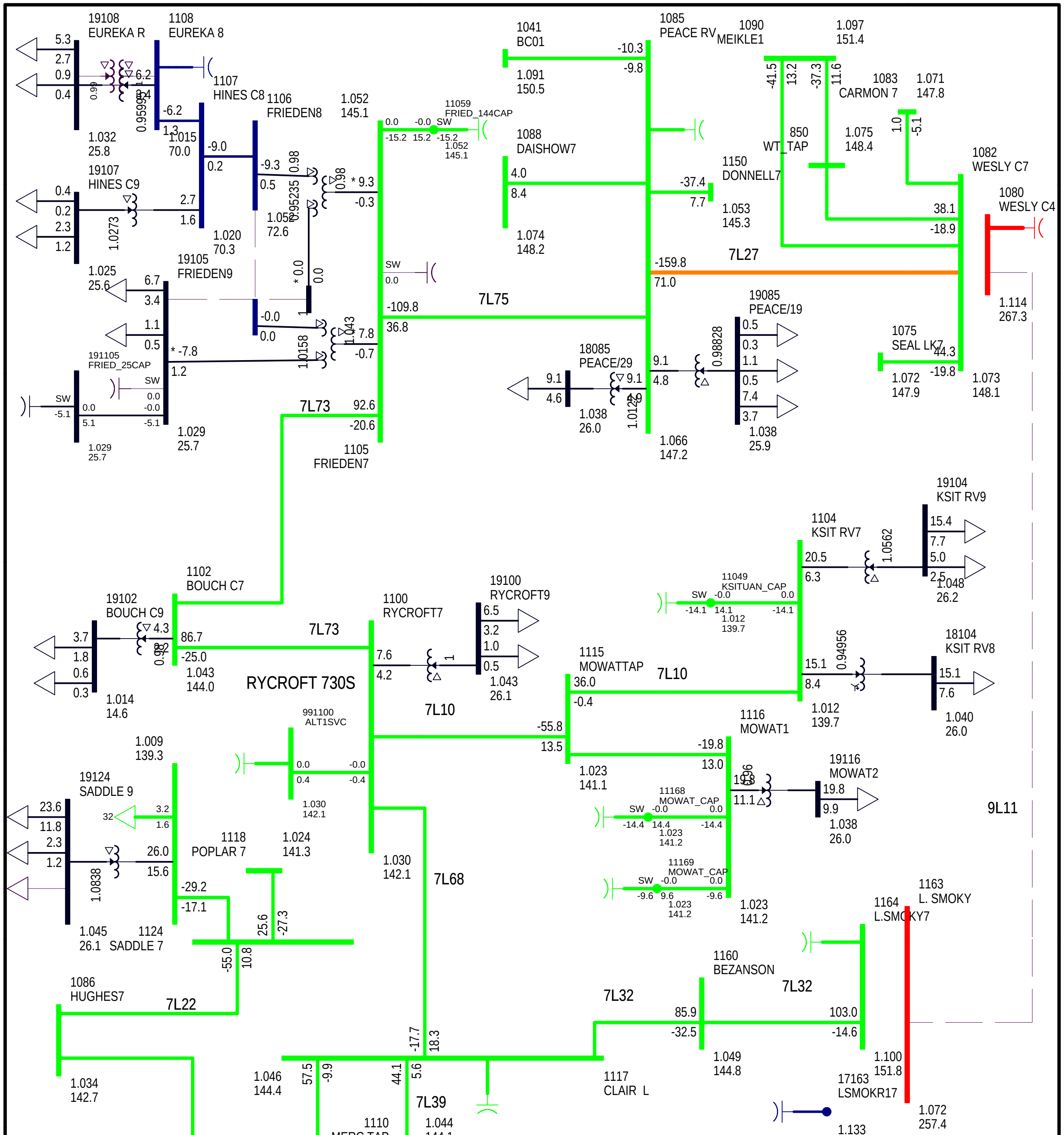
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
BASE CASE(N-0)
FIG B-45
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 95.3 MW



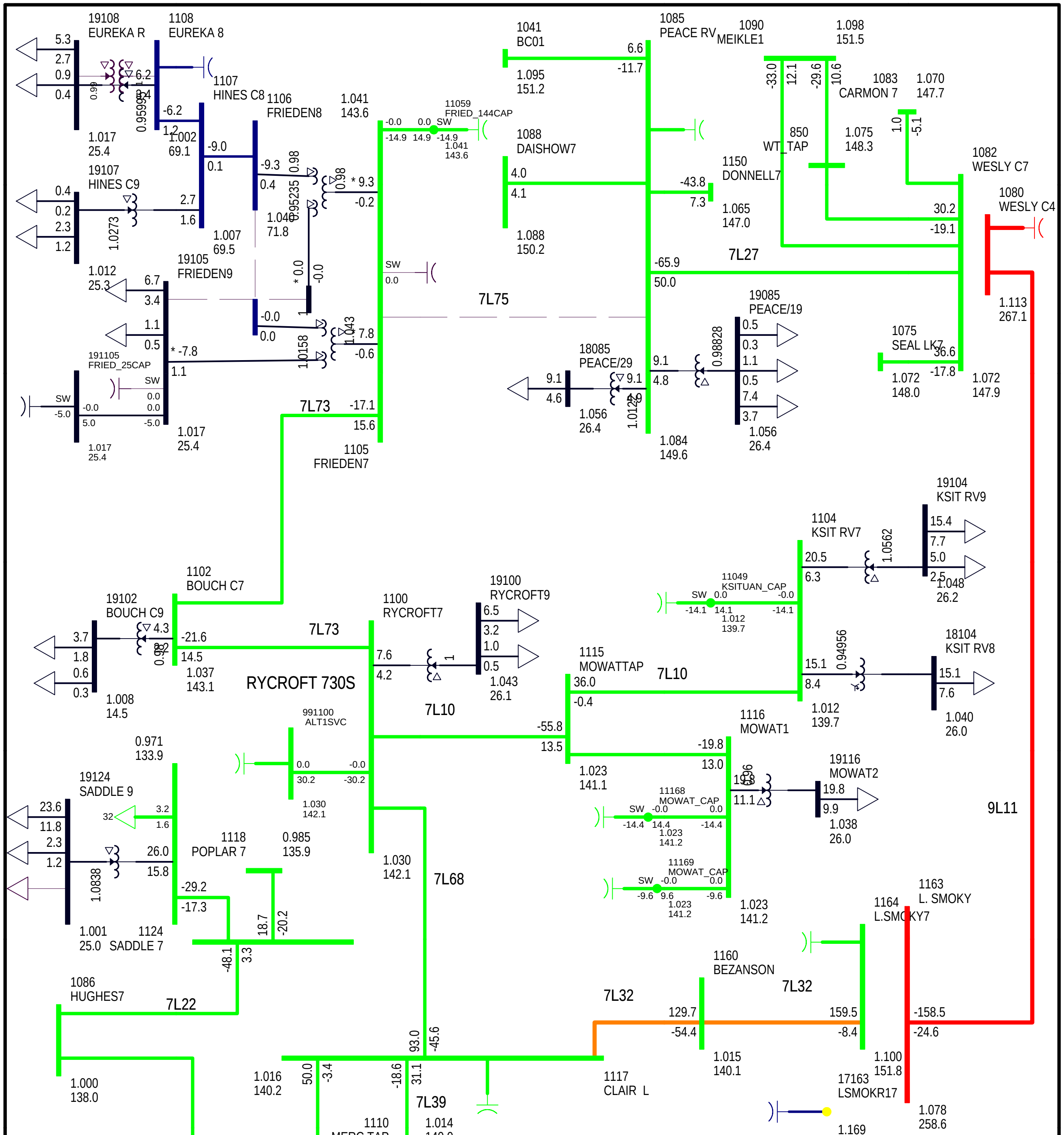
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
9L11 (N-1)
FIG B-46
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 99.7 MW



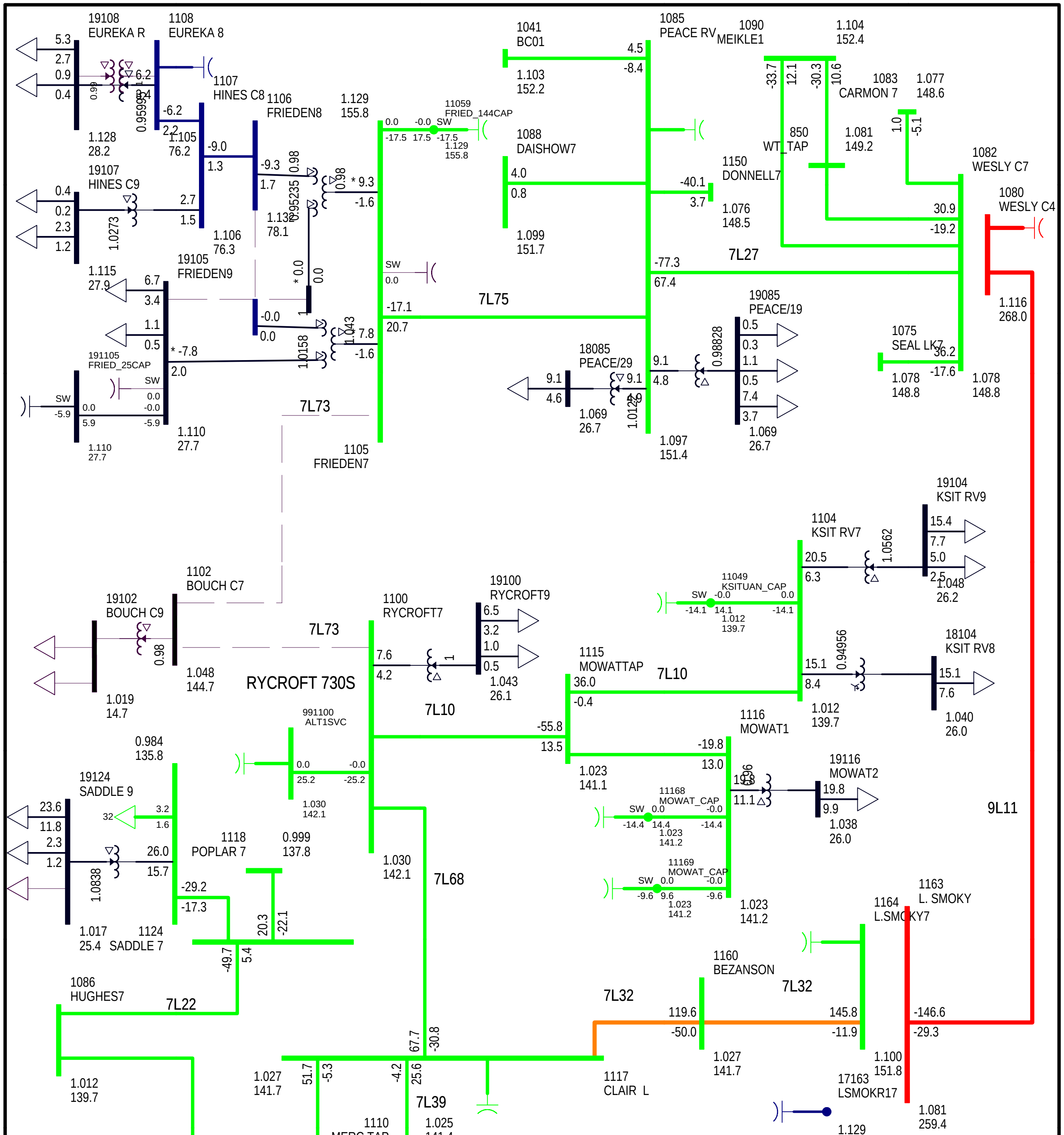
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L75 (N-1)
FIG B-47
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 93.0 MW



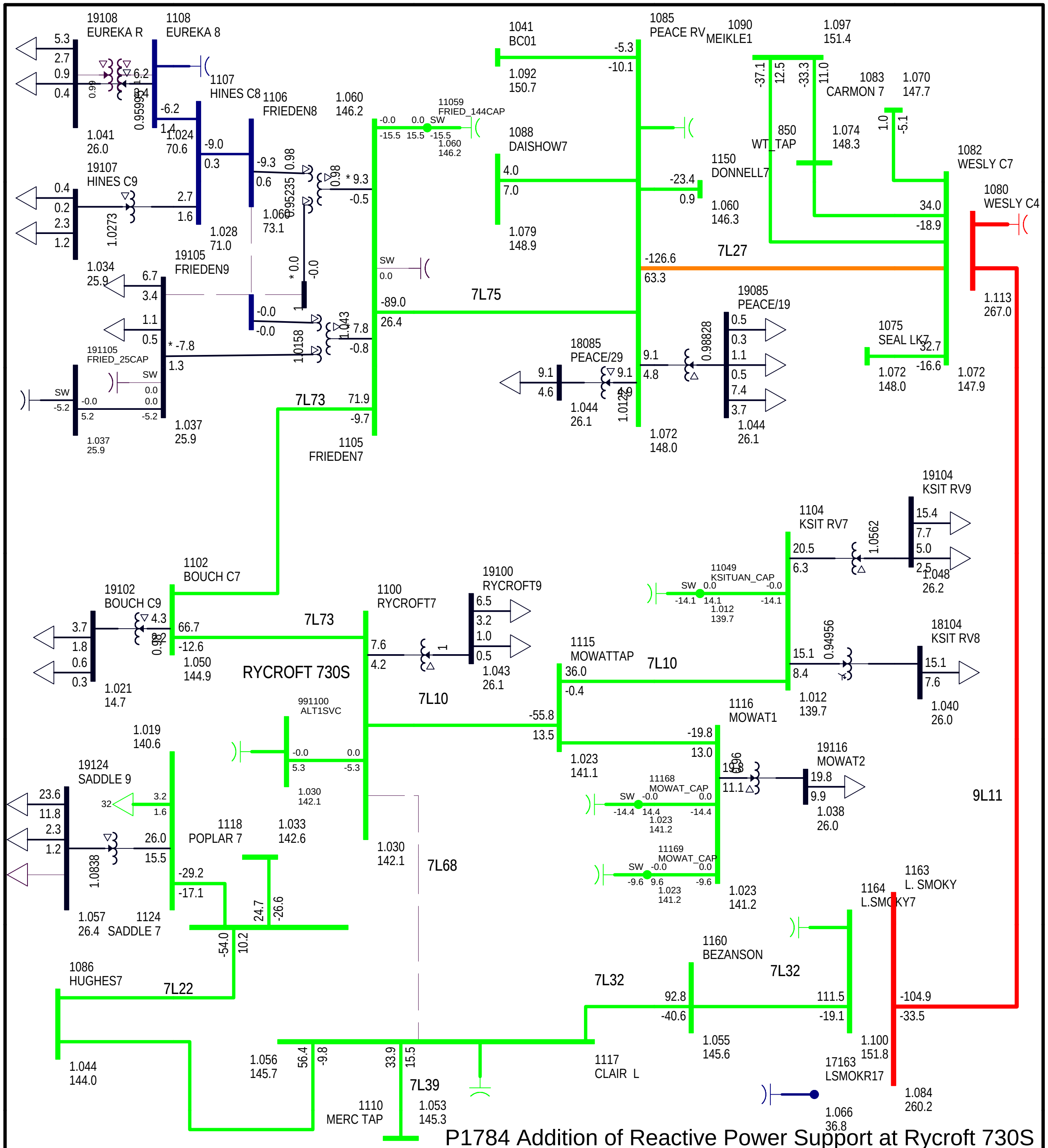
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L73 (N-1)
FIG B-48
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 79.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.2 MW

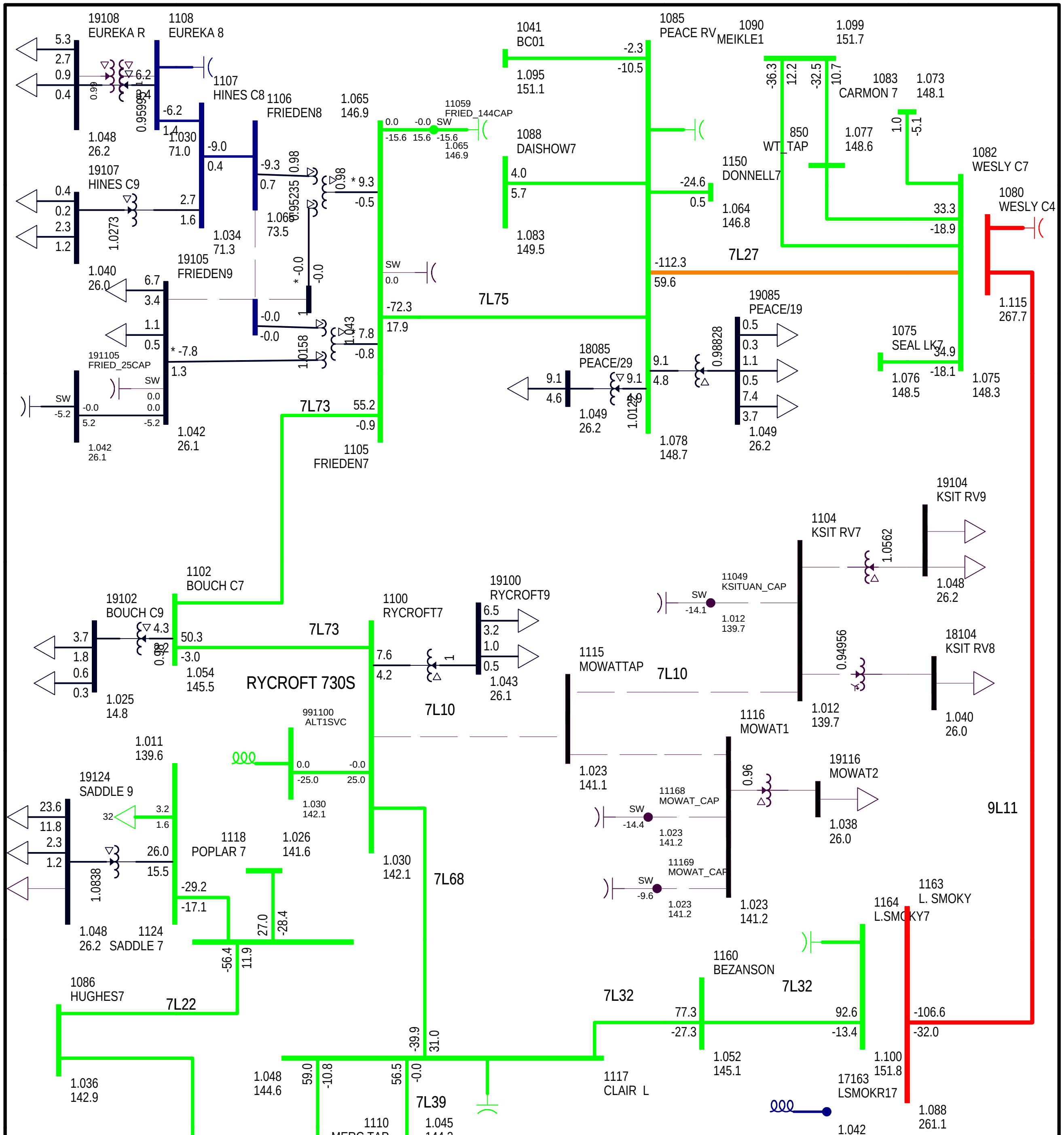


PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L68 (N-1)
FIG B-49
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 93.9 MW



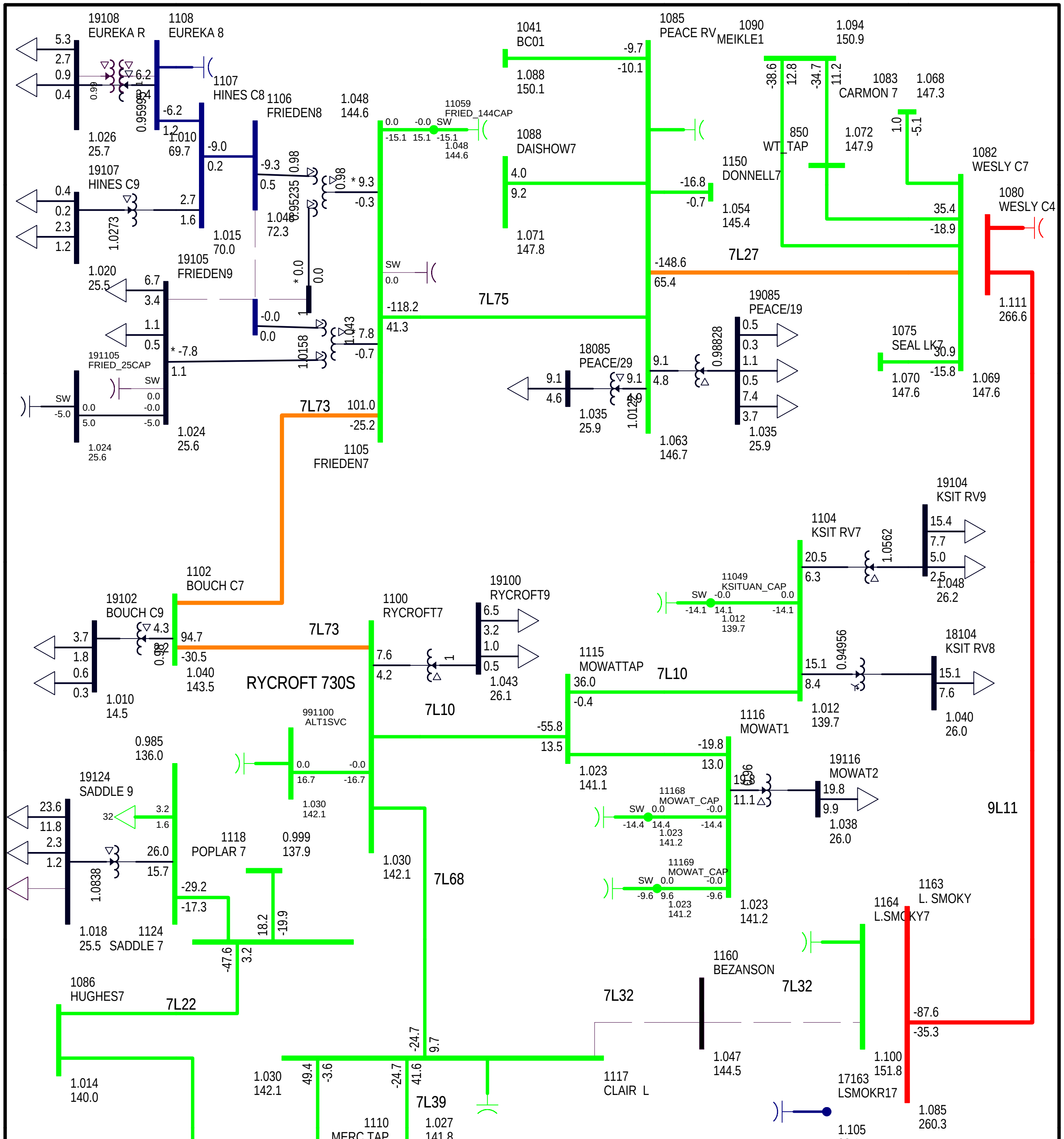
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L10 (N-1)
FIG B-50
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 28.5 MW

TOTAL FLOW INTO RYCROFT AREA: 35.6 MW



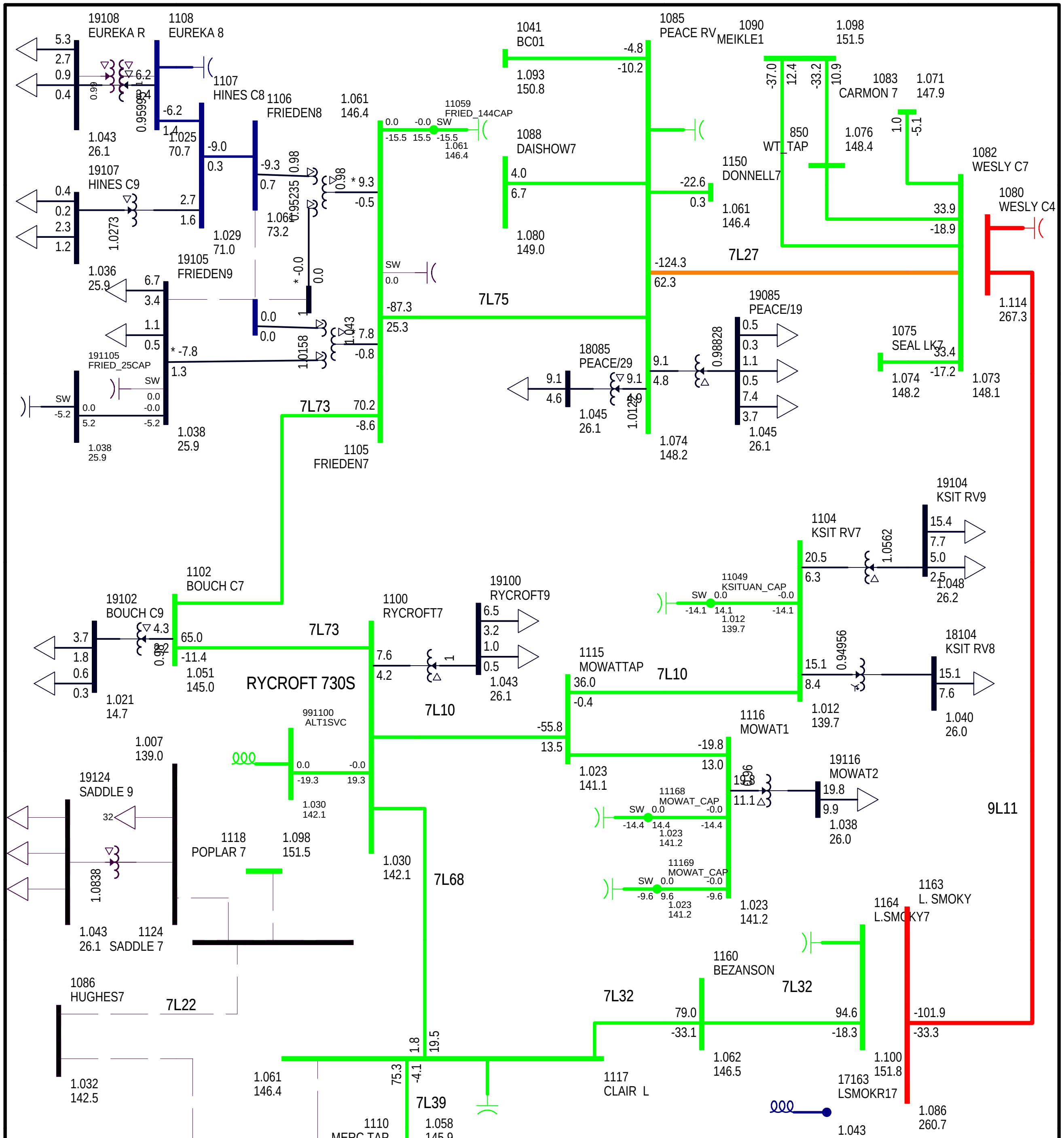
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L32 (N-1)
FIG B-51
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 102.3 MW



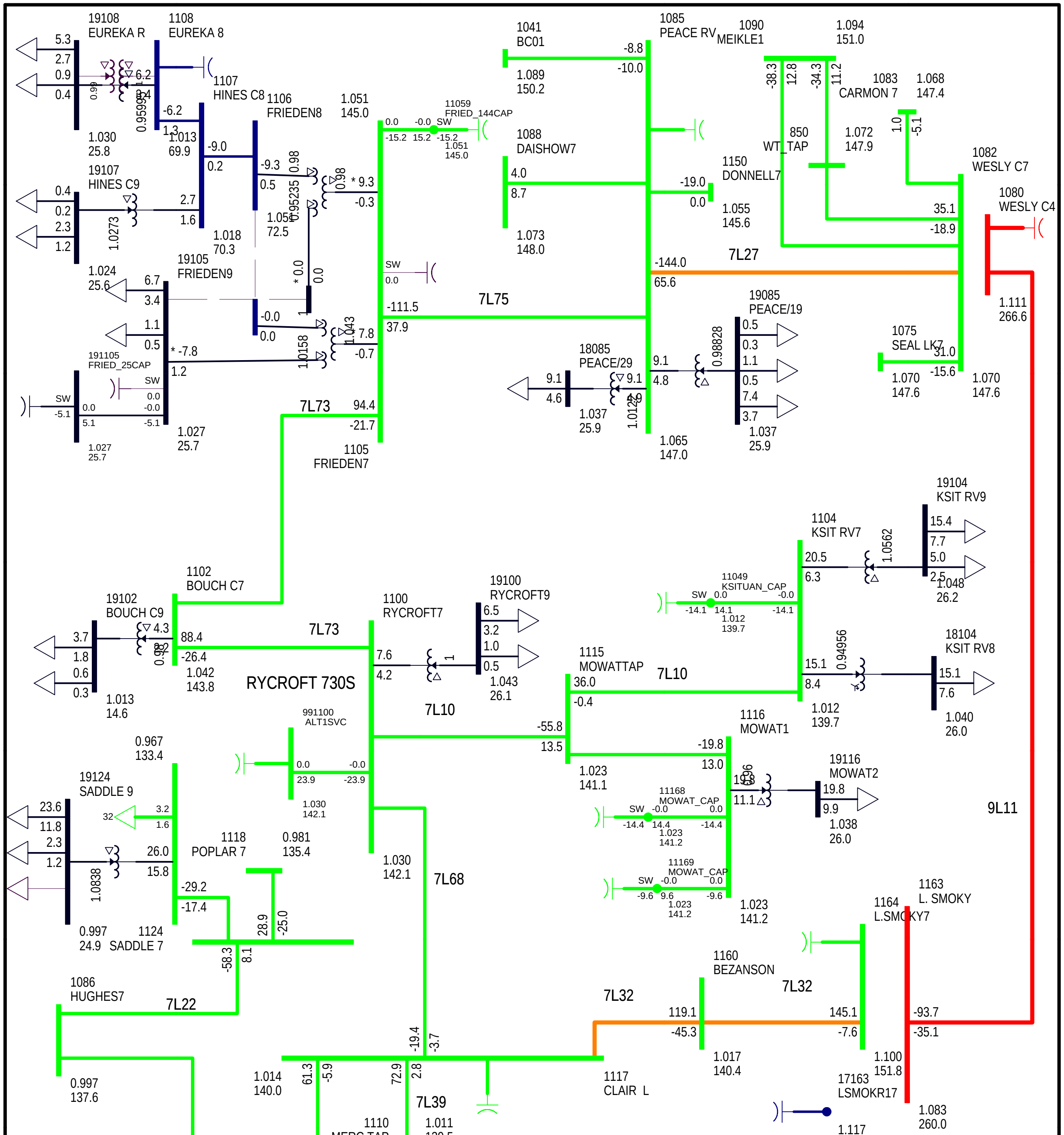
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L22 (N-1)
FIG B-52
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 93.7 MW



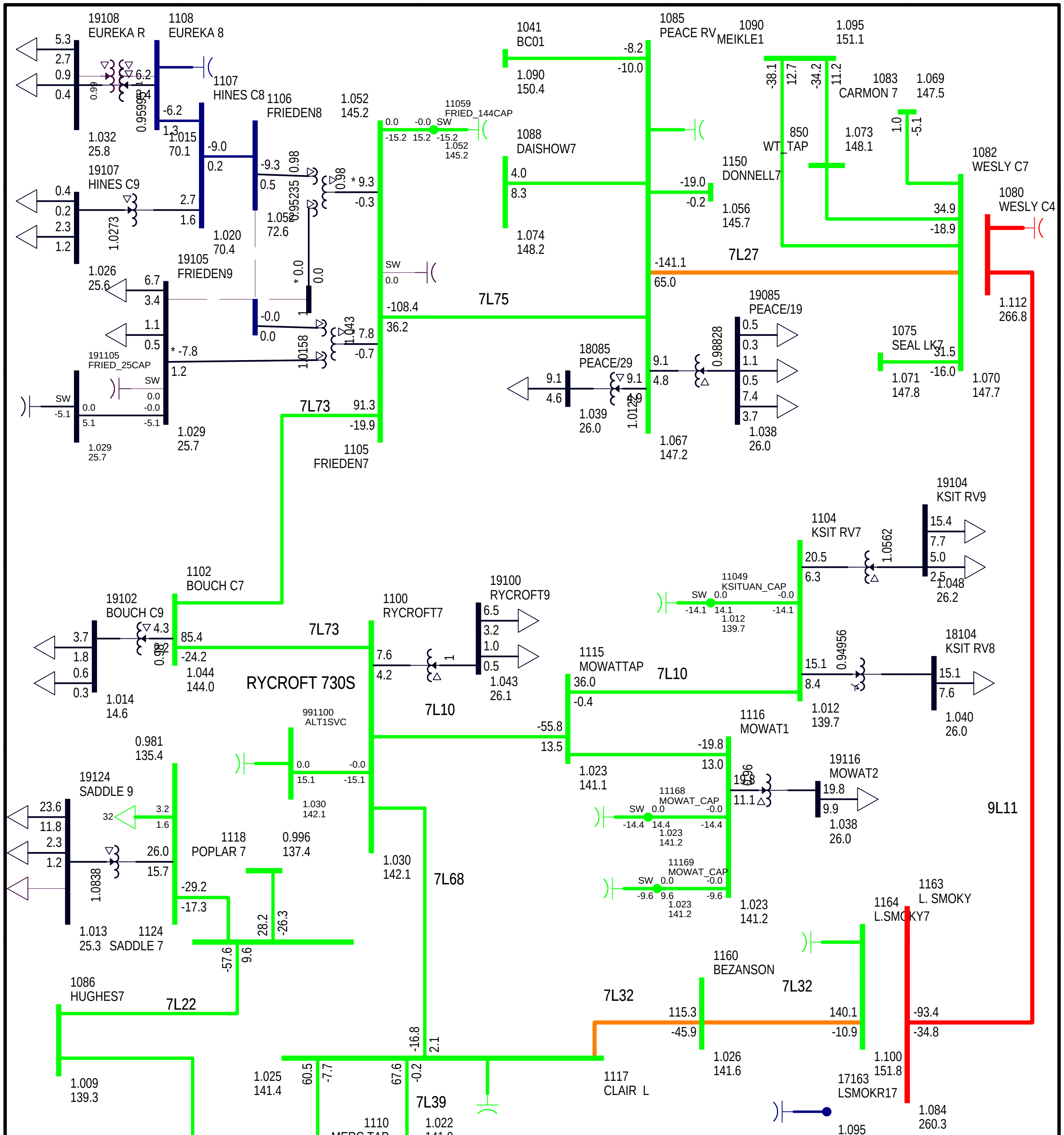
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L46 (N-1)
FIG B-53
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 100.0 MW



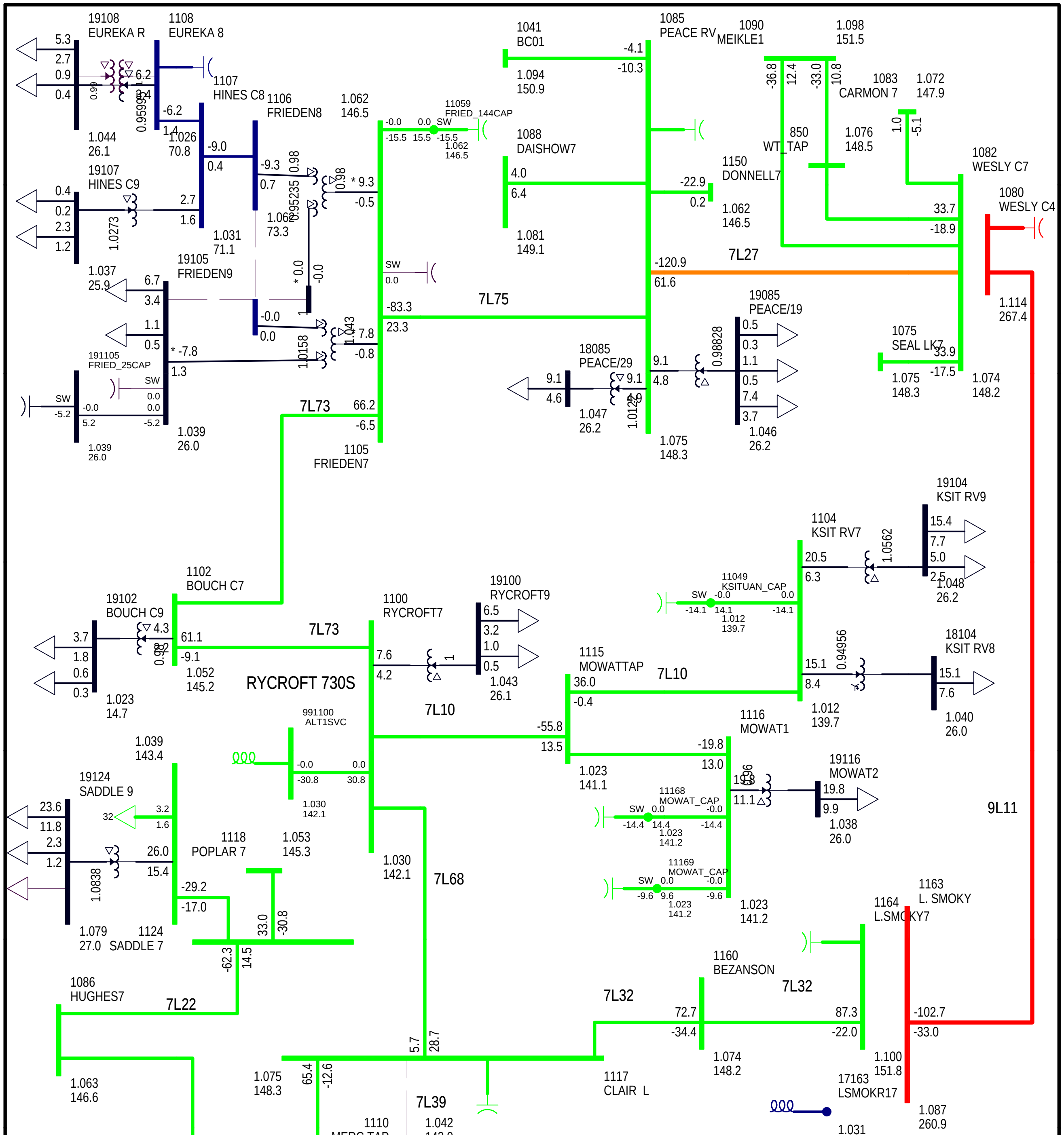
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L45 (N-1)
FIG B-54
FRI, NOV 03 2017 16:06

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 99.0 MW



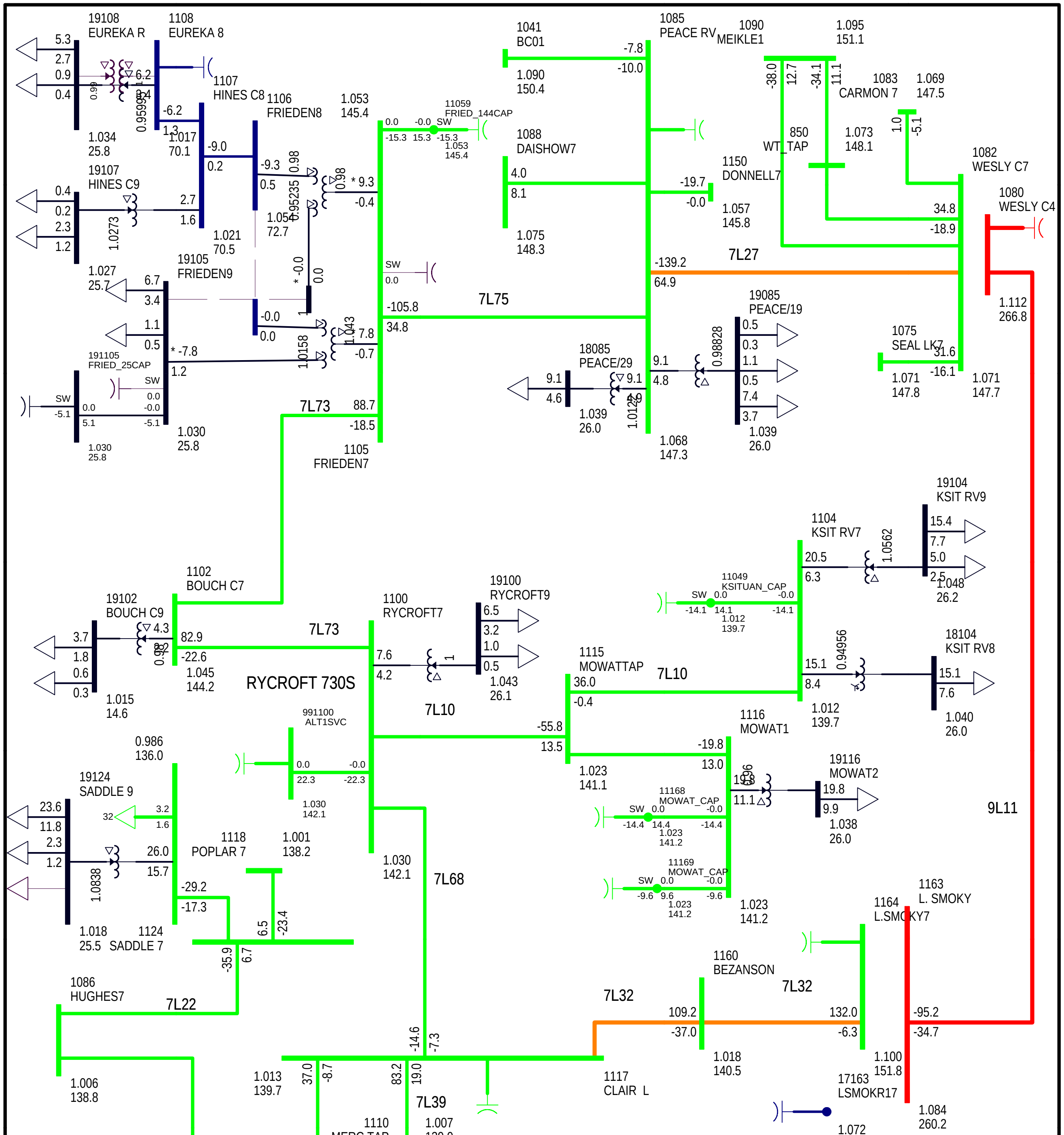
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L39 (N-1)
FIG B-55
FRI, NOV 03 2017 16:07

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 93.2 MW



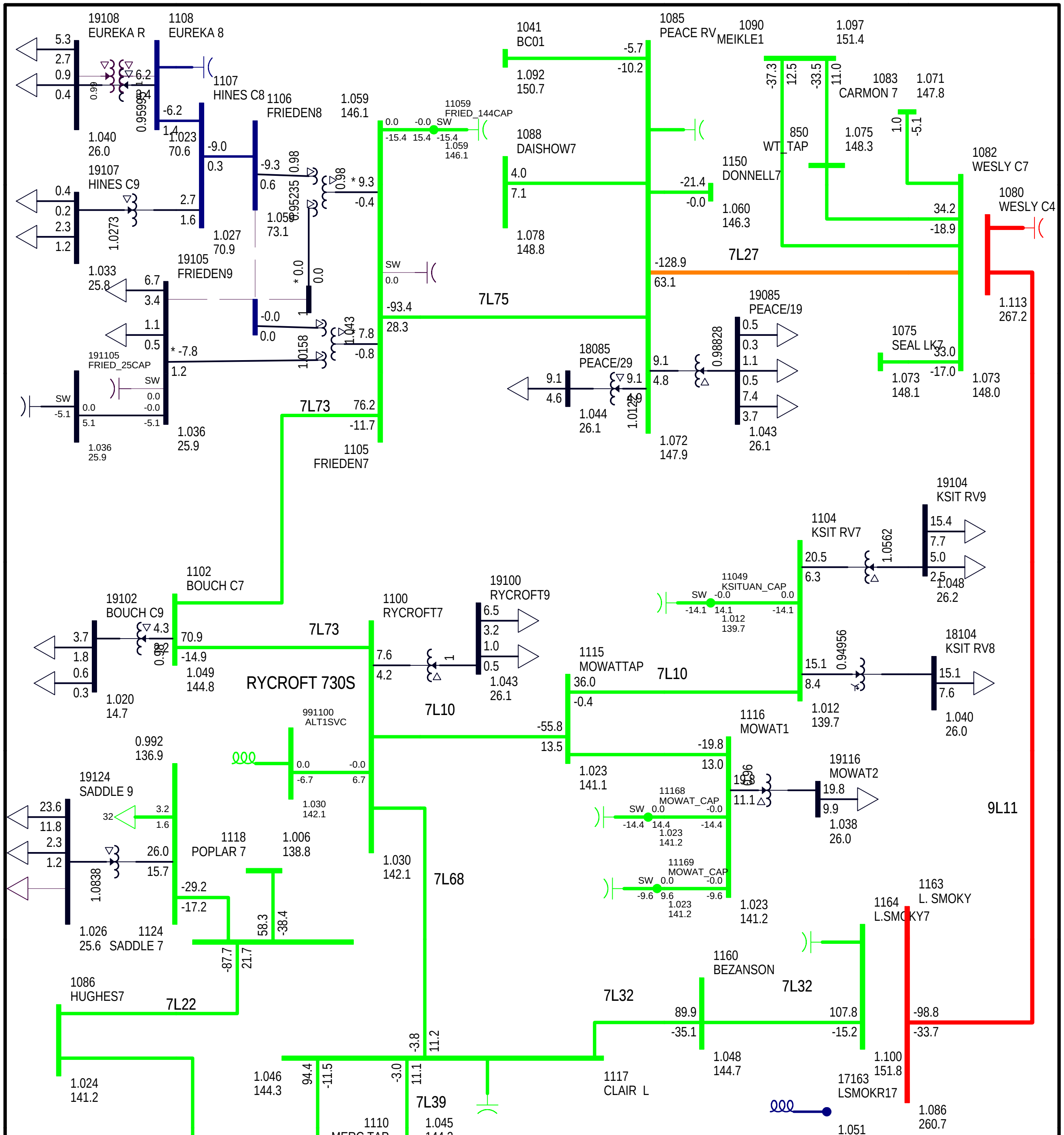
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L84 (N-1)
FIG B-56
FRI, NOV 03 2017 16:07

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 98.2 MW



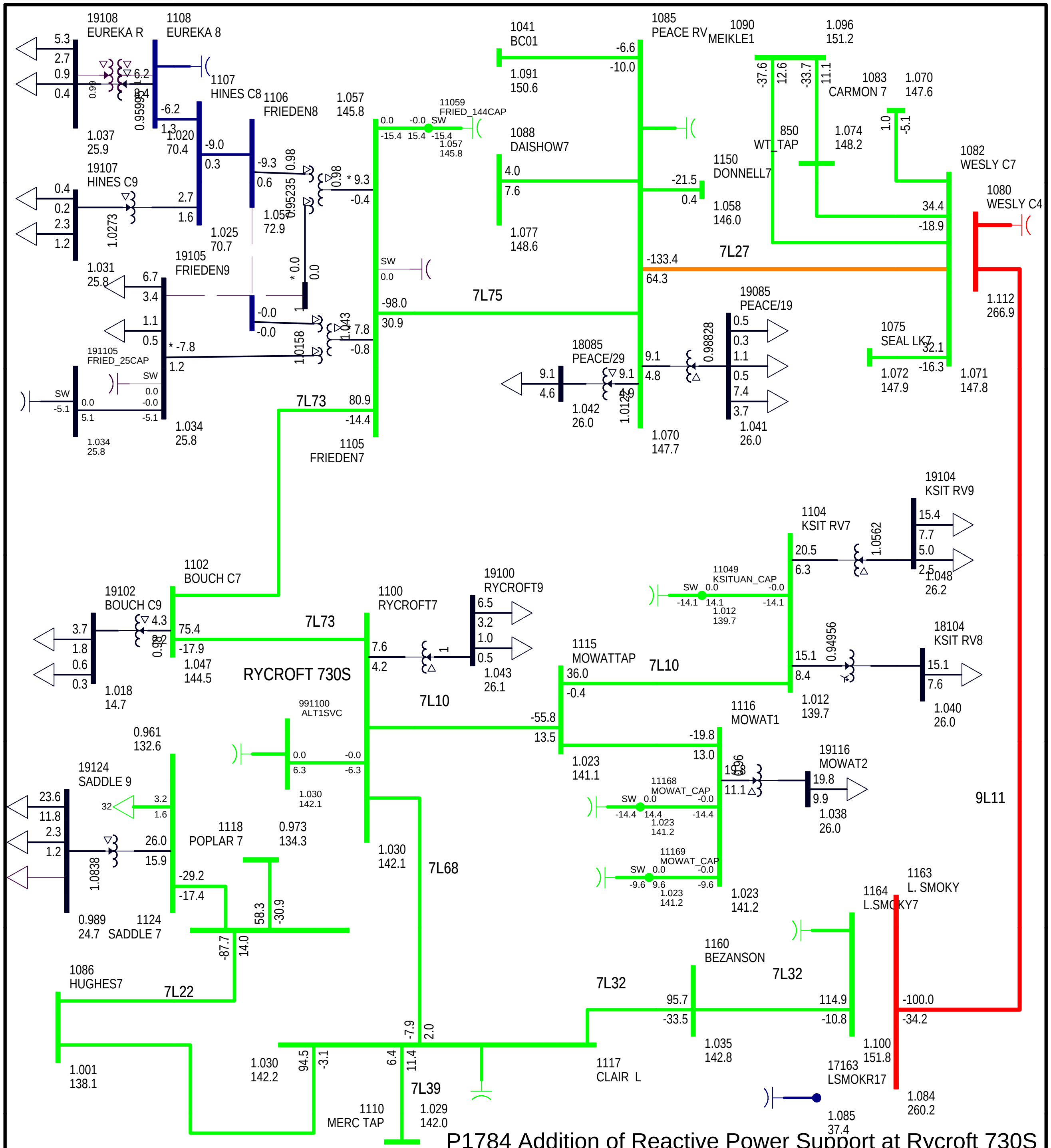
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L03 (N-1)
FIG B-57
FRI, NOV 03 2017 16:07

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 94.9 MW



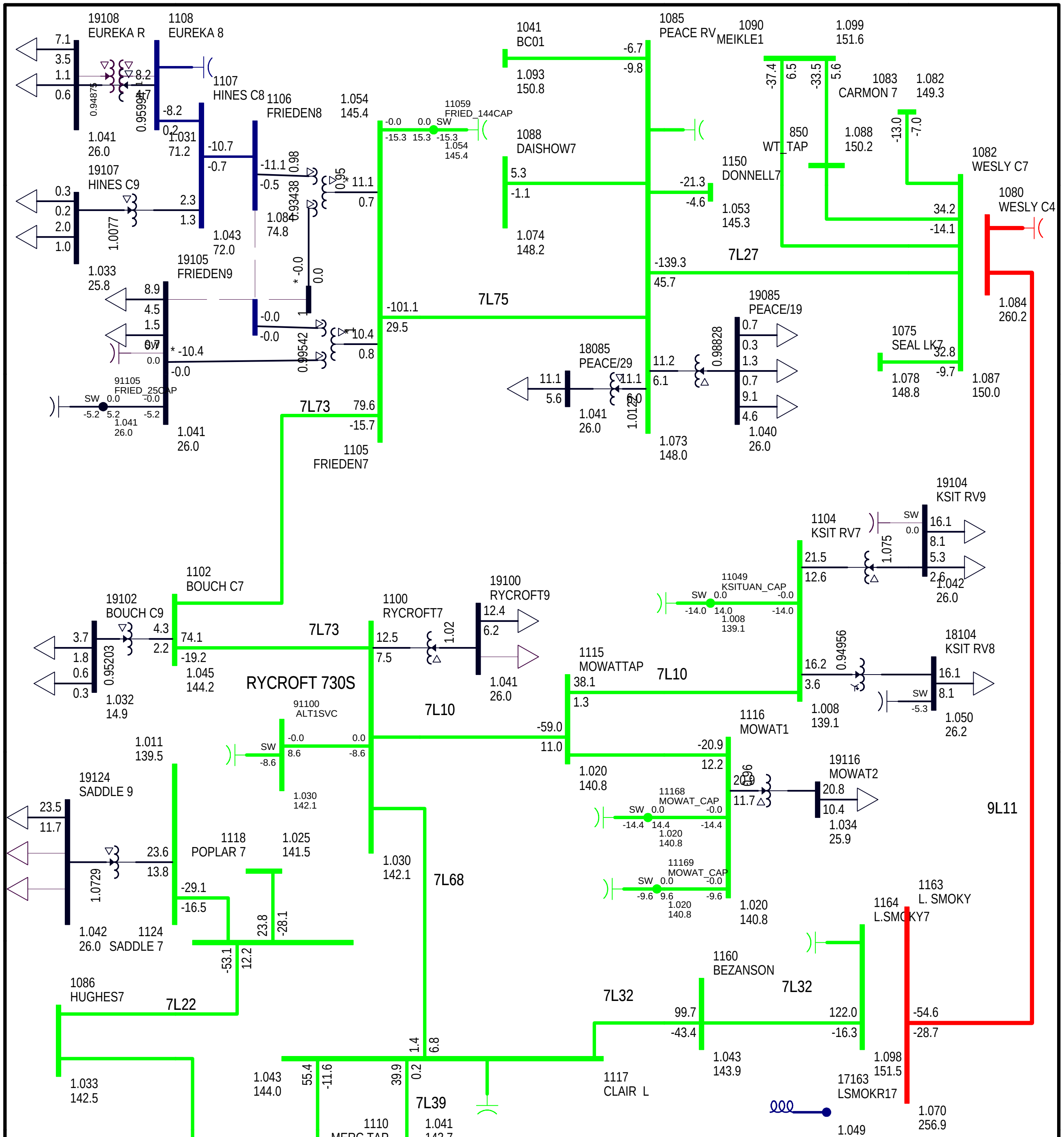
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 4 2036SP
7L69 (N-1)
FIG B-58
FRI, NOV 03 2017 16:07

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 96.0 MW



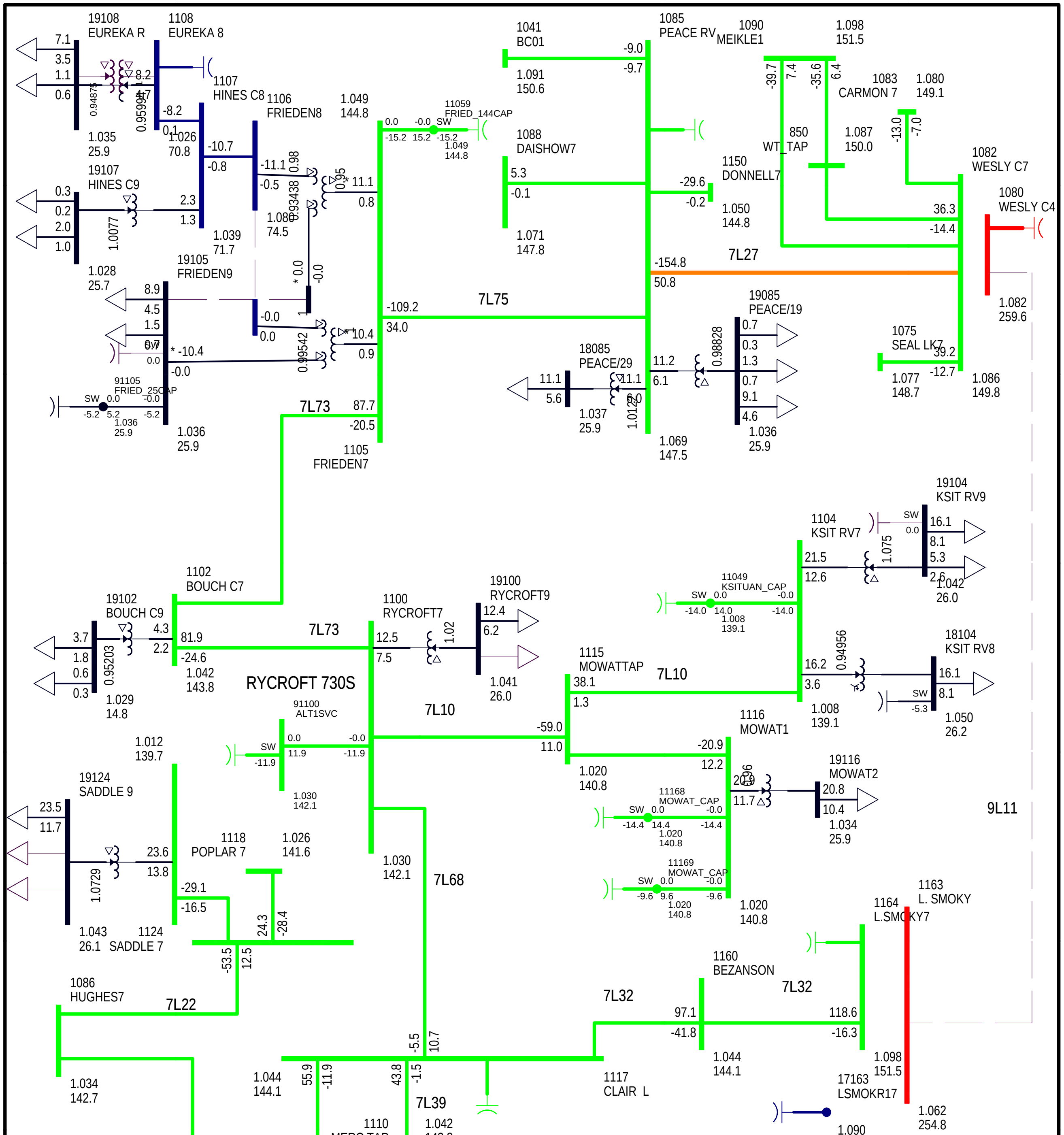
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
BASE CASE(N-0)
FIG B-59
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 108.9 MW



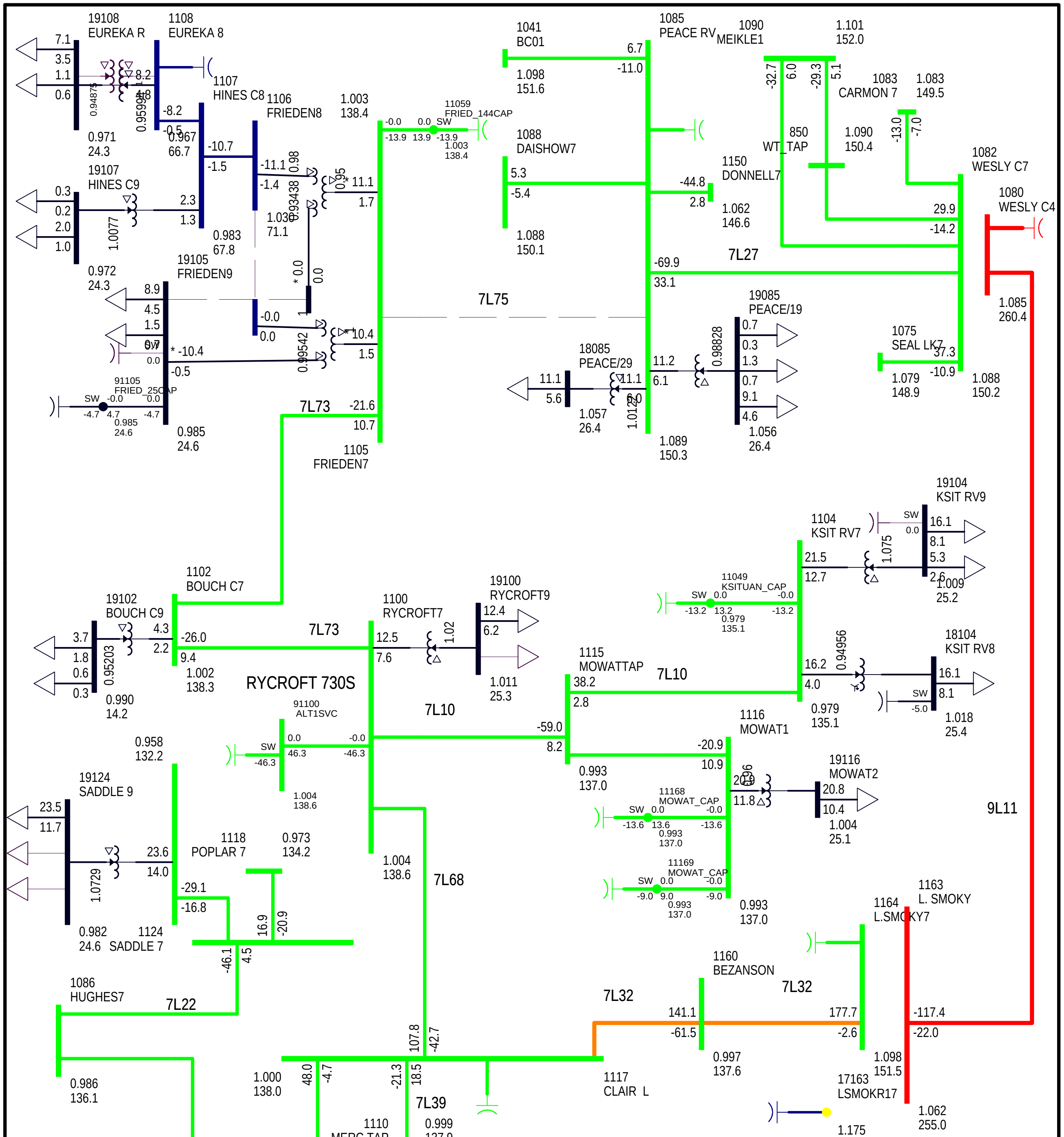
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
9L11 (N-1)
FIG B-60
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 111.2 MW



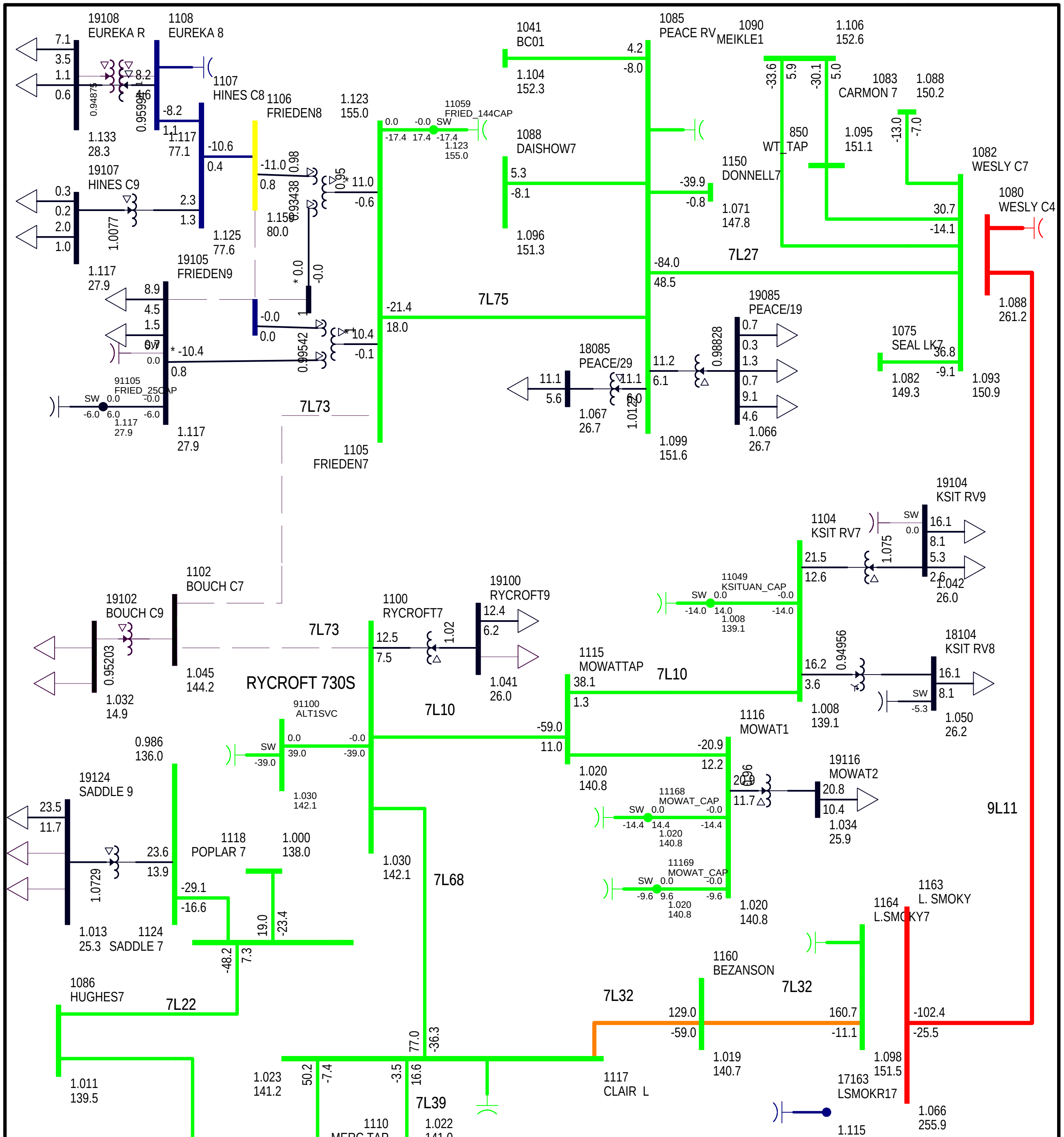
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L75 (N-1)
FIG B-61
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 107.8 MW



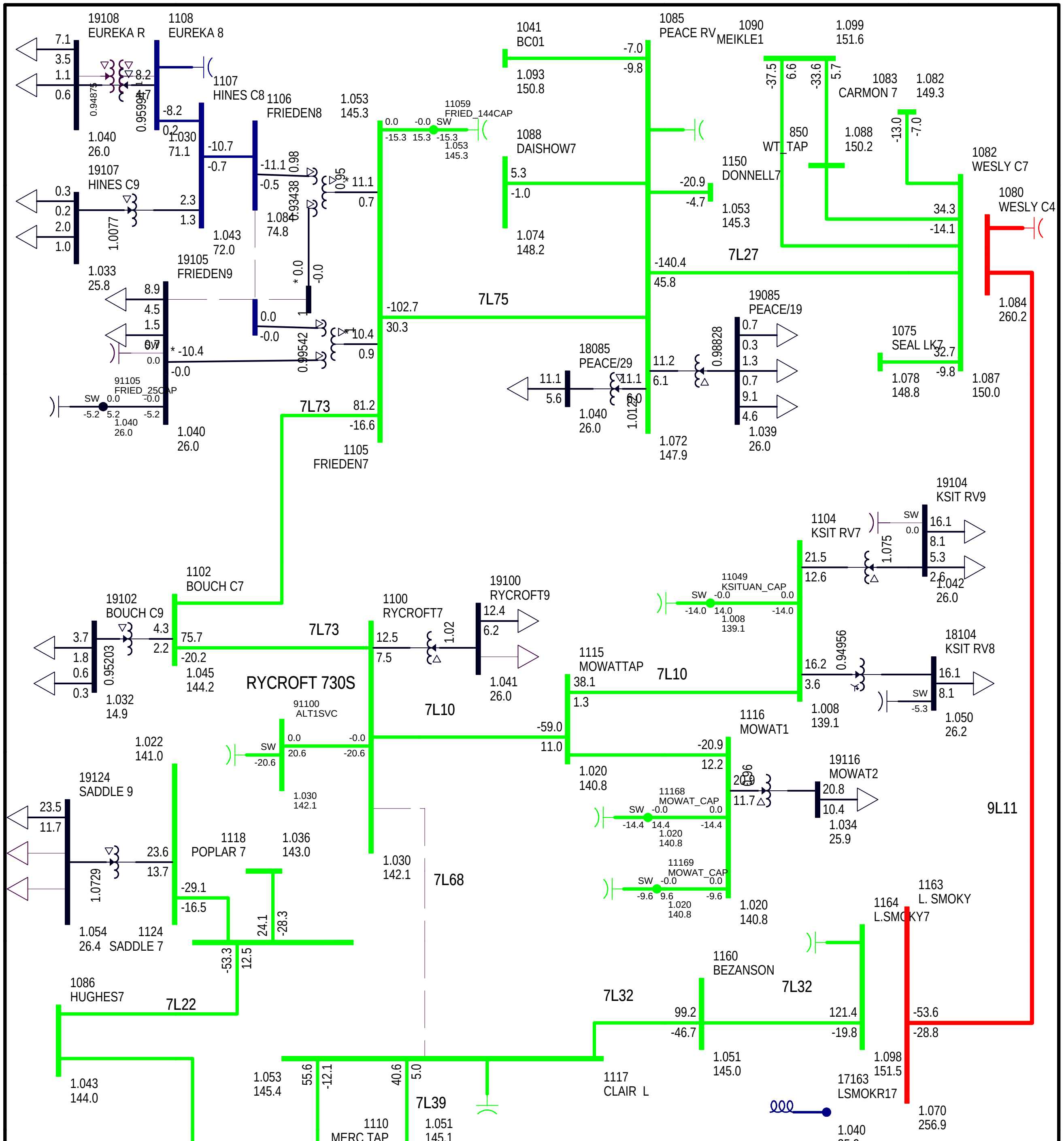
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L73 (N-1)
FIG B-62
TUE, NOV 07 2017   9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 91.7 MW

TOTAL FLOW INTO RYCROFT AREA: 98.8 MW



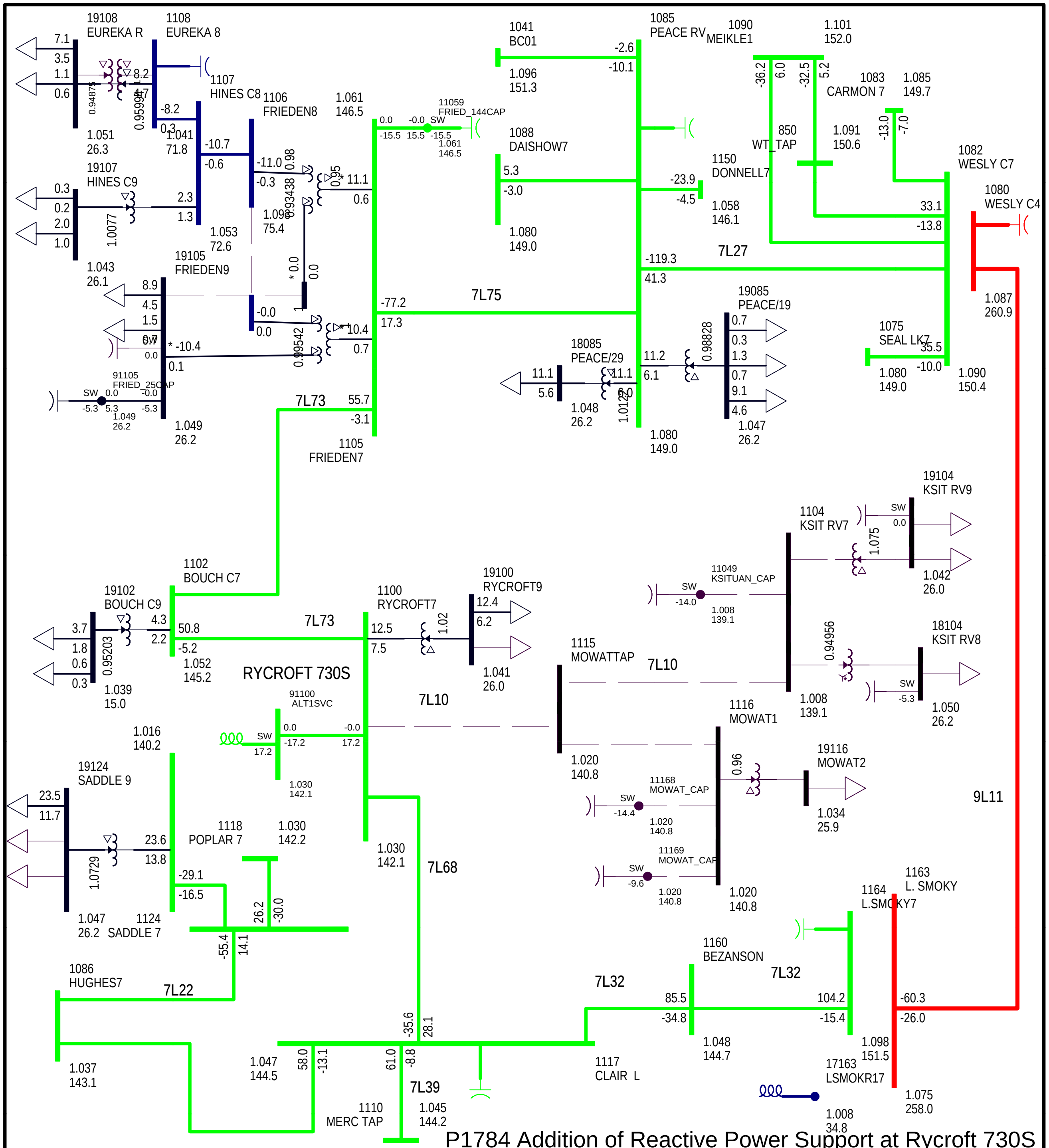
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L68 (N-1)
FIG B-63
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.2 MW

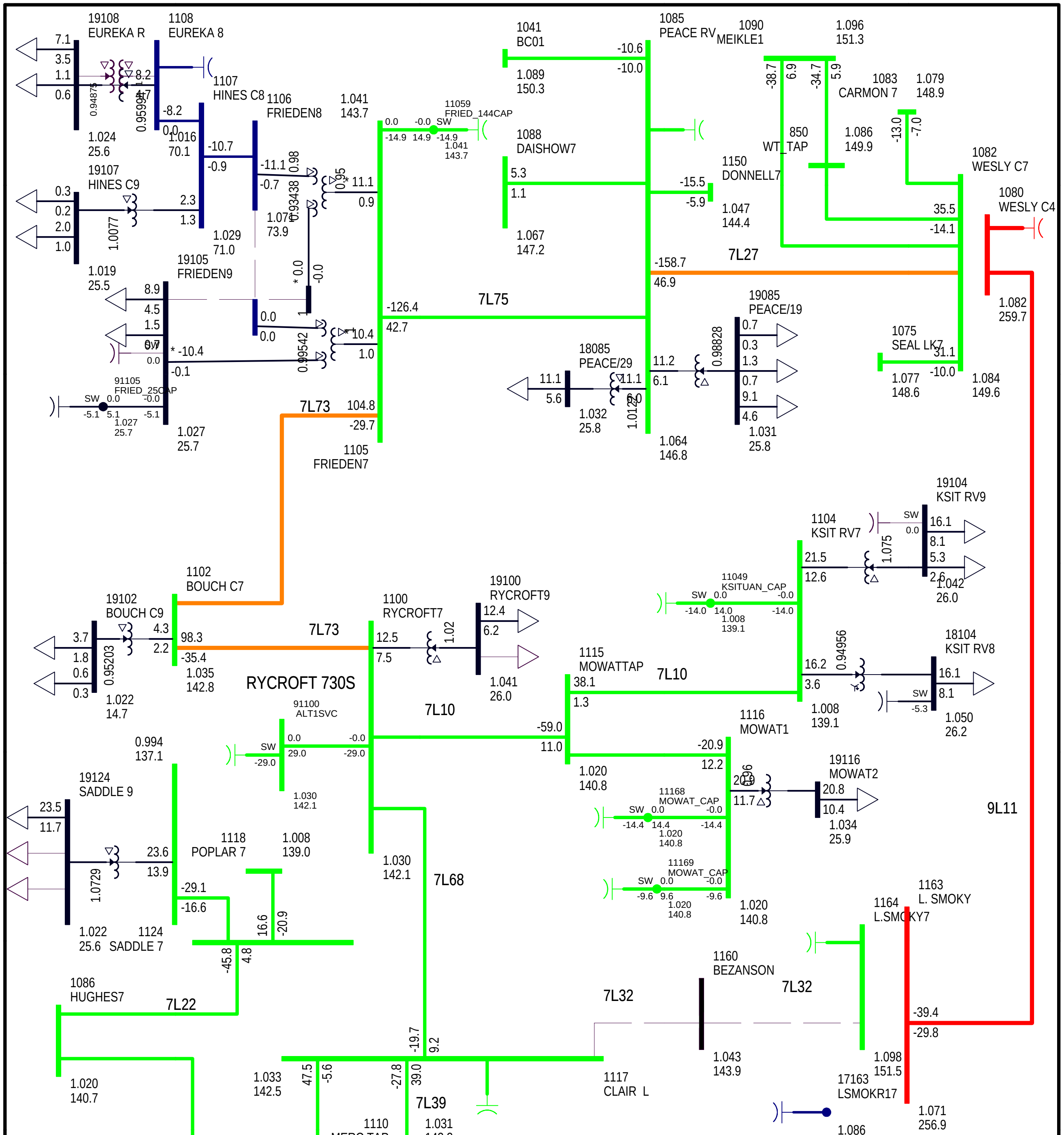


PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L10 (N-1)
FIG B-64
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 37.6 MW

TOTAL FLOW INTO RYCROFT AREA: 45.0 MW



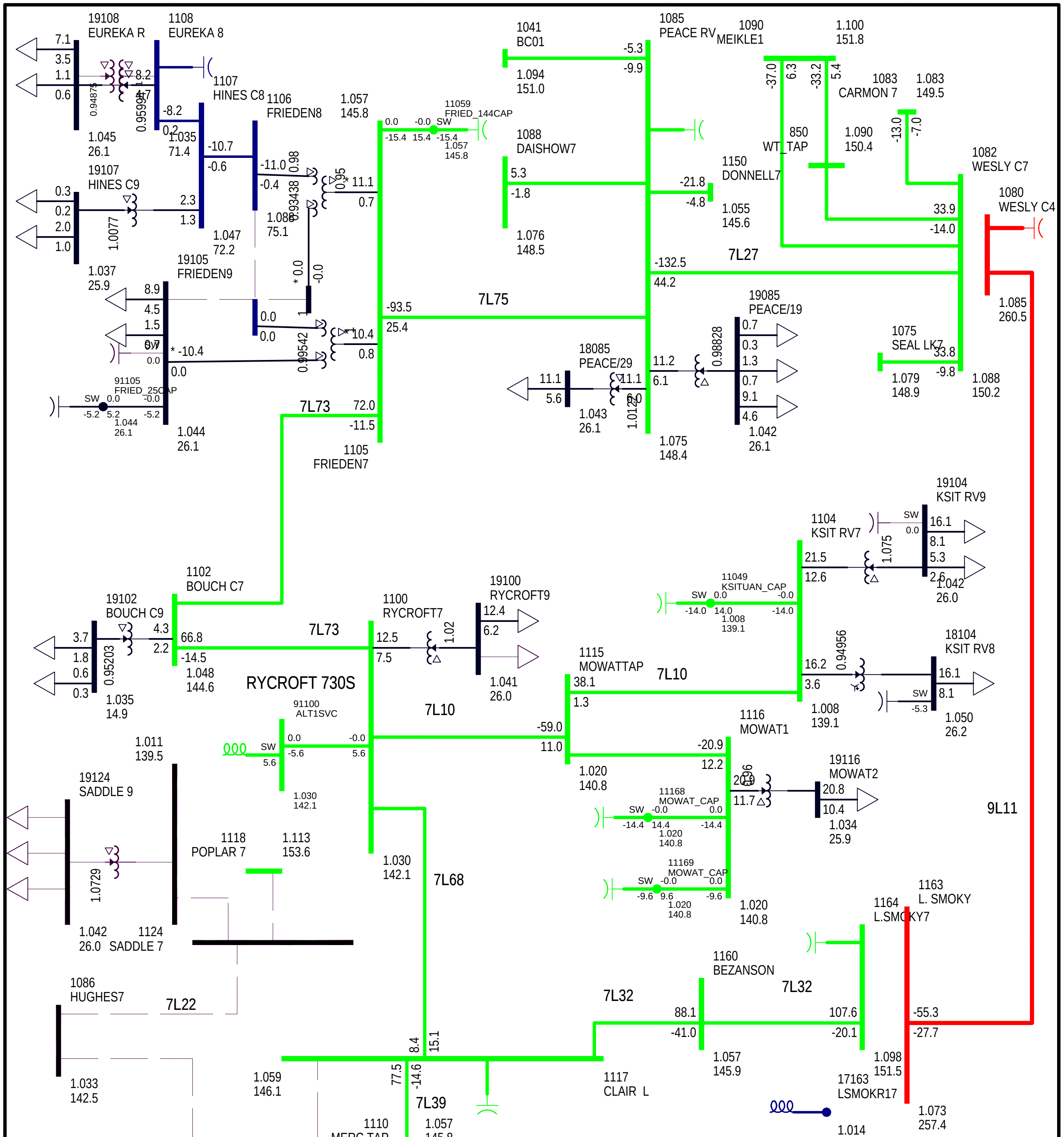
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L32 (N-1)
FIG B-65
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 116.9 MW



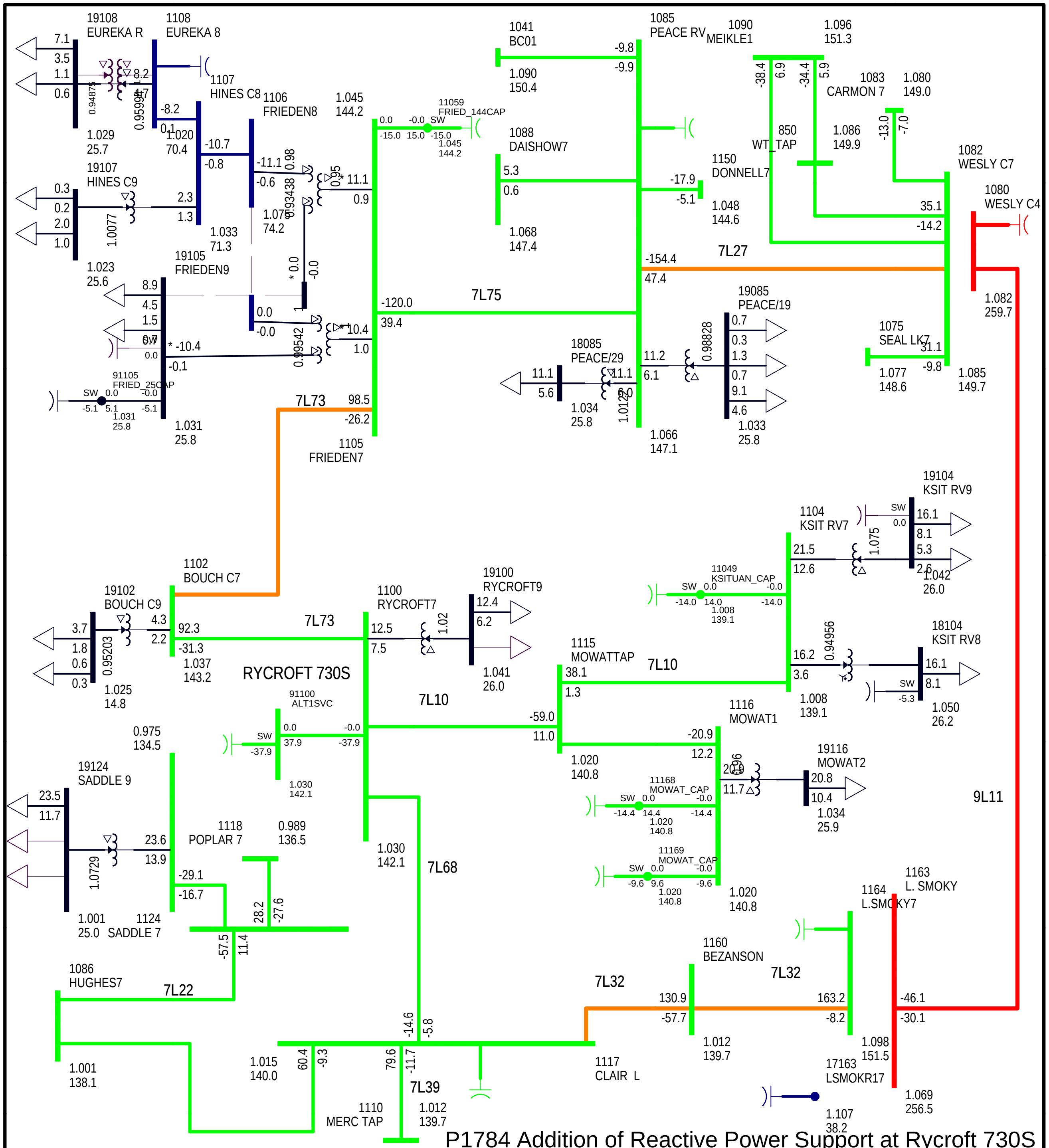
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L22 (N-1)
FIG B-66
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 107.2 MW

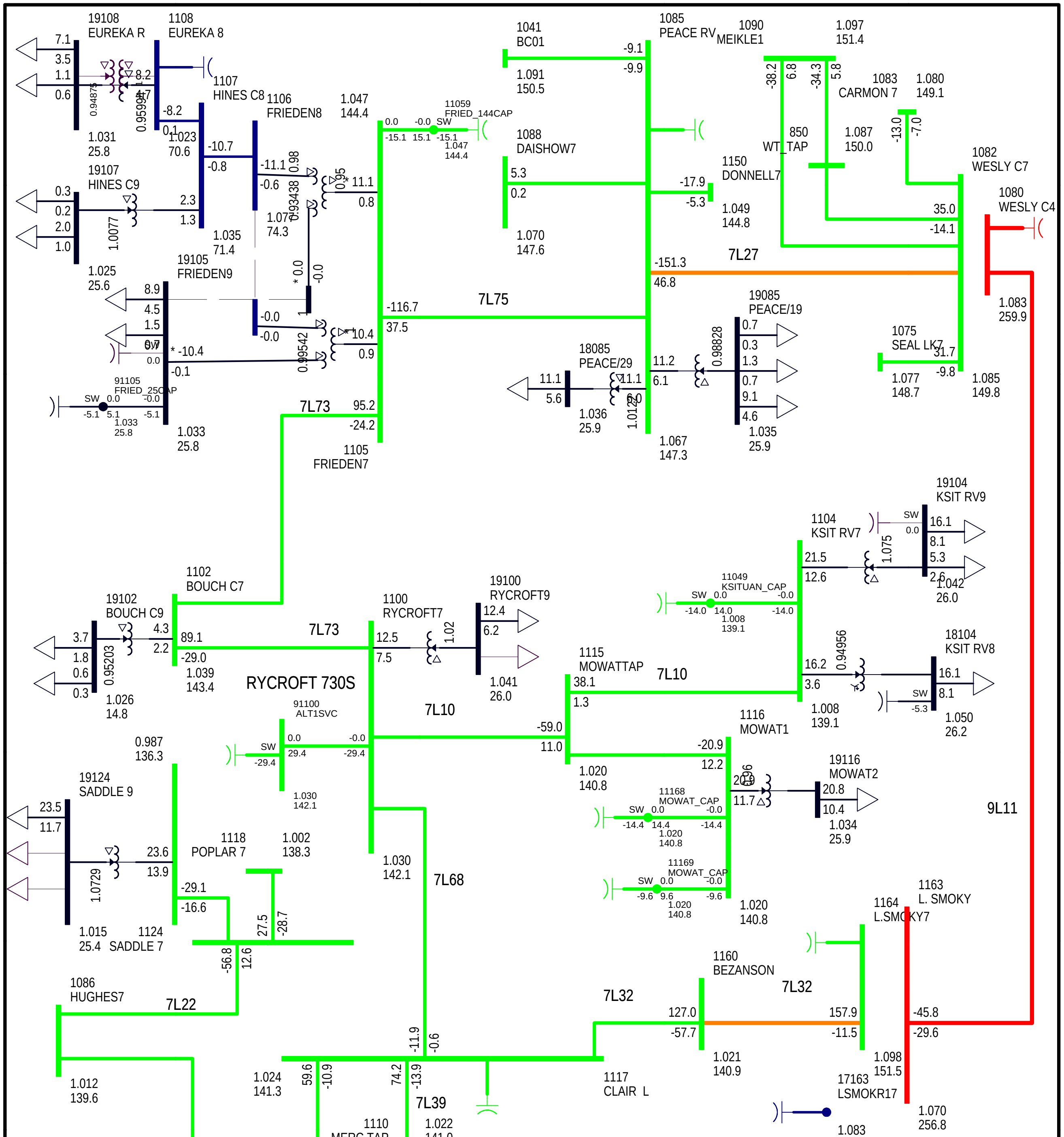


PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L46 (N-1)
FIG B-67
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 114.5 MW



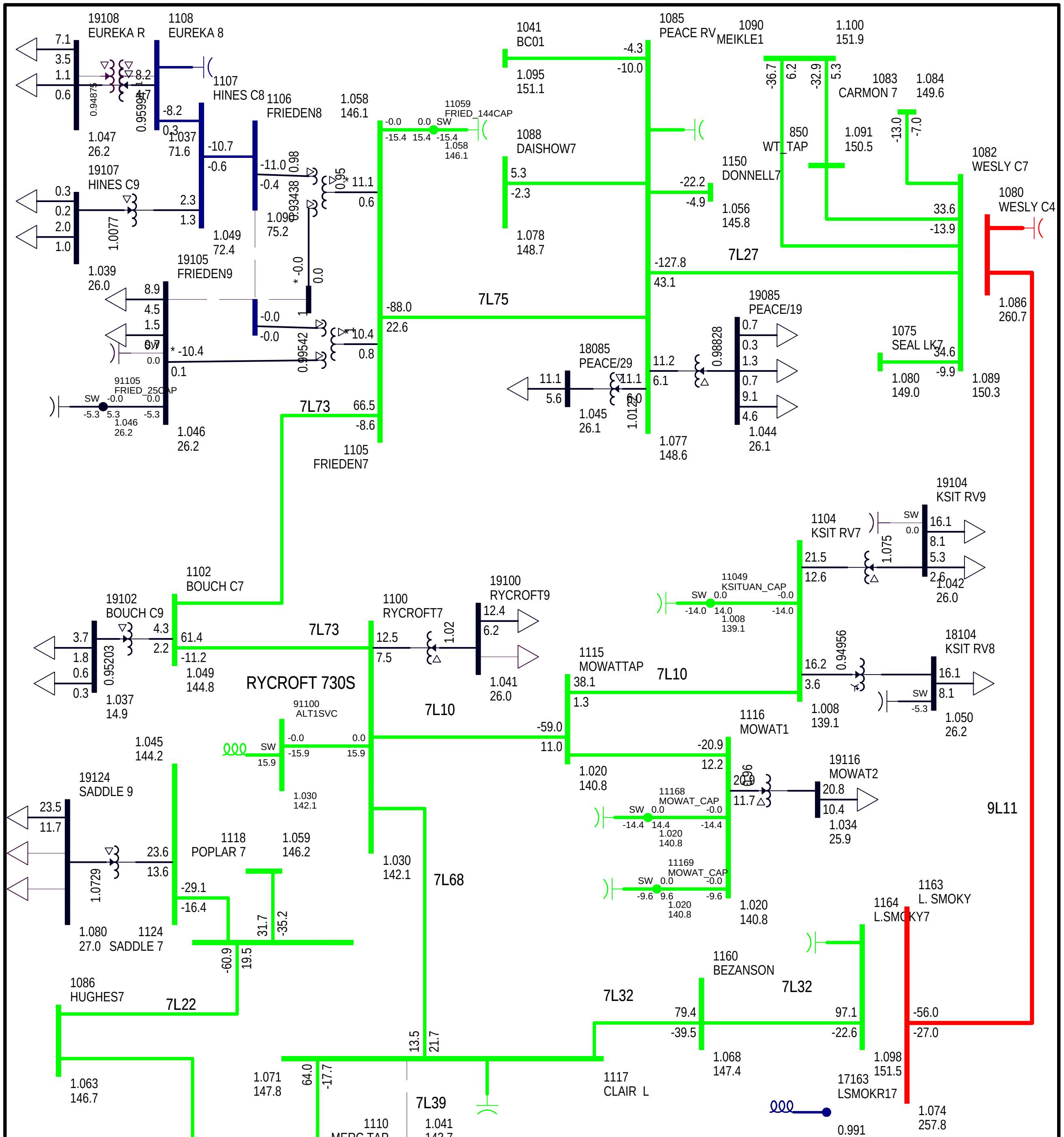
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L45 (N-1)
FIG B-68
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 113.4 MW



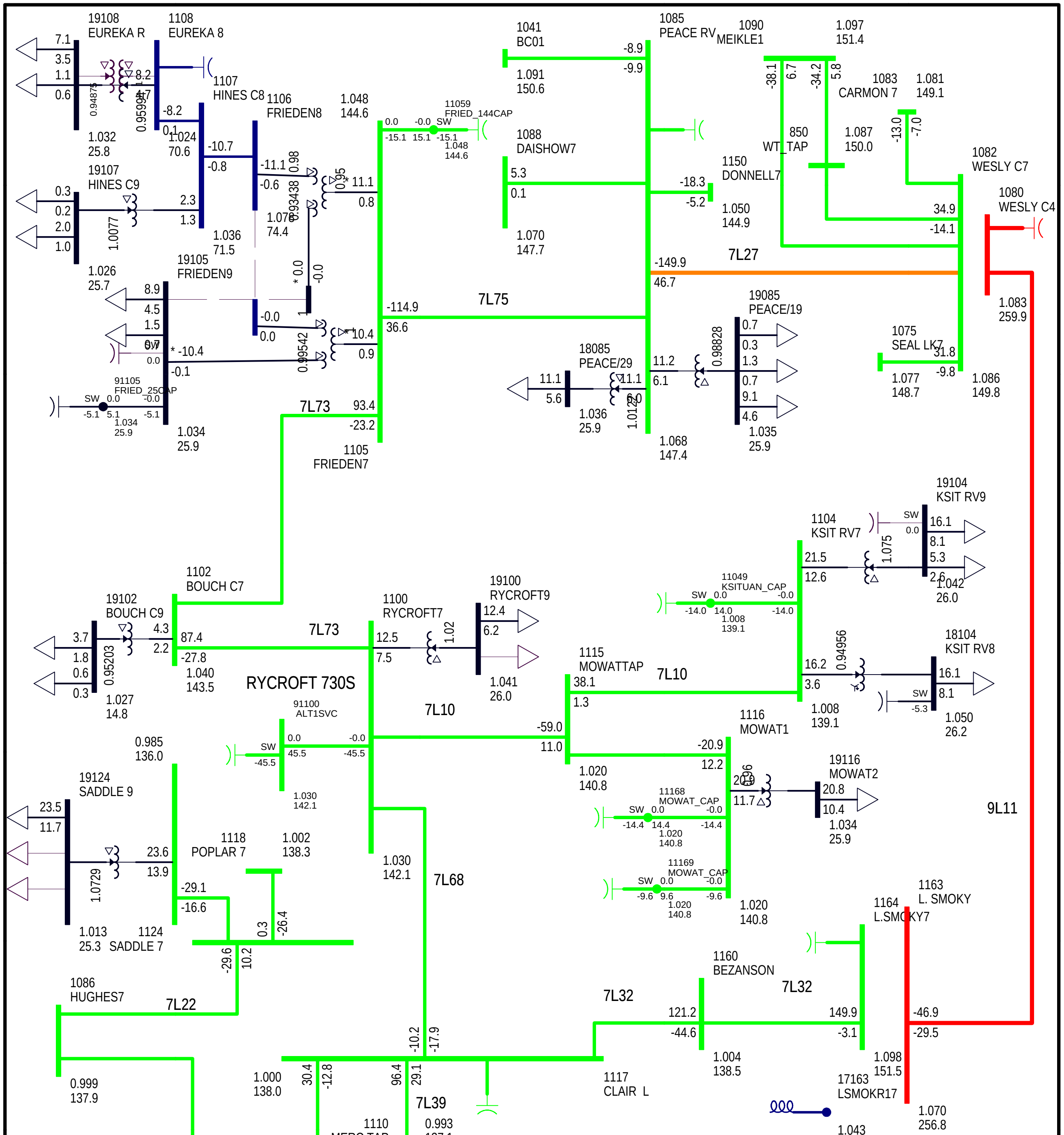
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L39 (N-1)
FIG B-69
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 106.2 MW



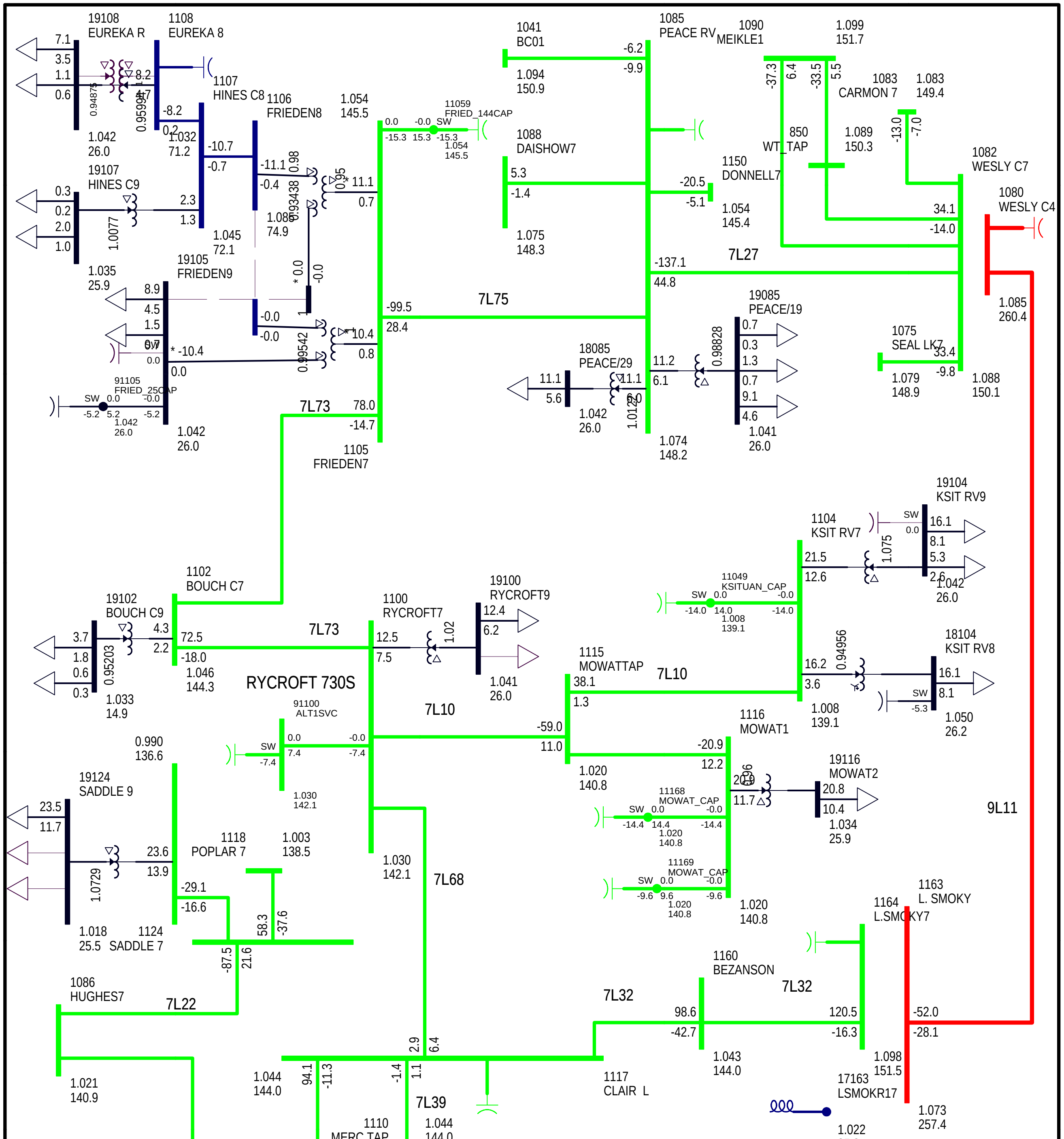
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L84 (N-1)
FIG B-70
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 113.0 MW



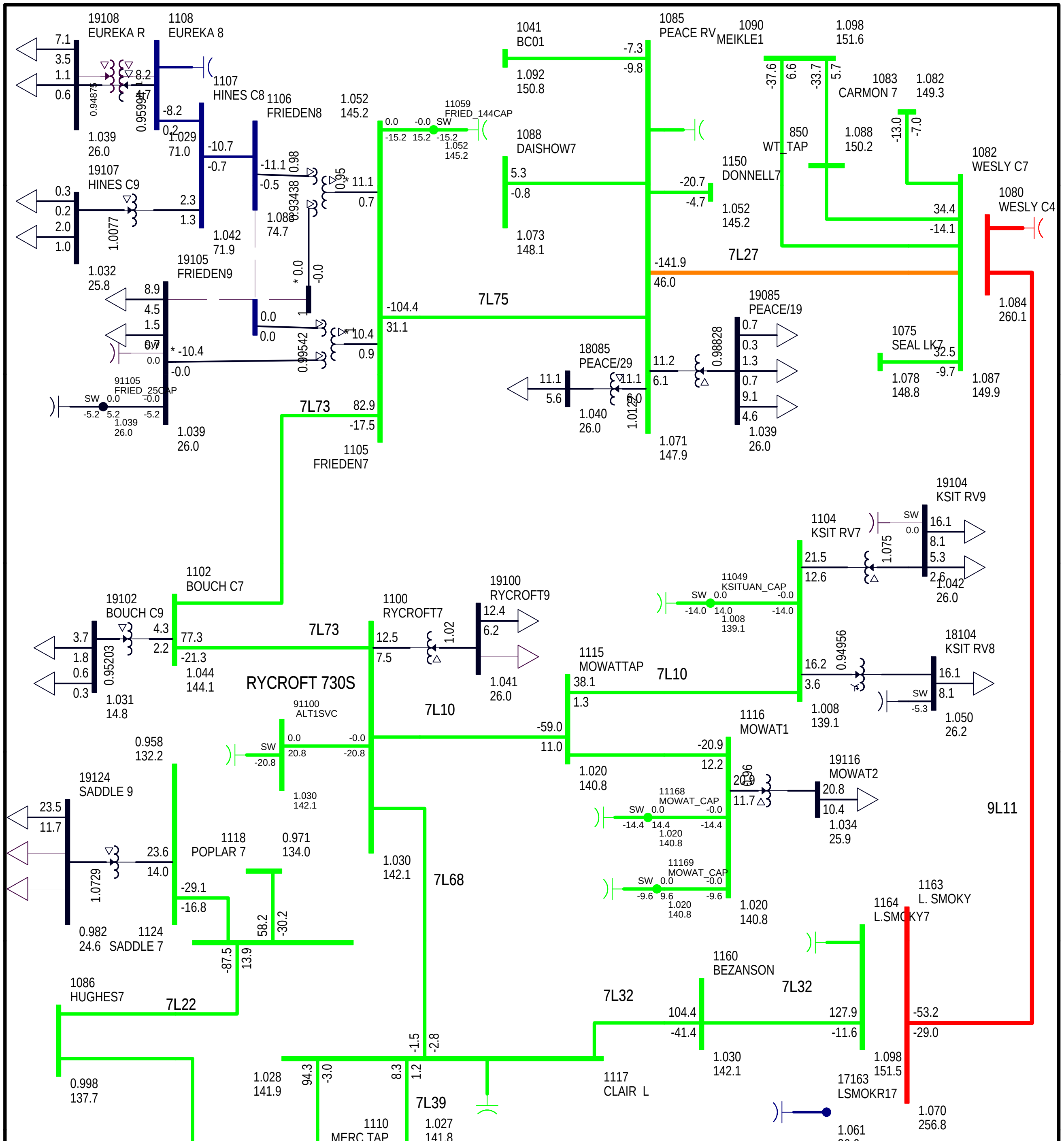
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L03 (N-1)
FIG B-71
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 108.4 MW



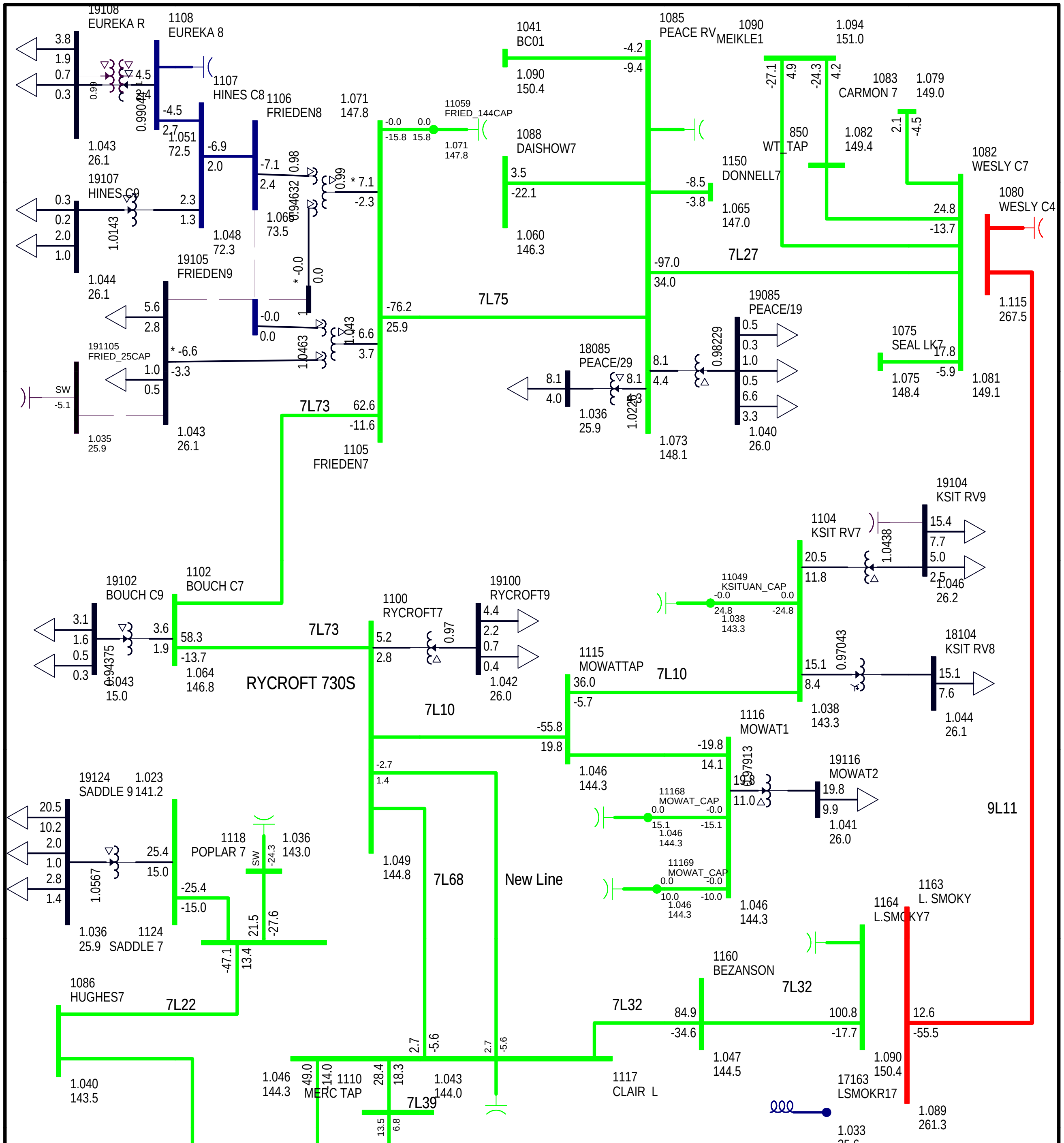
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT1: SCENARIO 5 2036WP
7L69 (N-1)
FIG B-72
TUE, NOV 07 2017 9:51

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.7 MW



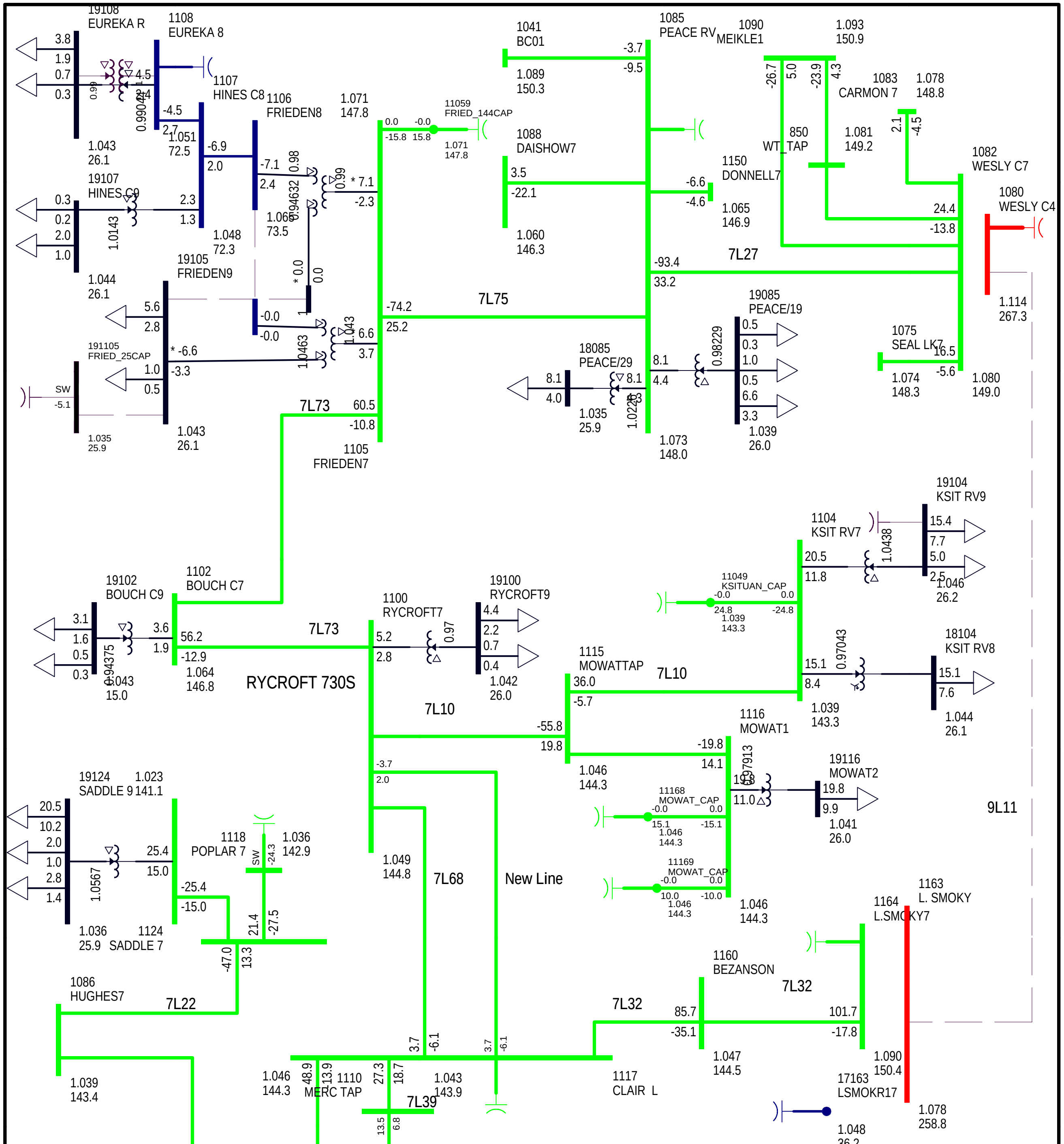
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
BASE CASE(N-0)
FIG B-73
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.3 MW



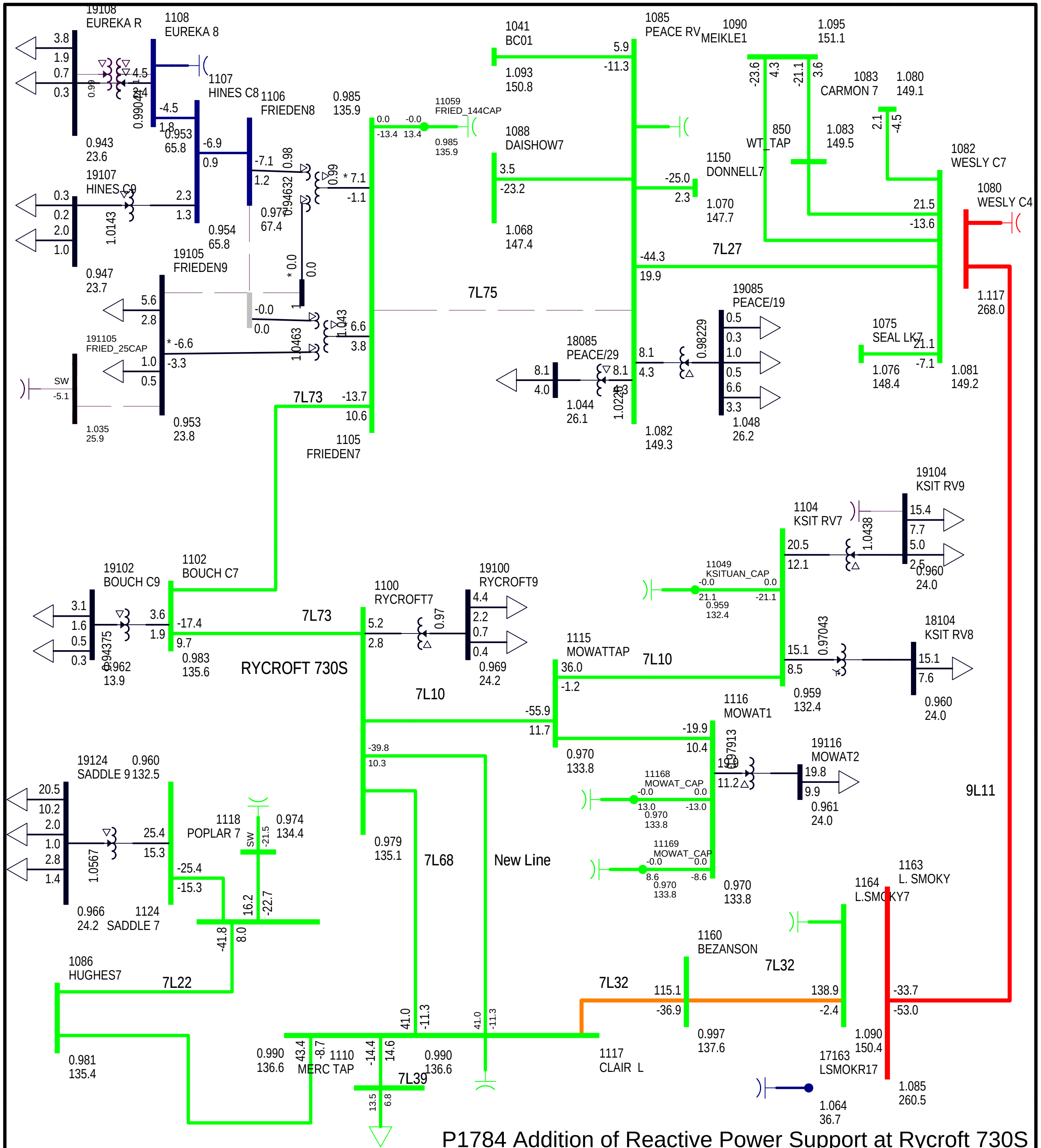
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
9L11 (N-1)
FIG B-74
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 84.9 MW



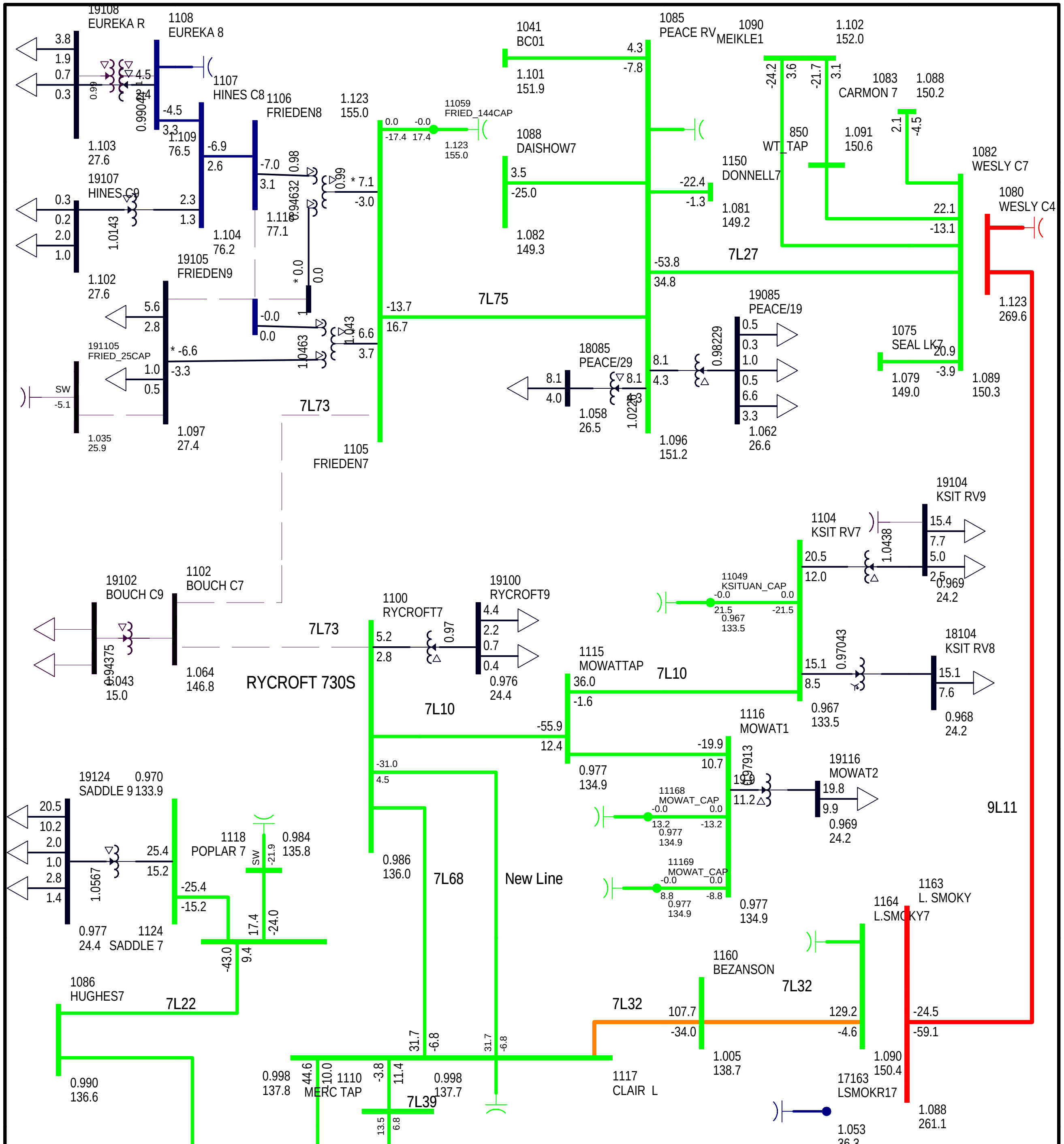
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L75 (N-1)
FIG B-75
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 82.1 MW



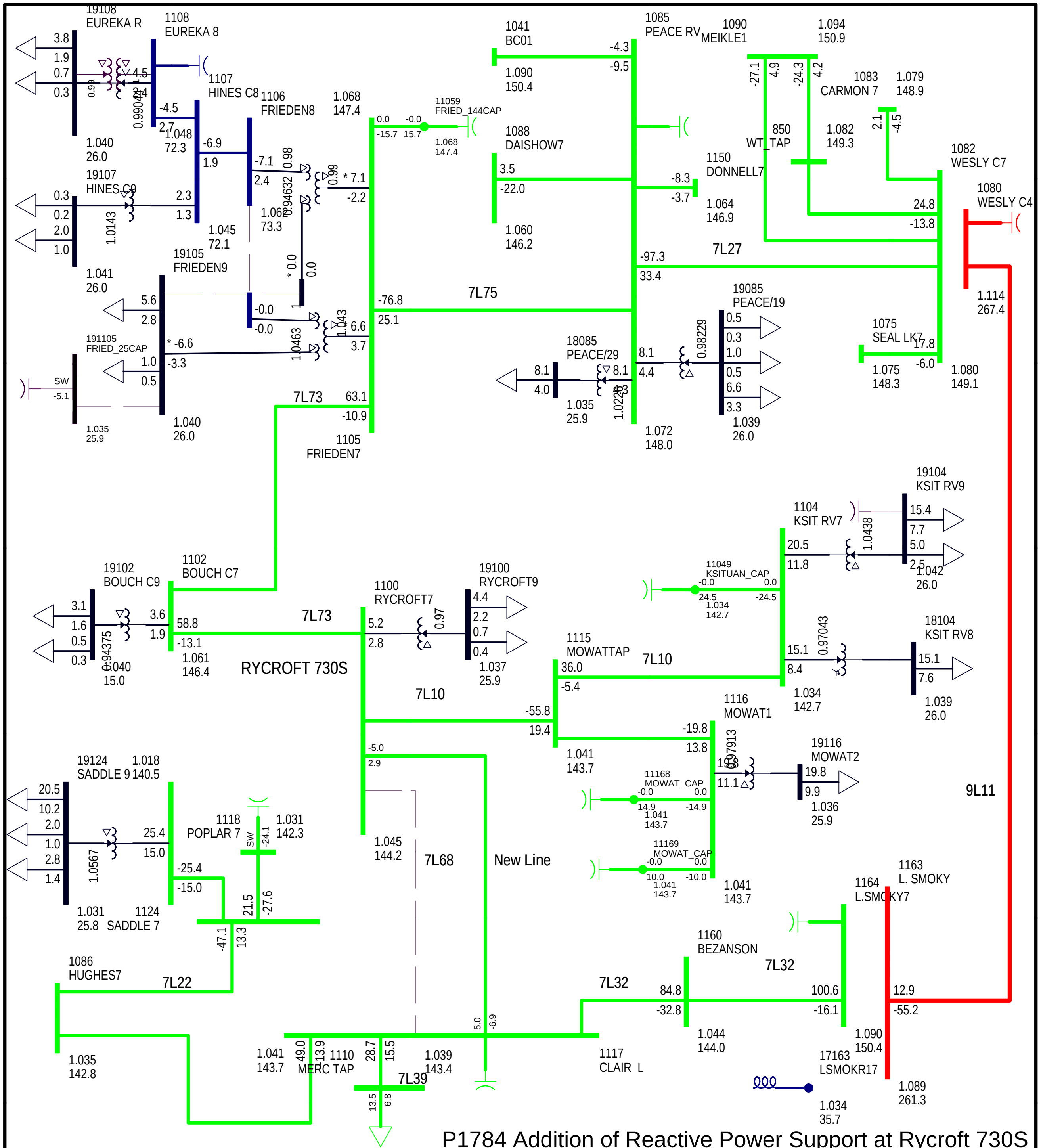
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L73 (N-1)
FIG B-76
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 73.9 MW

TOTAL FLOW INTO RYCROFT AREA: 77.4 MW

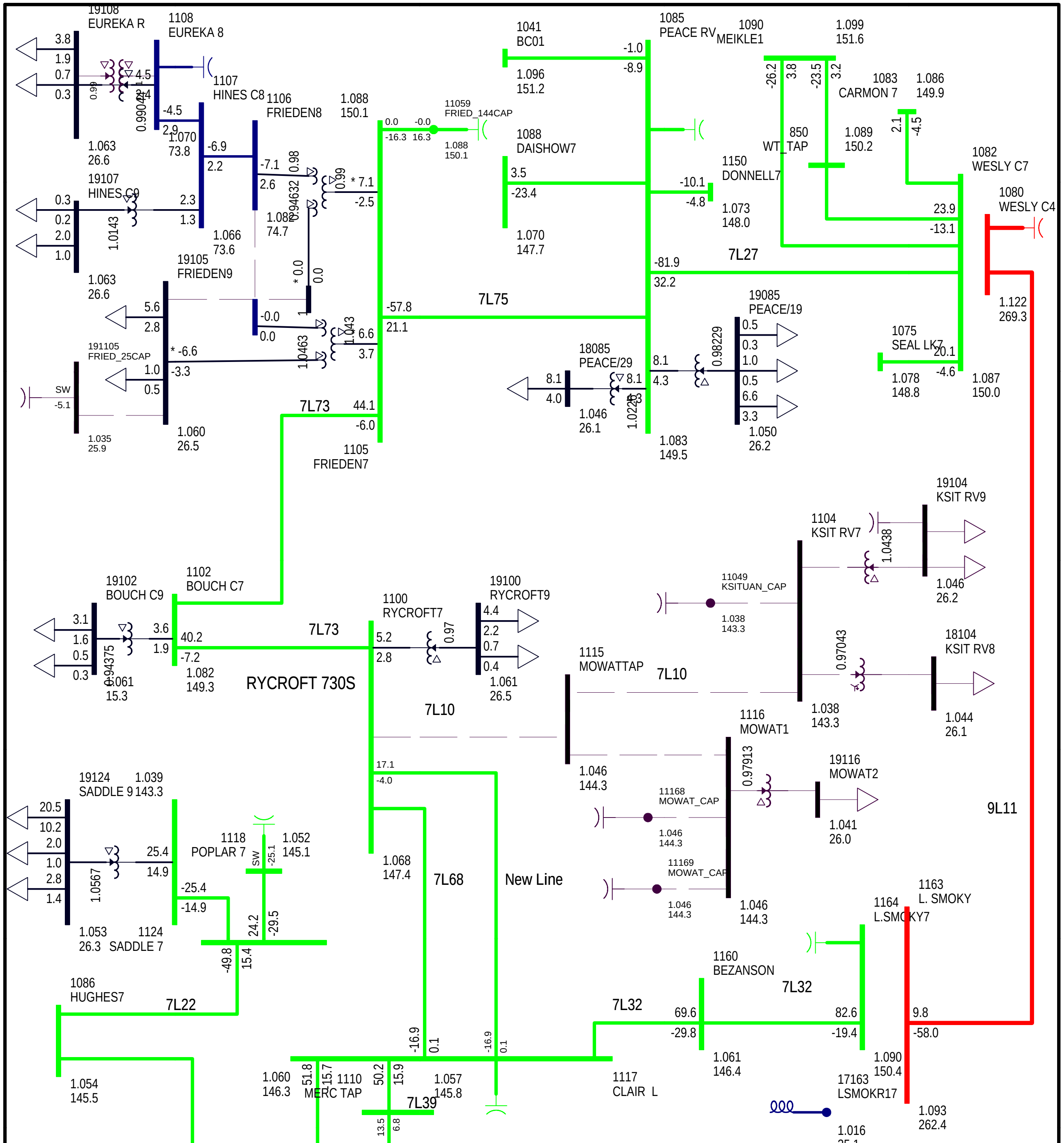


PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L68 (N-1)
FIG B-77
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.4 MW



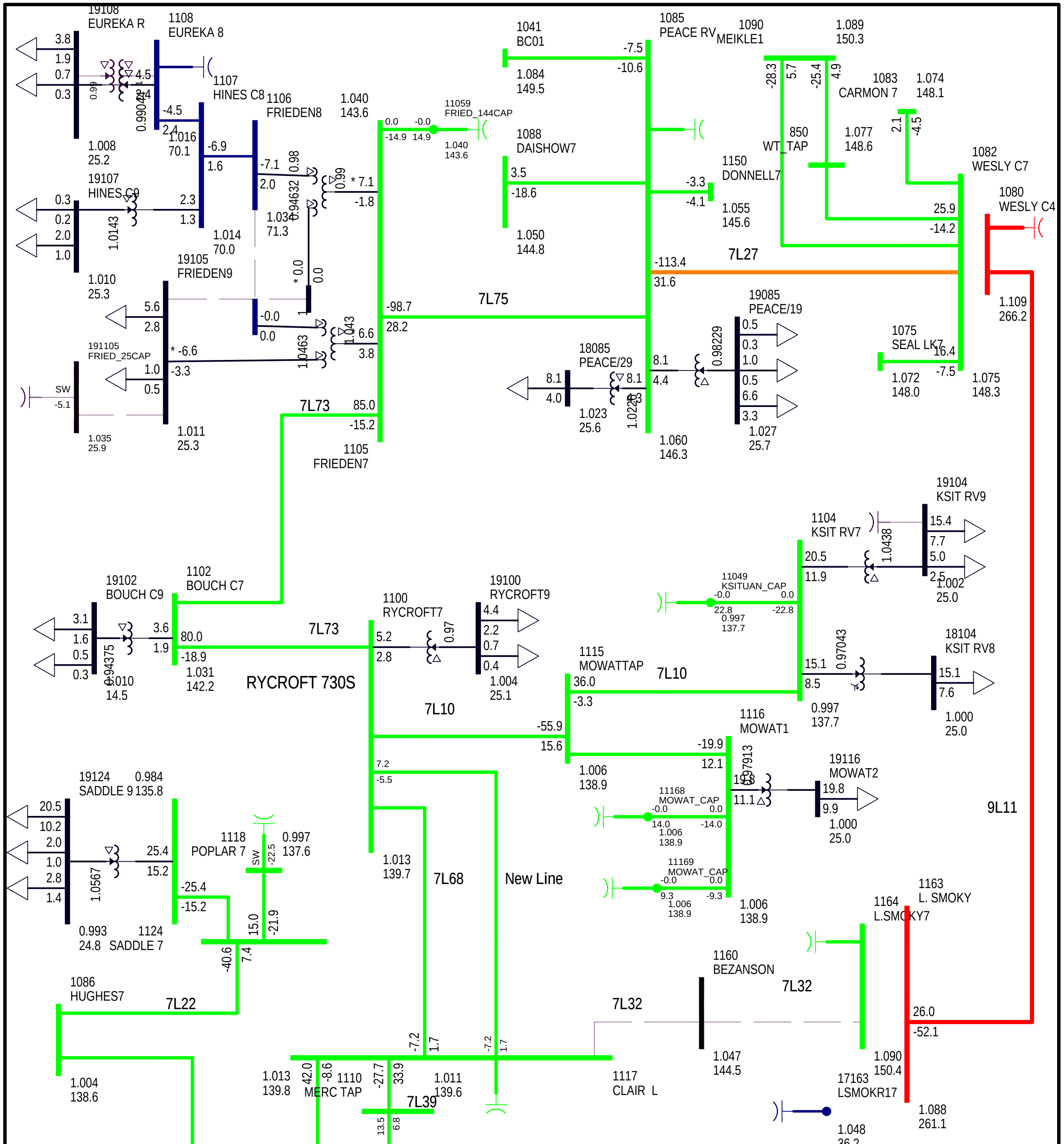
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L10 (N-1)
FIG B-78
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 22.2 MW

TOTAL FLOW INTO RYCROFT AREA: 26.0 MW



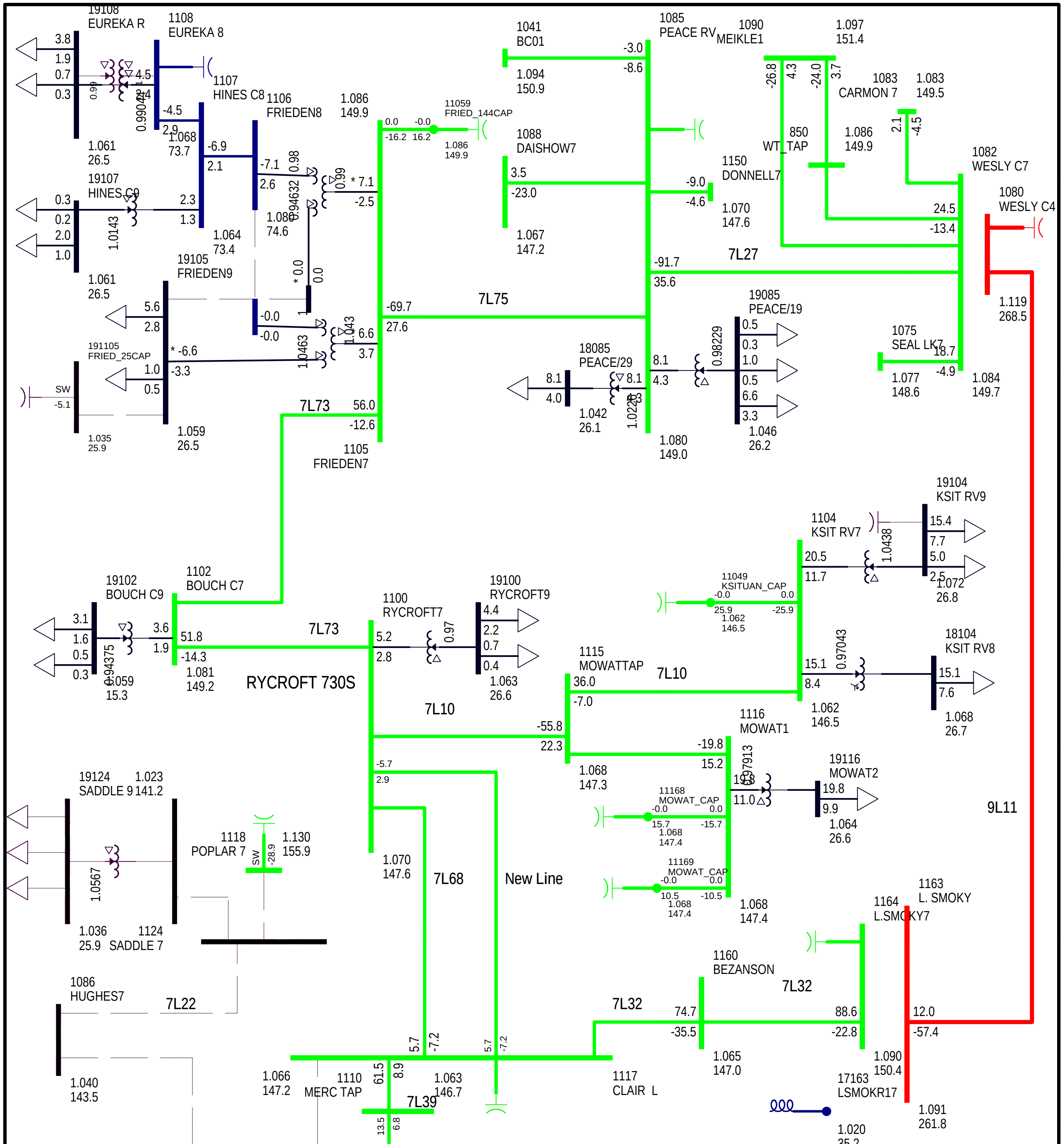
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L32 (N-1)
FIG B-79
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 90.5 MW



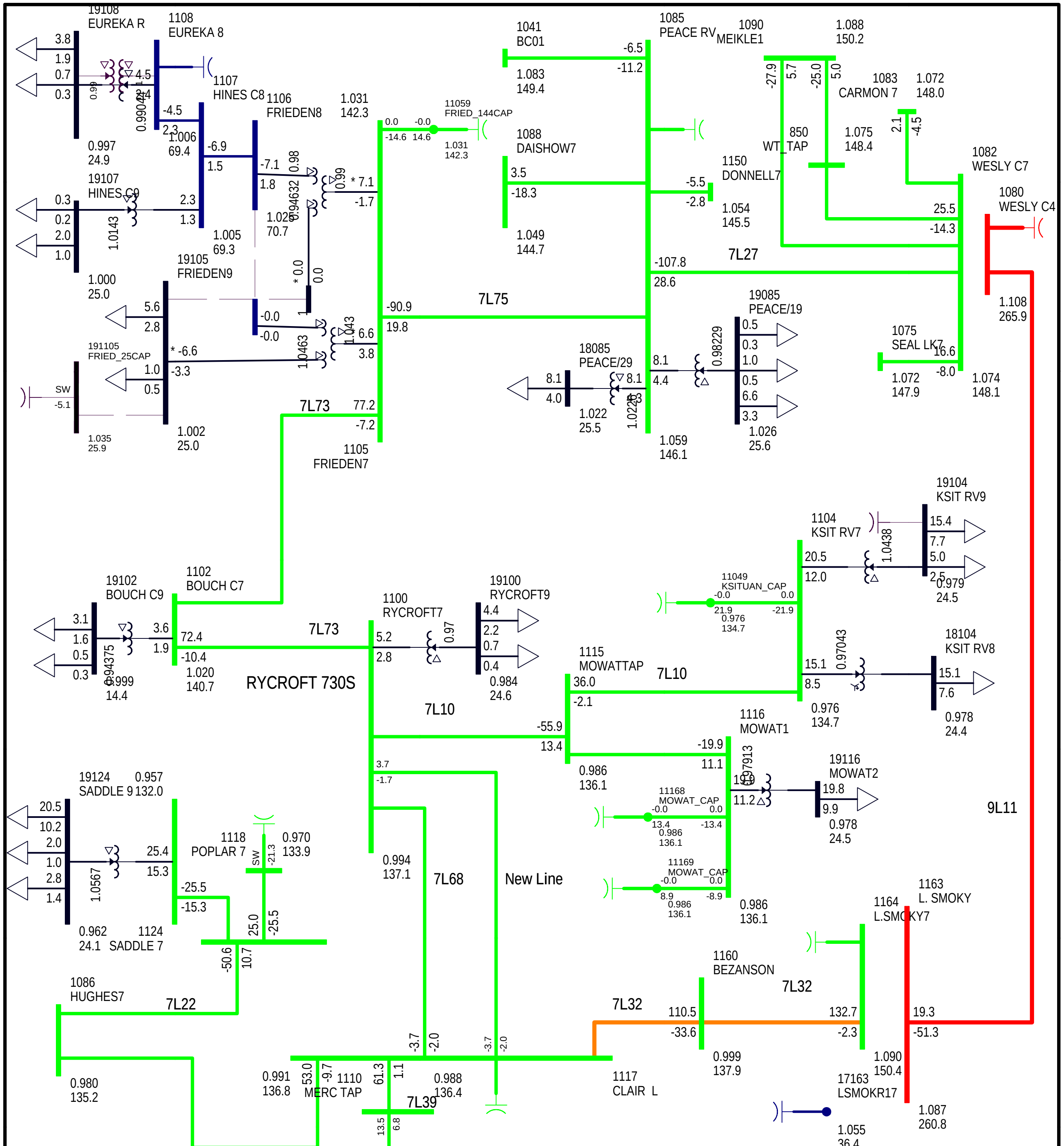
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L22 (N-1)
FIG B-80
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 84.2 MW



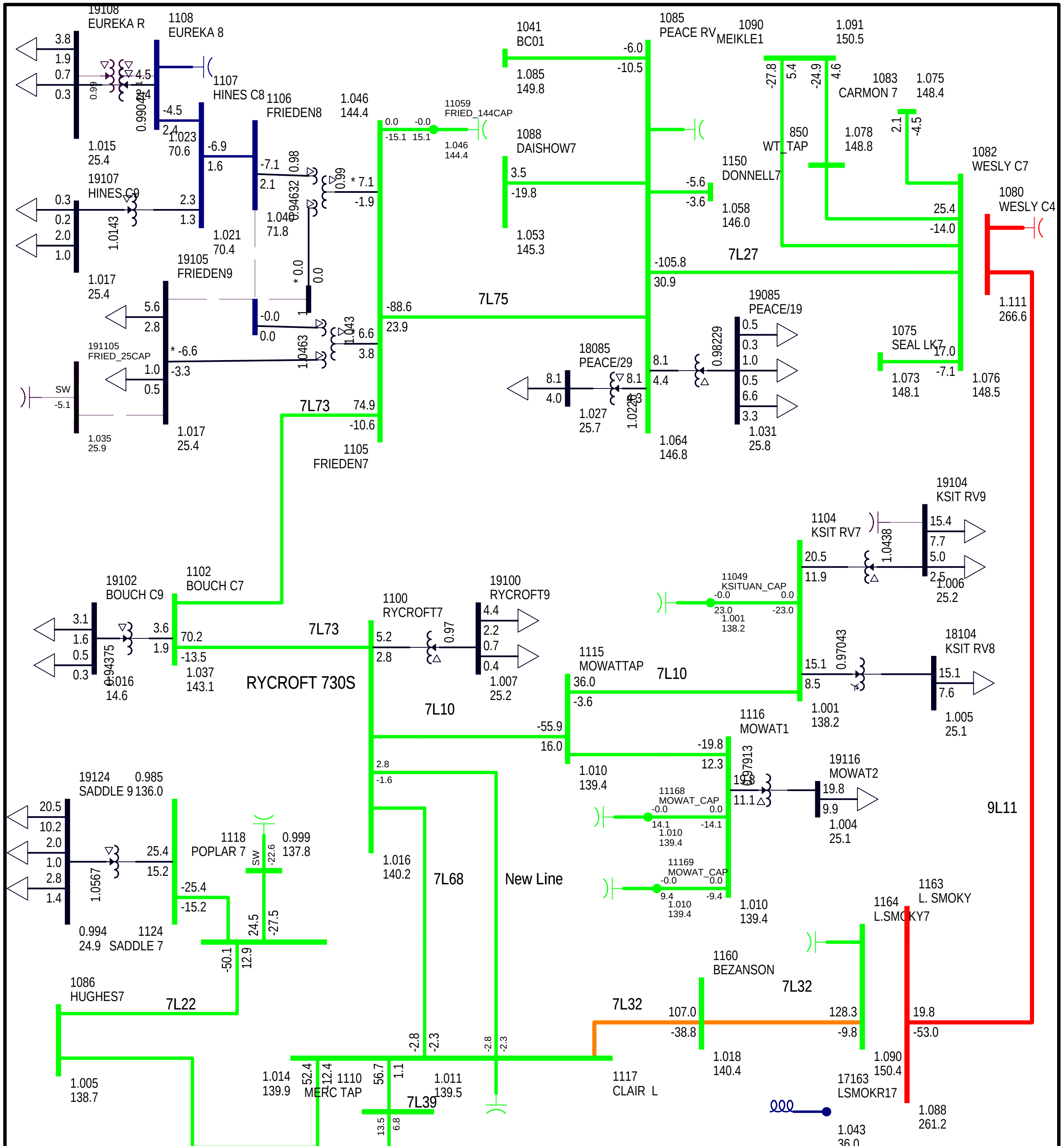
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L46 (N-1)
FIG B-81
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 88.5 MW



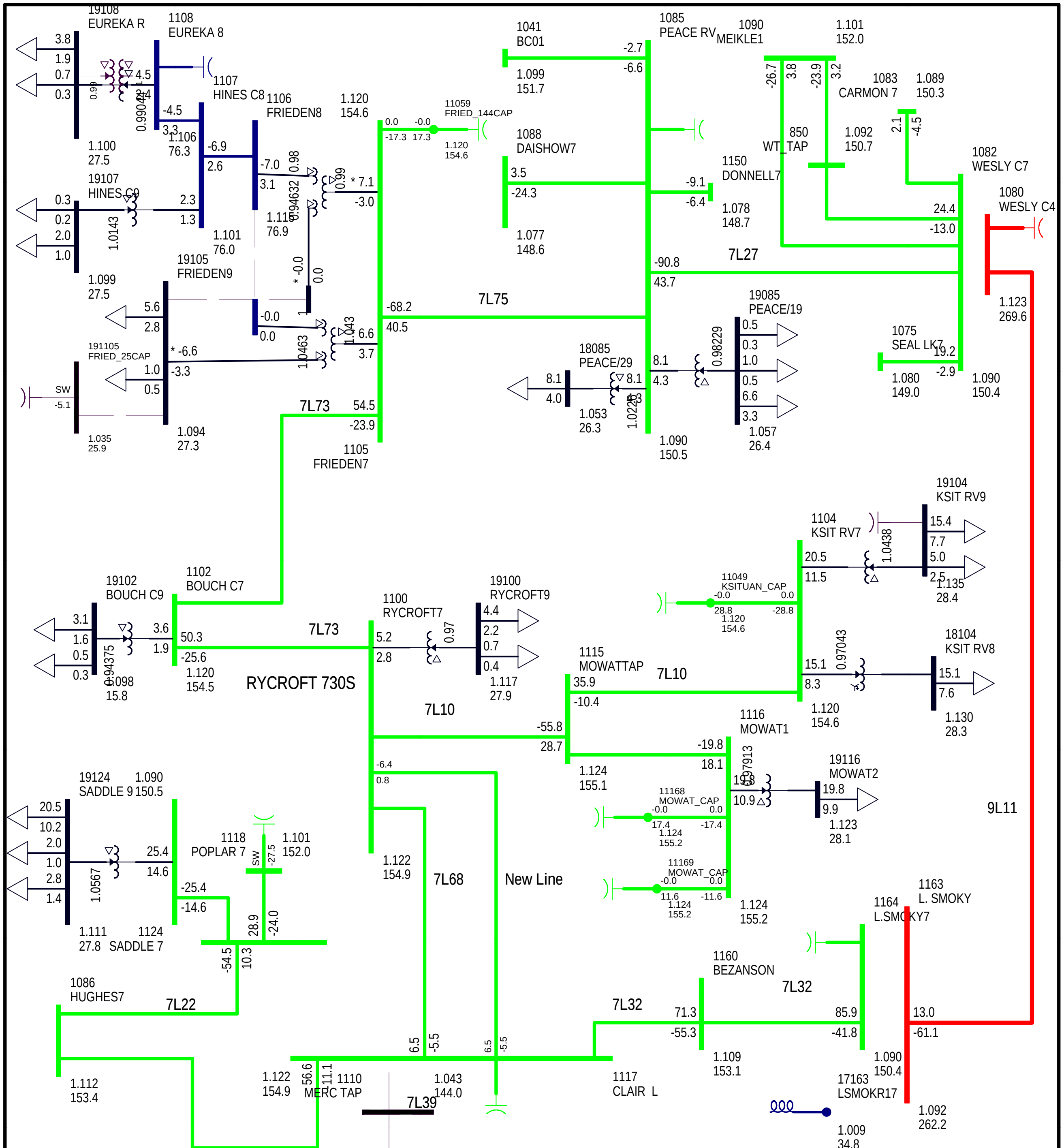
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L45 (N-1)
FIG B-82
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 87.9 MW



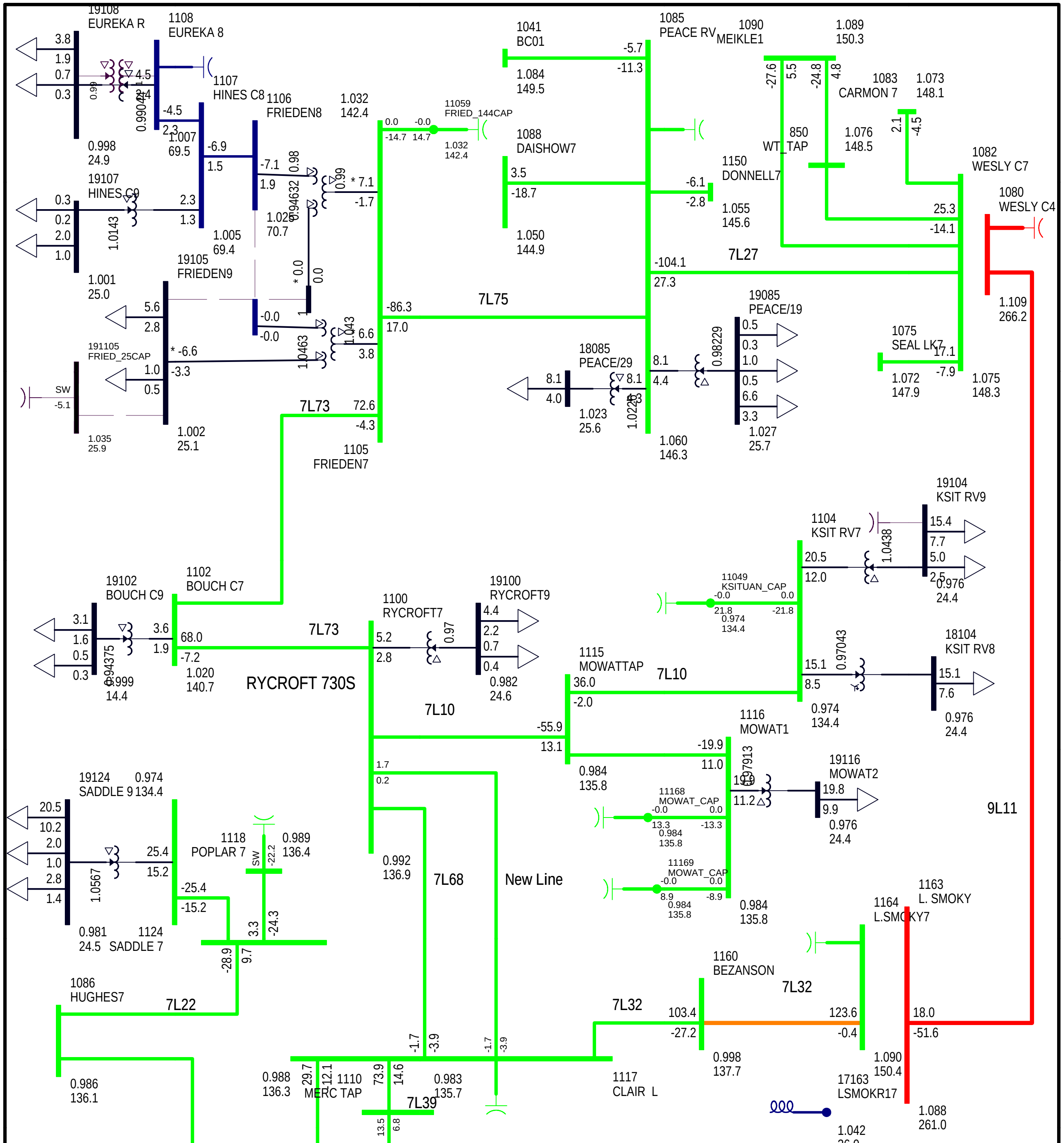
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L39 (N-1)
FIG B-83
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 84.4 MW



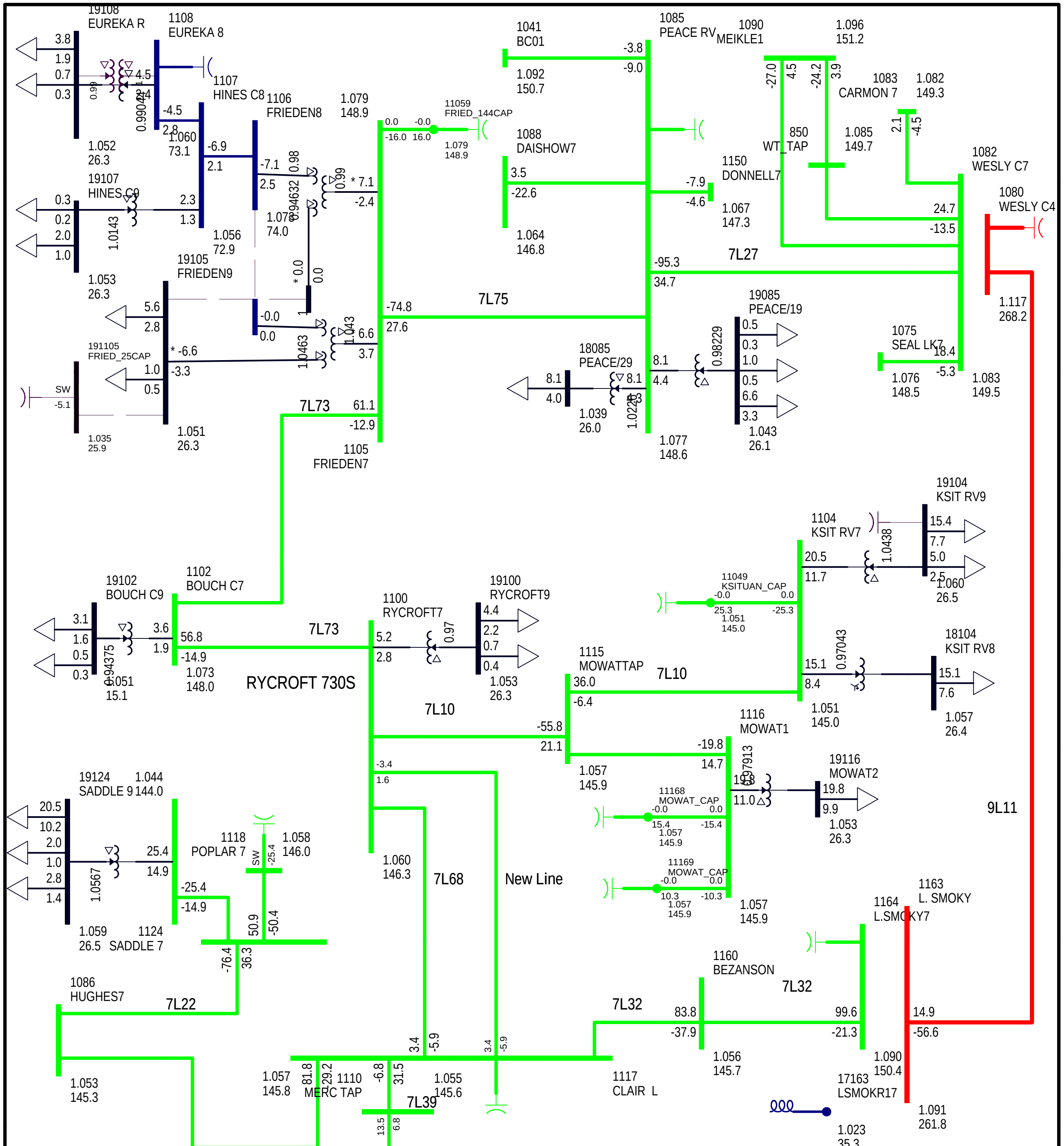
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L84 (N-1)
FIG B-84
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 87.5 MW



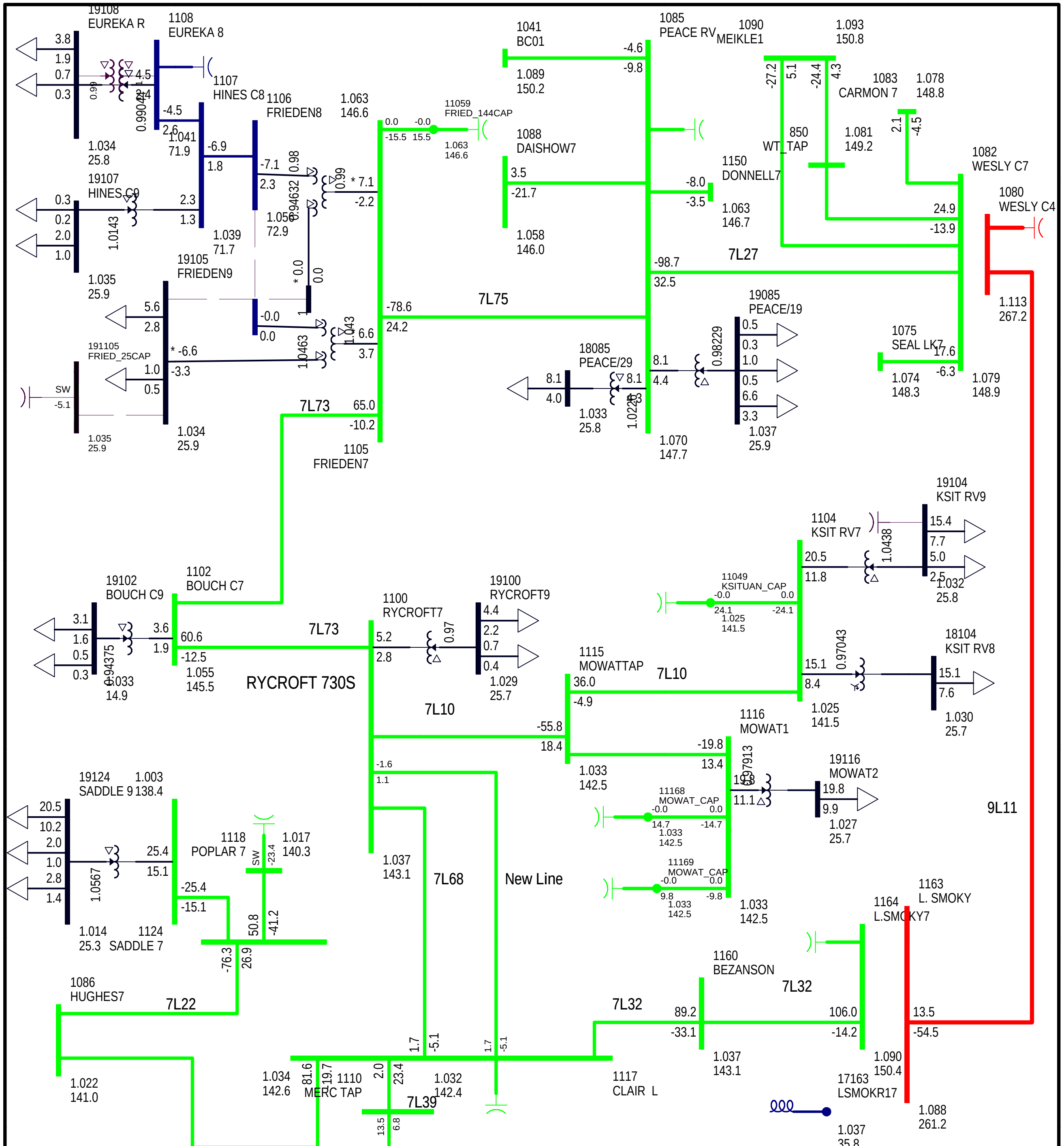
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L03 (N-1)
FIG B-85
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.0 MW



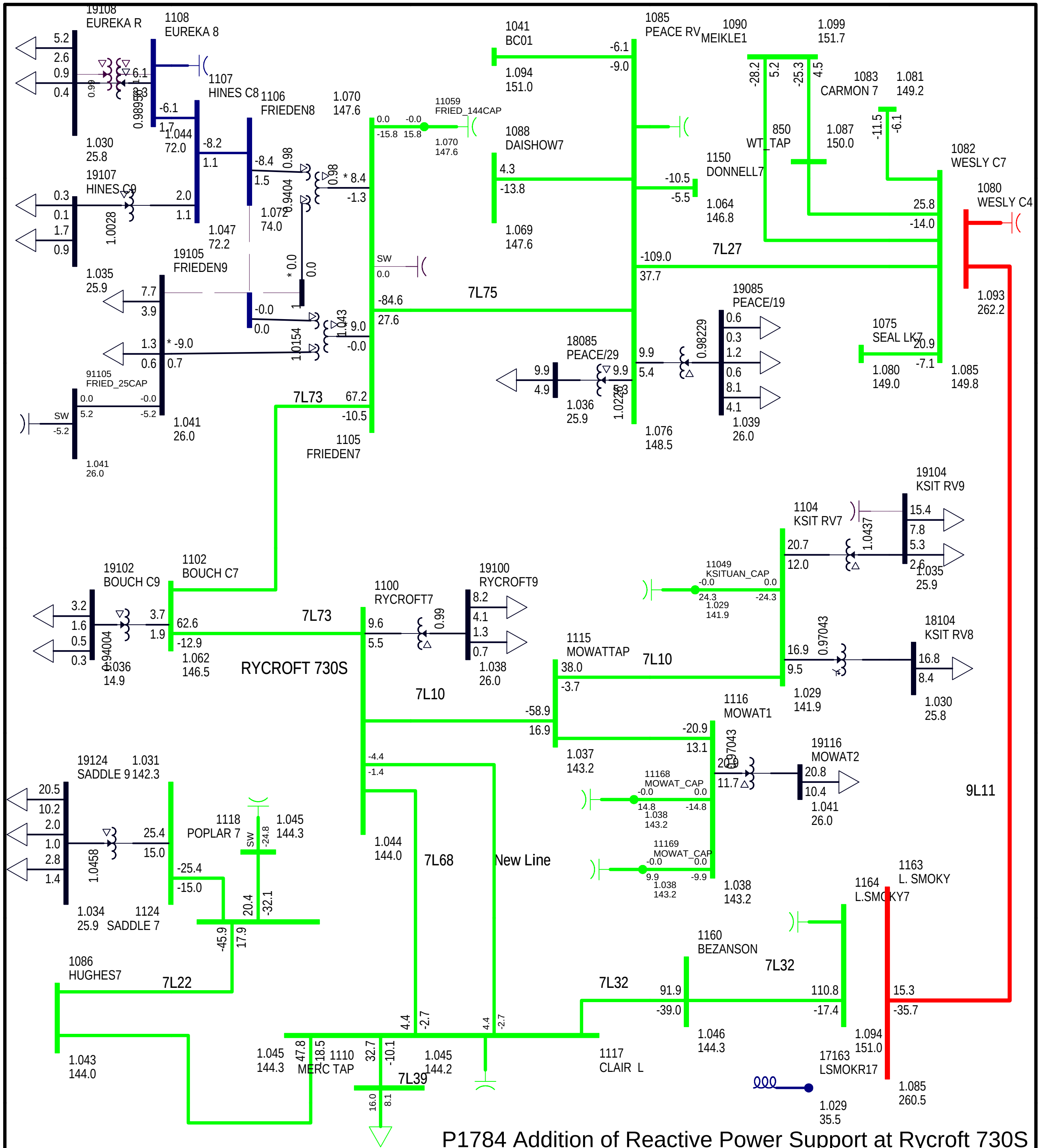
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 2 2026SP
7L69 (N-1)
FIG B-86
TUE, NOV 07 2017 9:57

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.7 MW

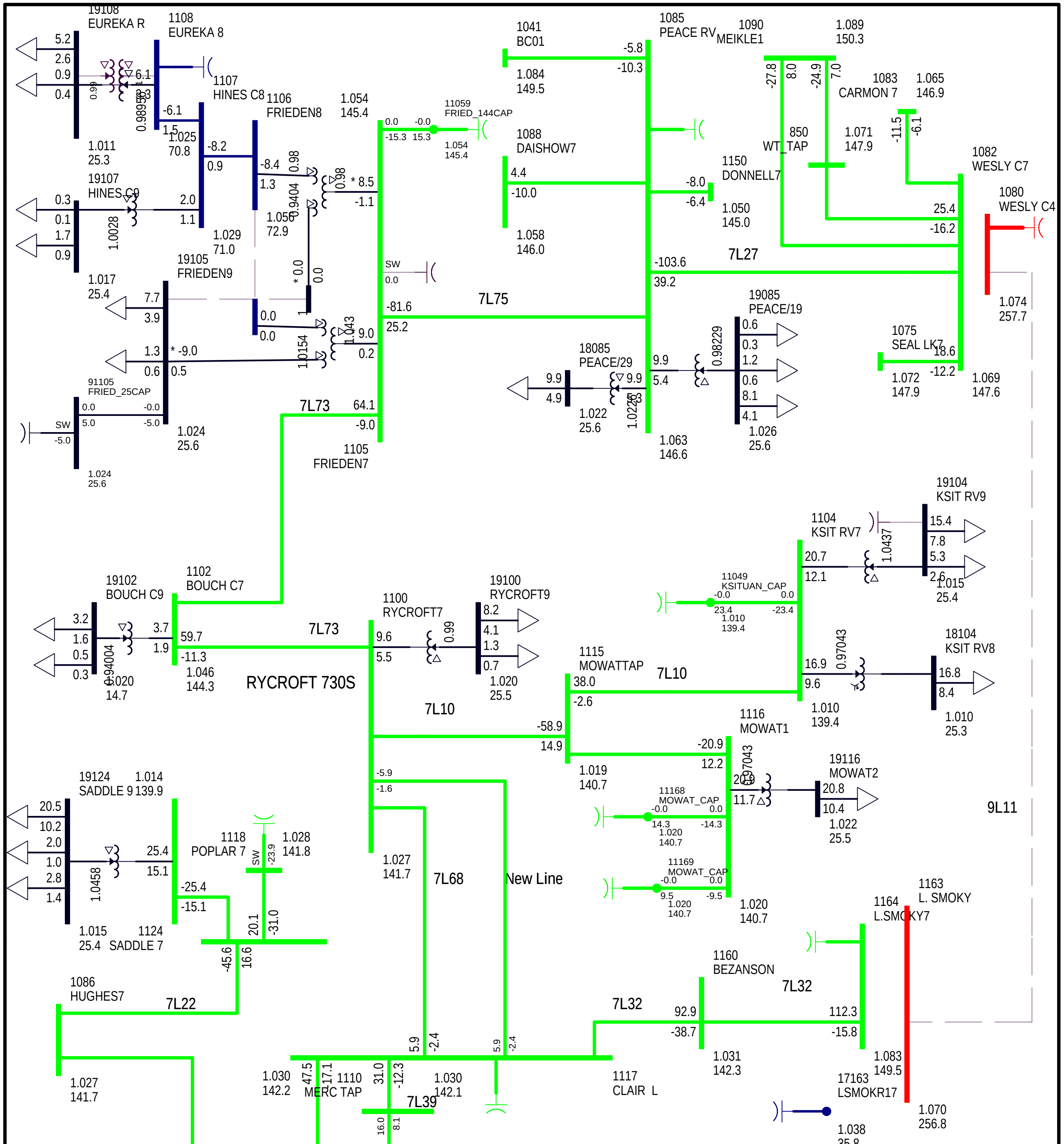


PROJECT 1784 OPT2: SCENARIO 3 2026WP
BASE CASE(N-0)
FIG B-87
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 93.4 MW



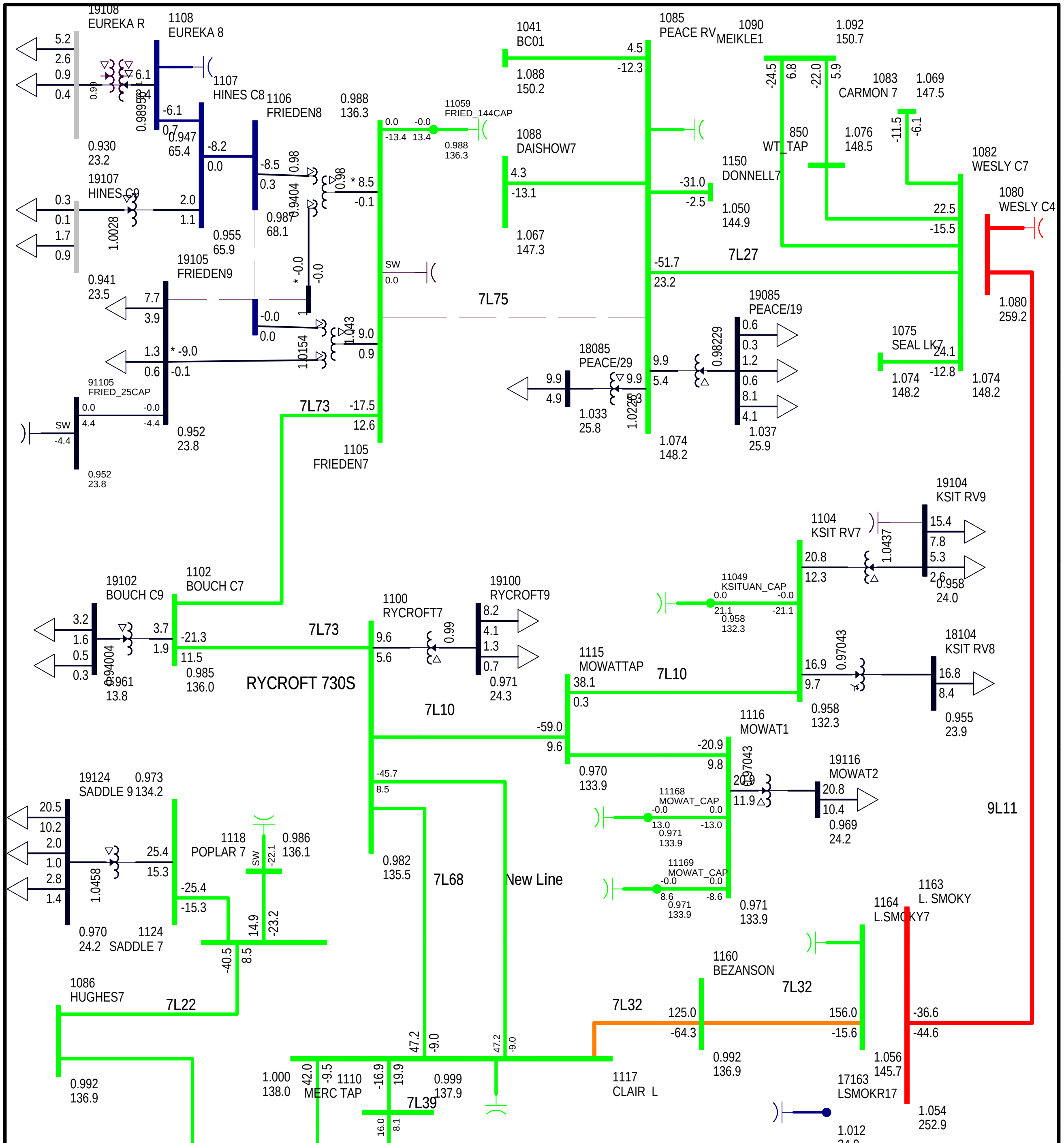
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
9L11 (N-1)
FIG B-88
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 91.6 MW



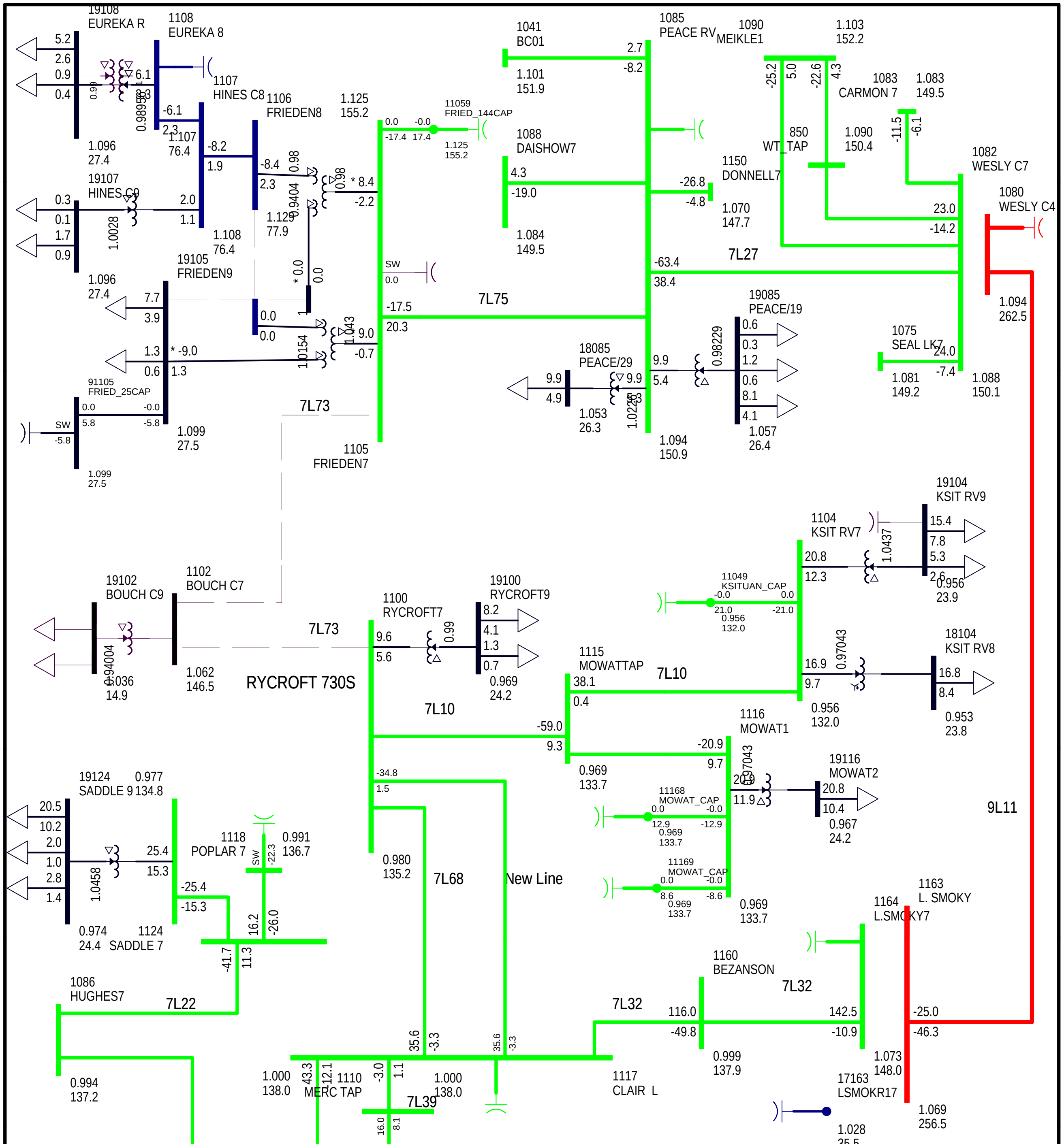
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L75 (N-1)
FIG B-89
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 47.2 MW



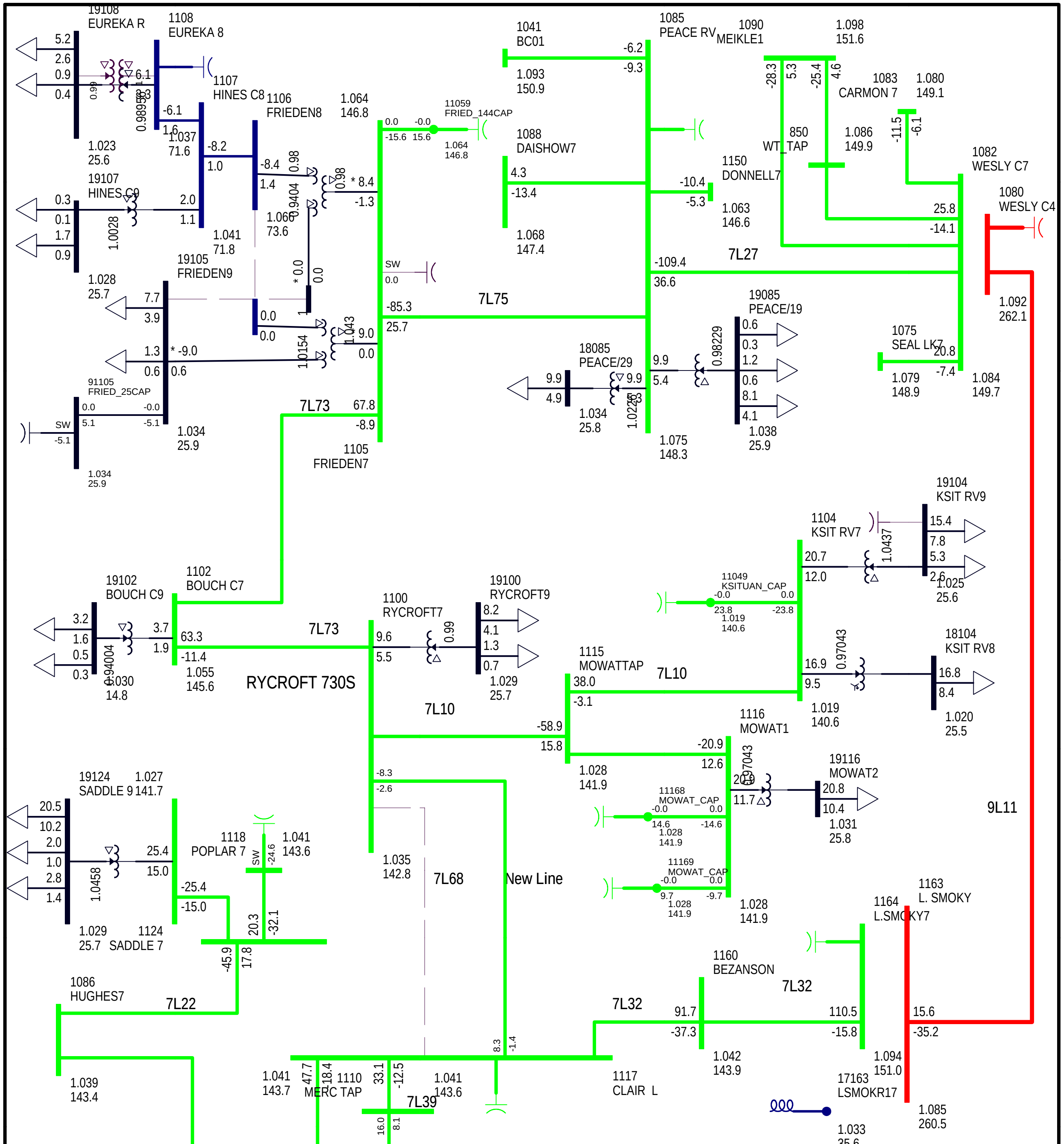
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L73 (N-1)
FIG B-90
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 84.9 MW

TOTAL FLOW INTO RYCROFT AREA: 53.5 MW



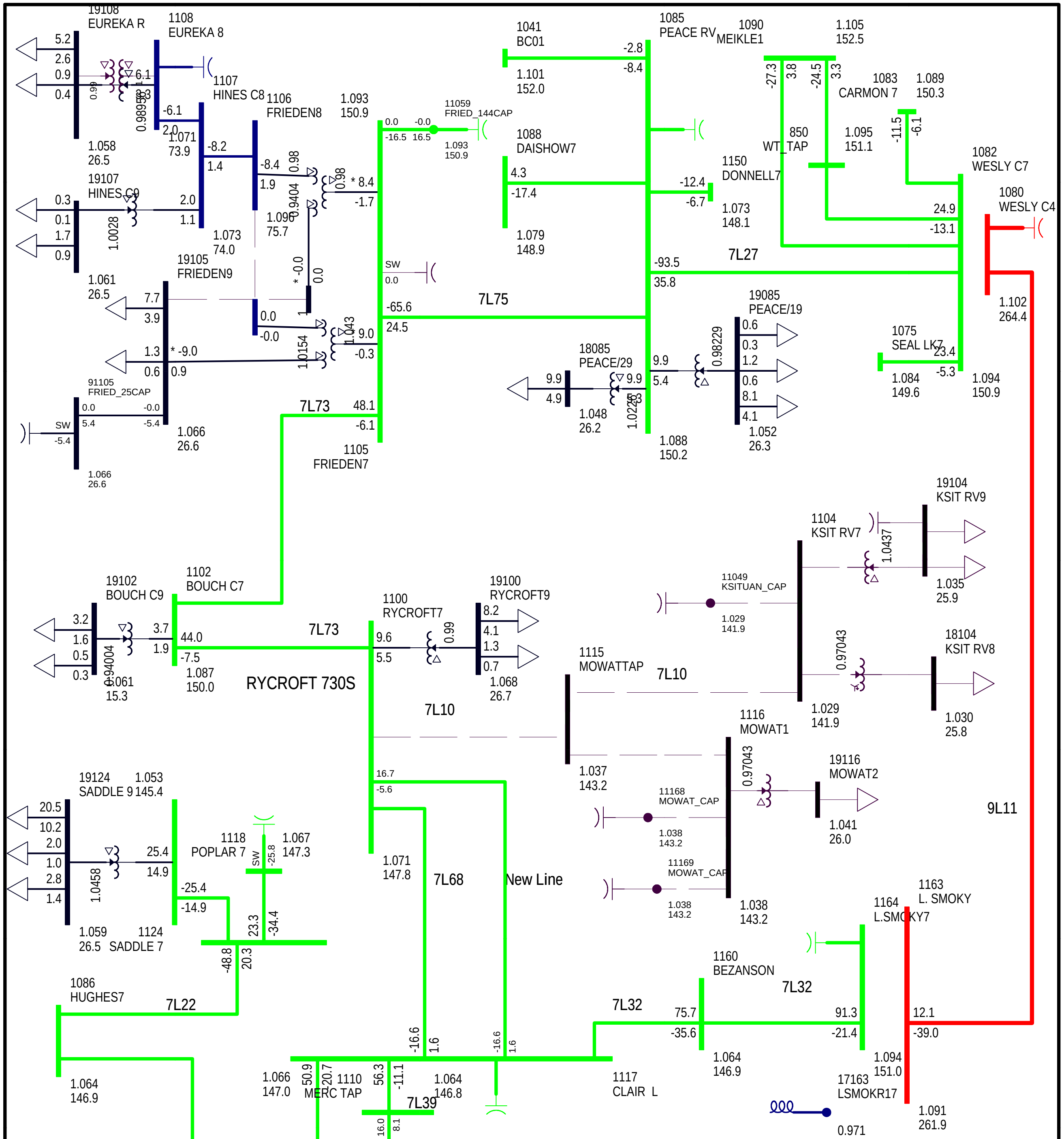
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L68 (N-1)
FIG B-91
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 89.7 MW



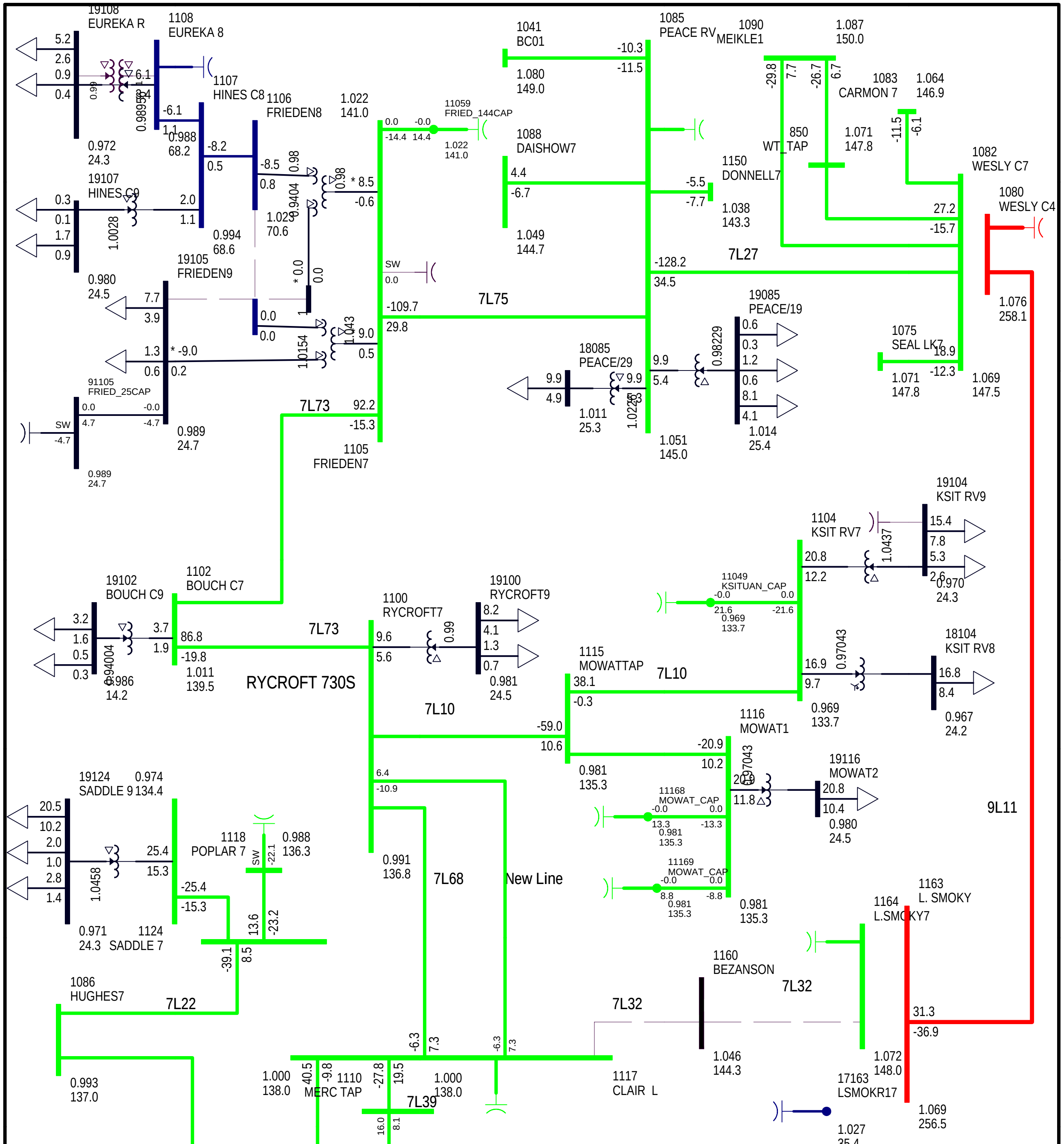
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L10 (N-1)
FIG B-92
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 30.3 MW

TOTAL FLOW INTO RYCROFT AREA: 51.6 MW



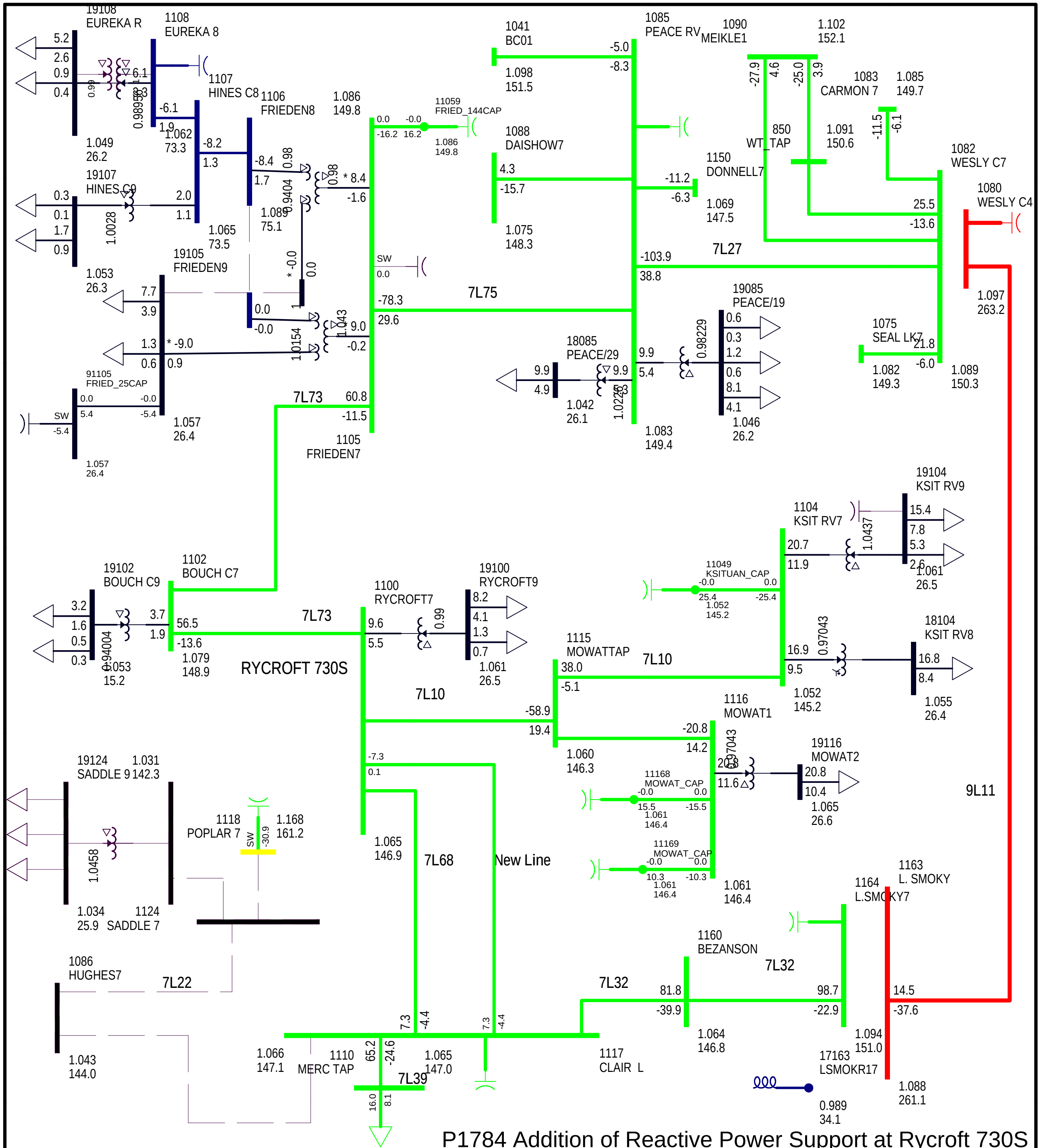
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L32 (N-1)
FIG B-93
TUE, NOV 07 2017 10:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 111.1 MW

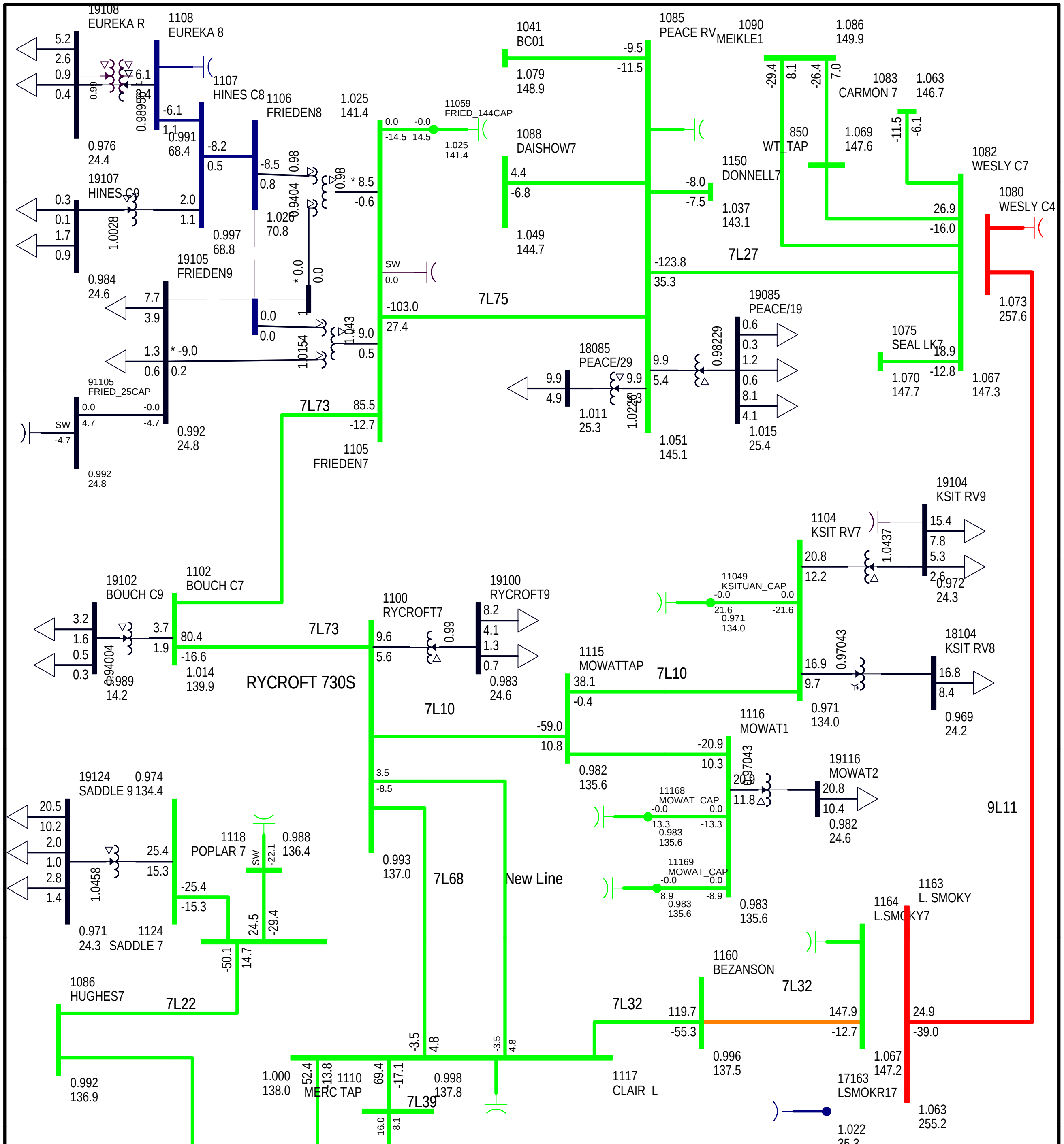


PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L22 (N-1)
FIG B-94
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 89.4 MW



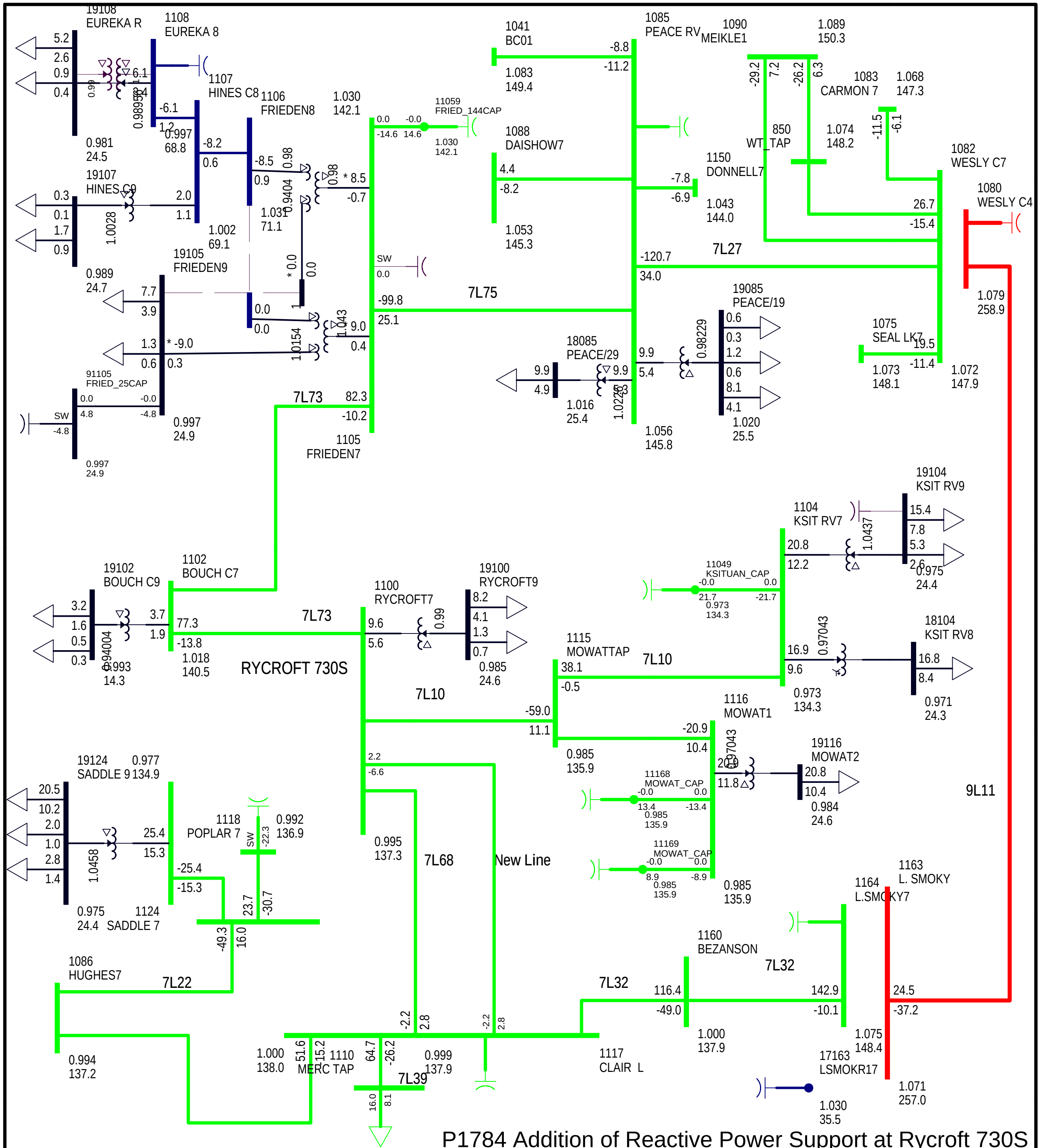
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L46 (N-1)
FIG B-95
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 106.3 MW

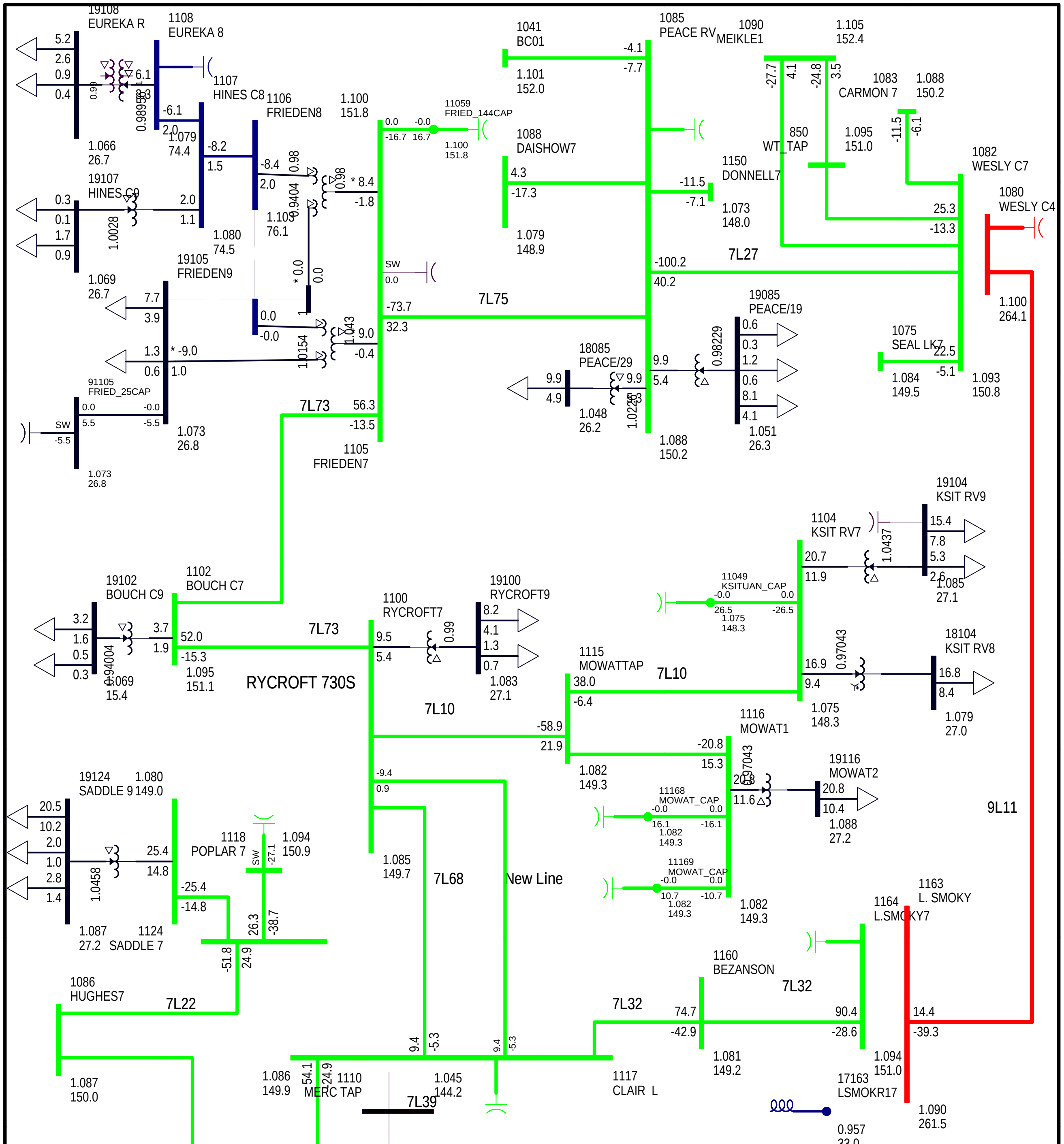


PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L45 (N-1)
FIG B-96
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 103.9 MW



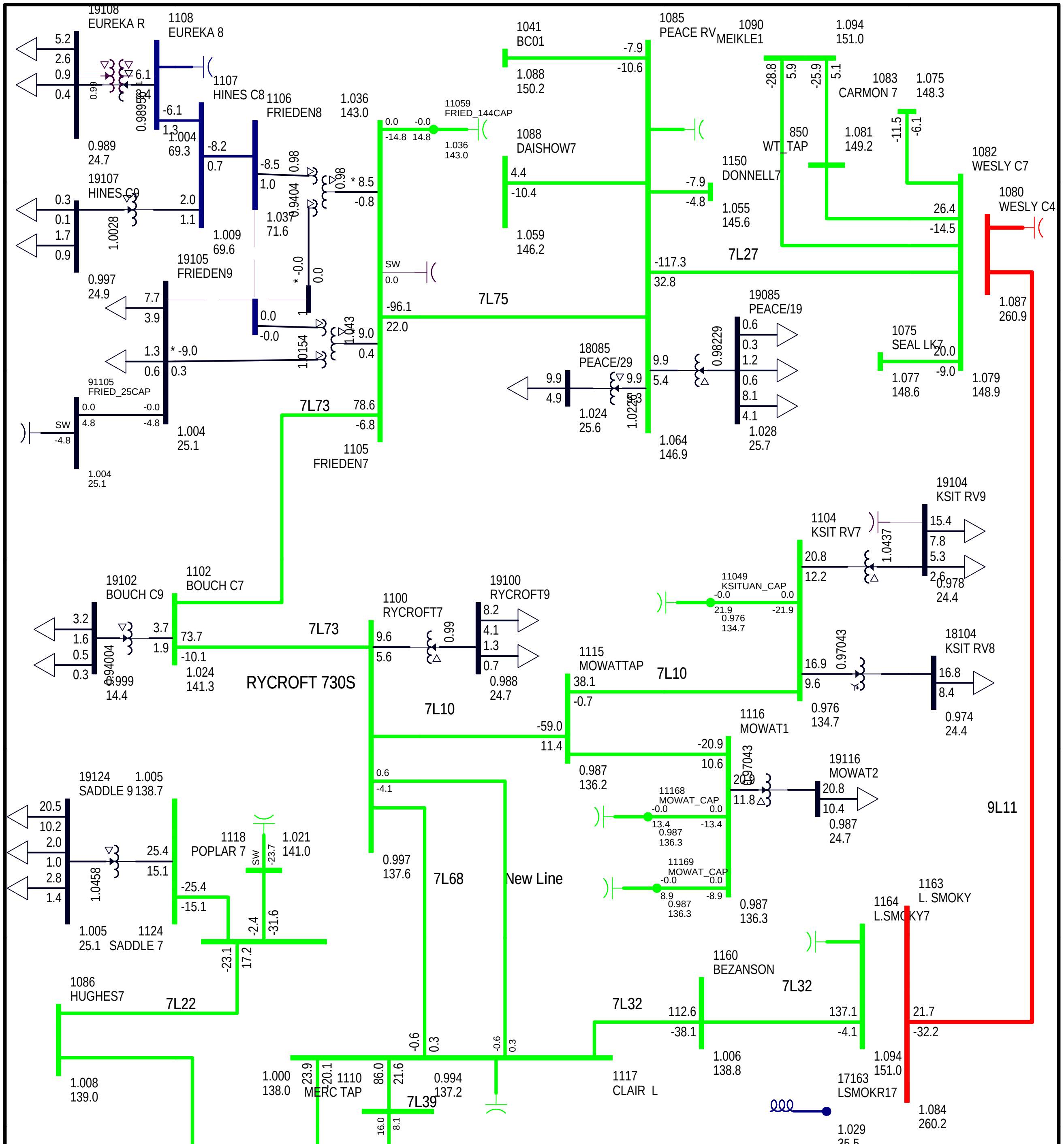
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L39 (N-1)
FIG B-97
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 86.6 MW



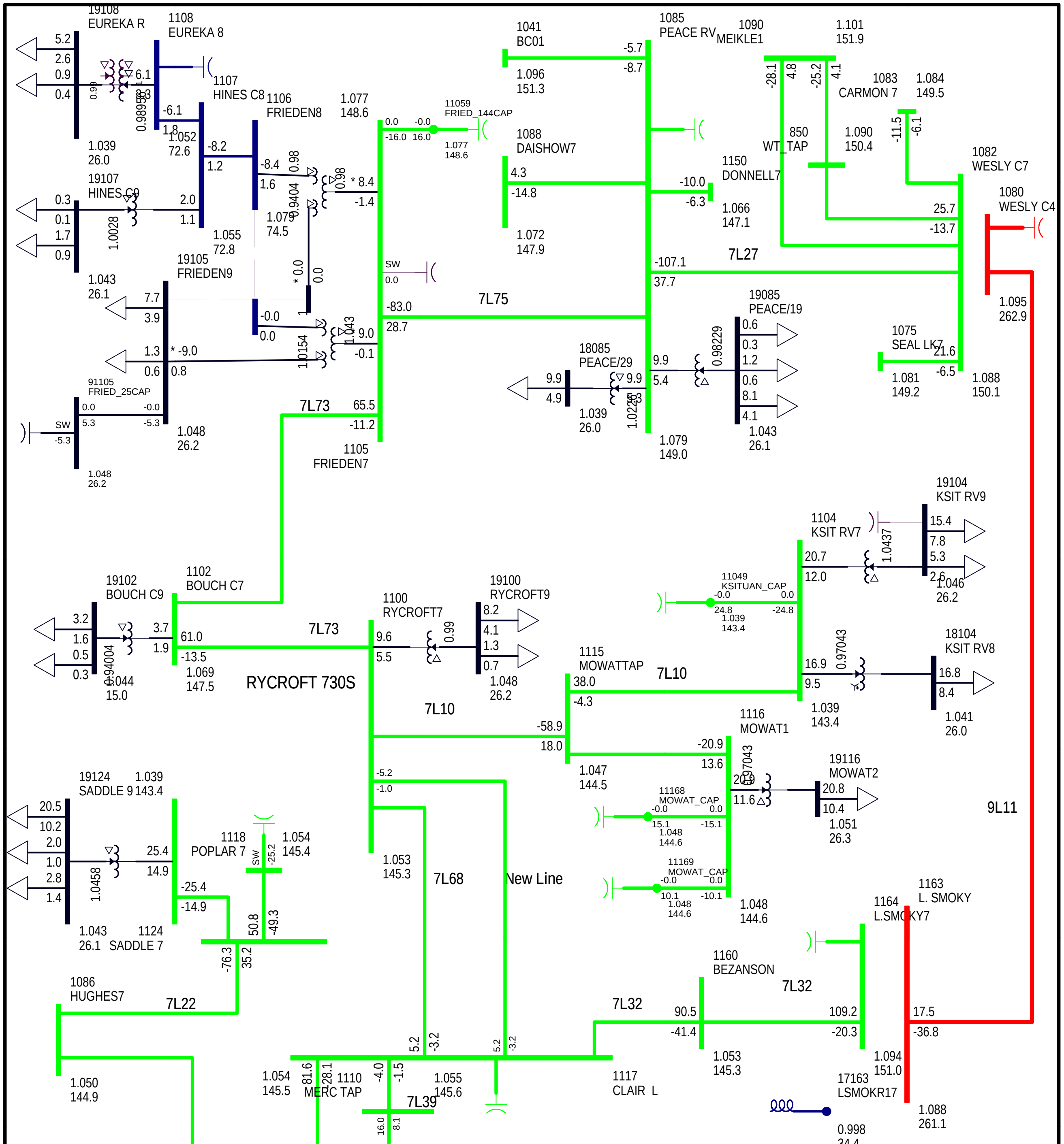
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L84 (N-1)
FIG B-98
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 101.2 MW



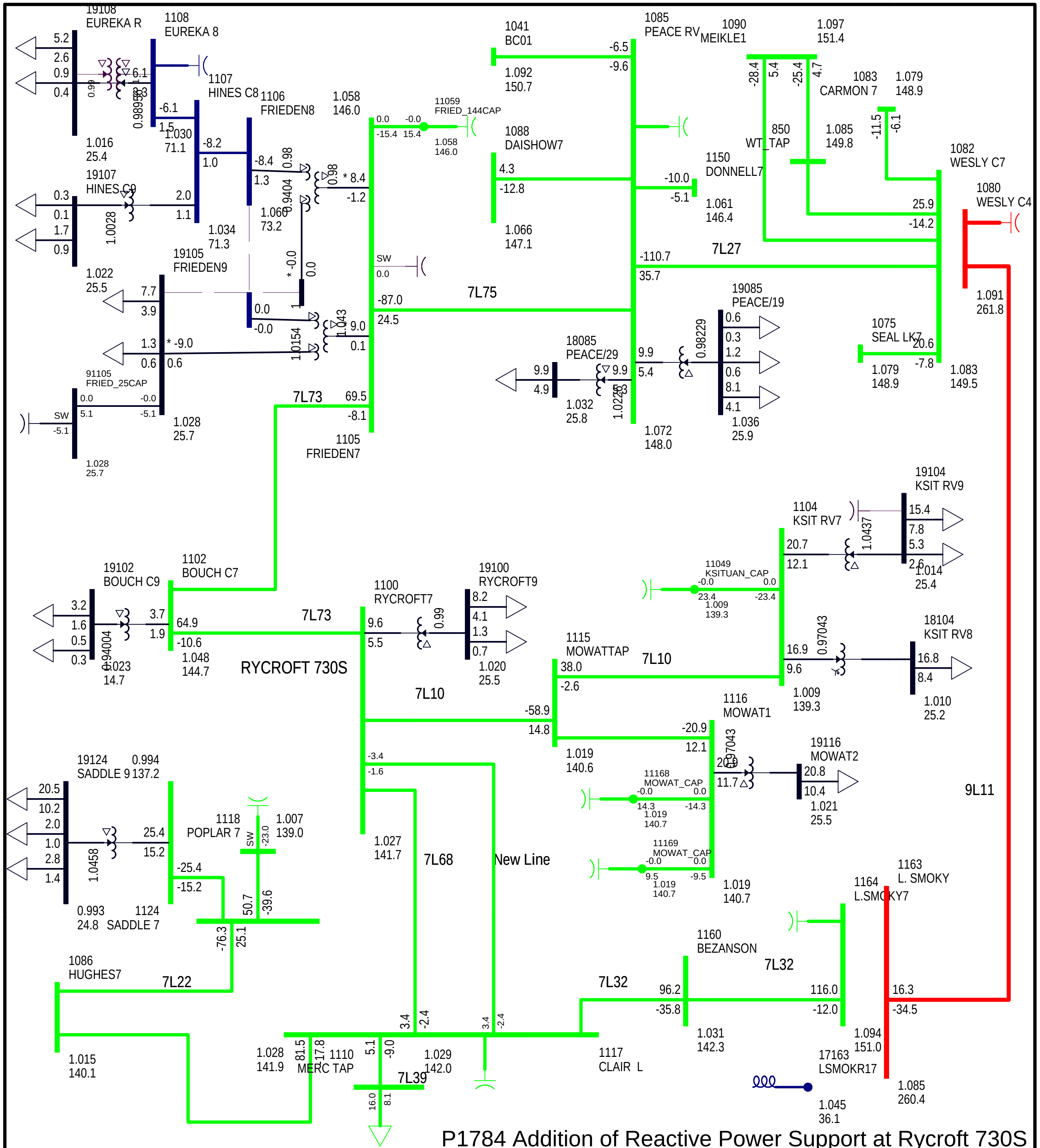
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L03 (N-1)
FIG B-99
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 92.3 MW



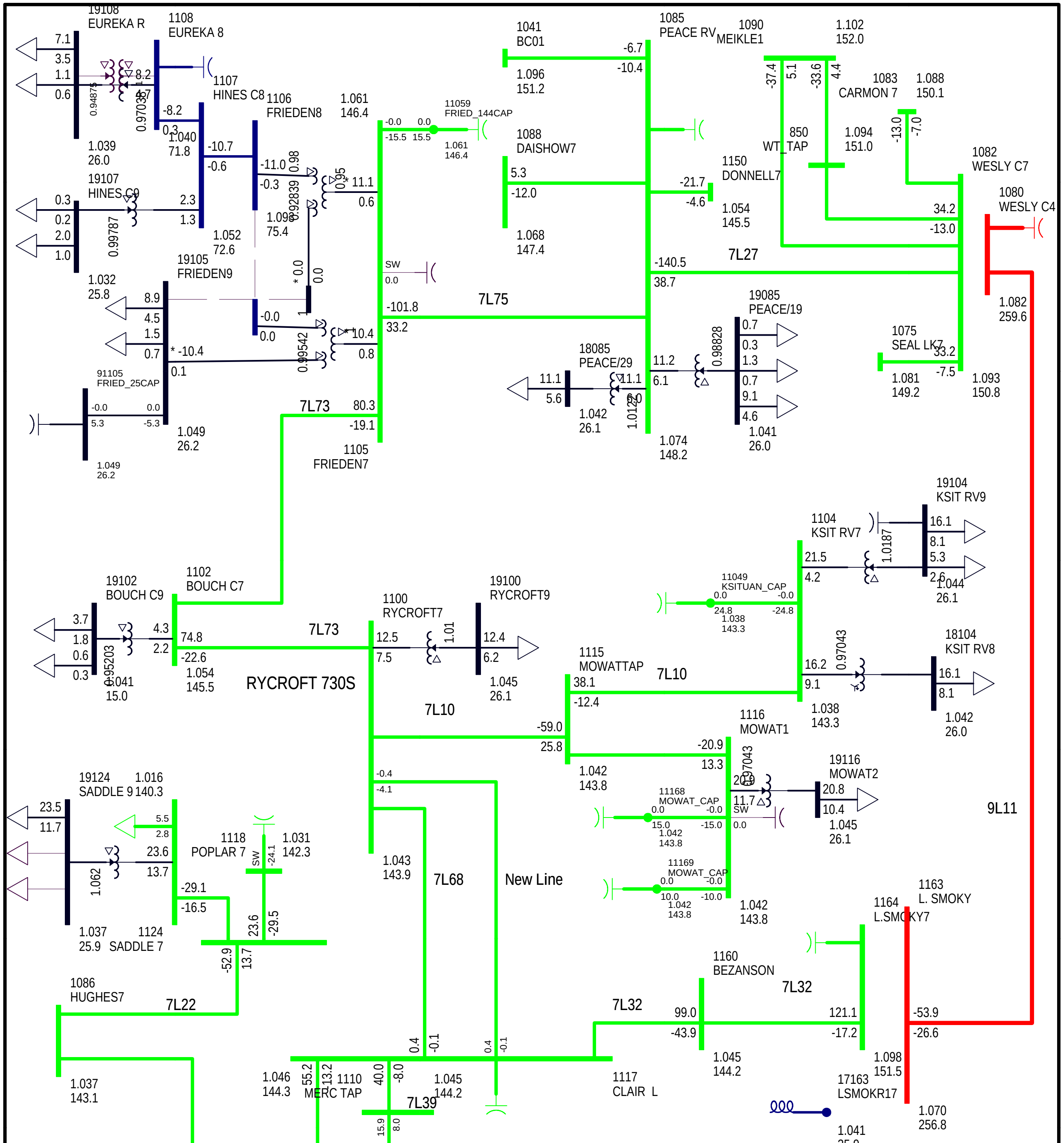
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 3 2026WP
7L69 (N-1)
FIG B-100
TUE, NOV 07 2017 10:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 95.0 MW



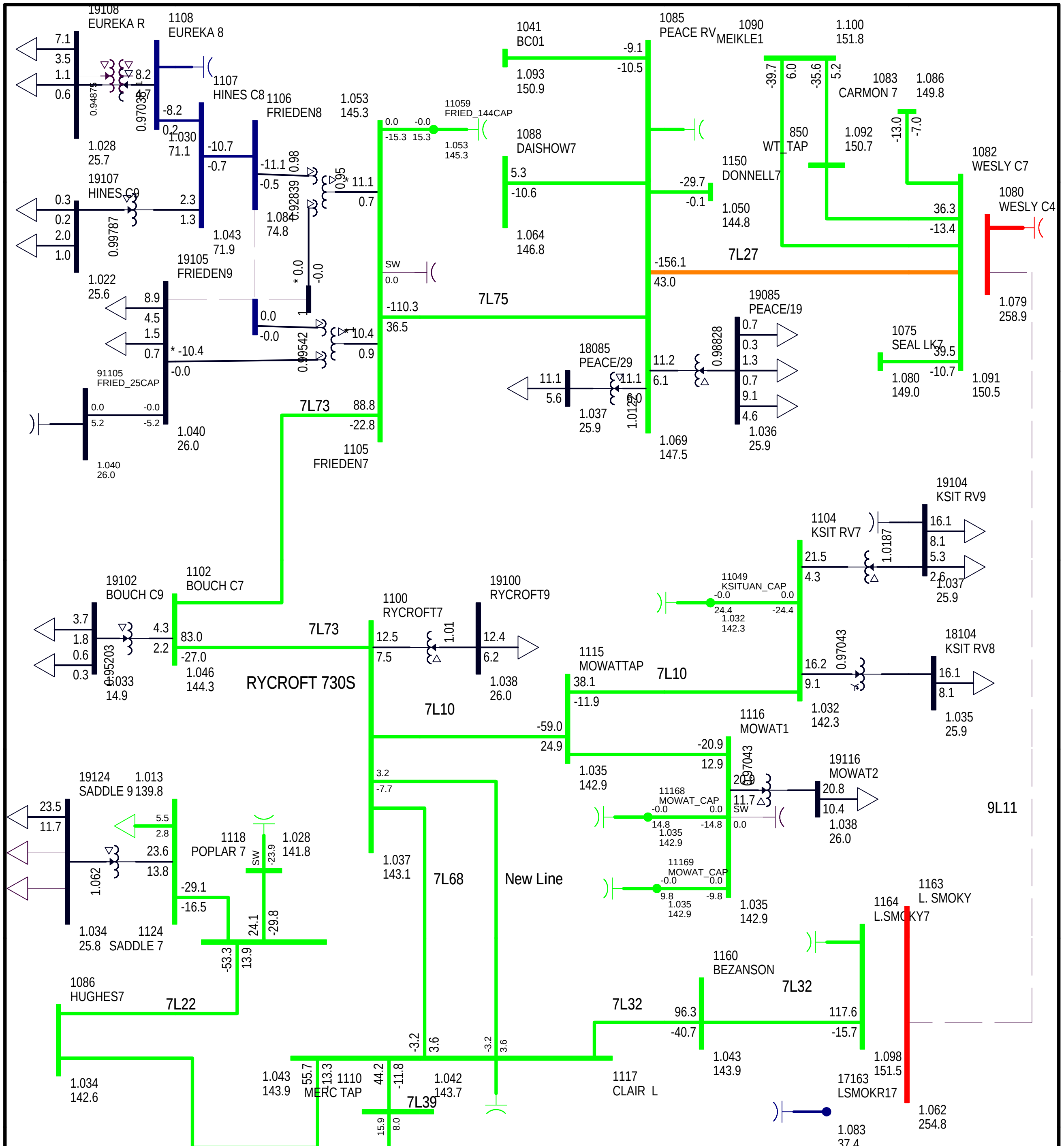
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5A 2036WP
BASE CASE(N-0)
FIG B-101
THU, NOV 09 2017 14:33

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.1 MW



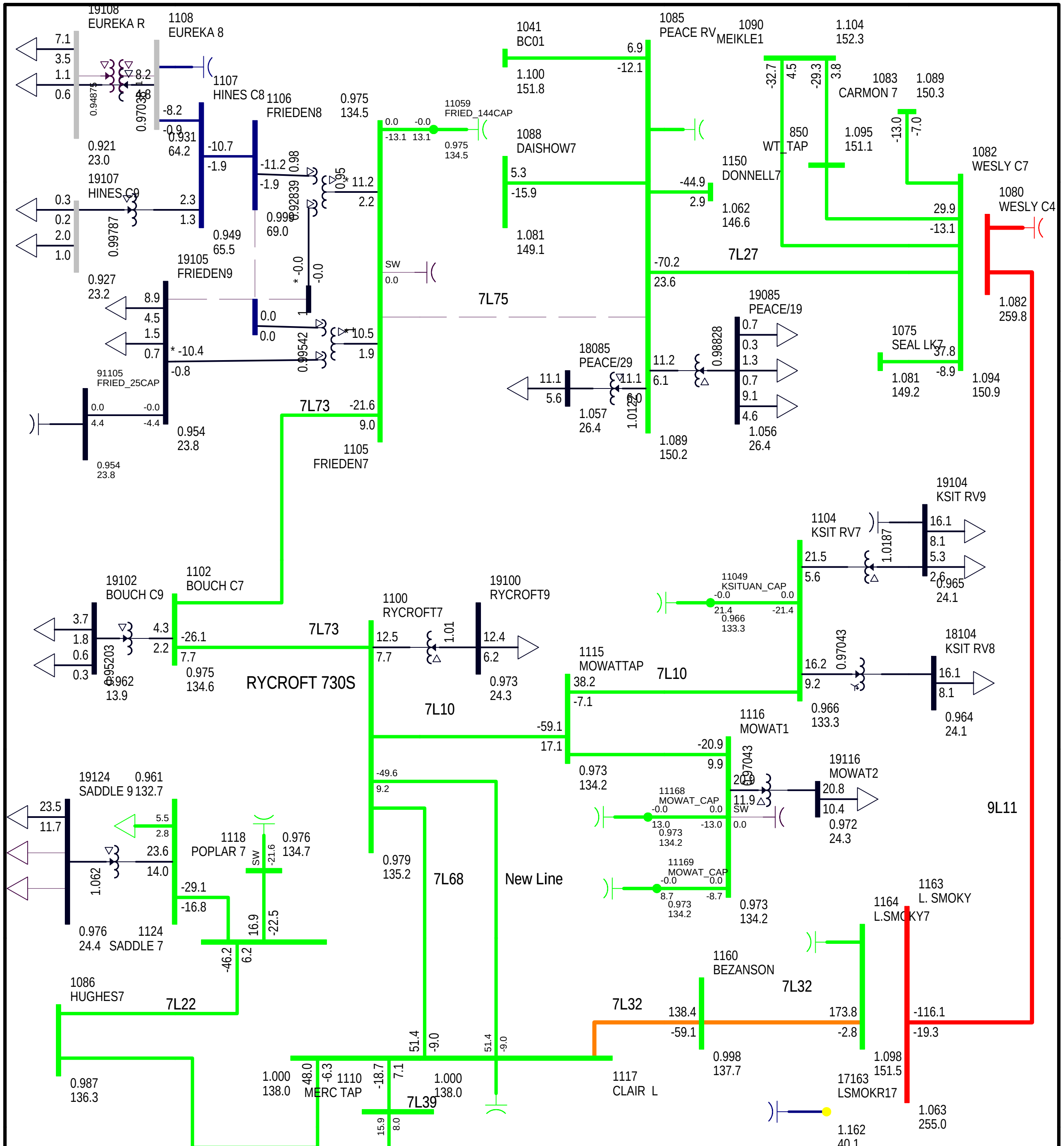
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5A 2036WP
9L11 (N-1)
FIG B-102
THU, NOV 09 2017 14:33

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 111.6 MW



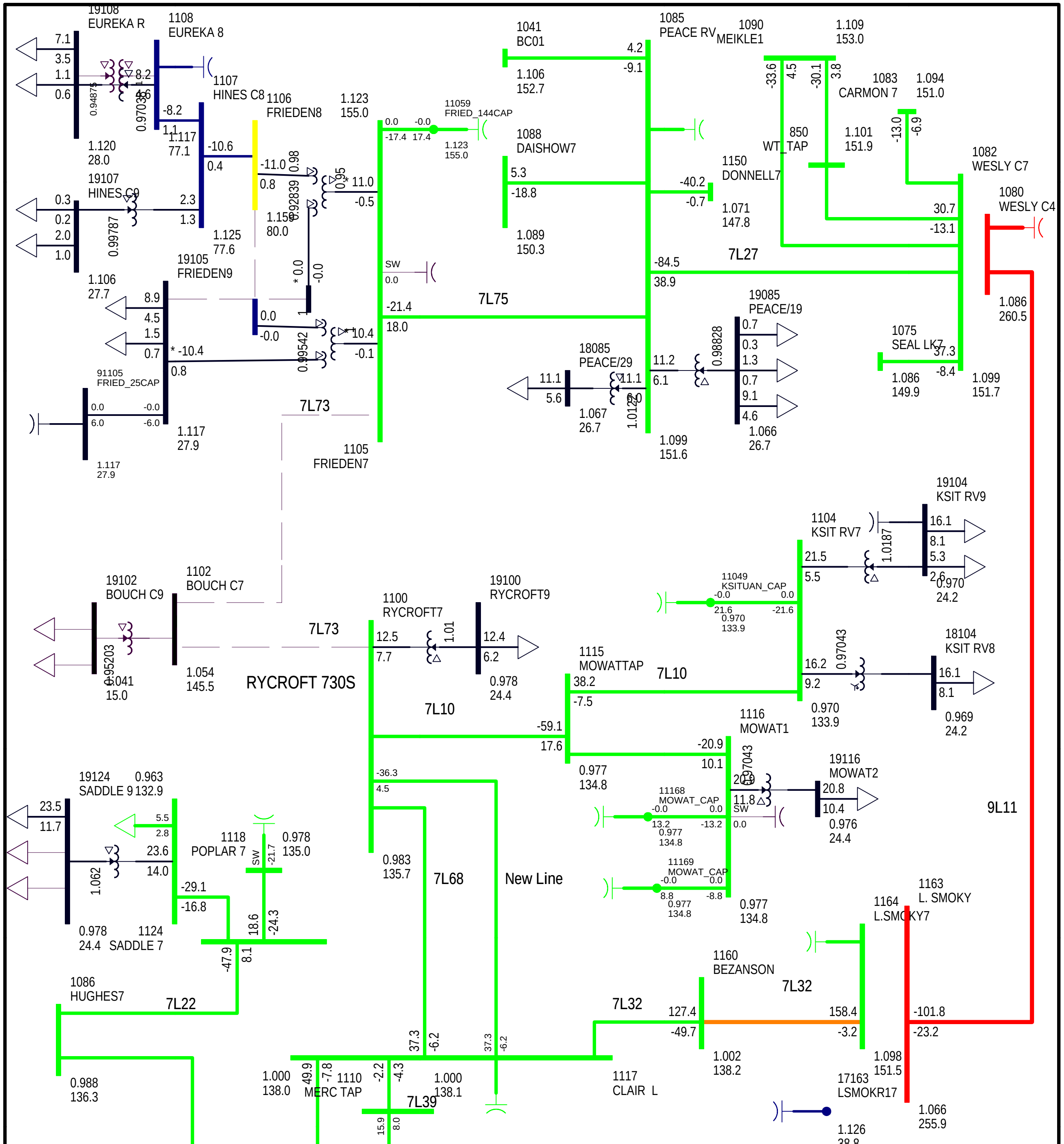
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5A 2036WP
7L75 (N-1)
FIG B-103
THU, NOV 09 2017 14:33

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 102.8 MW



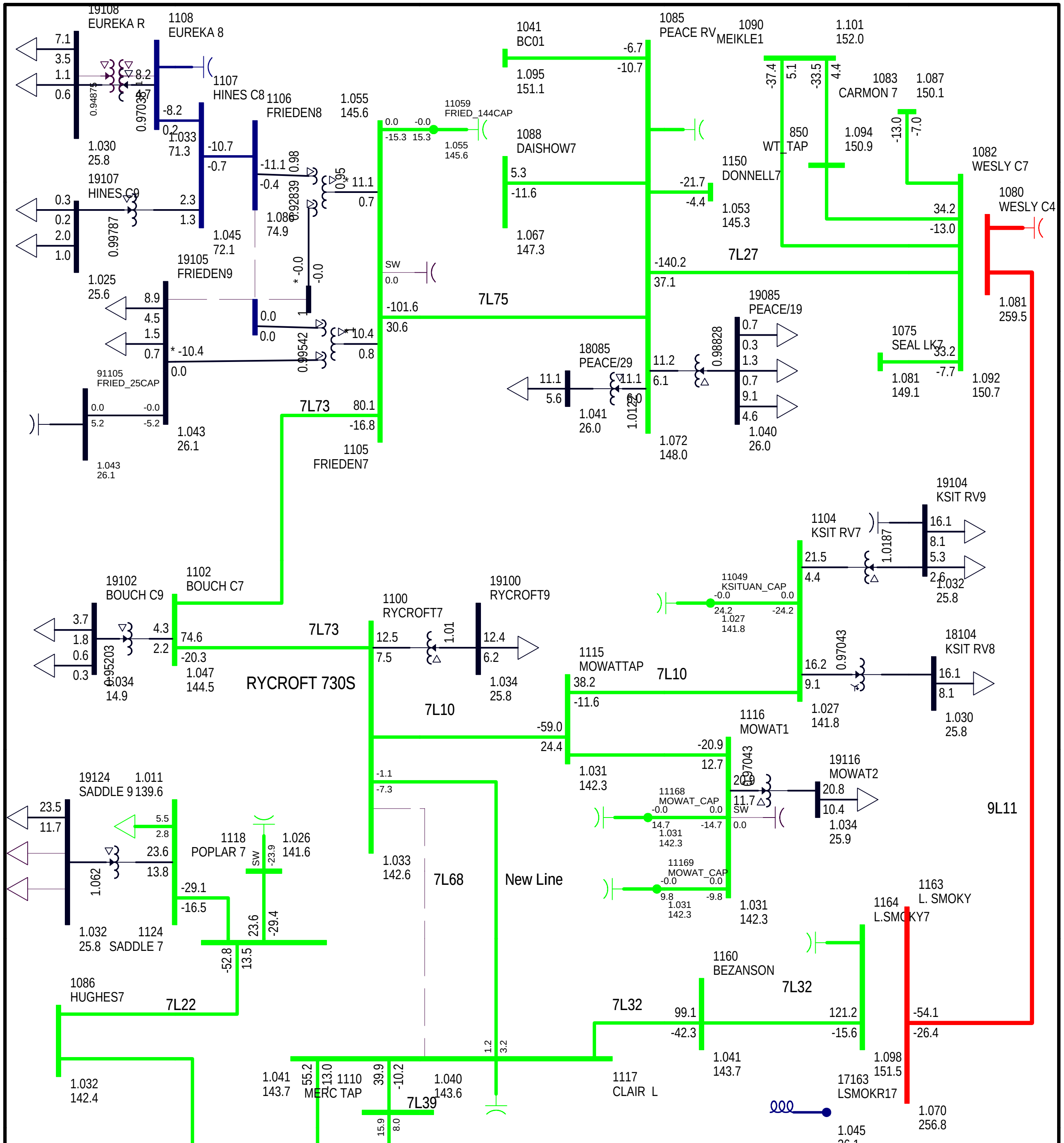
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5A 2036WP
7L73 (N-1)
FIG B-104
THU, NOV 09 2017 14:33

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 91.7 MW

TOTAL FLOW INTO RYCROFT AREA: 96.4 MW



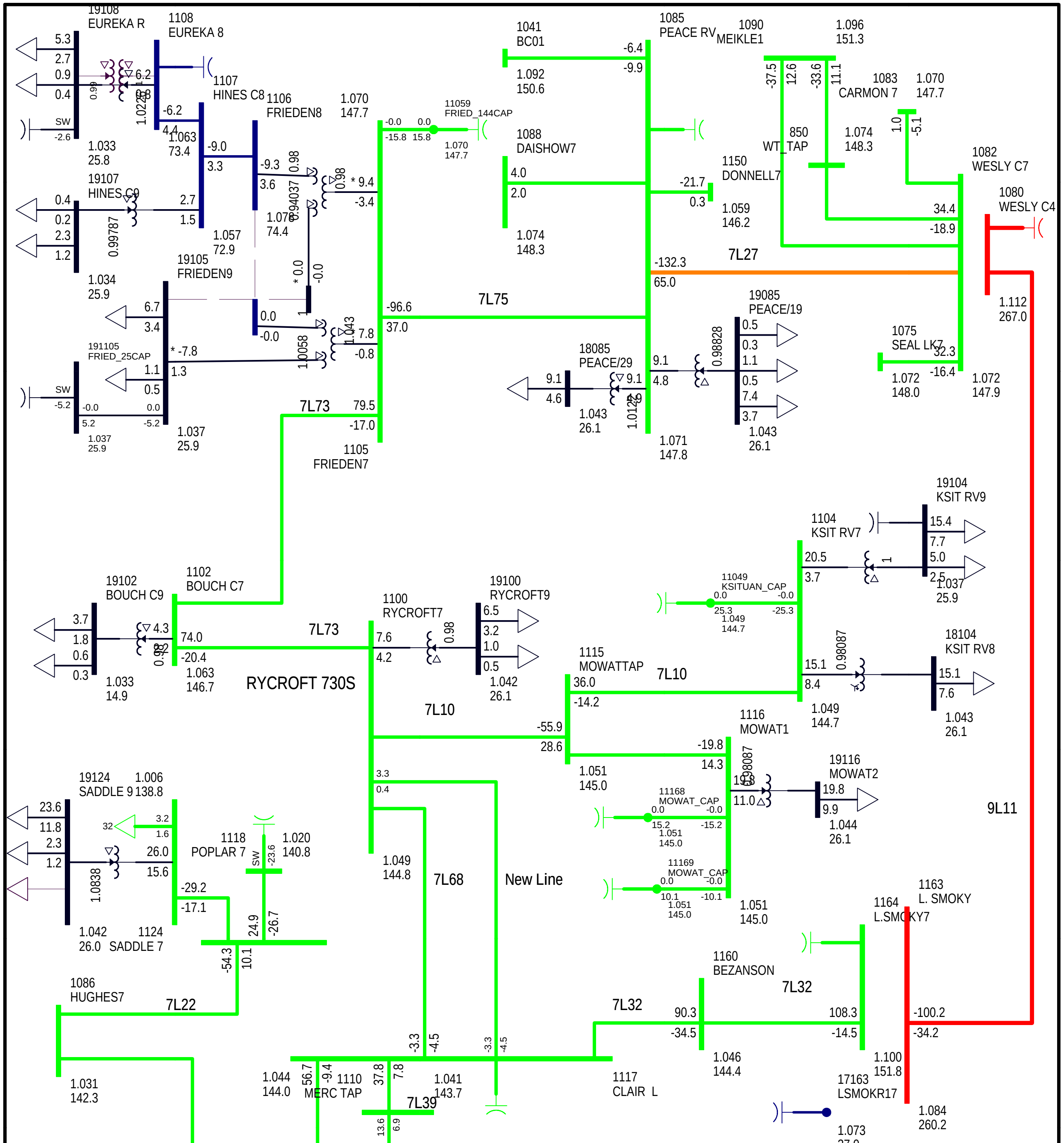
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5A 2036WP
7L68 (N-1)
FIG B-105
THU, NOV 09 2017 14:33

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.1 MW



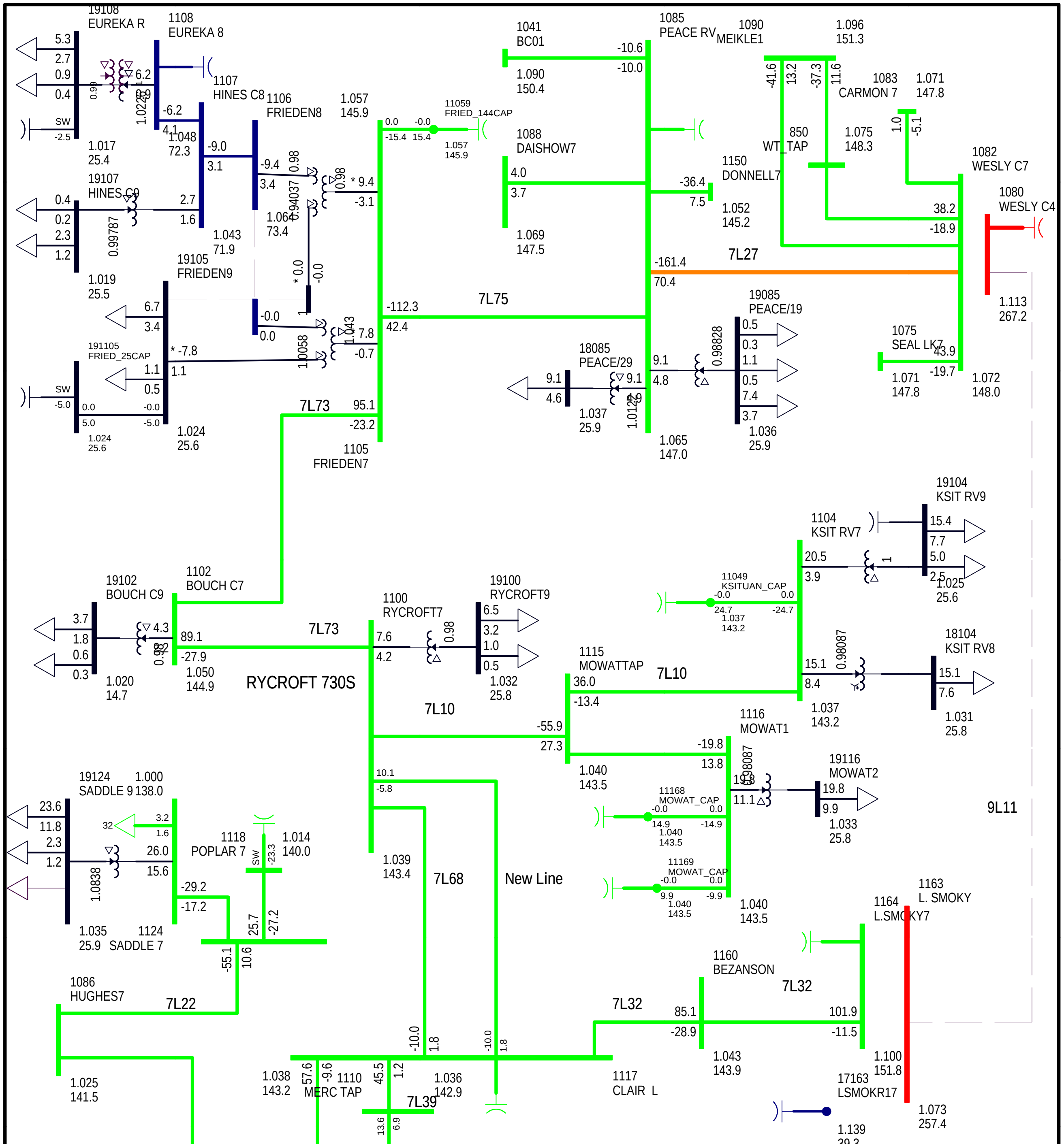
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
BASE CASE(N-0)
FIG B-106
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 99.2 MW



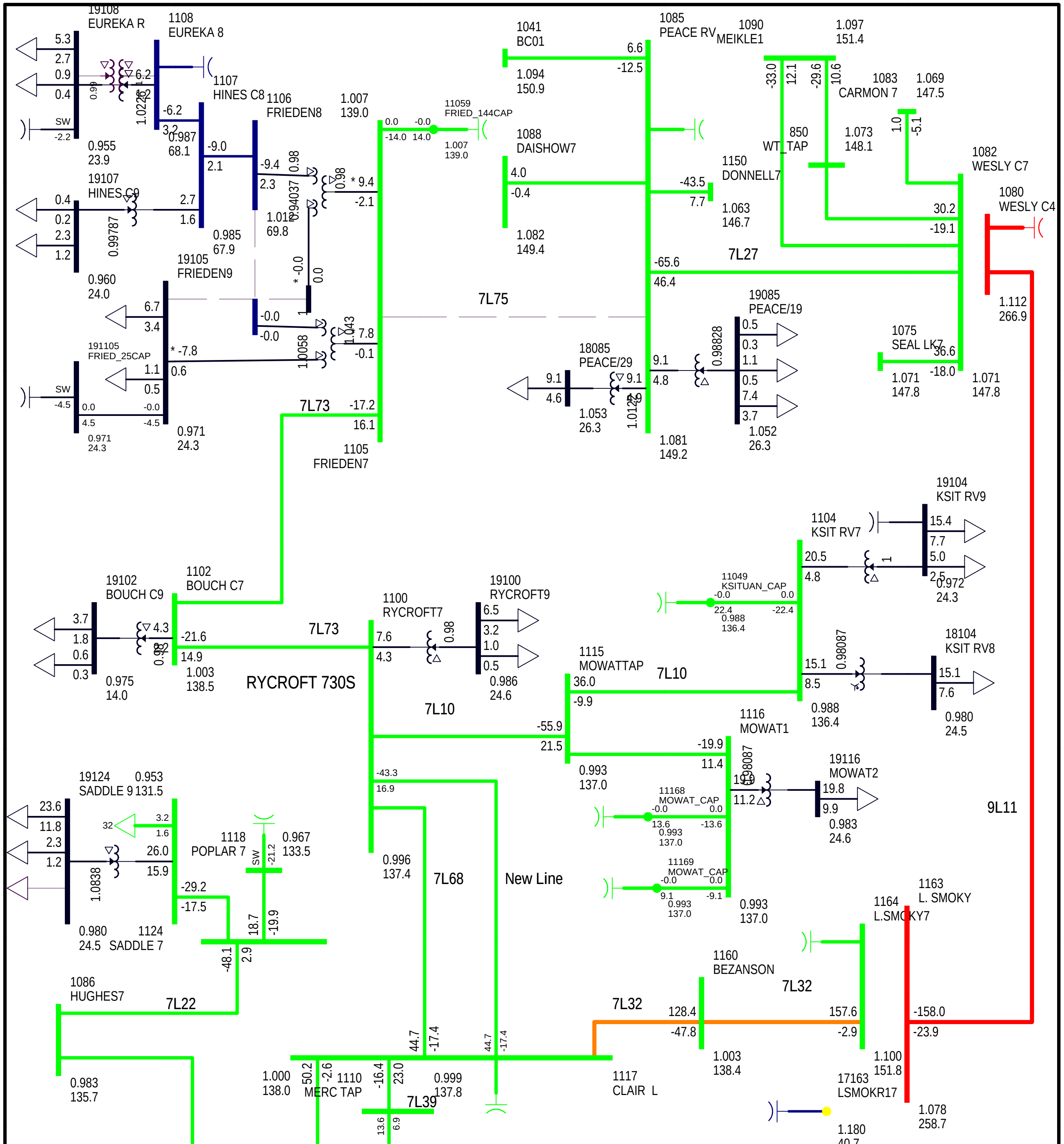
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
9L11 (N-1)
FIG B-107
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 110.4 MW



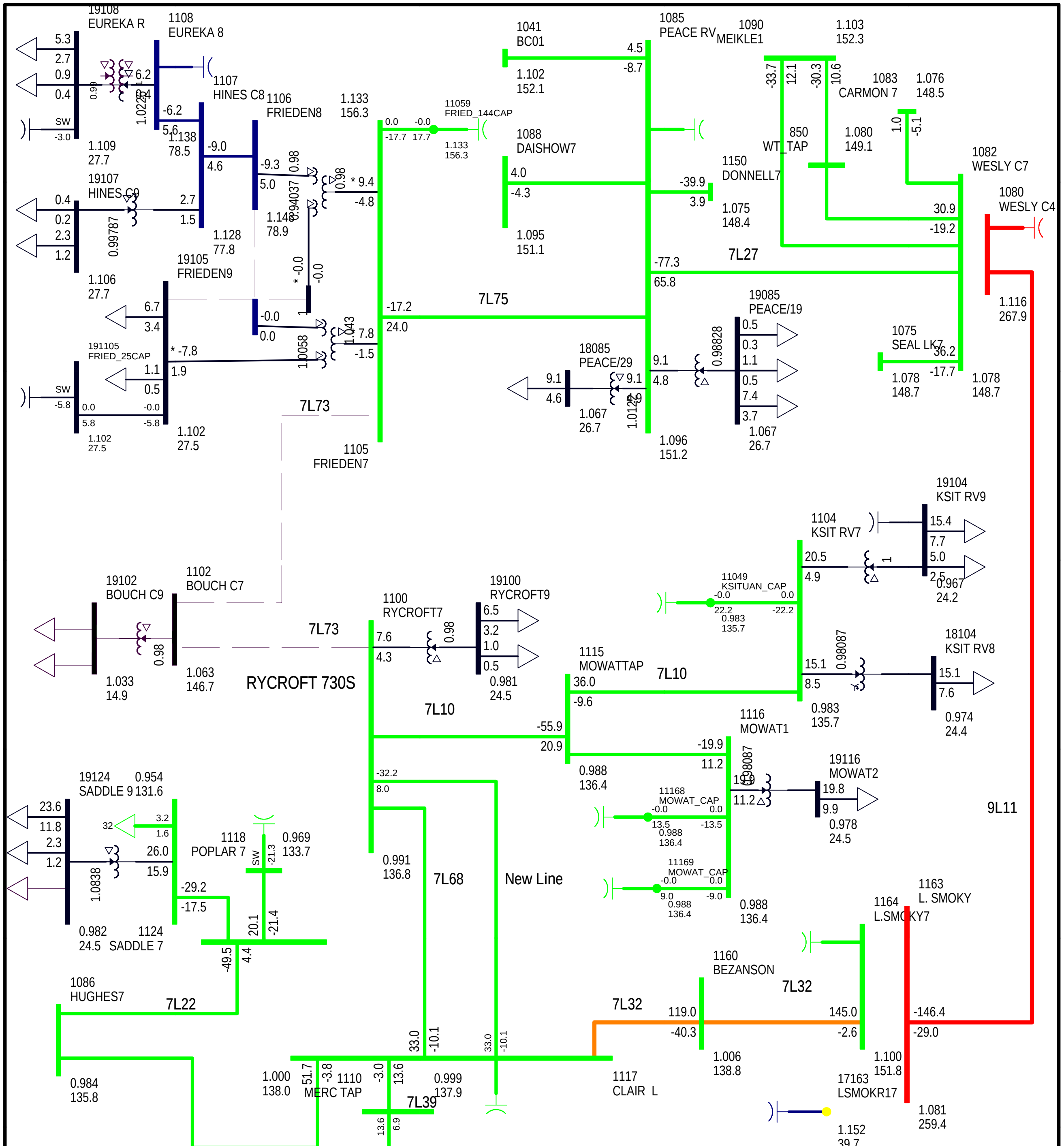
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L75 (N-1)
FIG B-108
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 44.7 MW



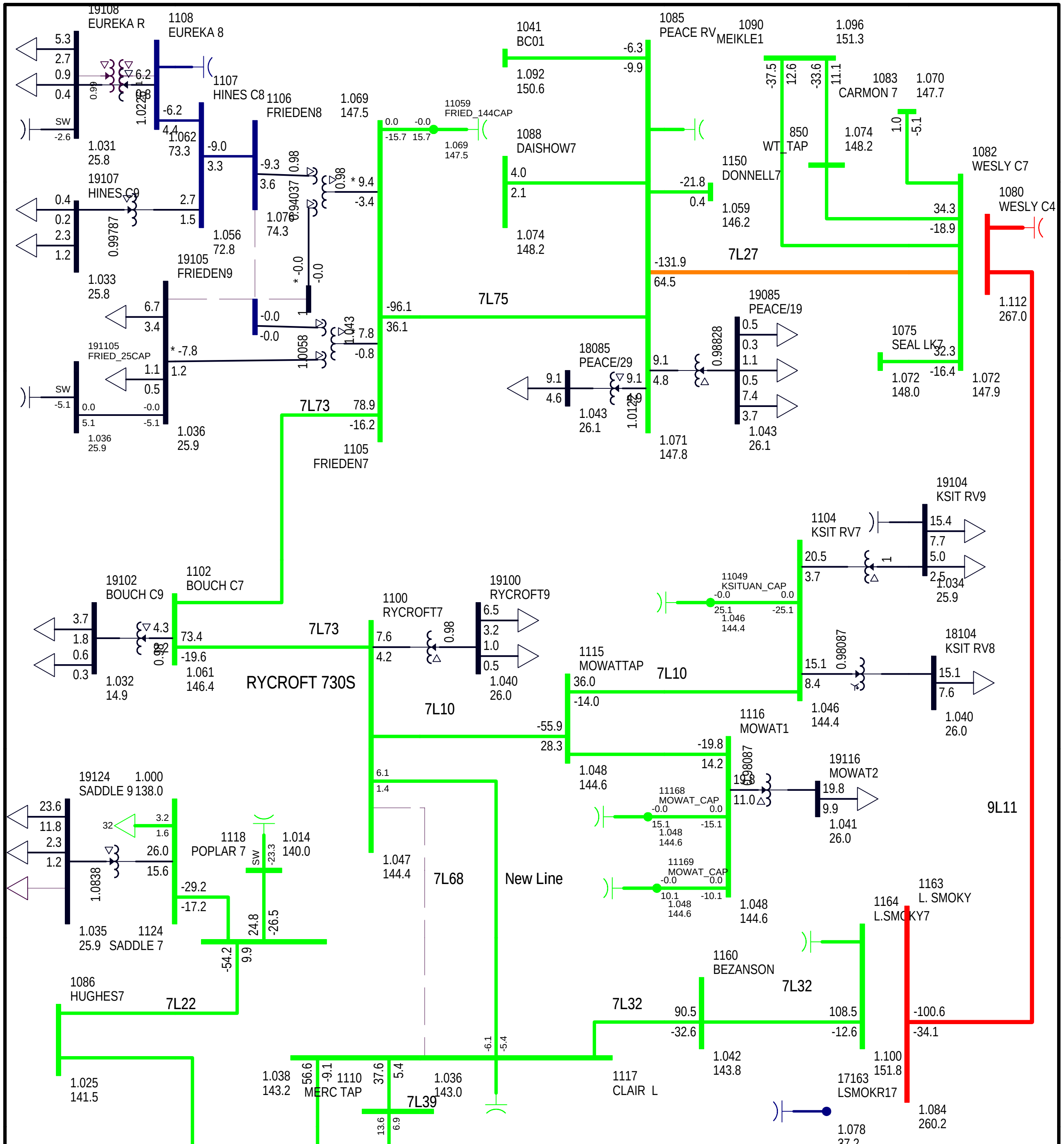
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L73 (N-1)
FIG B-109
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 79.5 MW

TOTAL FLOW INTO RYCROFT AREA: 50.7 MW



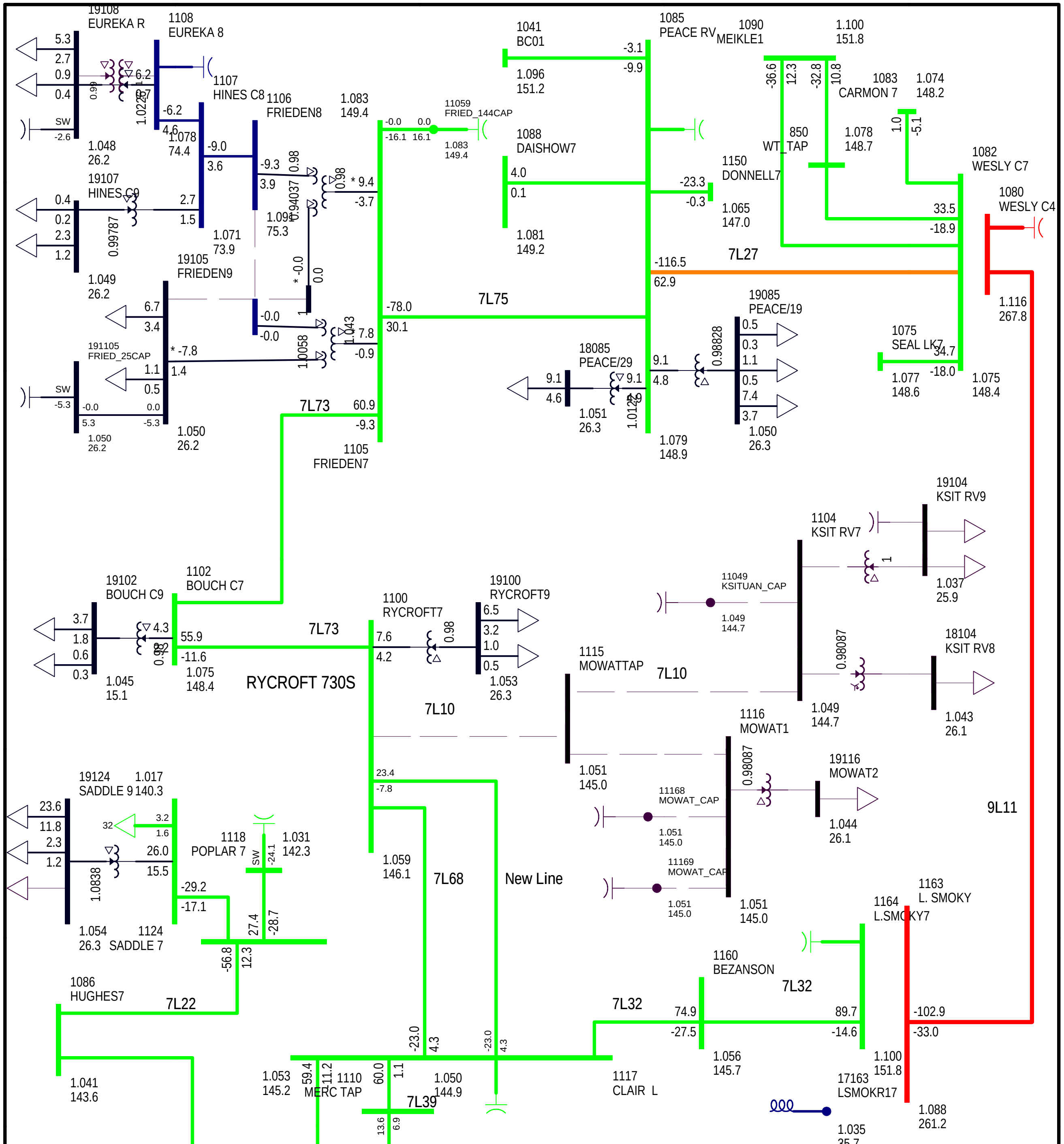
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L68 (N-1)
FIG B-110
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 101.9 MW



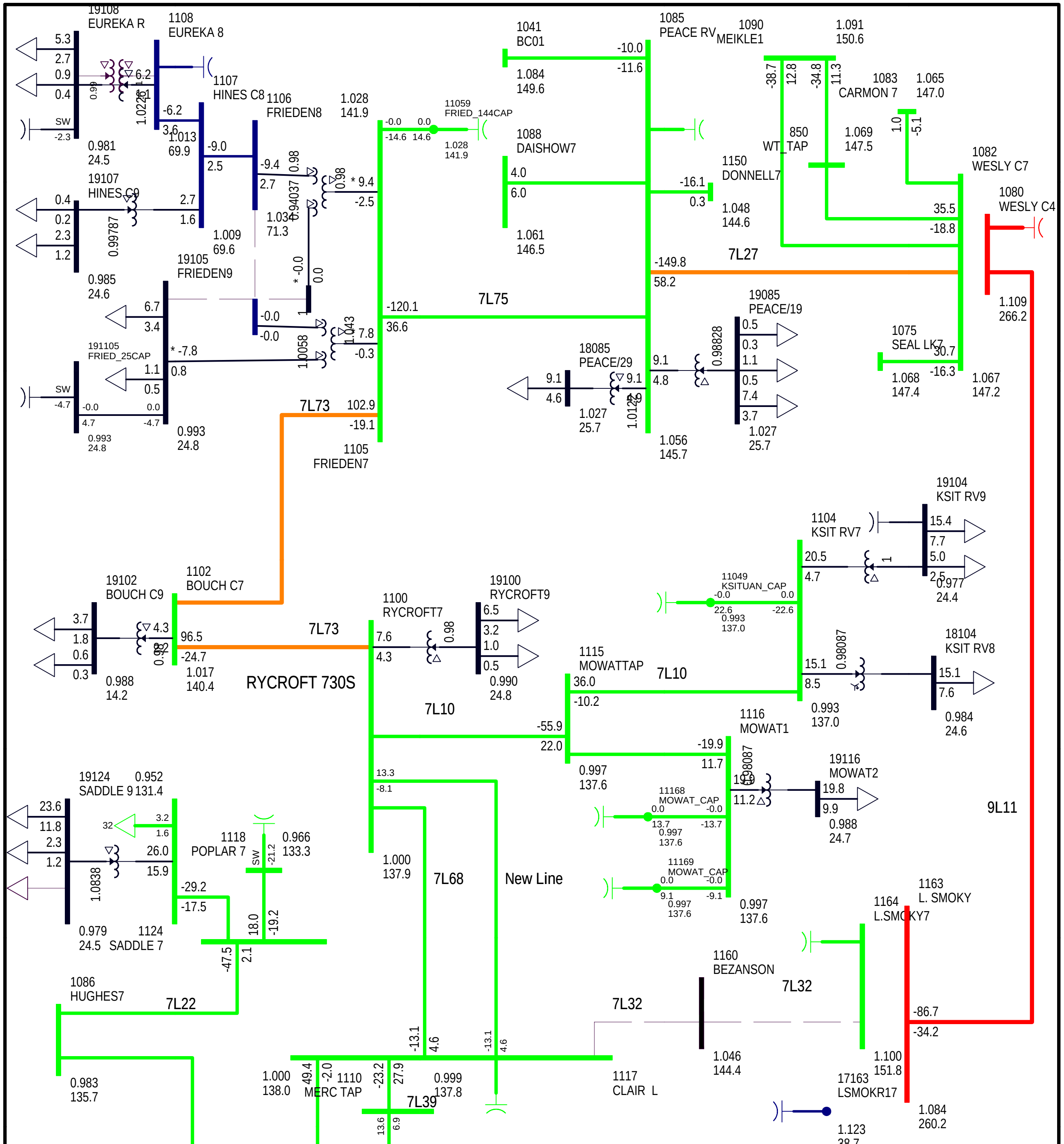
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L10 (N-1)
FIG B-111
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 28.5 MW

TOTAL FLOW INTO RYCROFT AREA: 58.8 MW



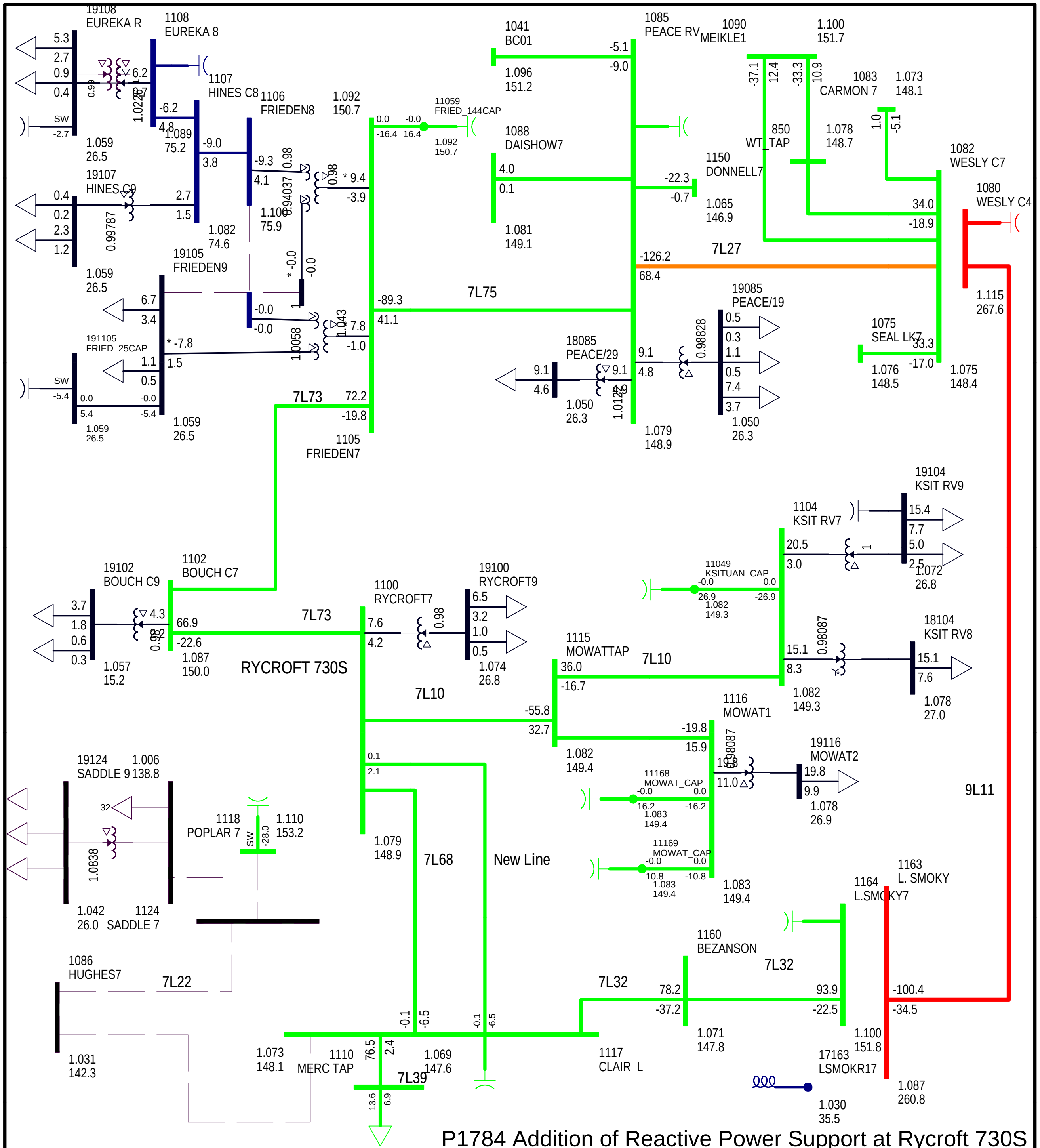
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L32 (N-1)
FIG B-112
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 116.2 MW

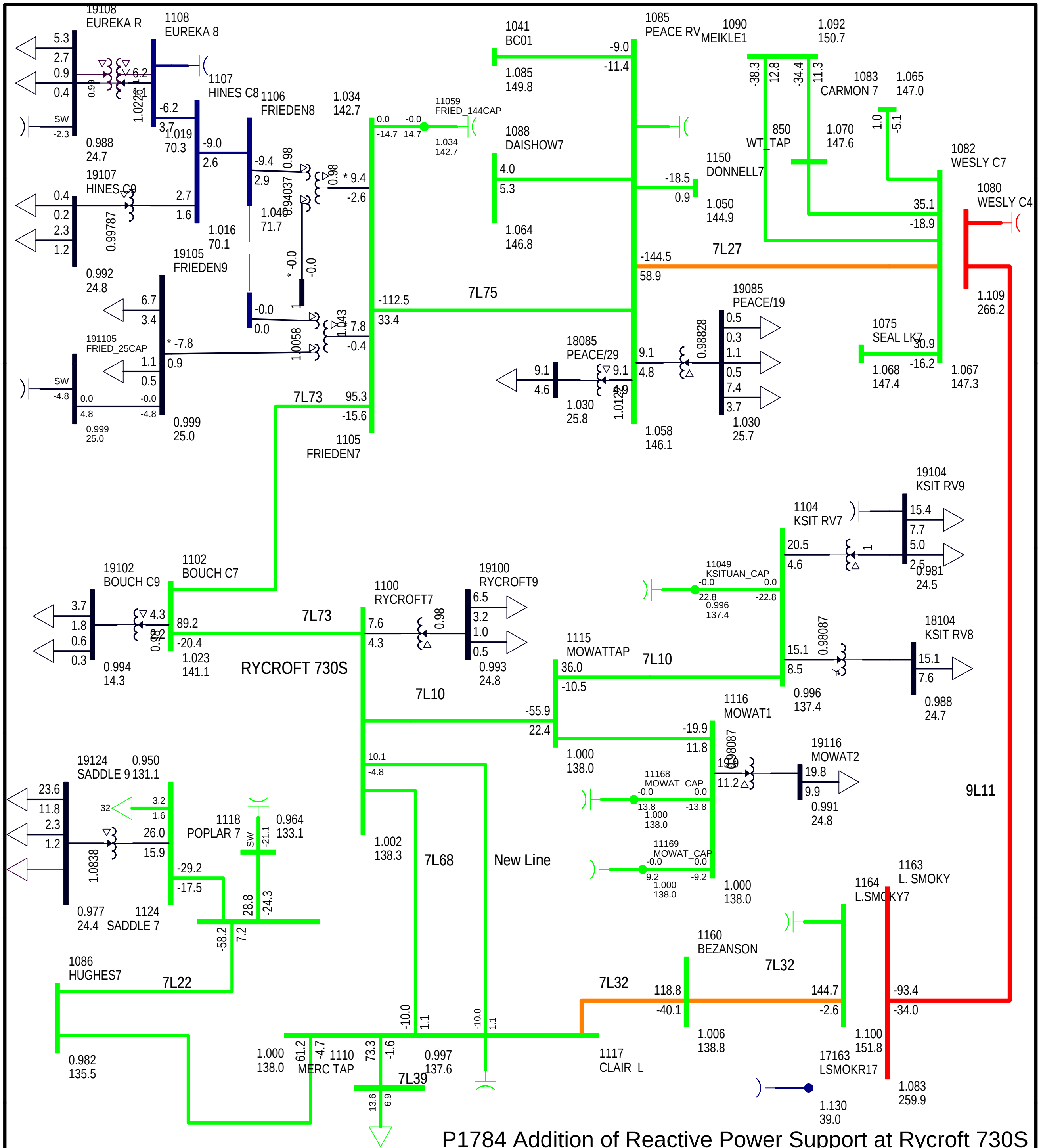


PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L22 (N-1)
FIG B-113
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 94.4 MW

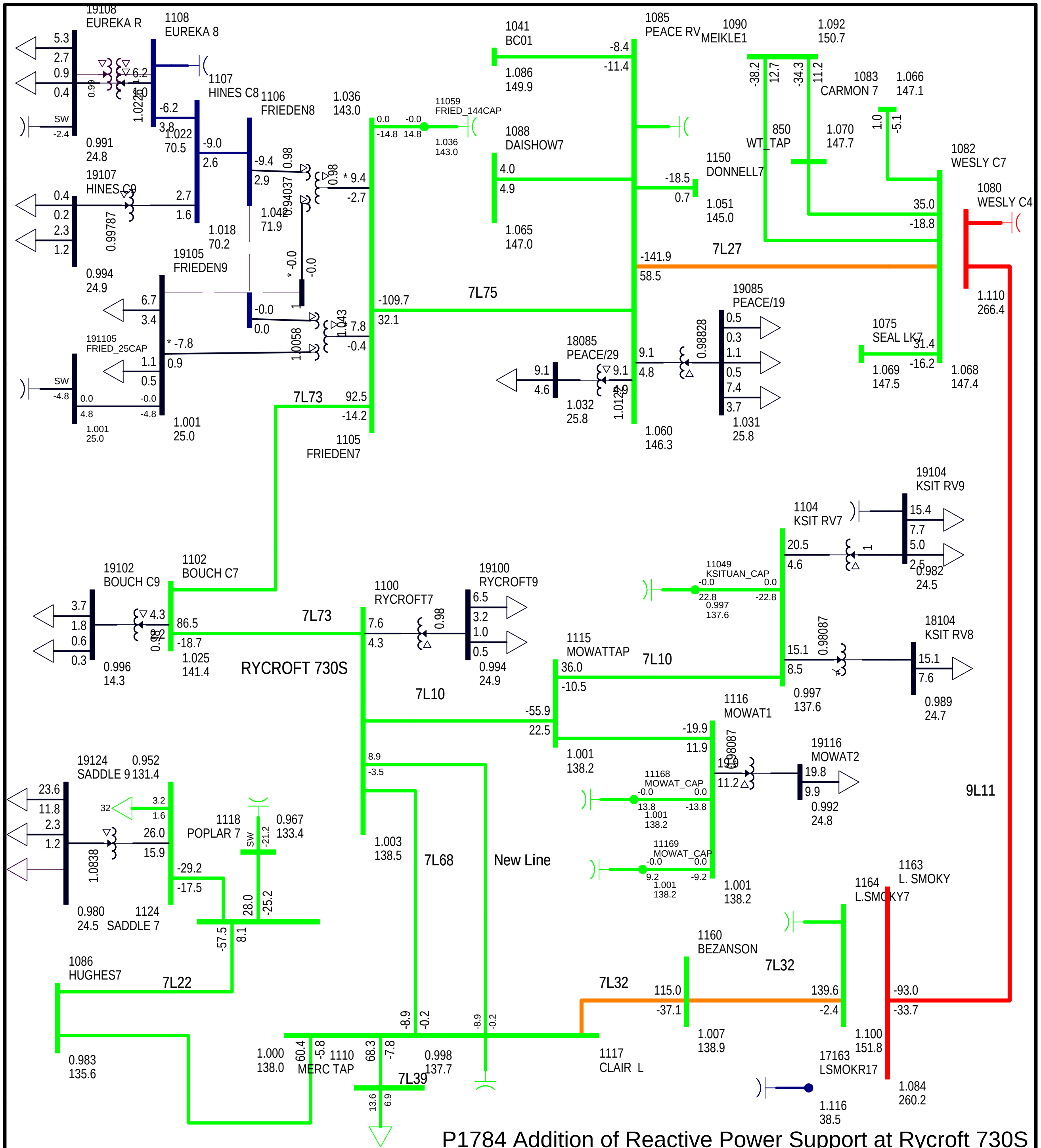


PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L46 (N-1)
FIG B-114
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 110.5 MW

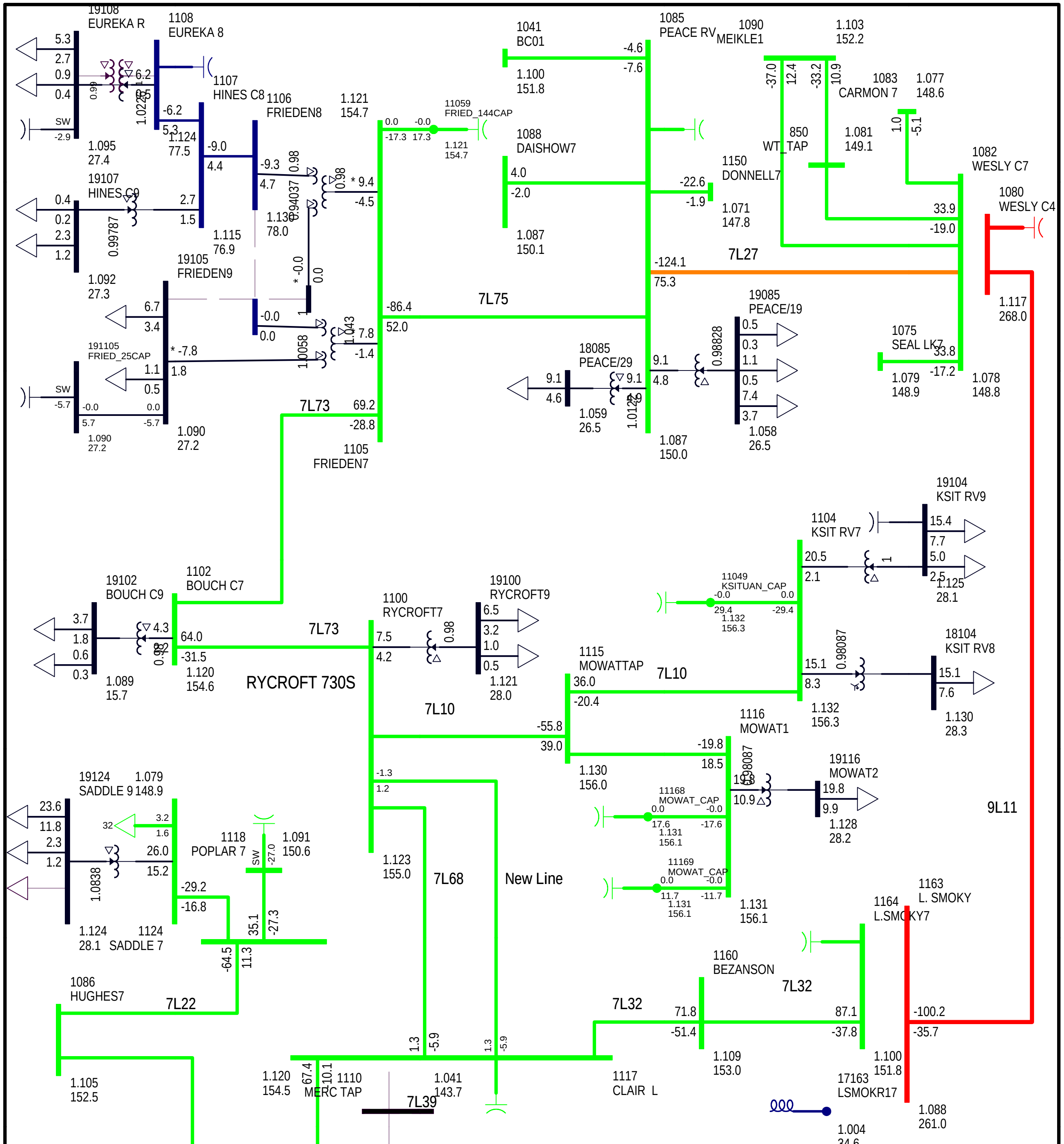


PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L45 (N-1)
FIG B-115
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 108.4 MW



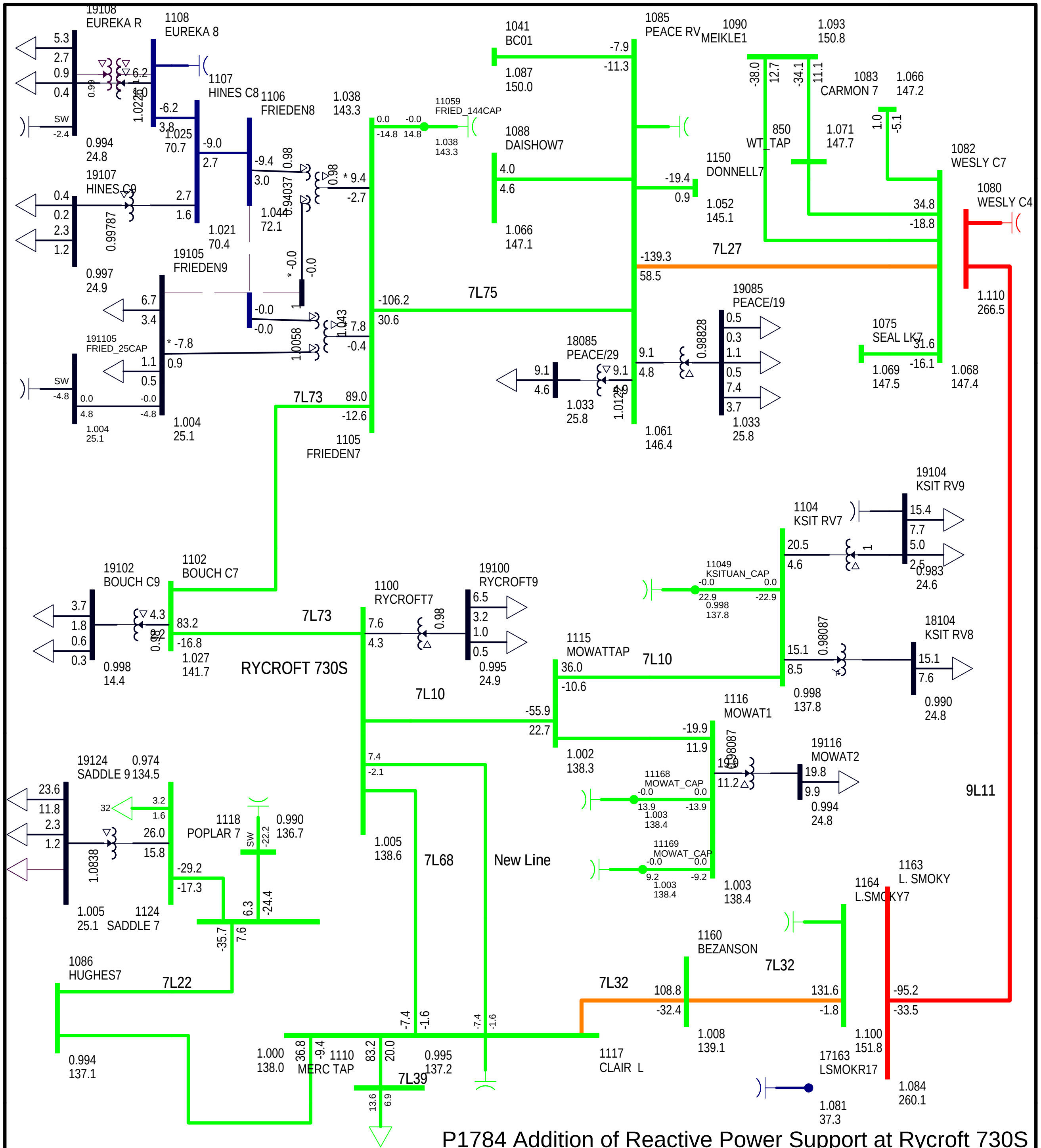
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L39 (N-1)
FIG B-116
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 92.9 MW

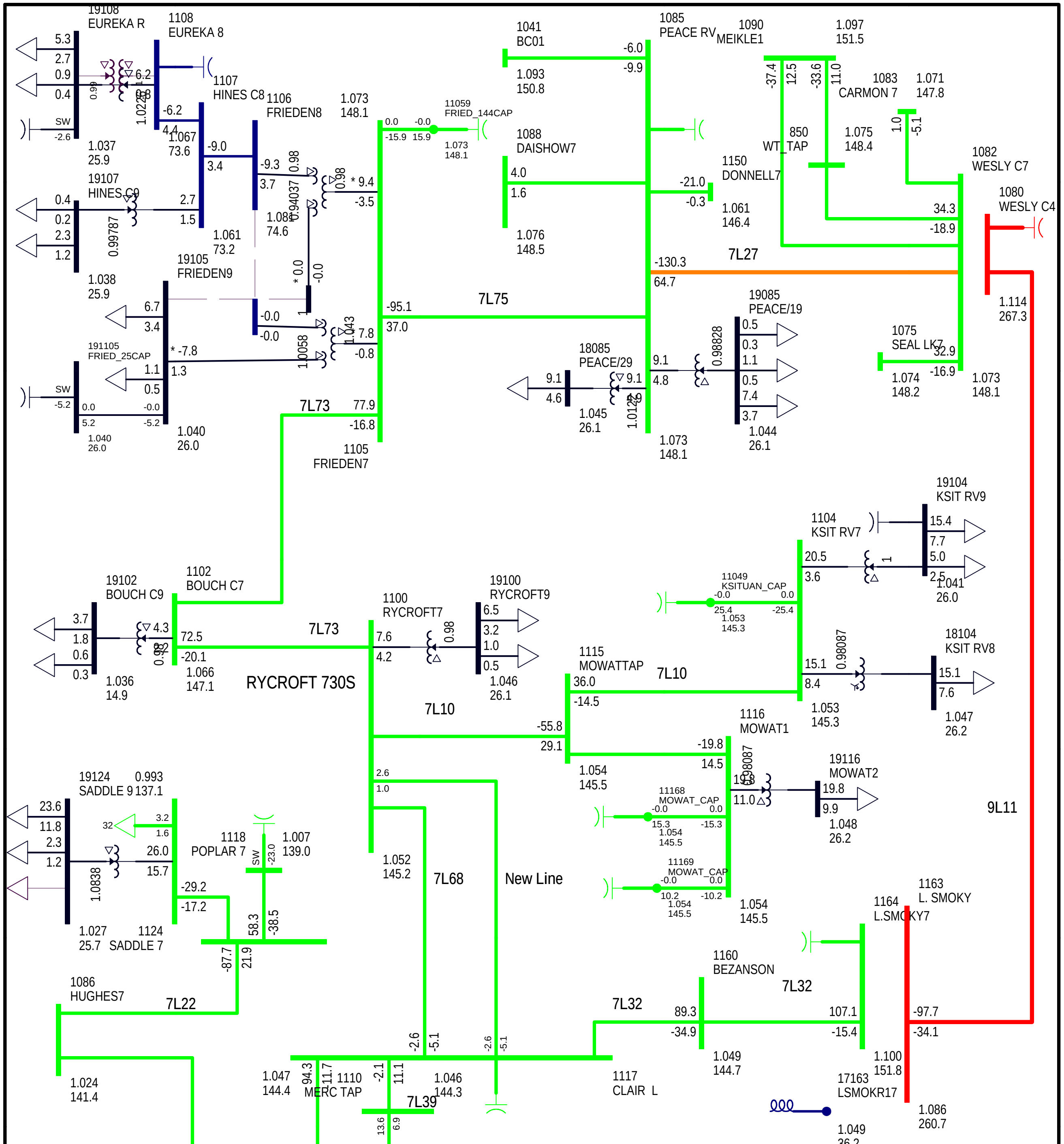


PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L84 (N-1)
FIG B-117
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 105.9 MW



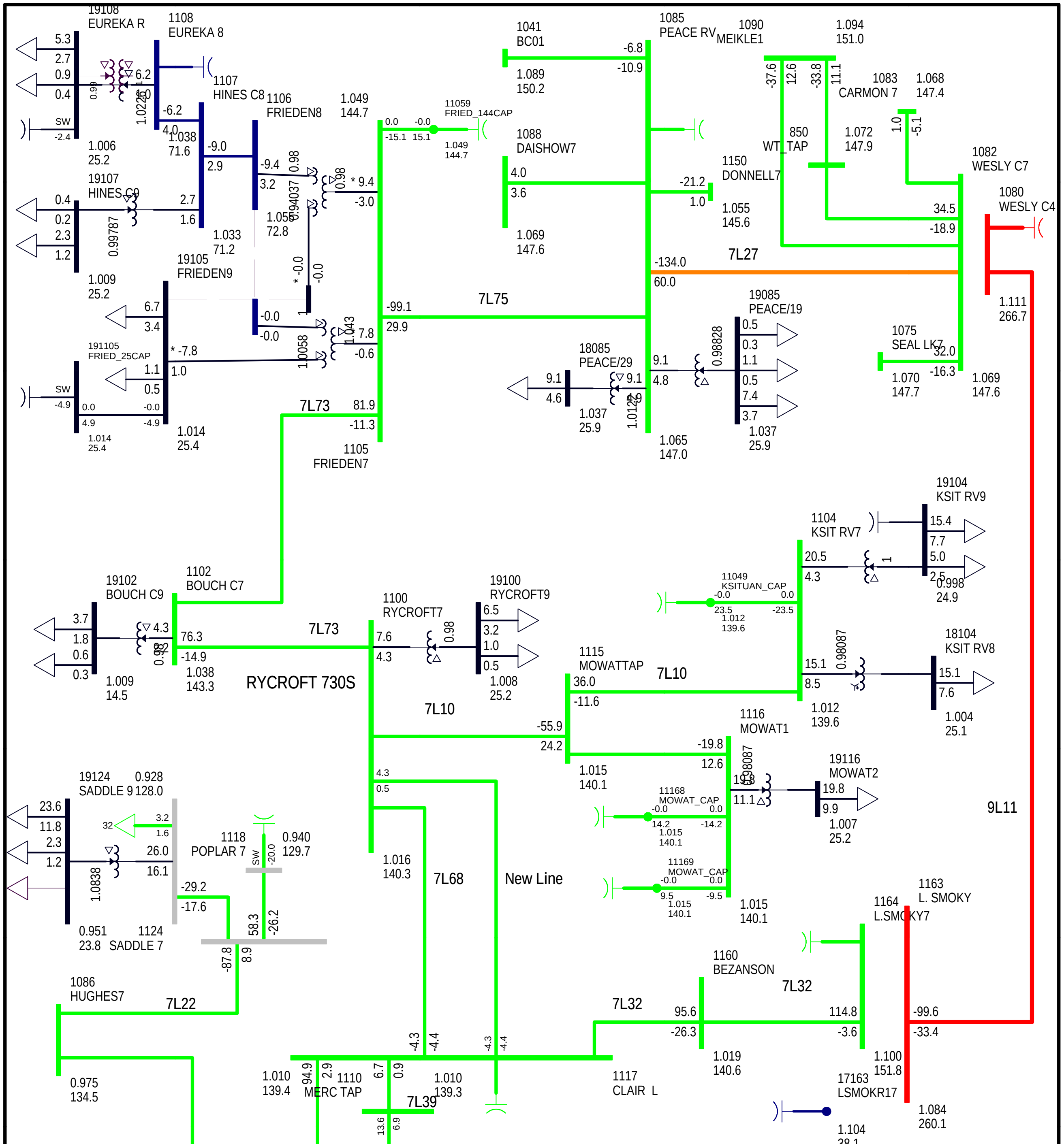
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L03 (N-1)
FIG B-118
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 98.2 MW



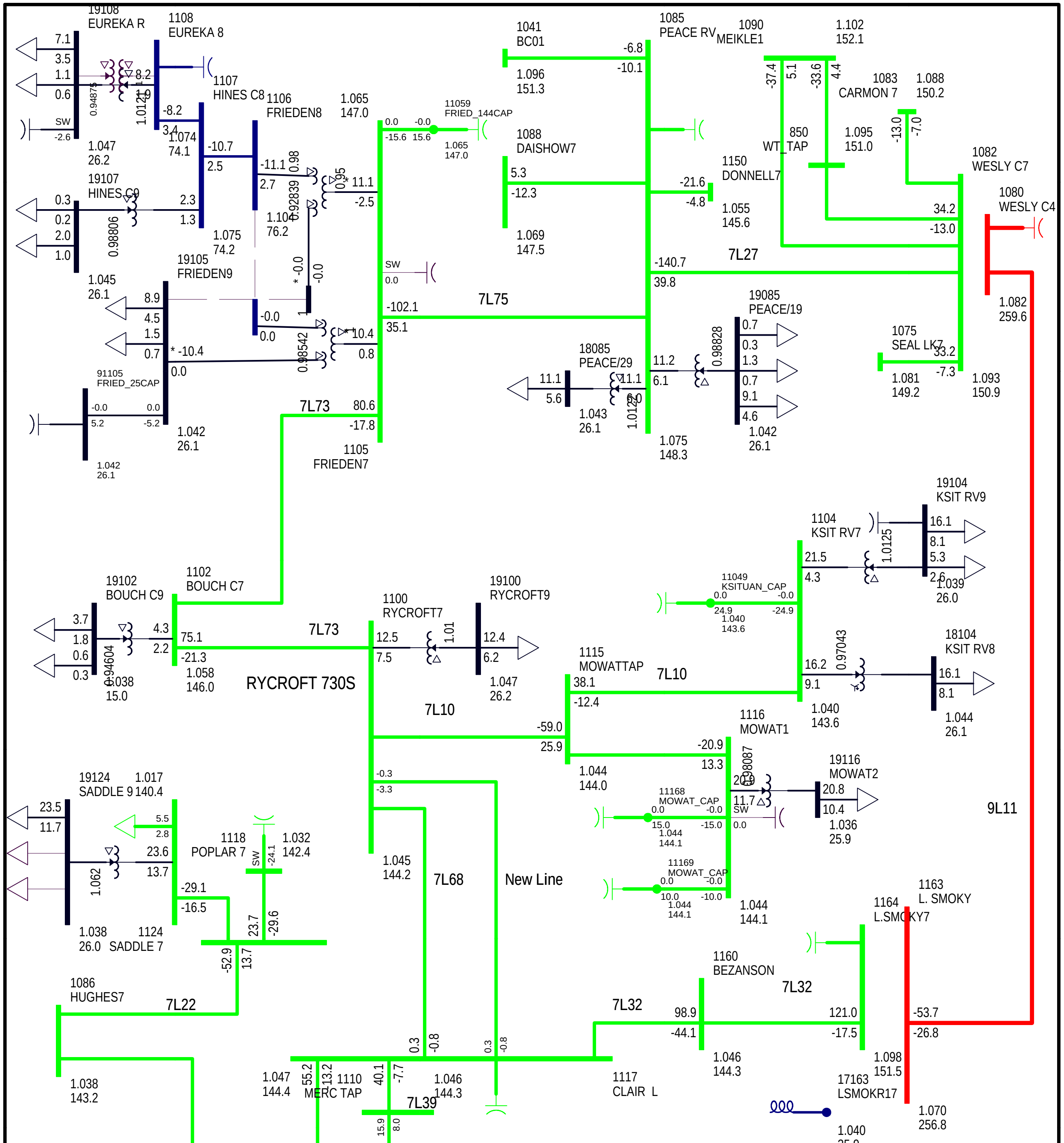
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 4 2036SP
7L69 (N-1)
FIG B-119
THU, NOV 09 2017 14:09

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 100.9 MW



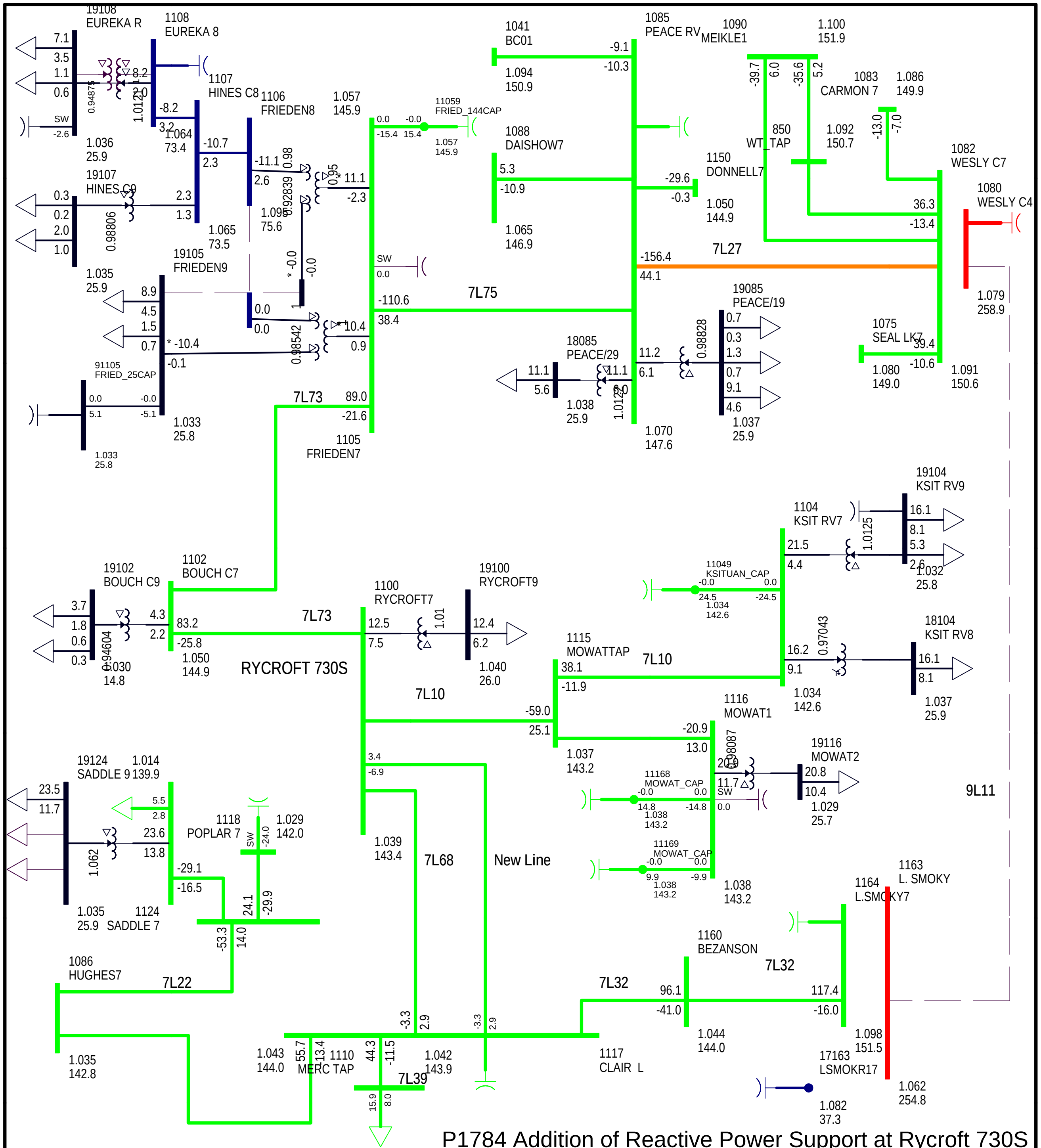
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
BASE CASE(N-0)
FIG B-120
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.2 MW



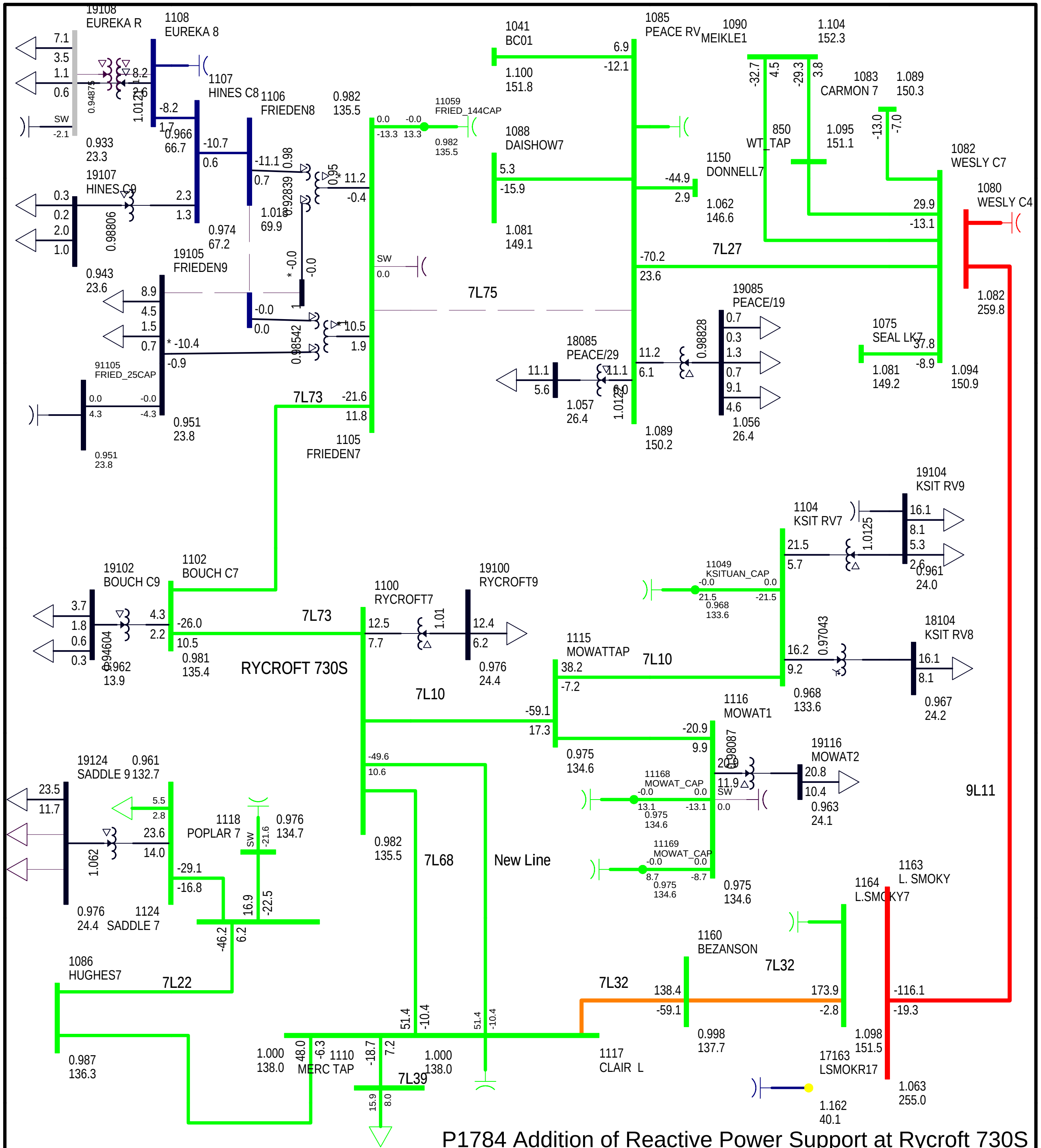
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
9L11 (N-1)
FIG B-121
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 111.6 MW

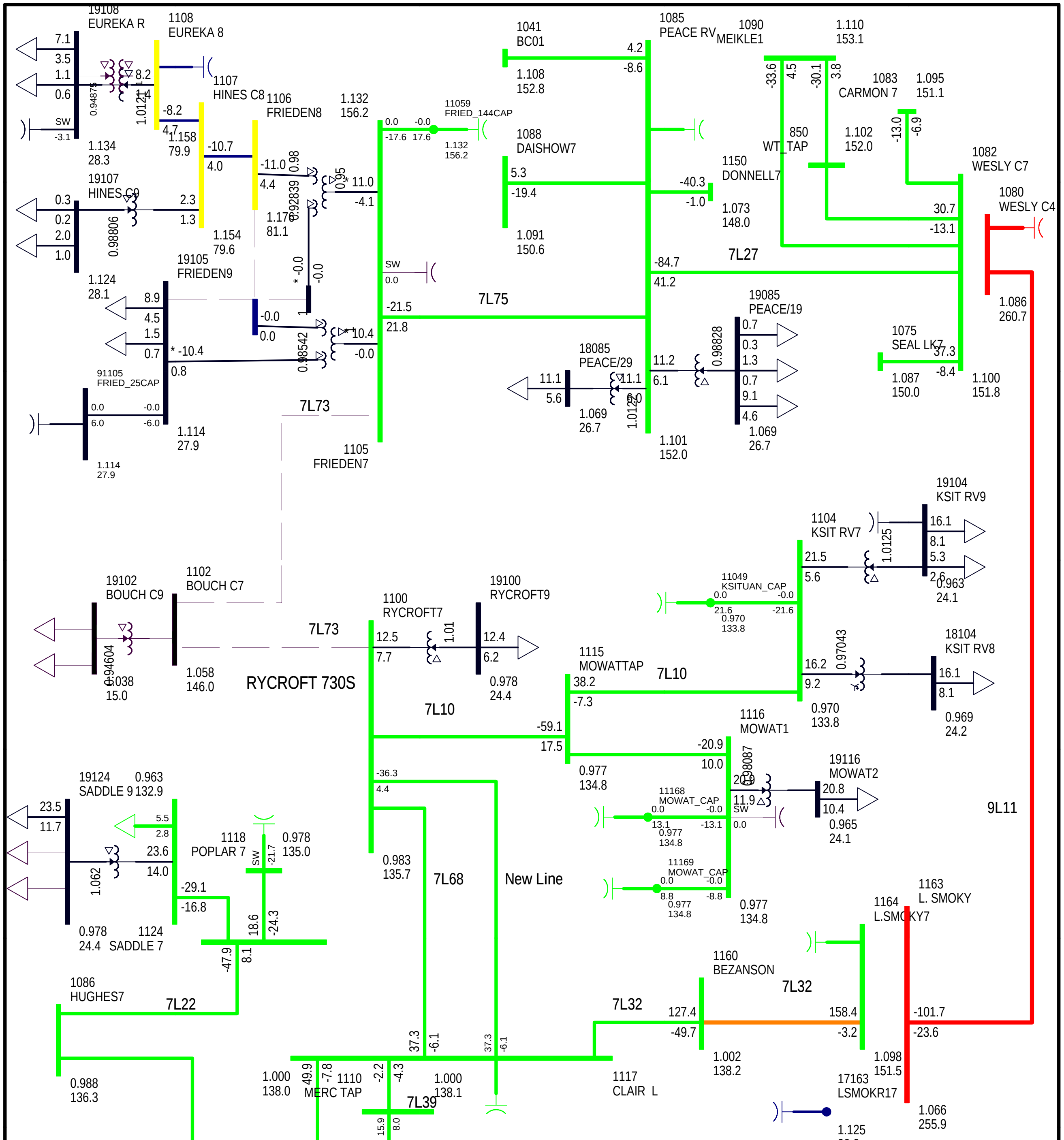


PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L75 (N-1)
FIG B-122
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 102.8 MW



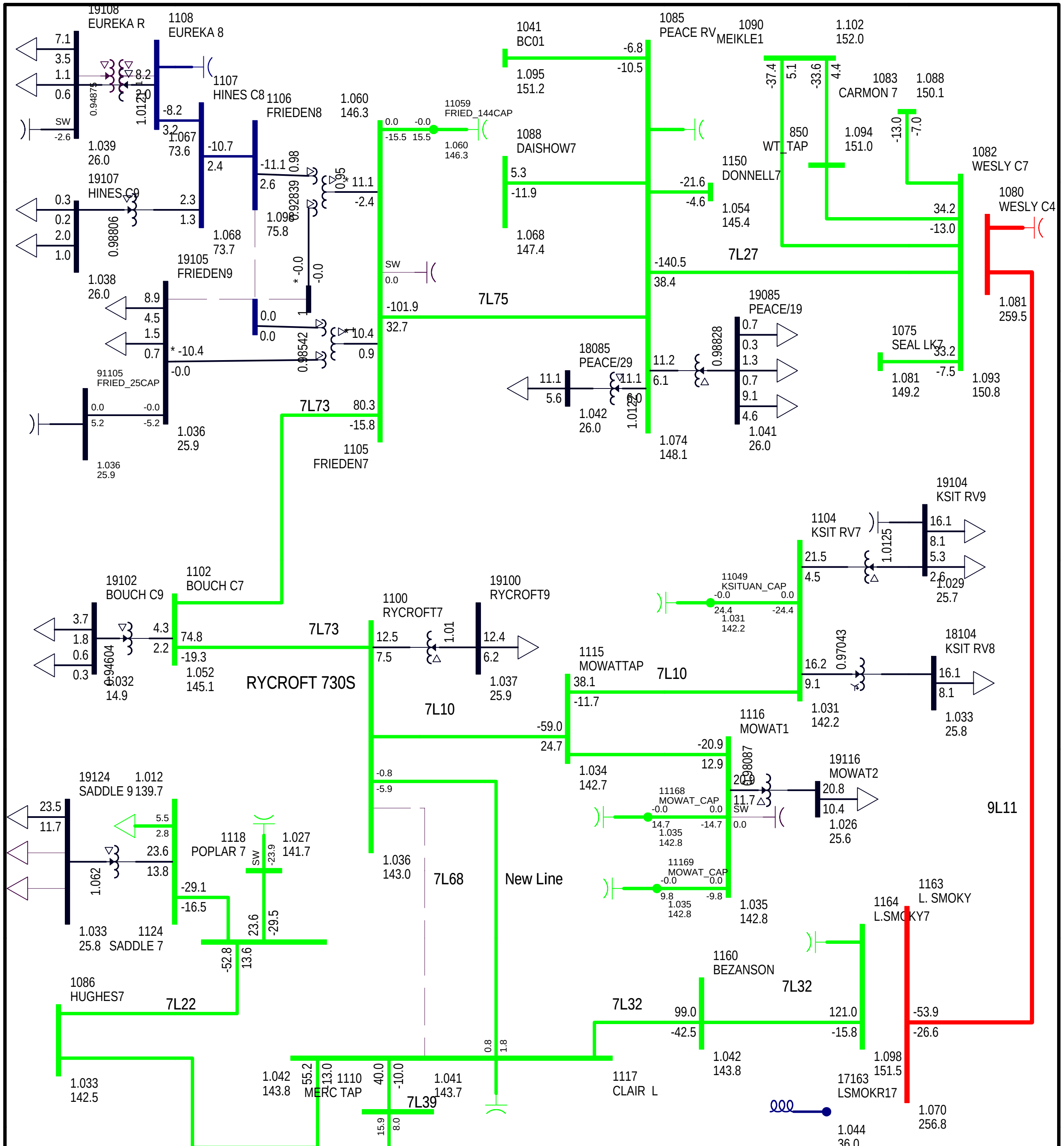
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L73 (N-1)
FIG B-123
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 91.7 MW

TOTAL FLOW INTO RYCROFT AREA: 96.6 MW



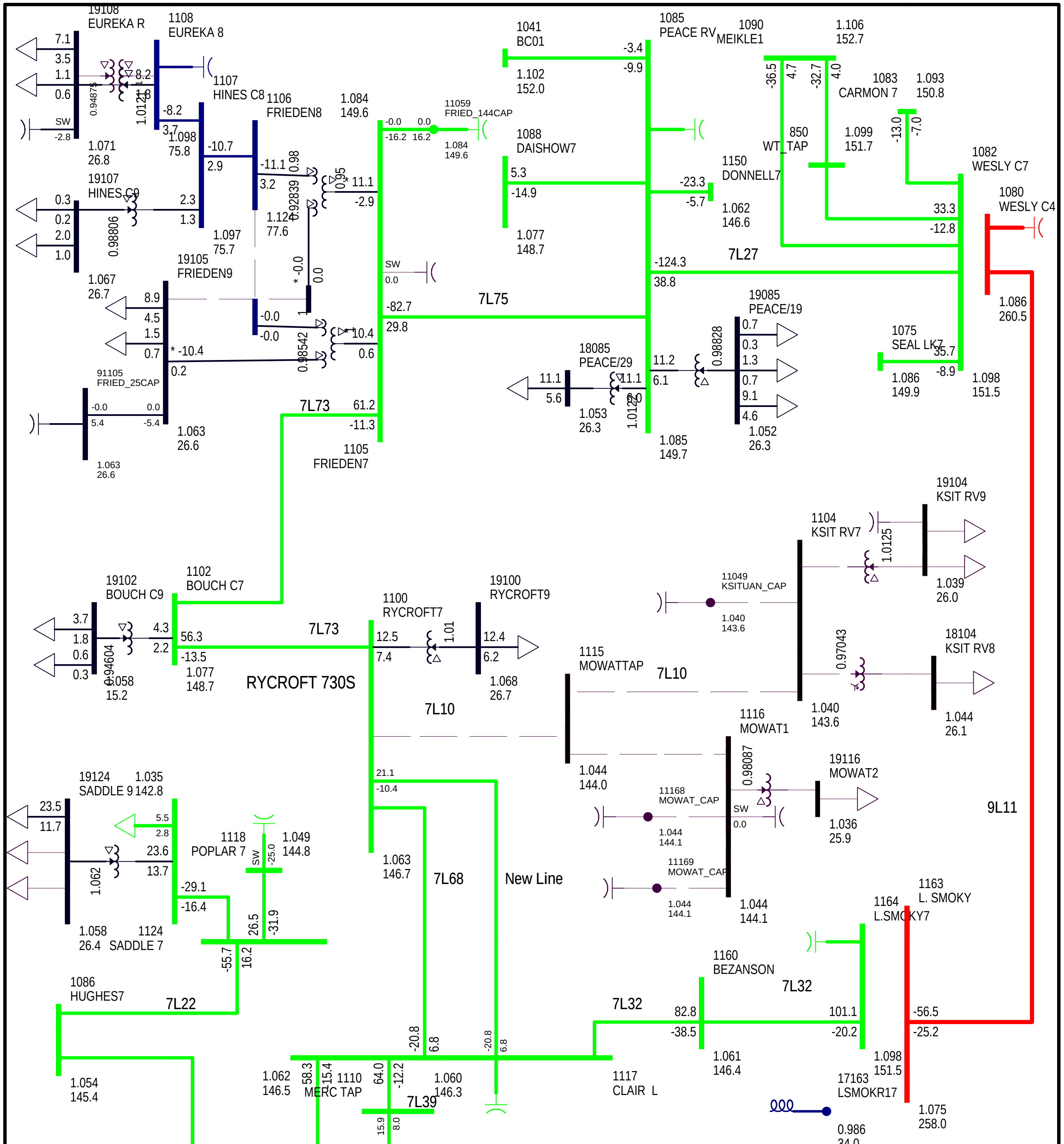
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L68 (N-1)
FIG B-124
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.1 MW



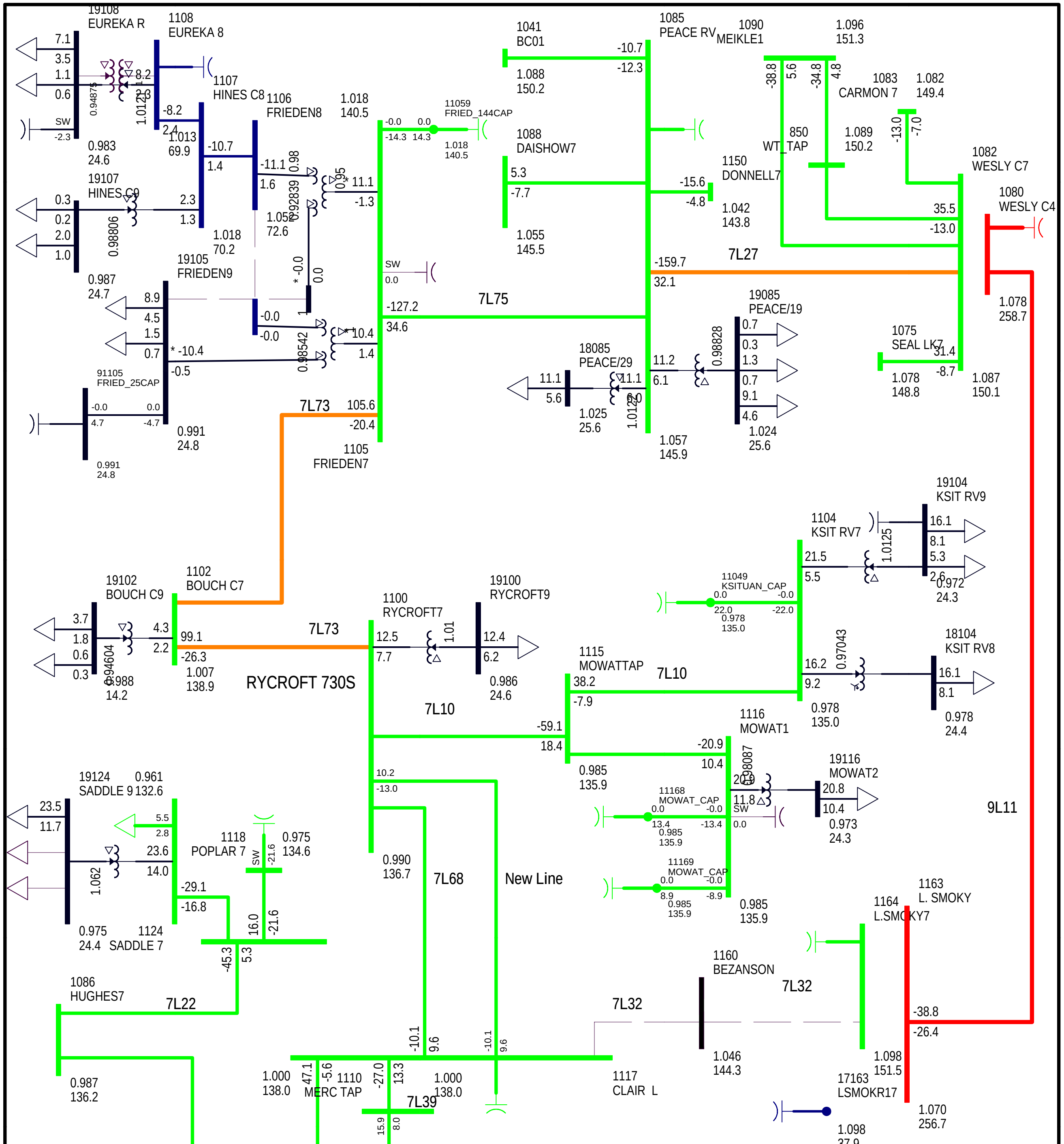
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L10 (N-1)
FIG B-125
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 37.6 MW

TOTAL FLOW INTO RYCROFT AREA: 45.4 MW



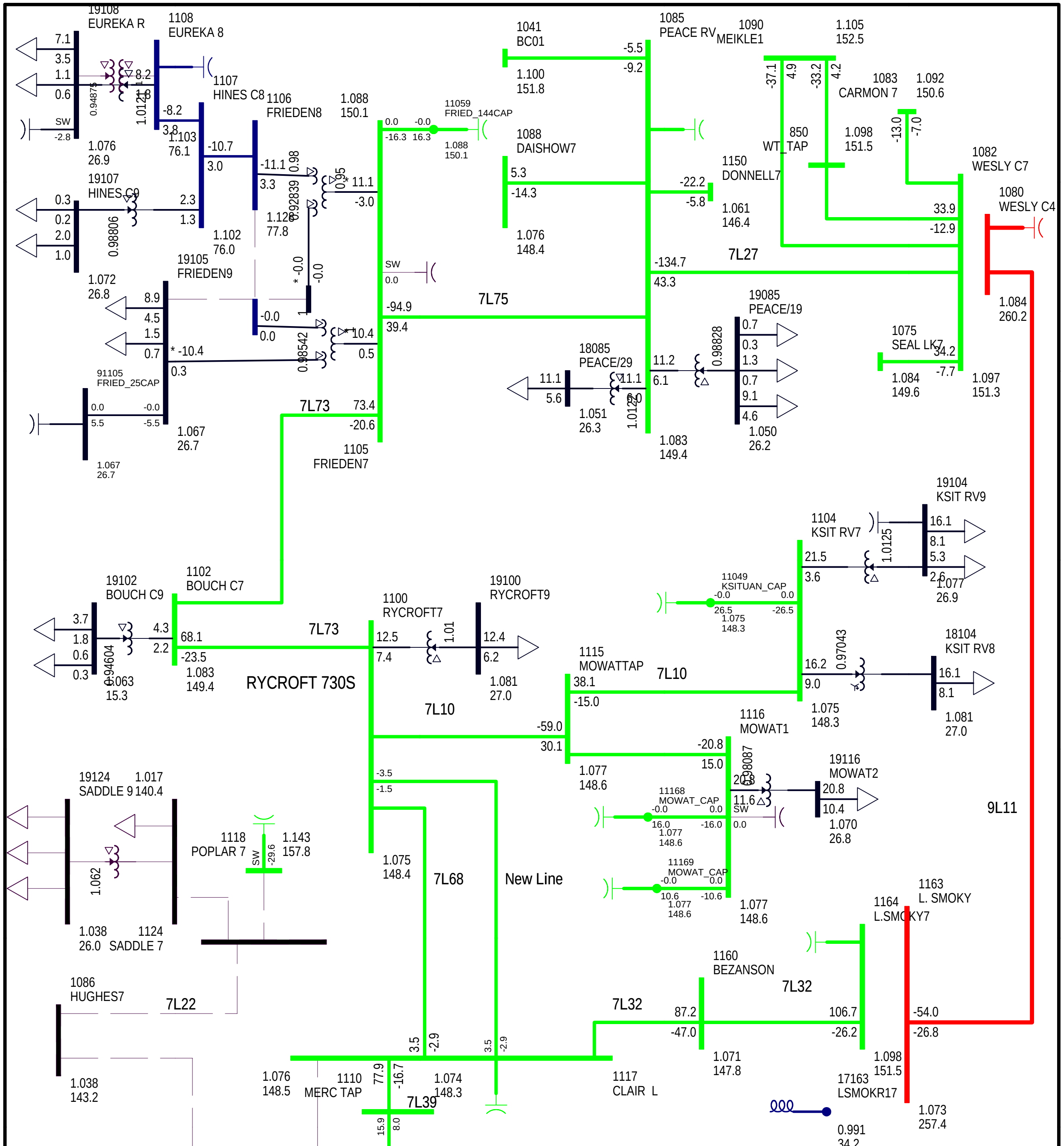
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L32 (N-1)
FIG B-126
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 117.5 MW



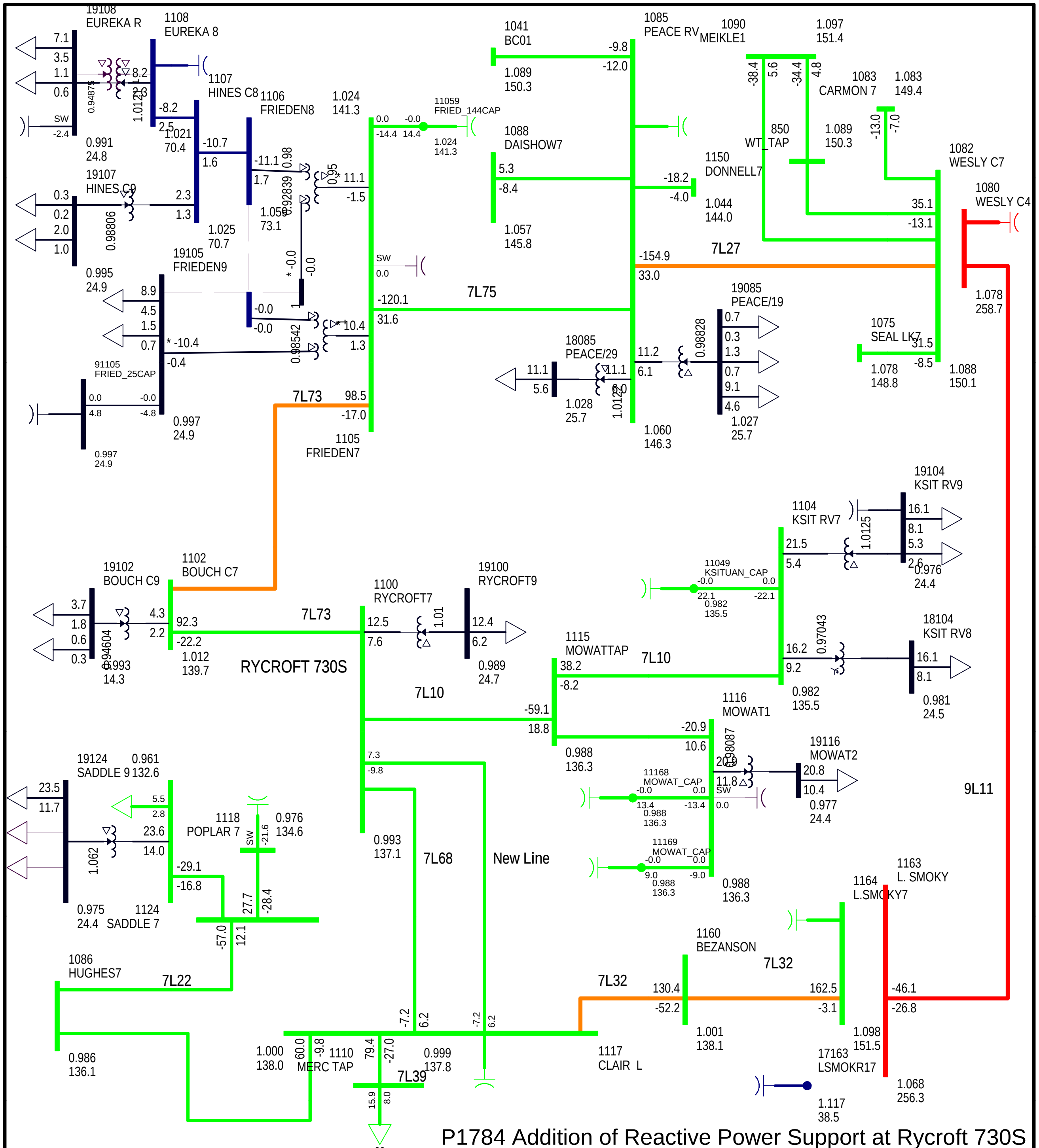
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L22 (N-1)
FIG B-127
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 107.5 MW



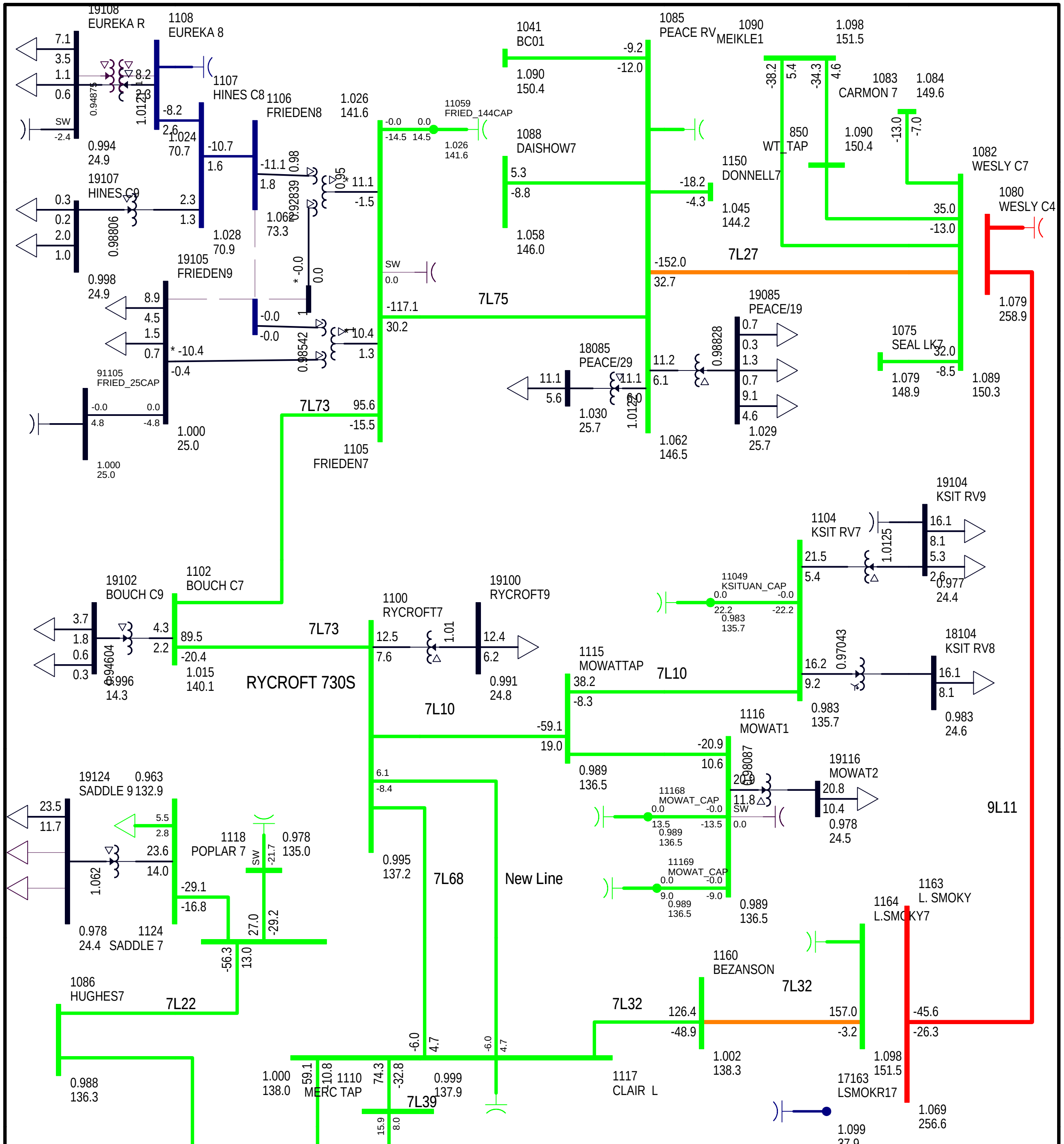
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L46 (N-1)
FIG B-128
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 114.8 MW



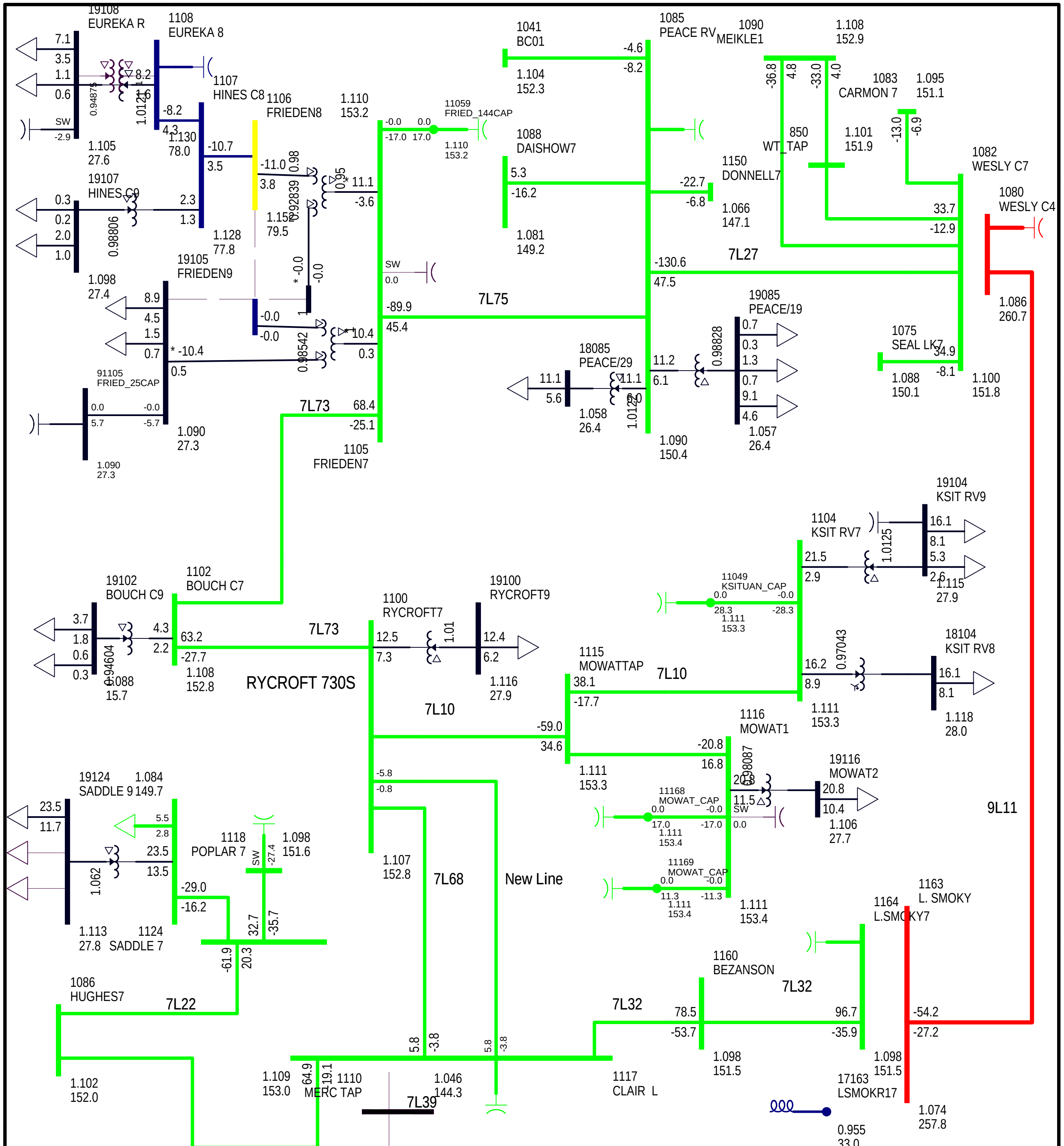
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L45 (N-1)
FIG B-129
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 113.8 MW



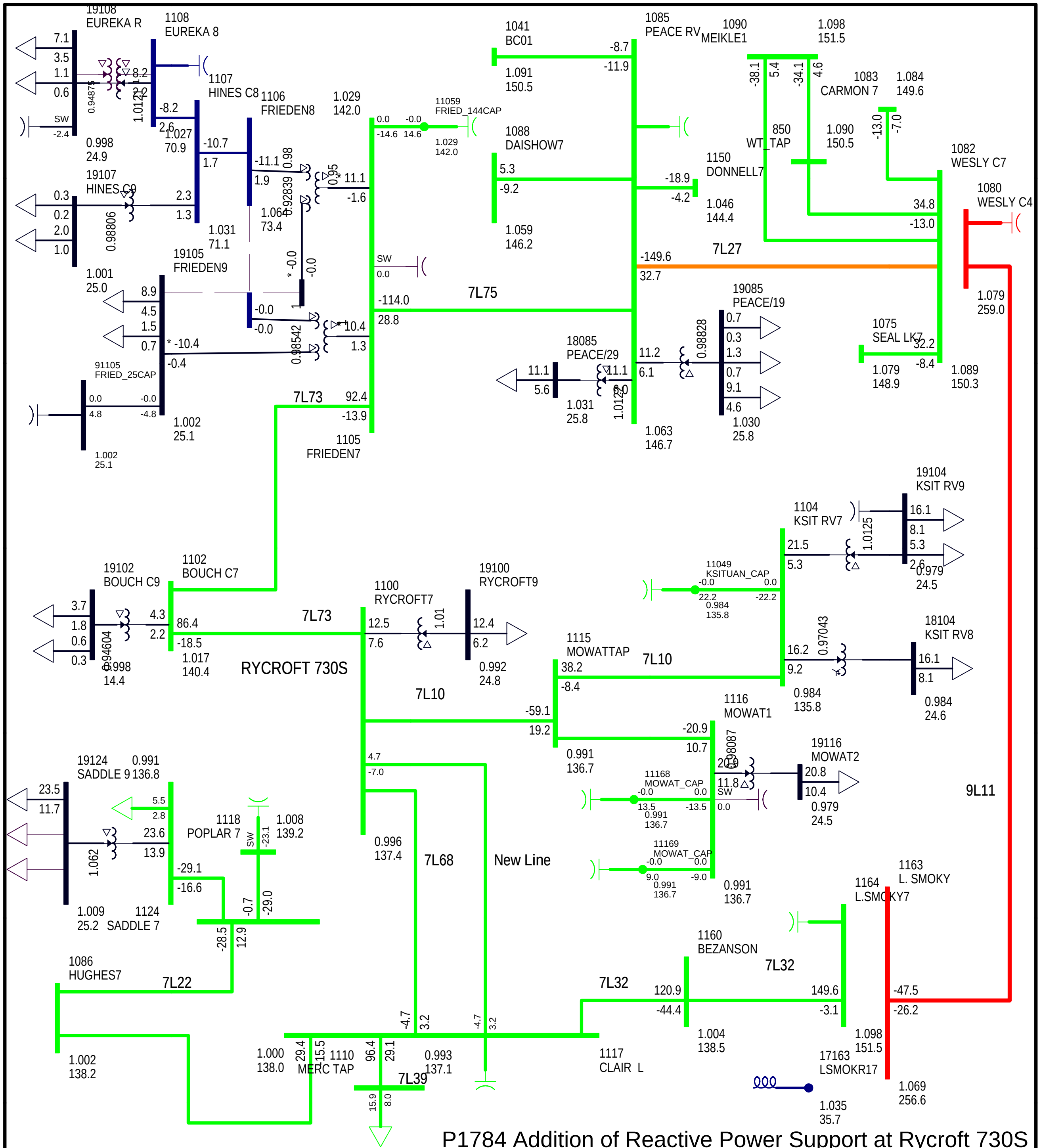
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L39 (N-1)
FIG B-130
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 106.6 MW



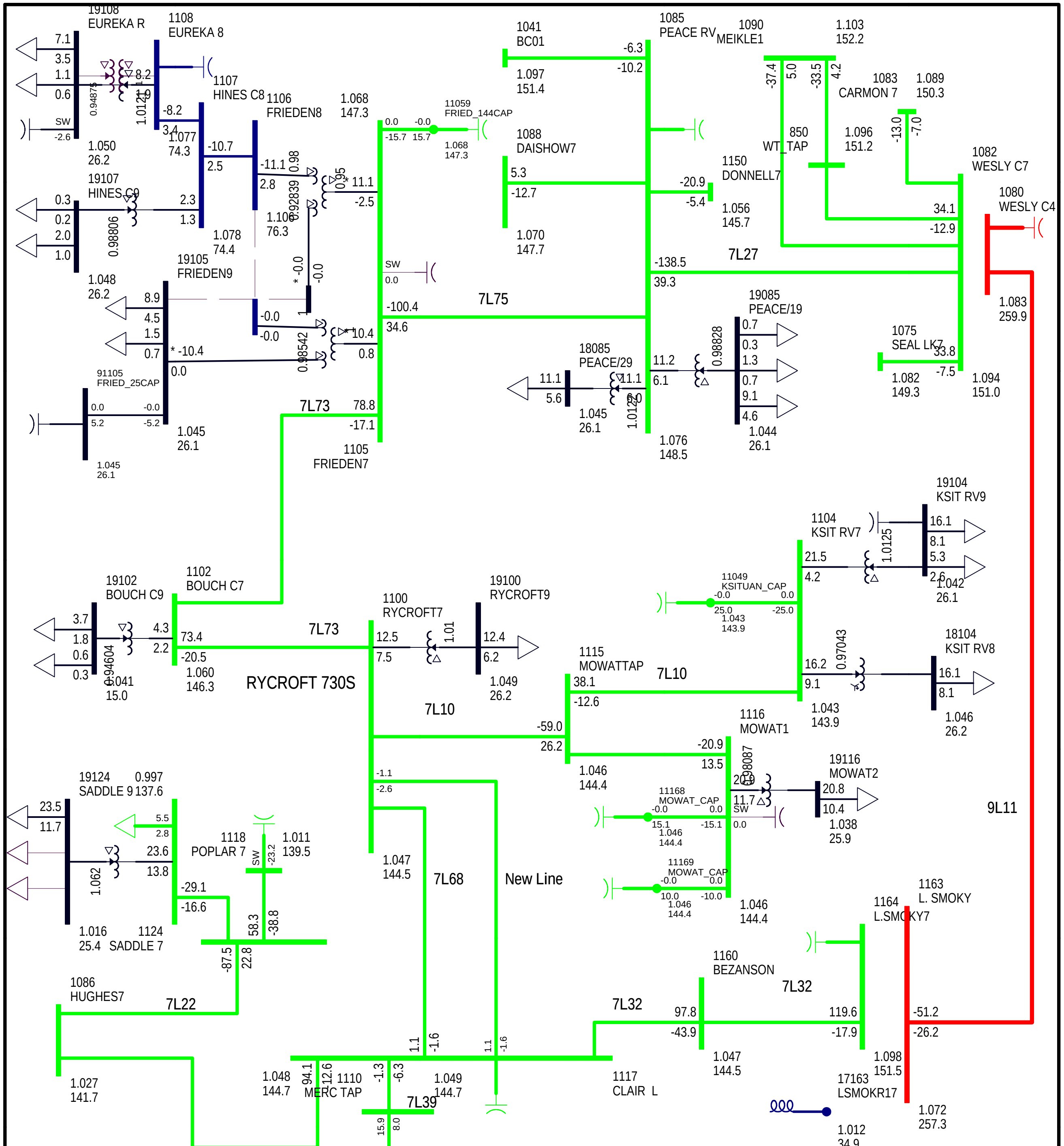
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L84 (N-1)
FIG B-131
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 112.7 MW



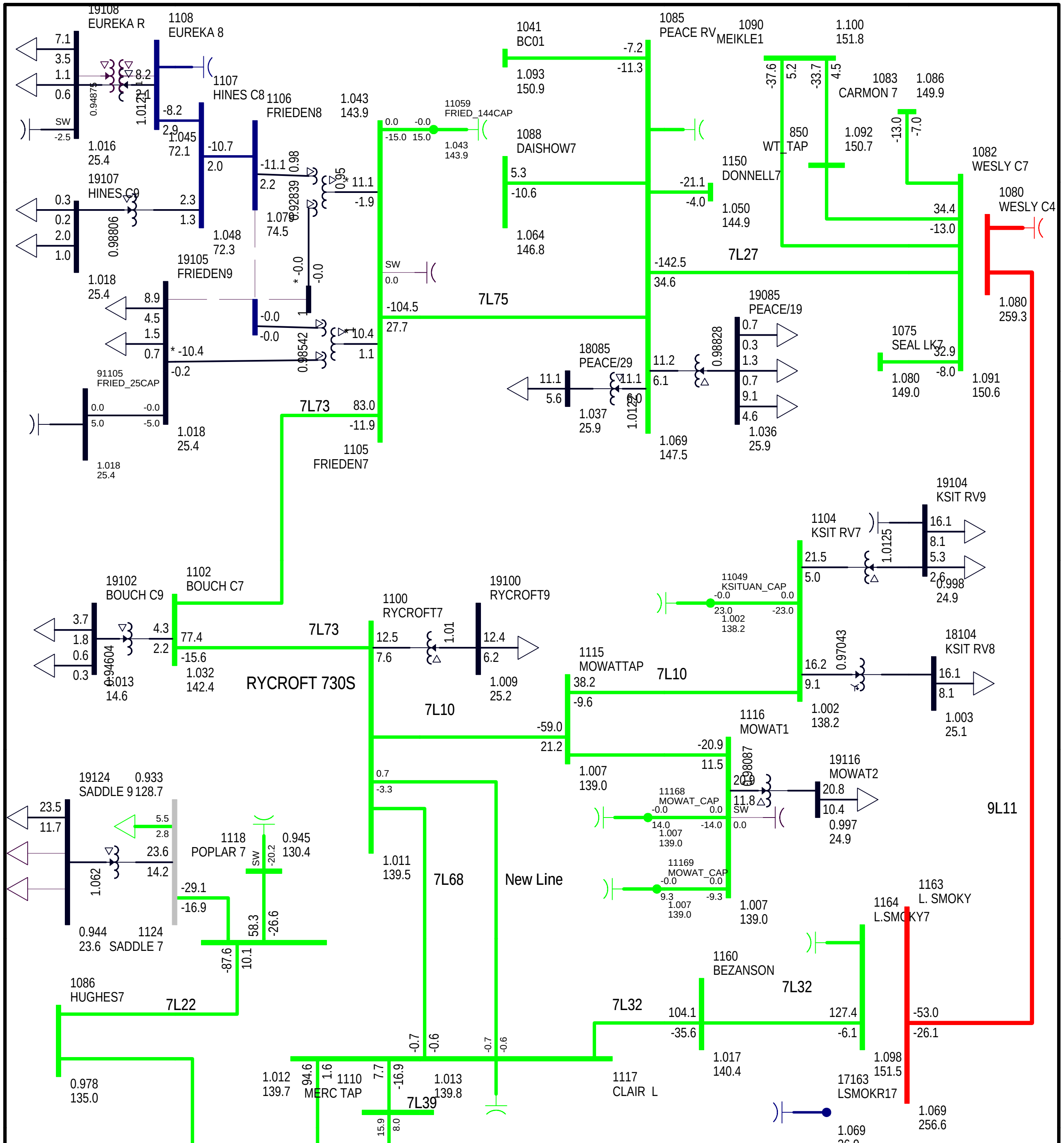
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L03 (N-1)
FIG B-132
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 108.7 MW



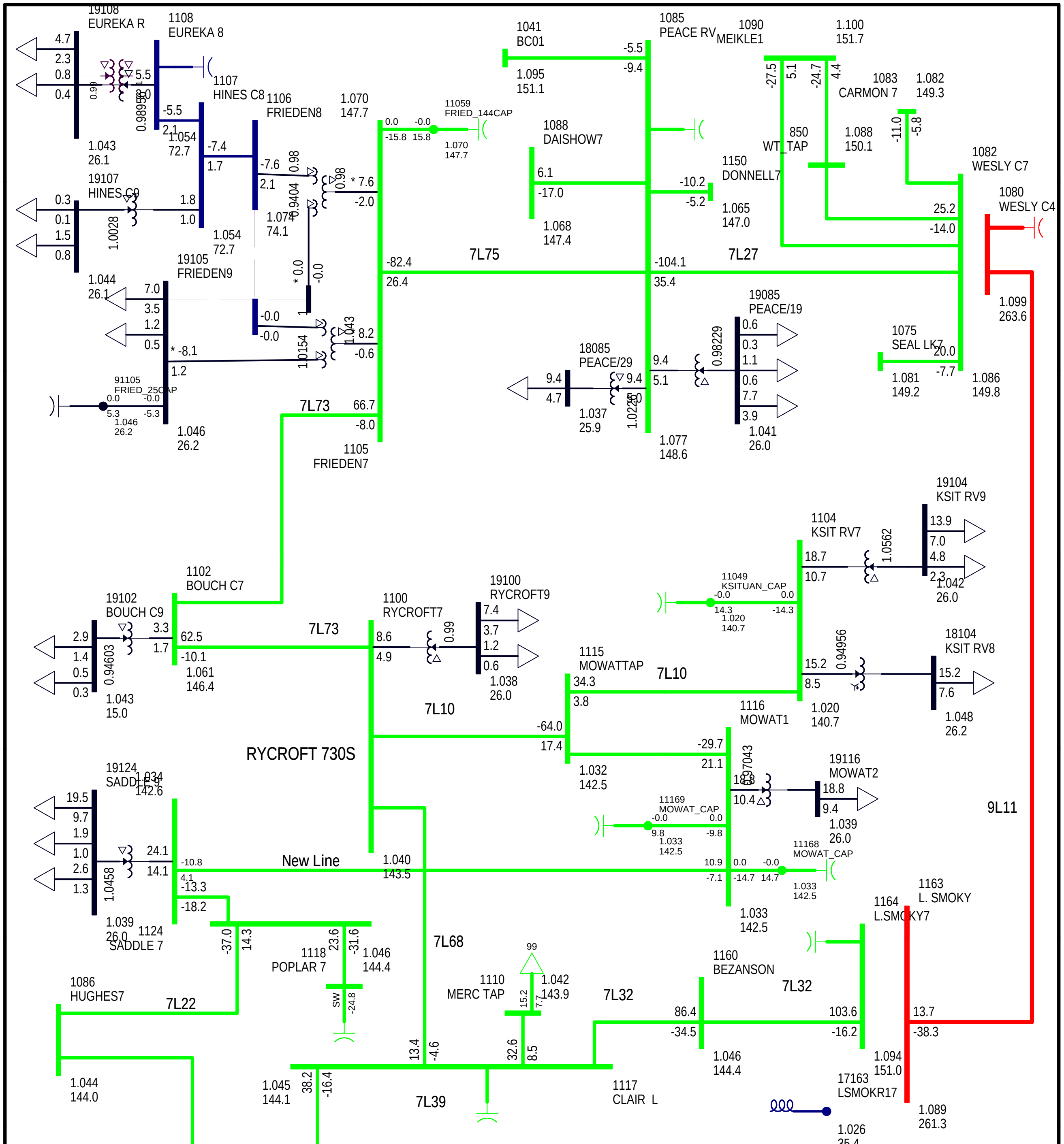
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT2: SCENARIO 5 2036WP
7L69 (N-1)
FIG B-133
THU, NOV 09 2017 14:12

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.8 MW



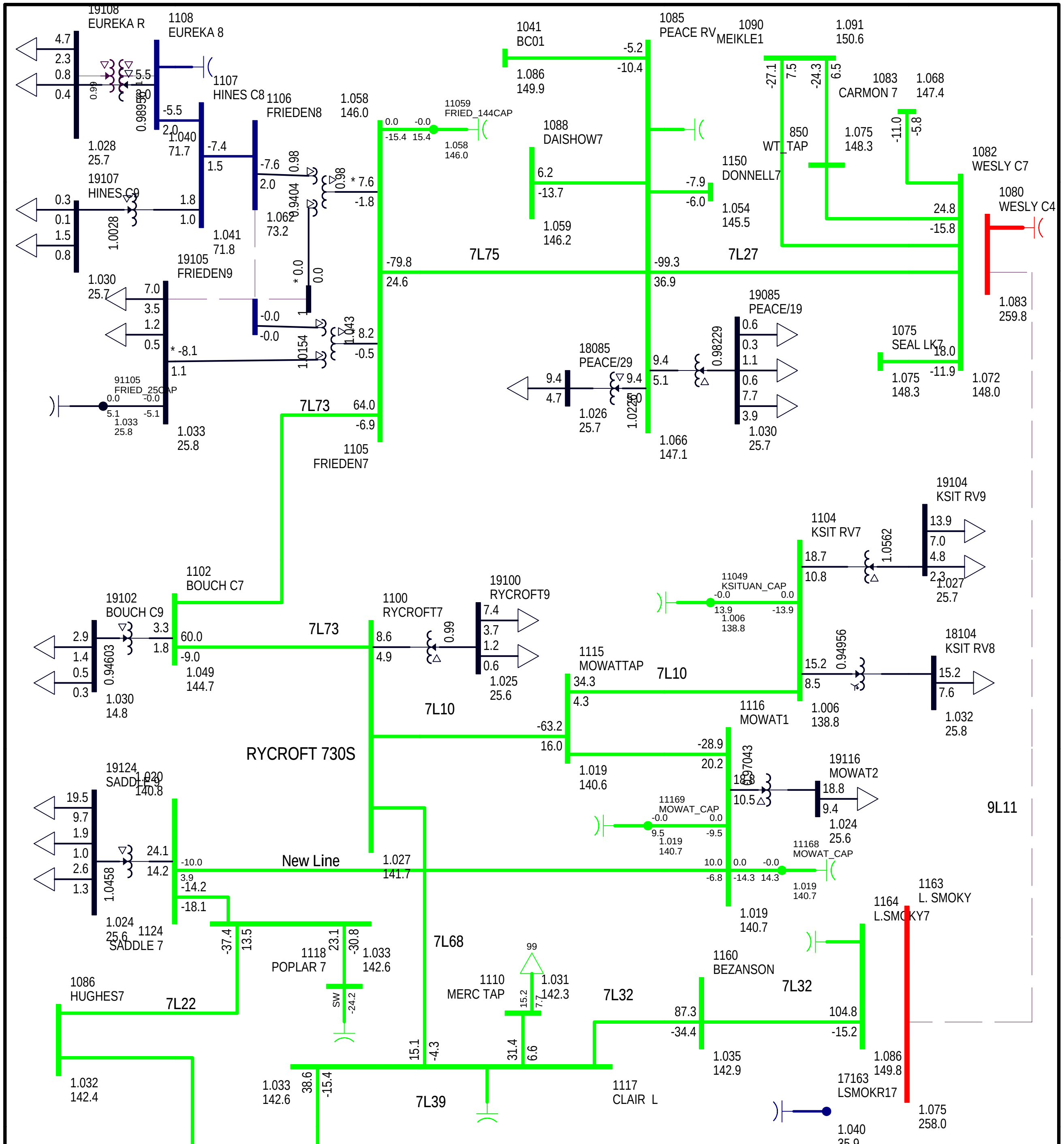
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 1F
BASE CASE(N-0)
FIG B-134
THU, NOV 09 2017 14:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 100.0 MW



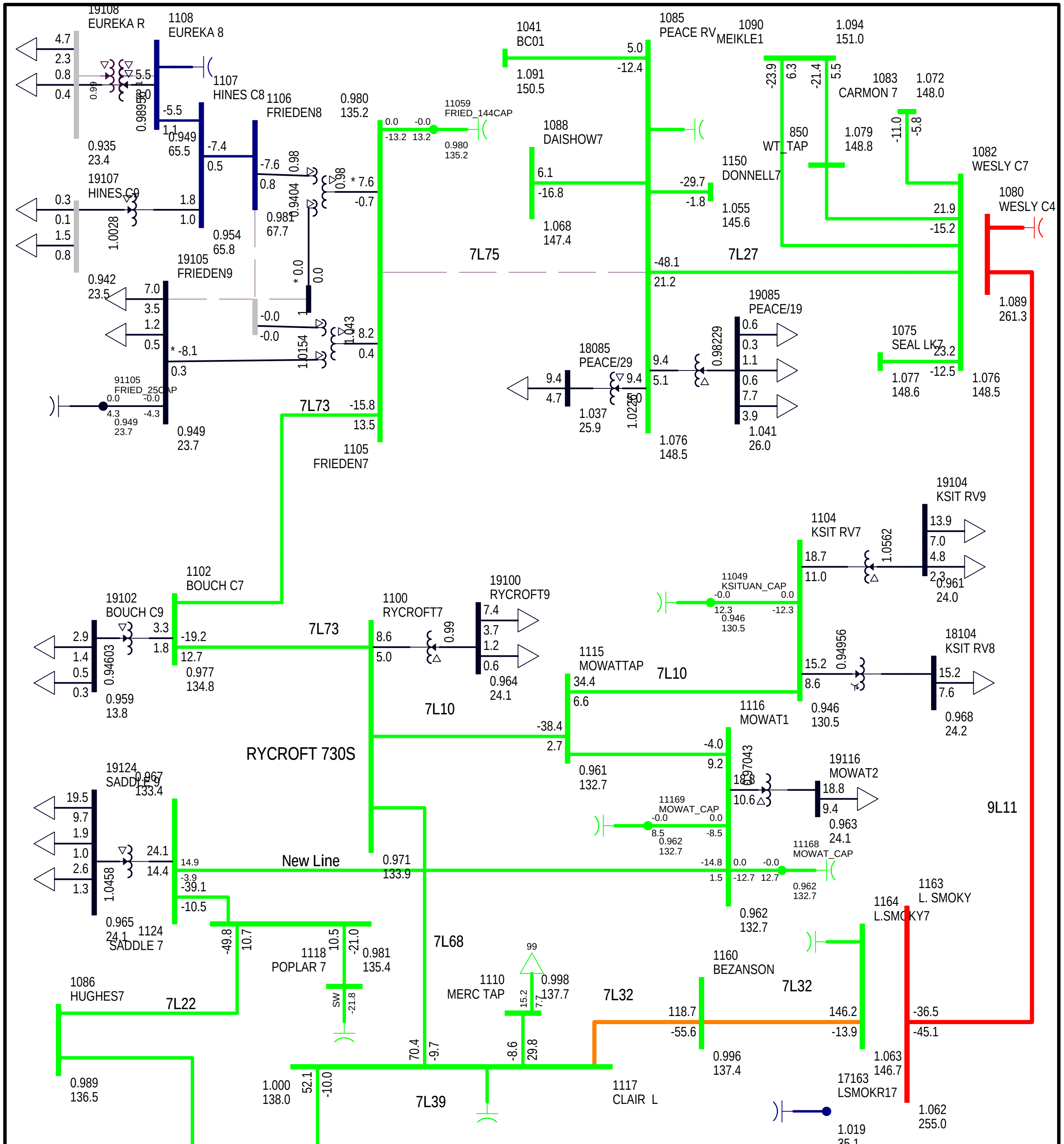
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 1F
9L11 (N-1)
FIG B-135
THU, NOV 09 2017 14:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 98.8 MW



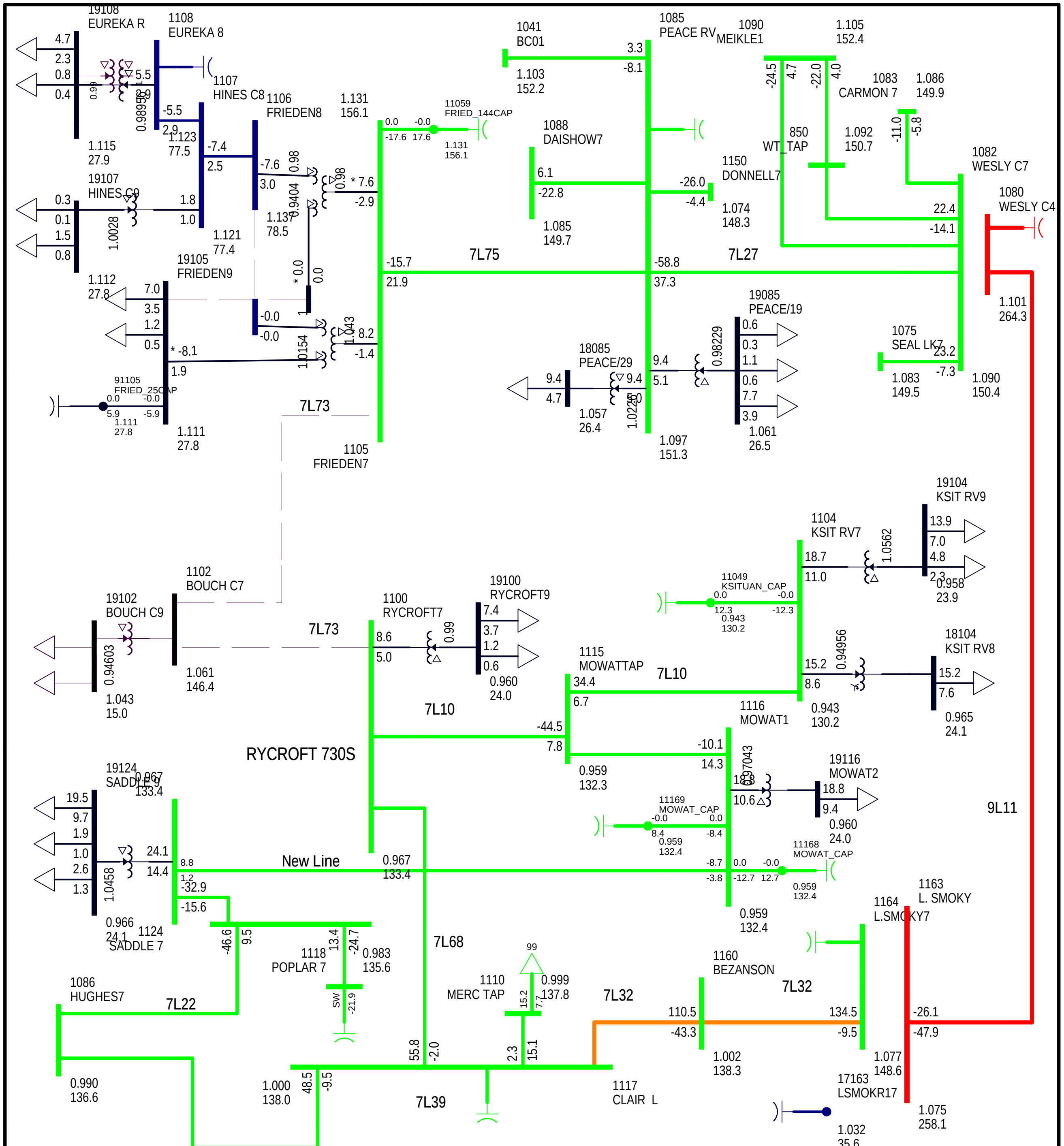
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 1F
7L75 (N-1)
FIG B-136
THU, NOV 09 2017 14:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 70.4 MW



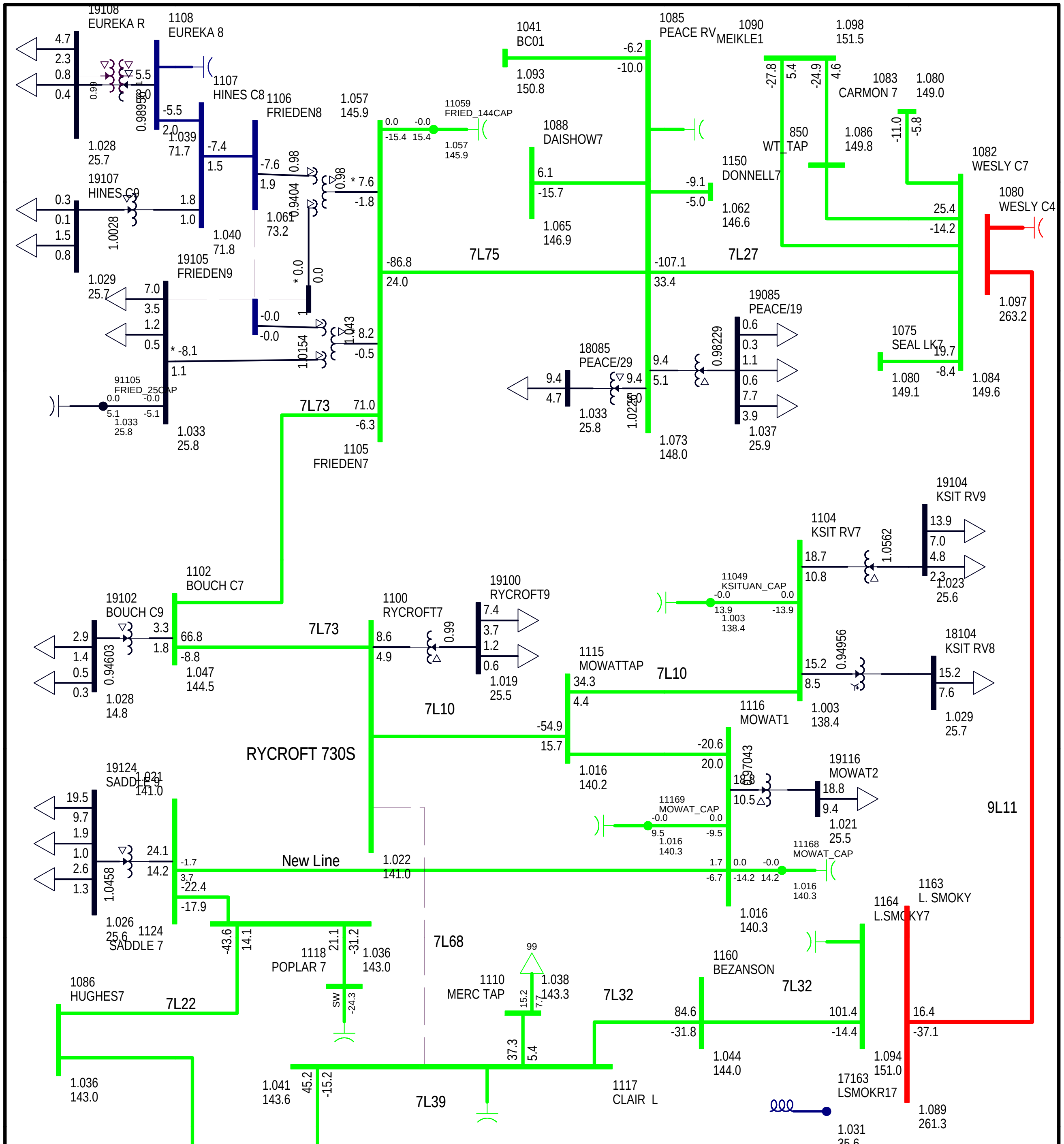
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 1F
7L73 (N-1)
FIG B-137
THU, NOV 09 2017 14:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 76.7 MW

TOTAL FLOW INTO RYCROFT AREA: 72.0 MW



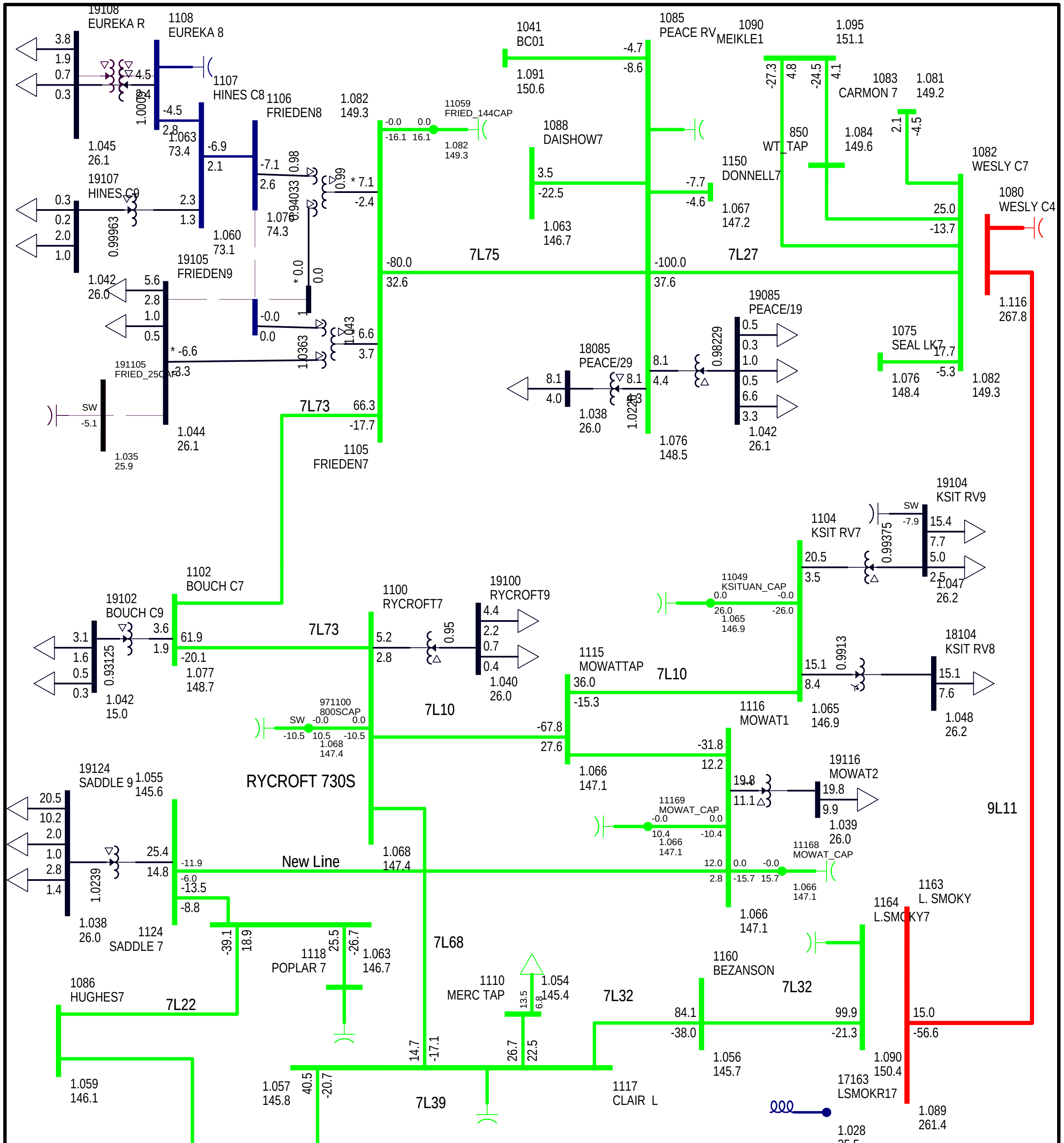
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 1F
7L68 (N-1)
FIG B-138
THU, NOV 09 2017 14:17

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 80.0 MW

TOTAL FLOW INTO RYCROFT AREA: 91.4 MW



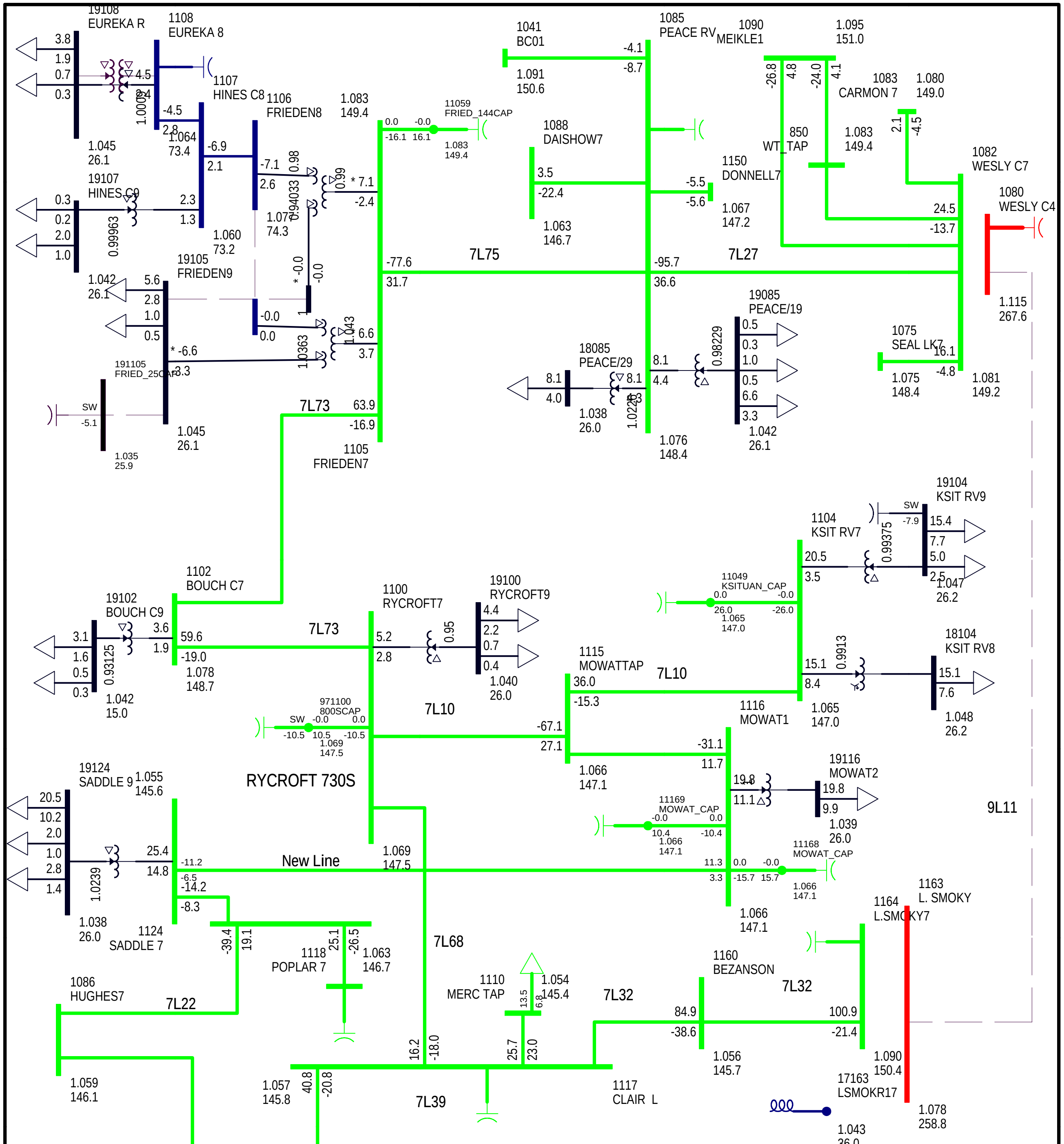
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
BASE CASE(N-0)
FIG B-139
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 98.8 MW



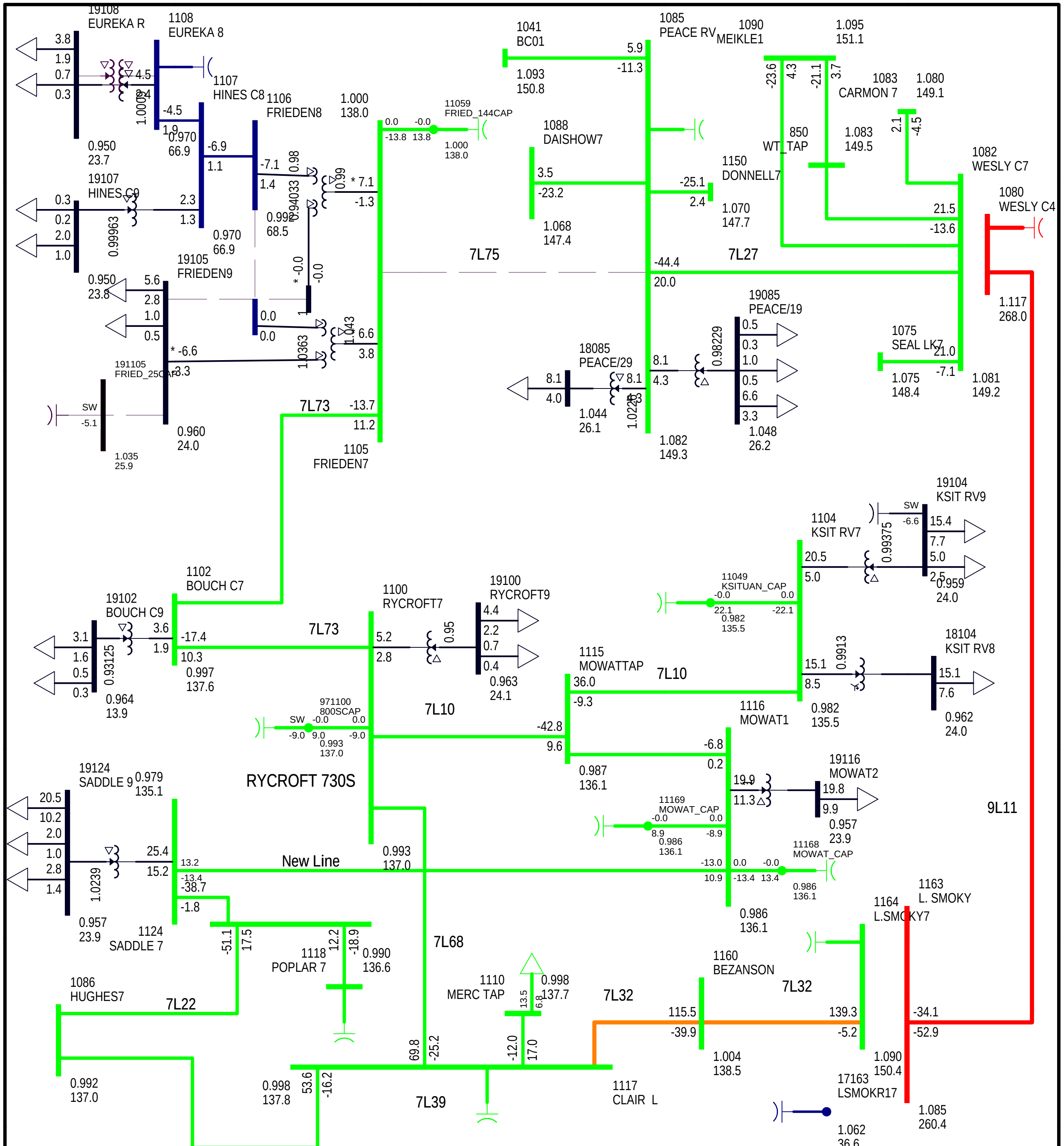
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
9L11 (N-1)
FIG B-140
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 97.7 MW



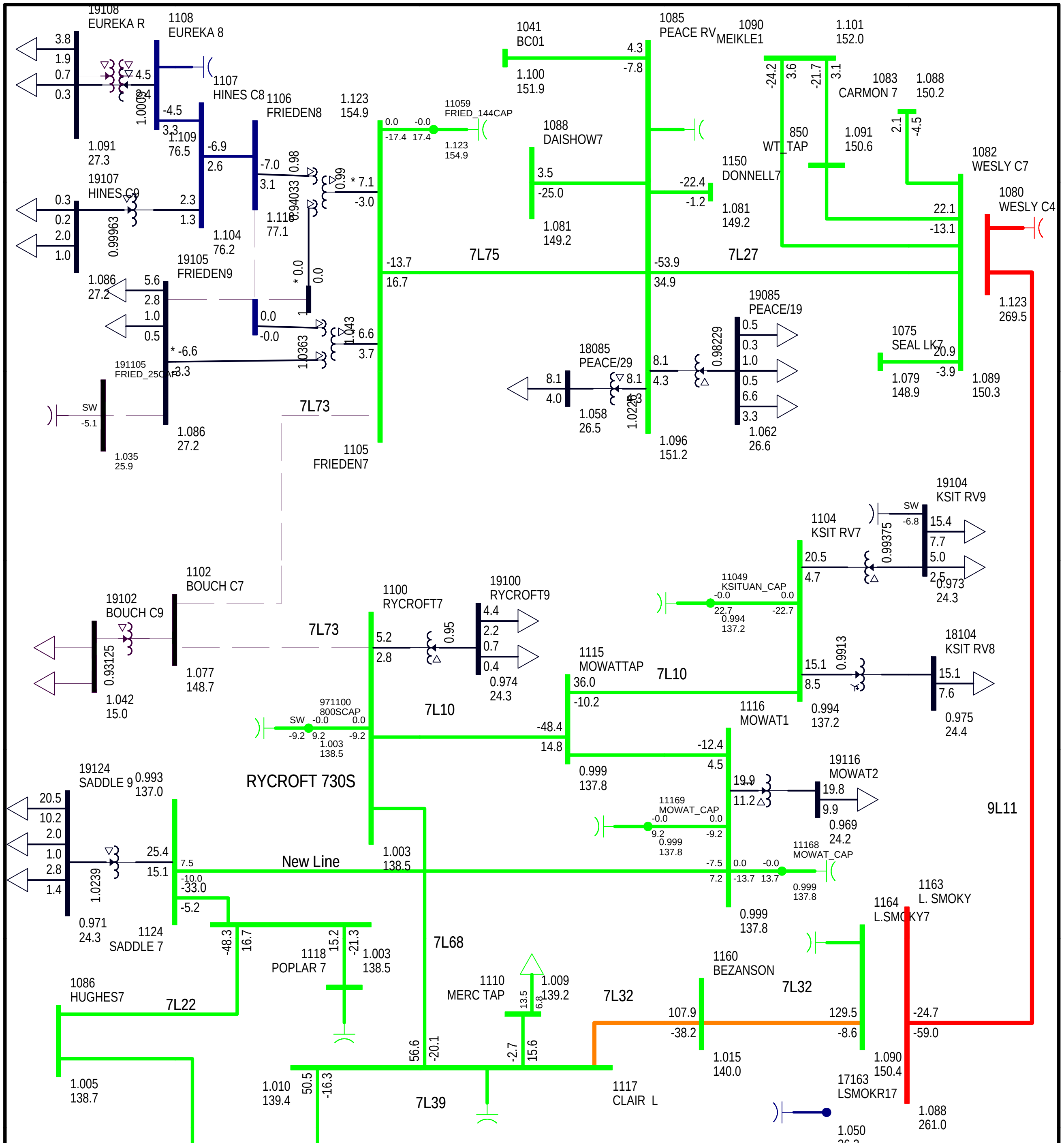
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L75 (N-1)
FIG B-141
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 69.8 MW



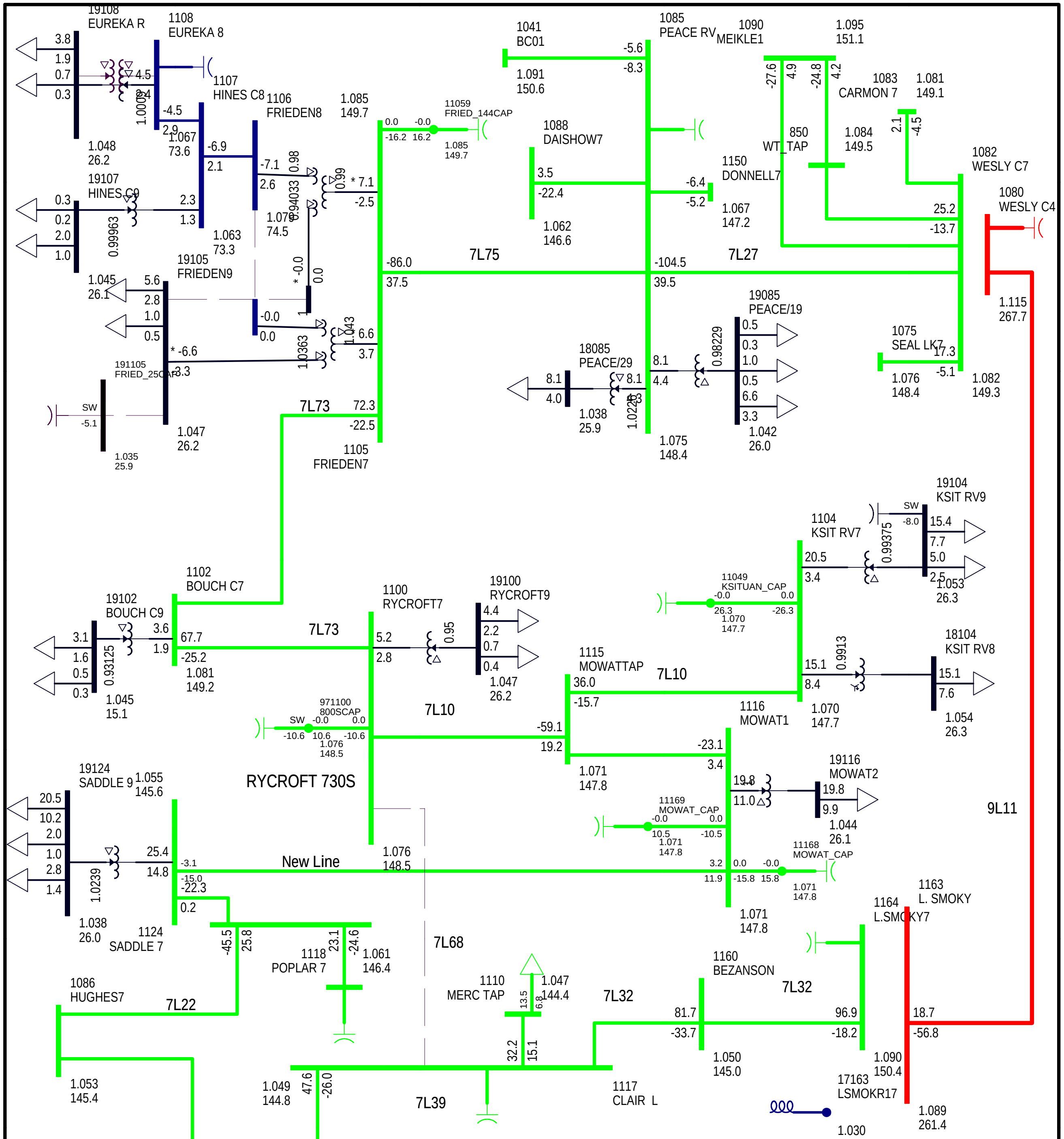
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L73 (N-1)
FIG B-142
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 73.9 MW

TOTAL FLOW INTO RYCROFT AREA: 70.6 MW



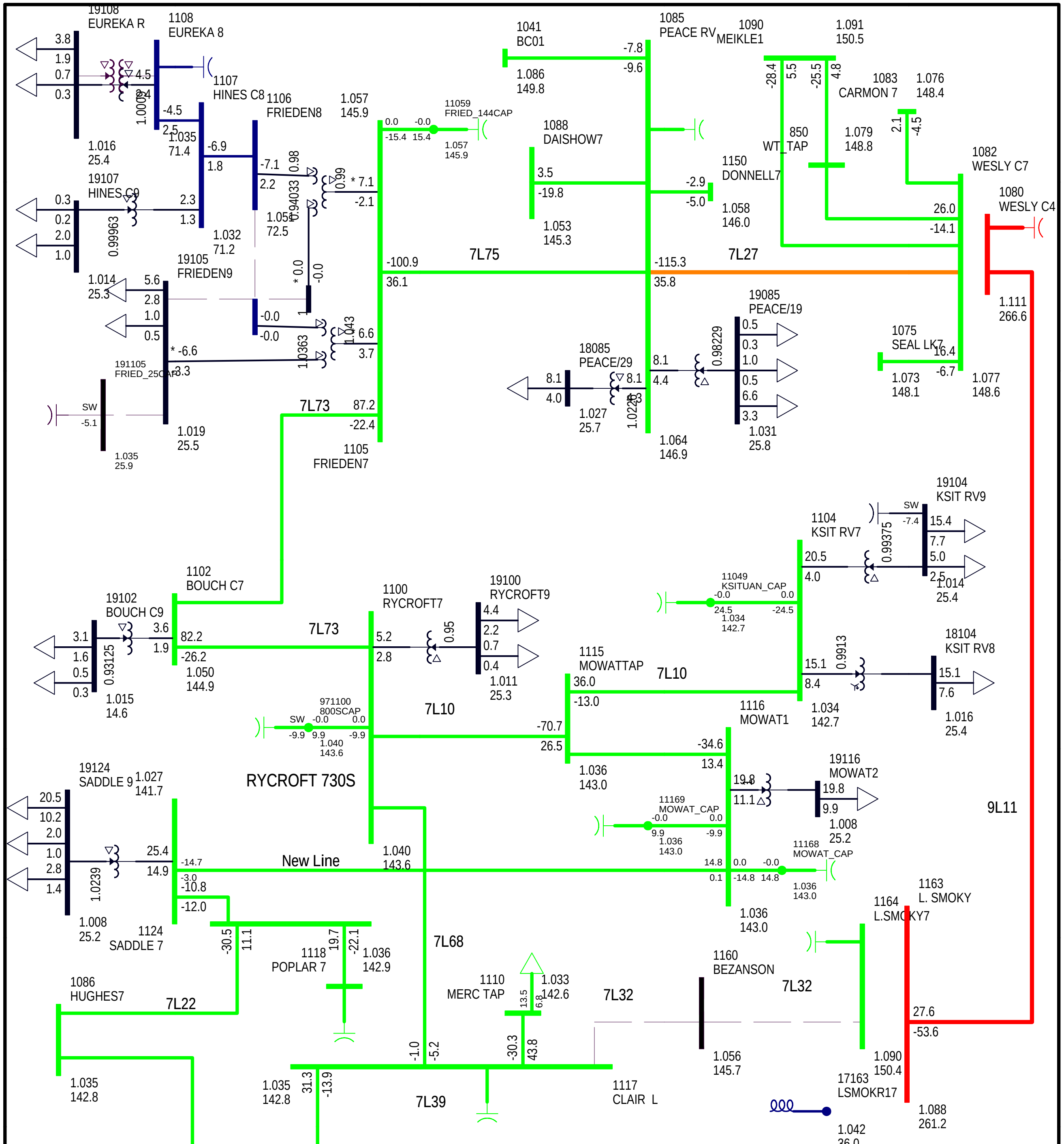
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L68 (N-1)
FIG B-143
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 90.7 MW



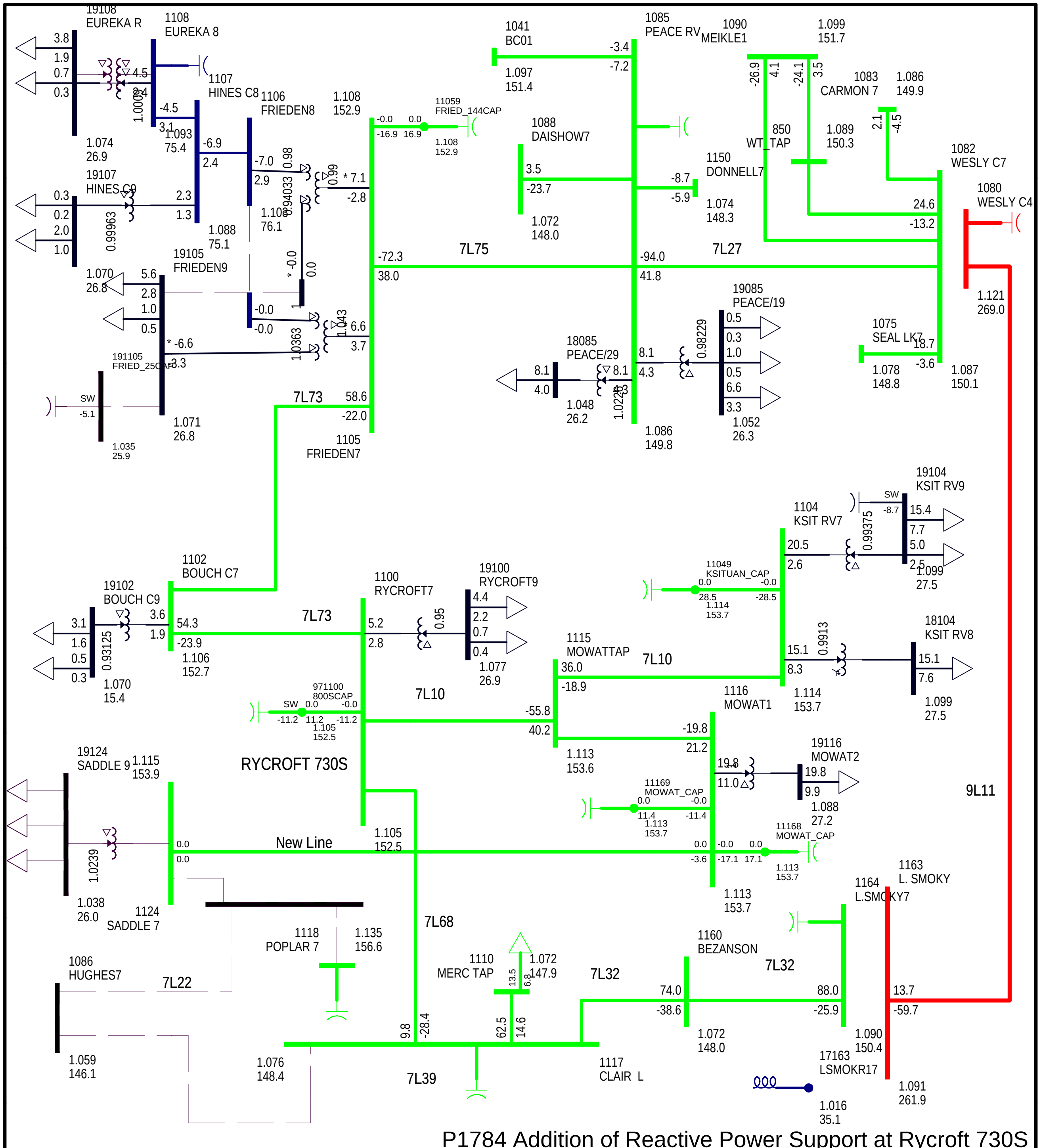
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L32 (N-1)
FIG B-144
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 106.4 MW

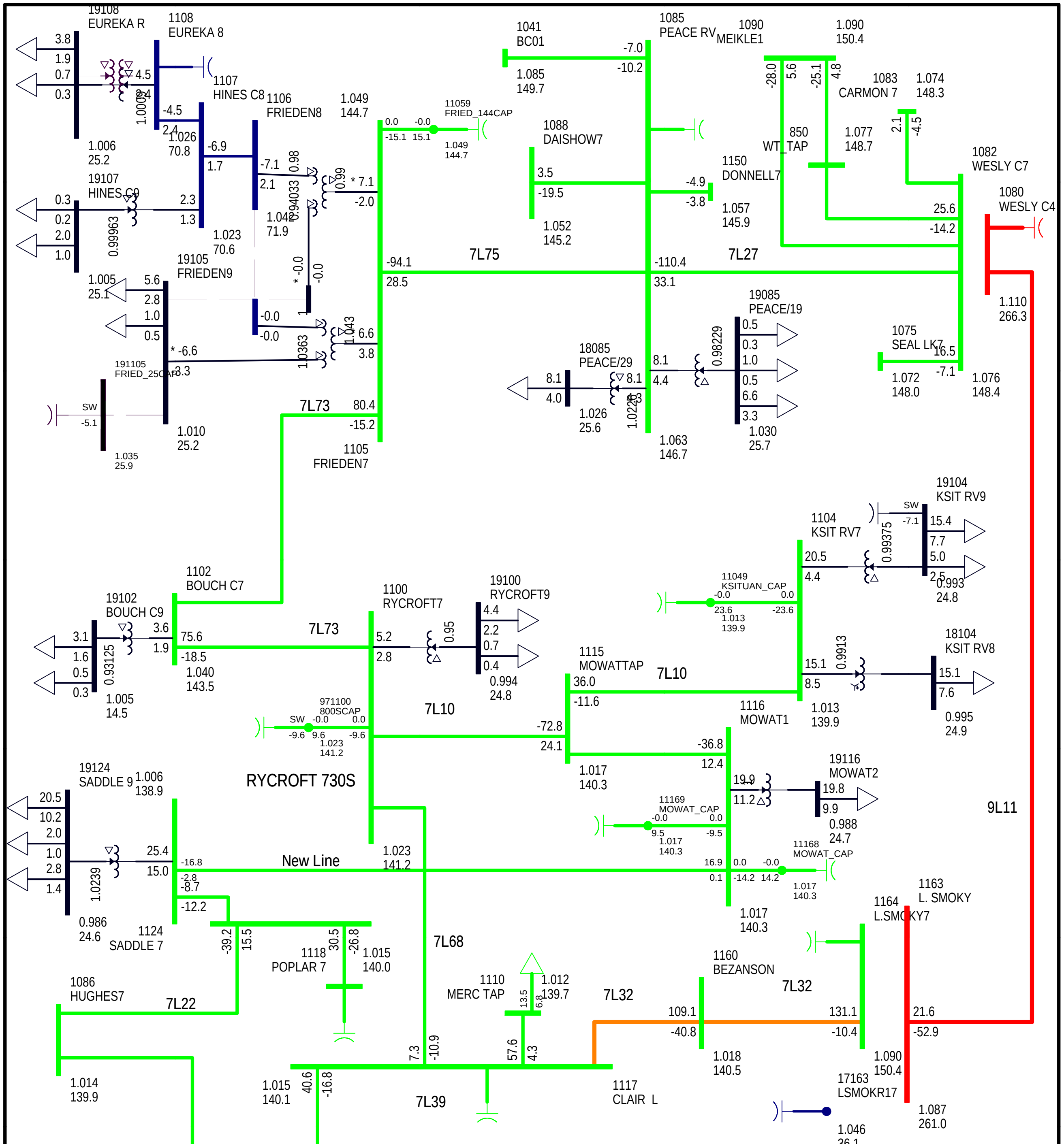


PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L22 (N-1)
FIG B-145
THU, NOV 09 2017 14:18

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 85.5 MW



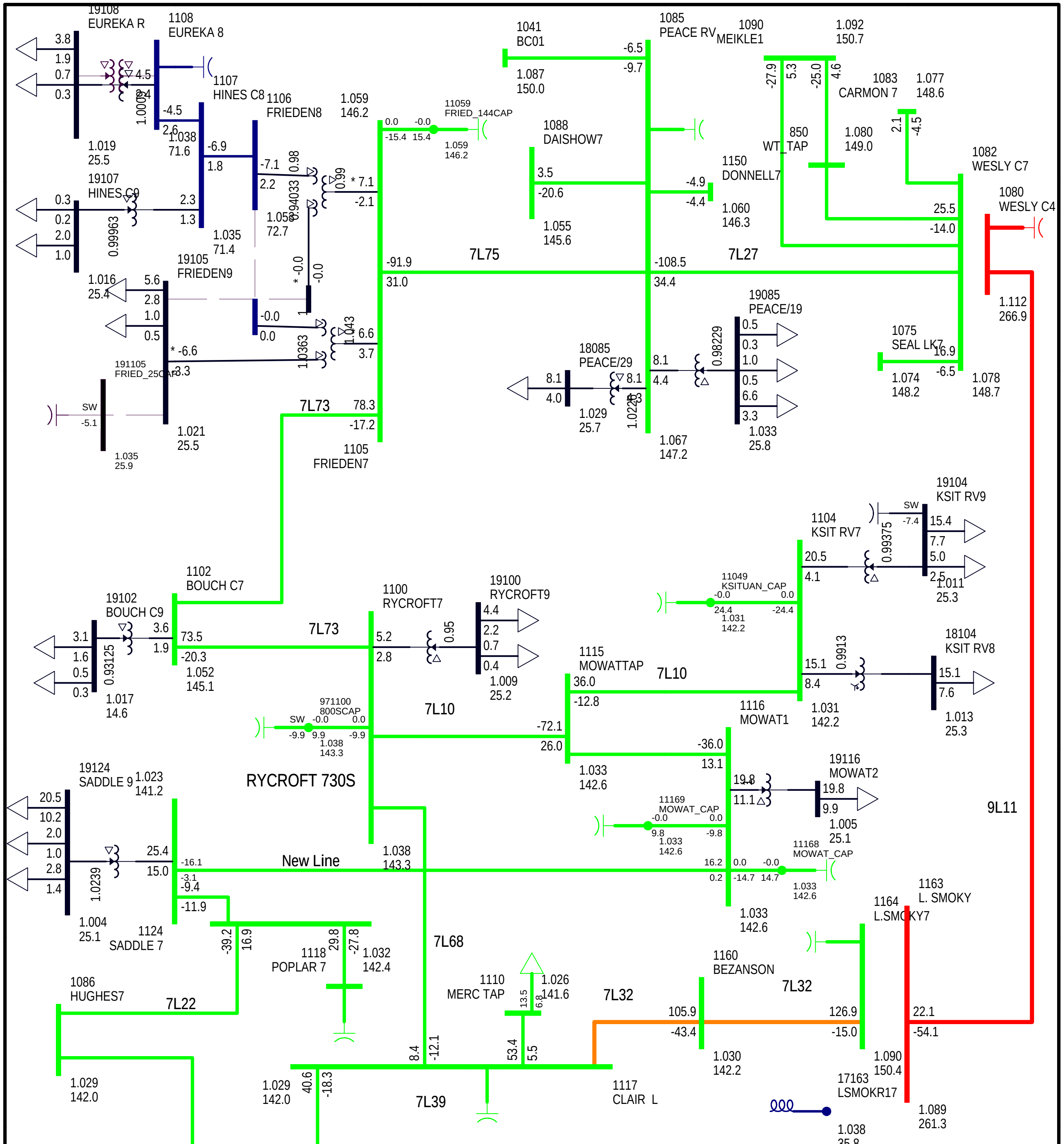
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L46 (N-1)
FIG B-146
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 106.9 MW



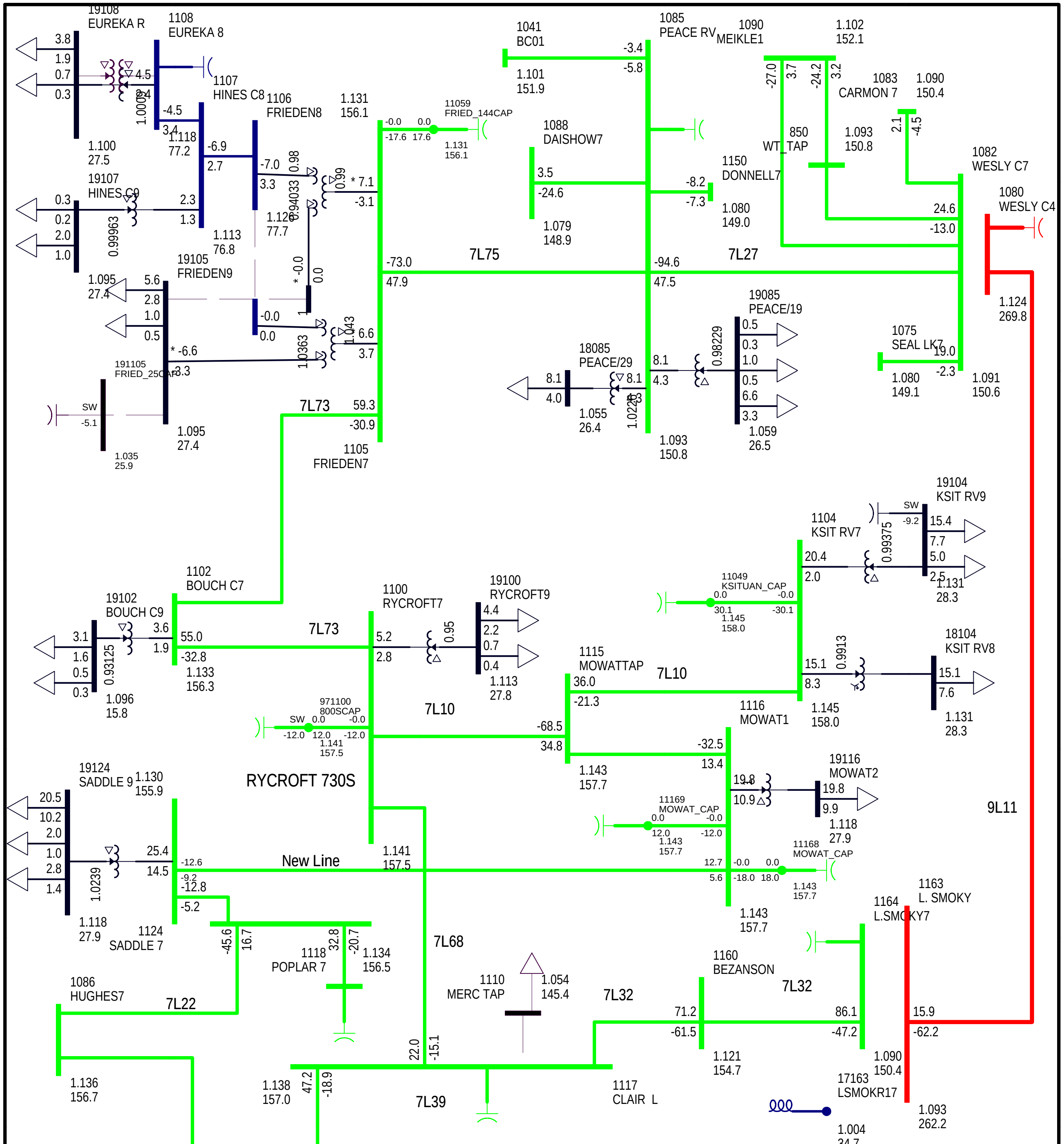
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L45 (N-1)
FIG B-147
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 105.6 MW



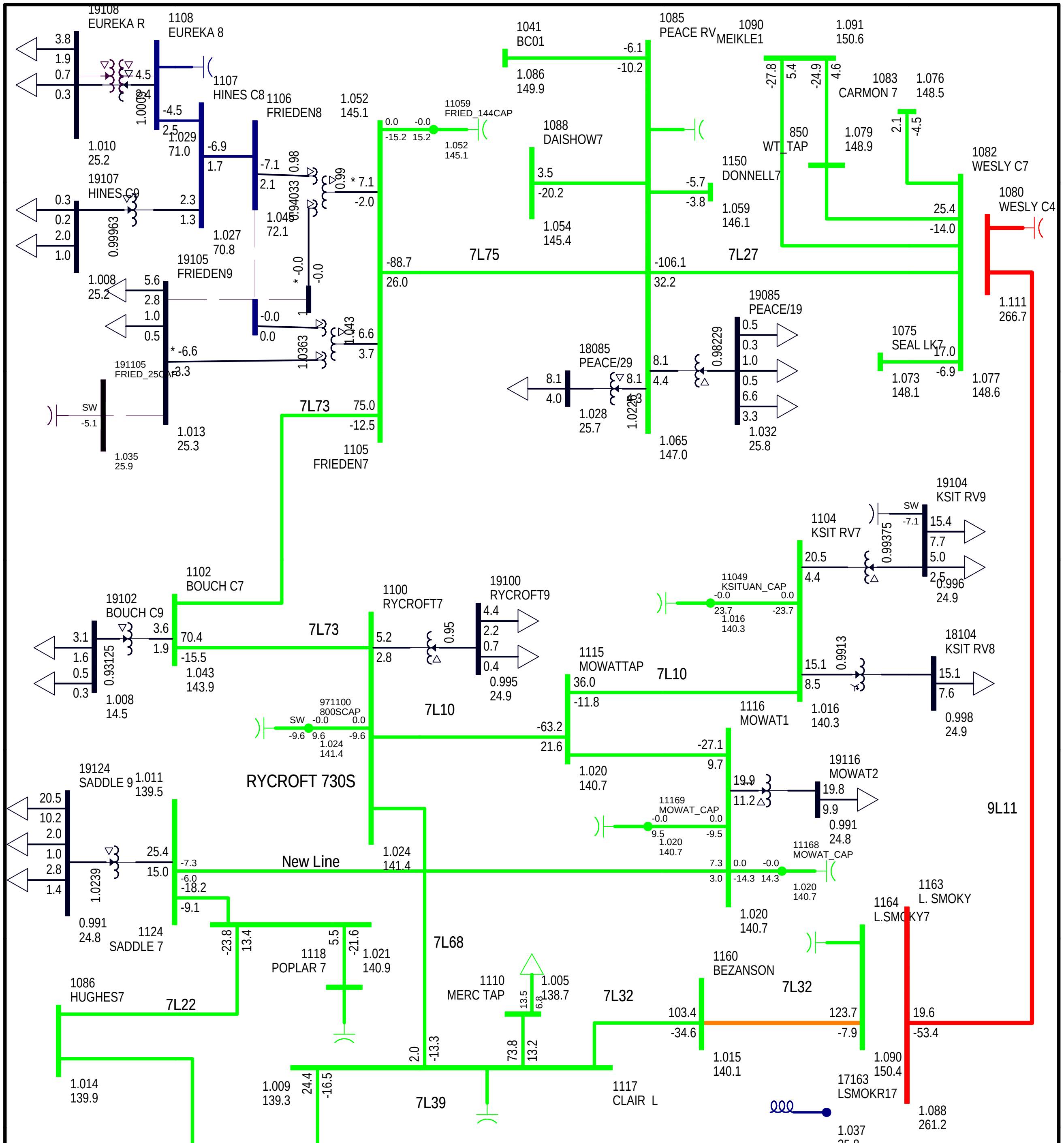
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L39 (N-1)
FIG B-148
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 98.9 MW



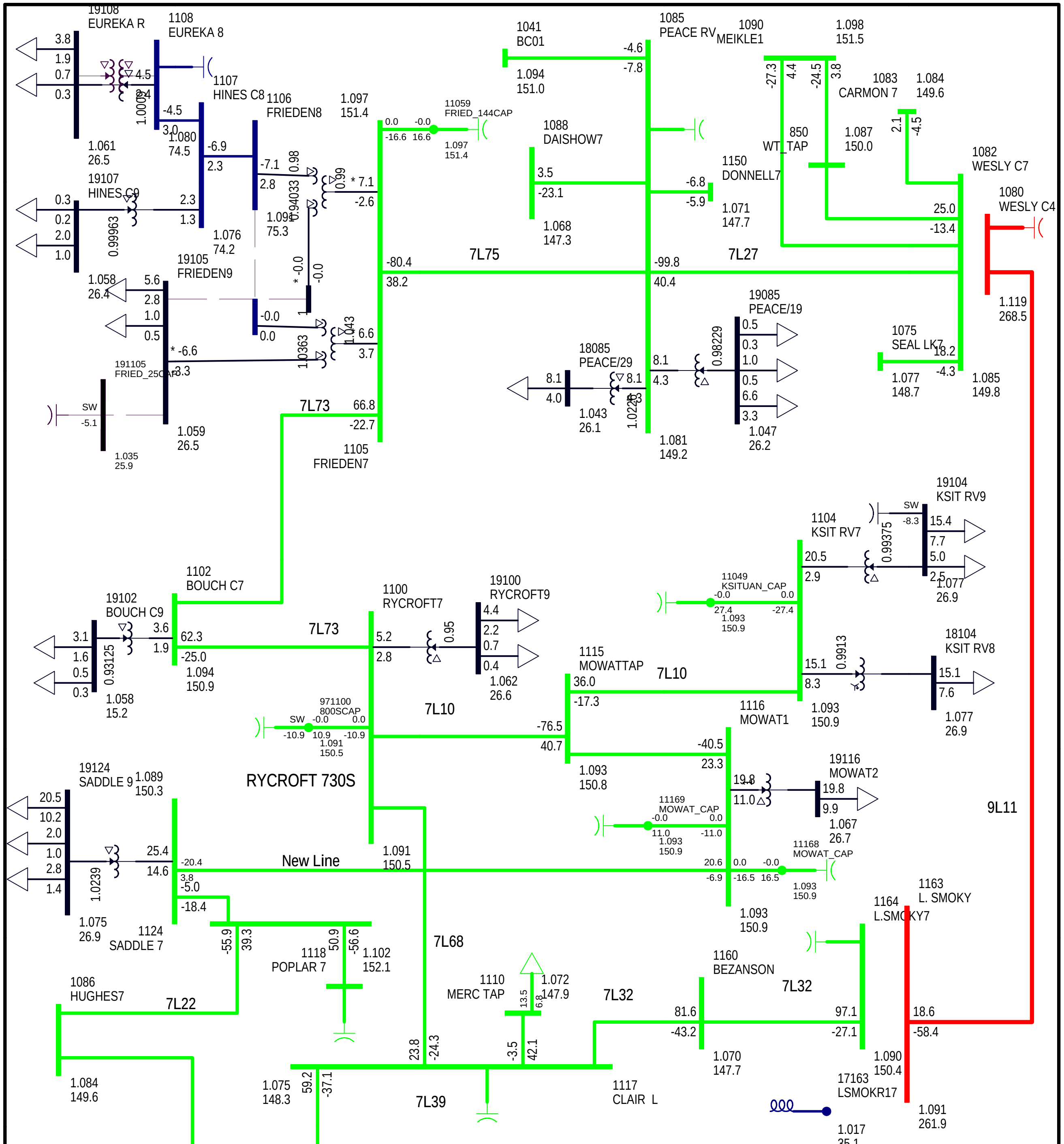
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L84 (N-1)
FIG B-149
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 95.6 MW



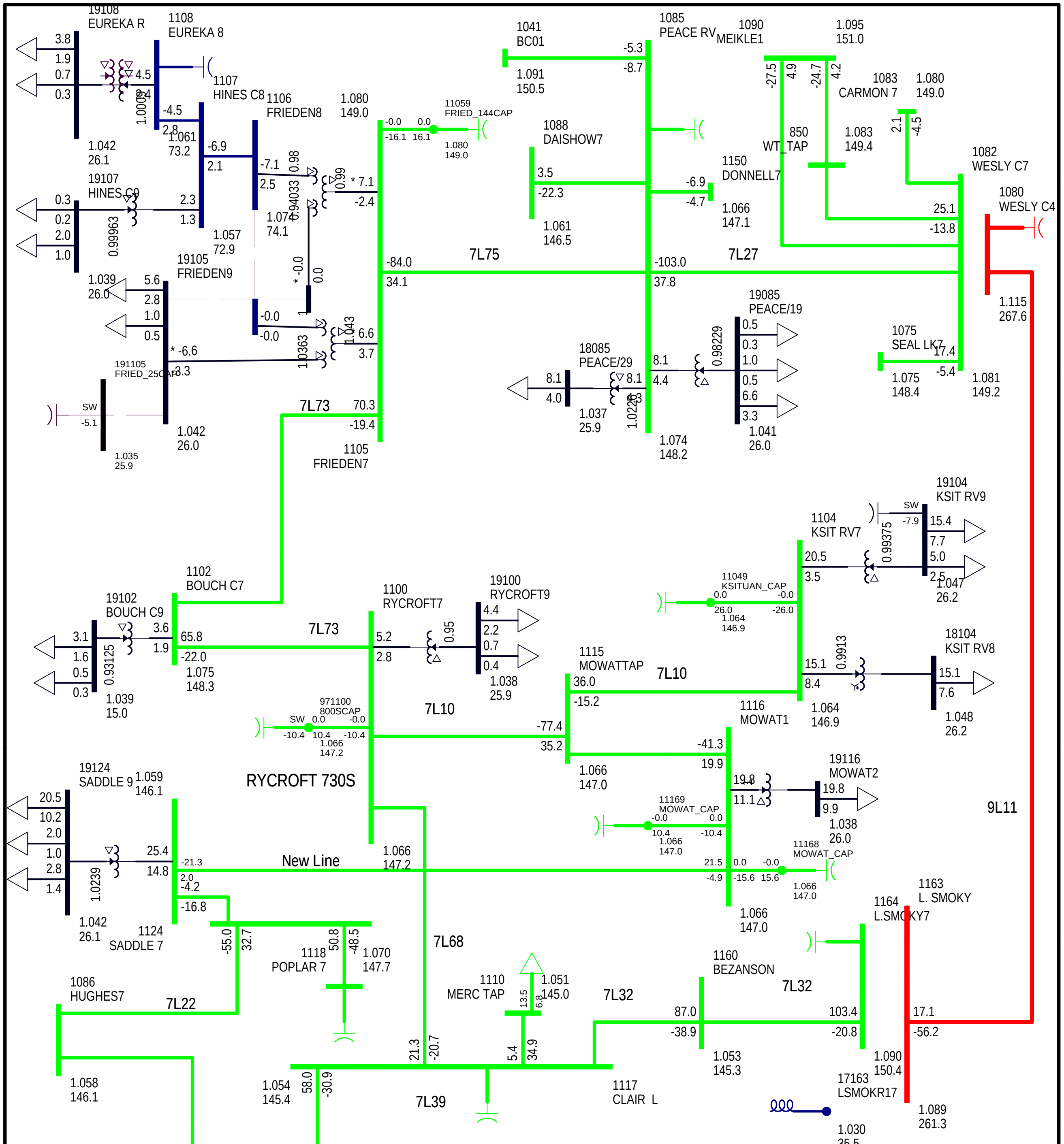
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L03 (N-1)
FIG B-150
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 108.5 MW



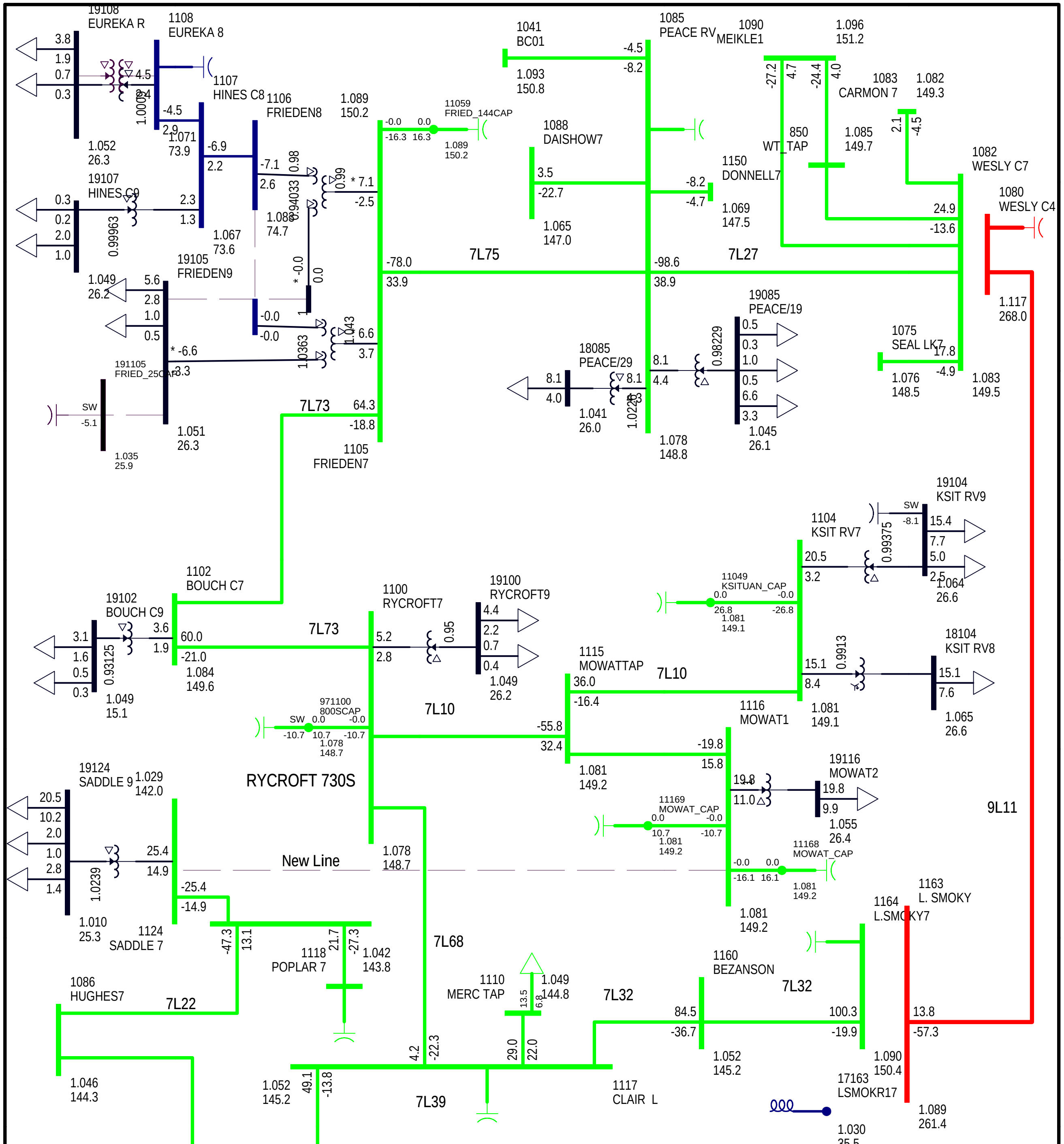
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L69 (N-1)
FIG B-151
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 109.8 MW



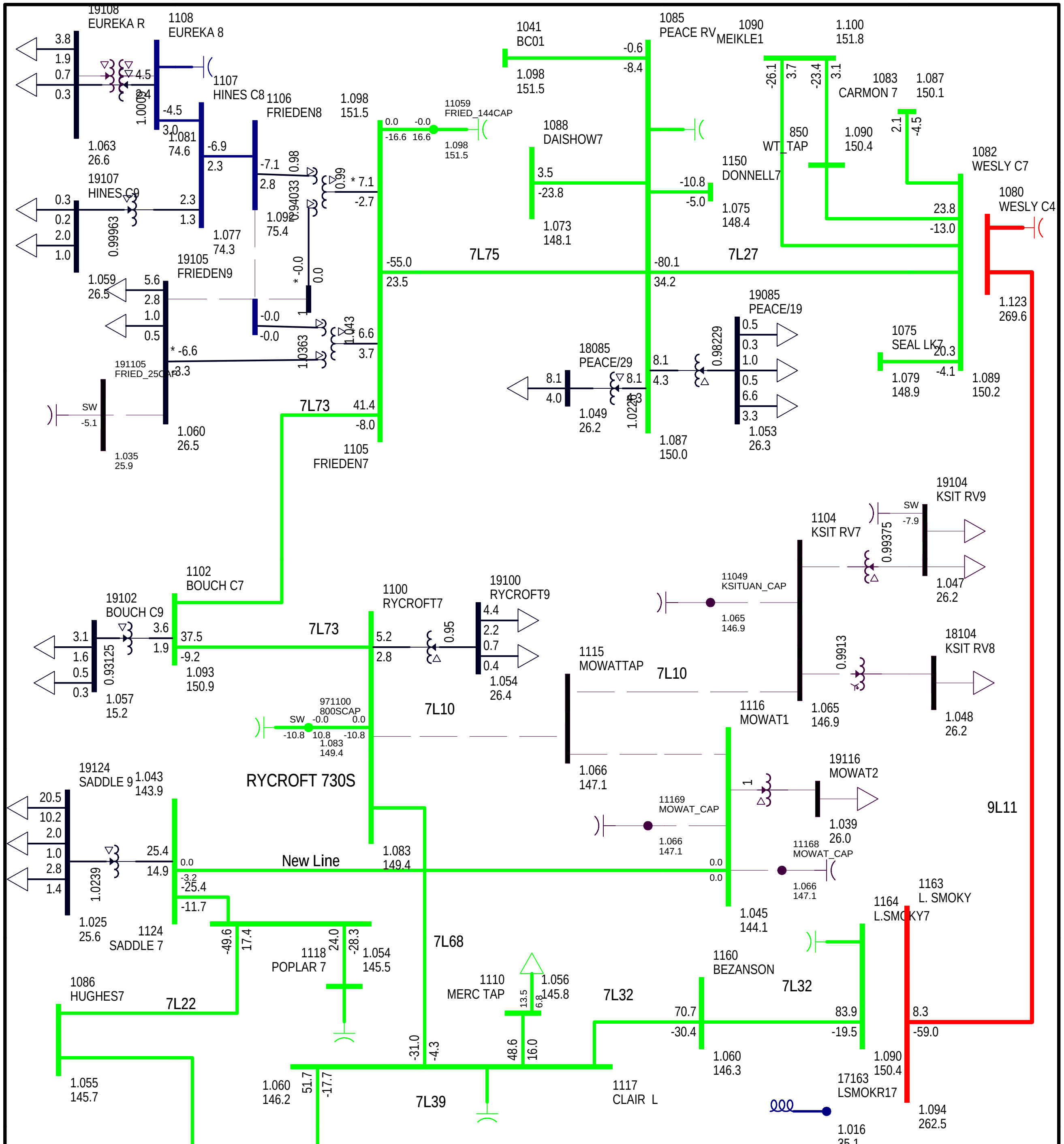
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
NEWLINE_OPT3 (N-1)
FIG B-152
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 77.5 MW

TOTAL FLOW INTO RYCROFT AREA: 86.1 MW



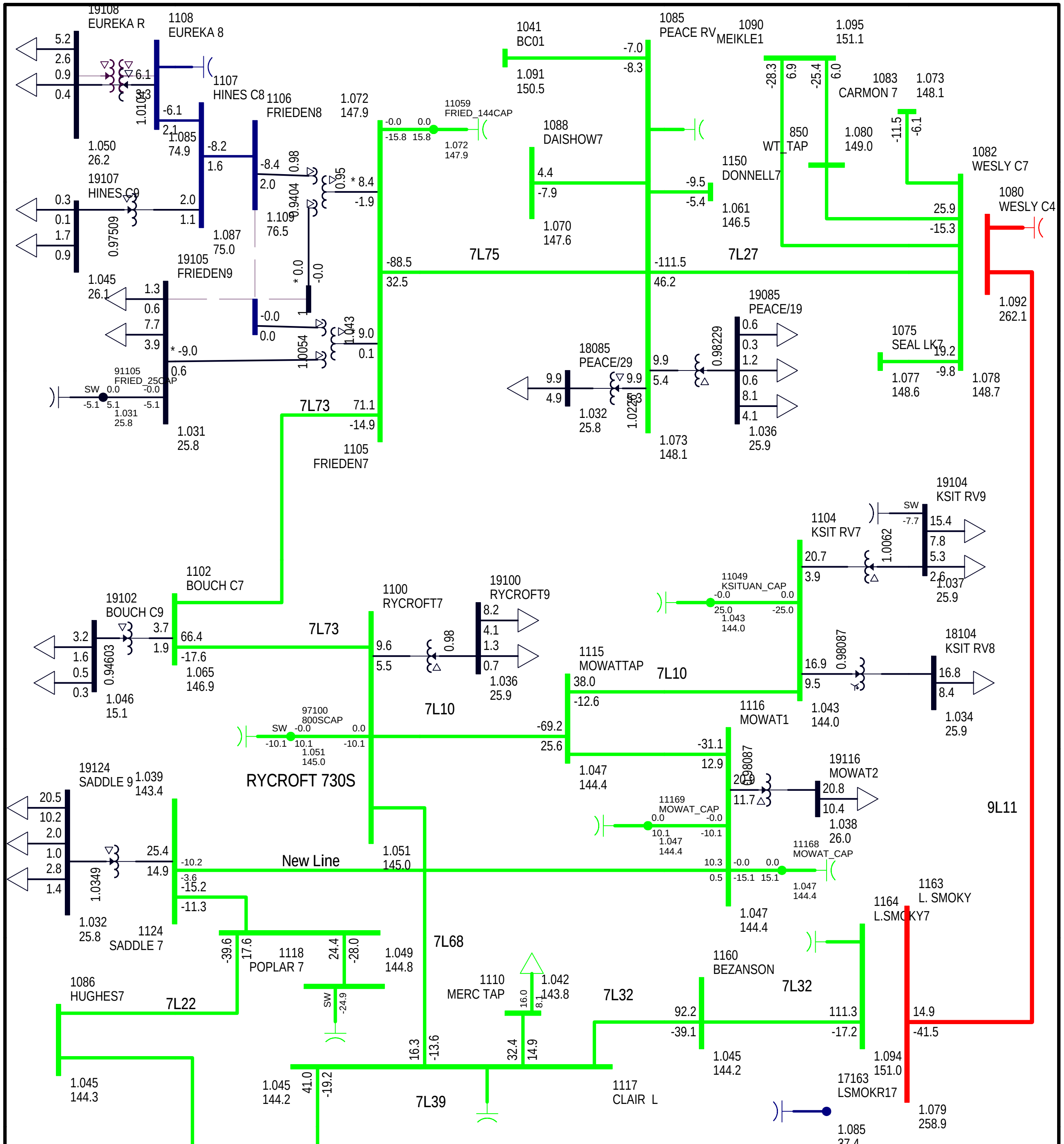
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: 2026SP SCENARIO 2
7L10_OPT3 (N-1)
FIG B-153
THU, NOV 09 2017 14:19

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 22.2 MW

TOTAL FLOW INTO RYCROFT AREA: 25.9 MW



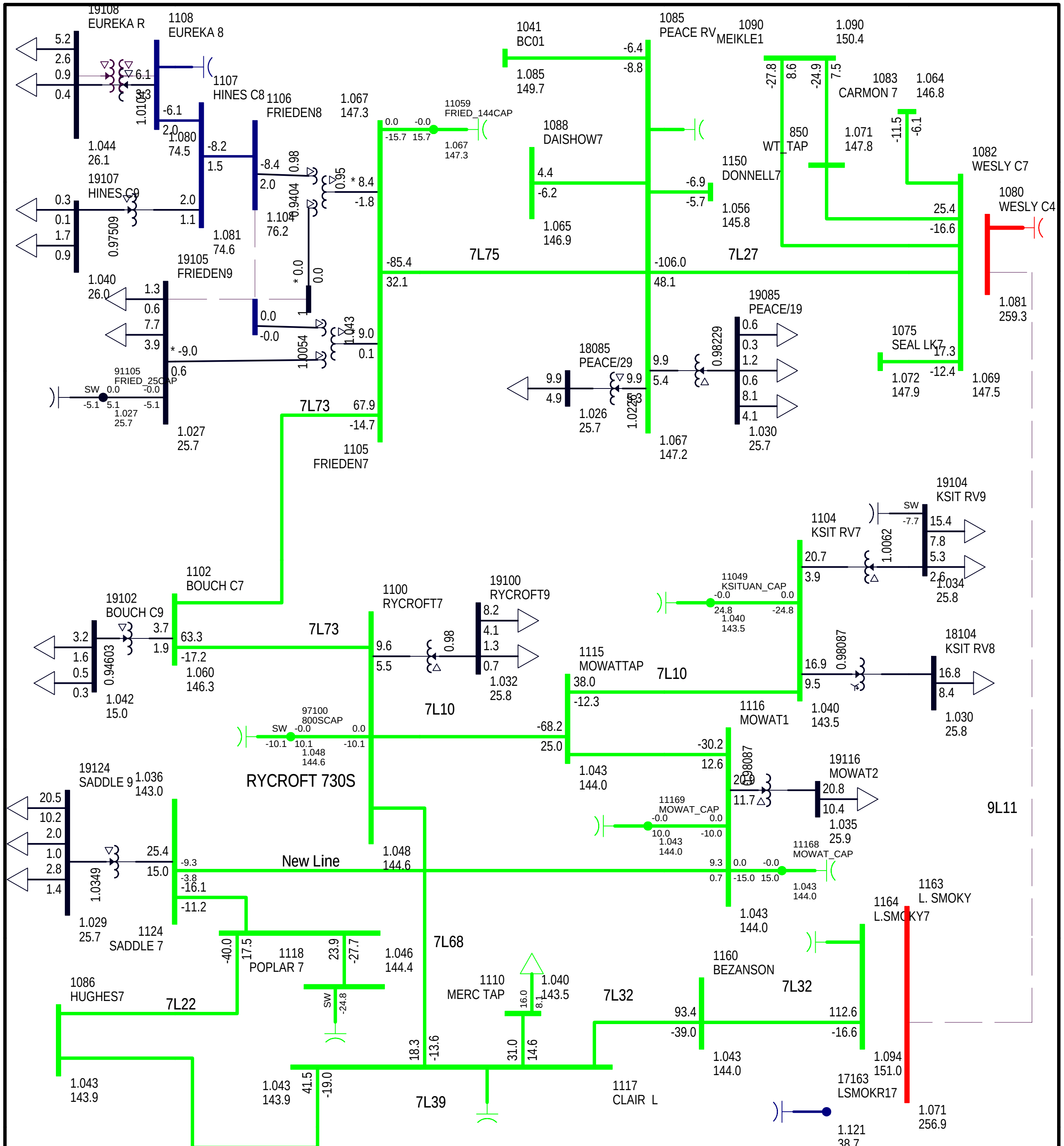
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
BASE CASE(N-0)
FIG B-154
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 109.7 MW



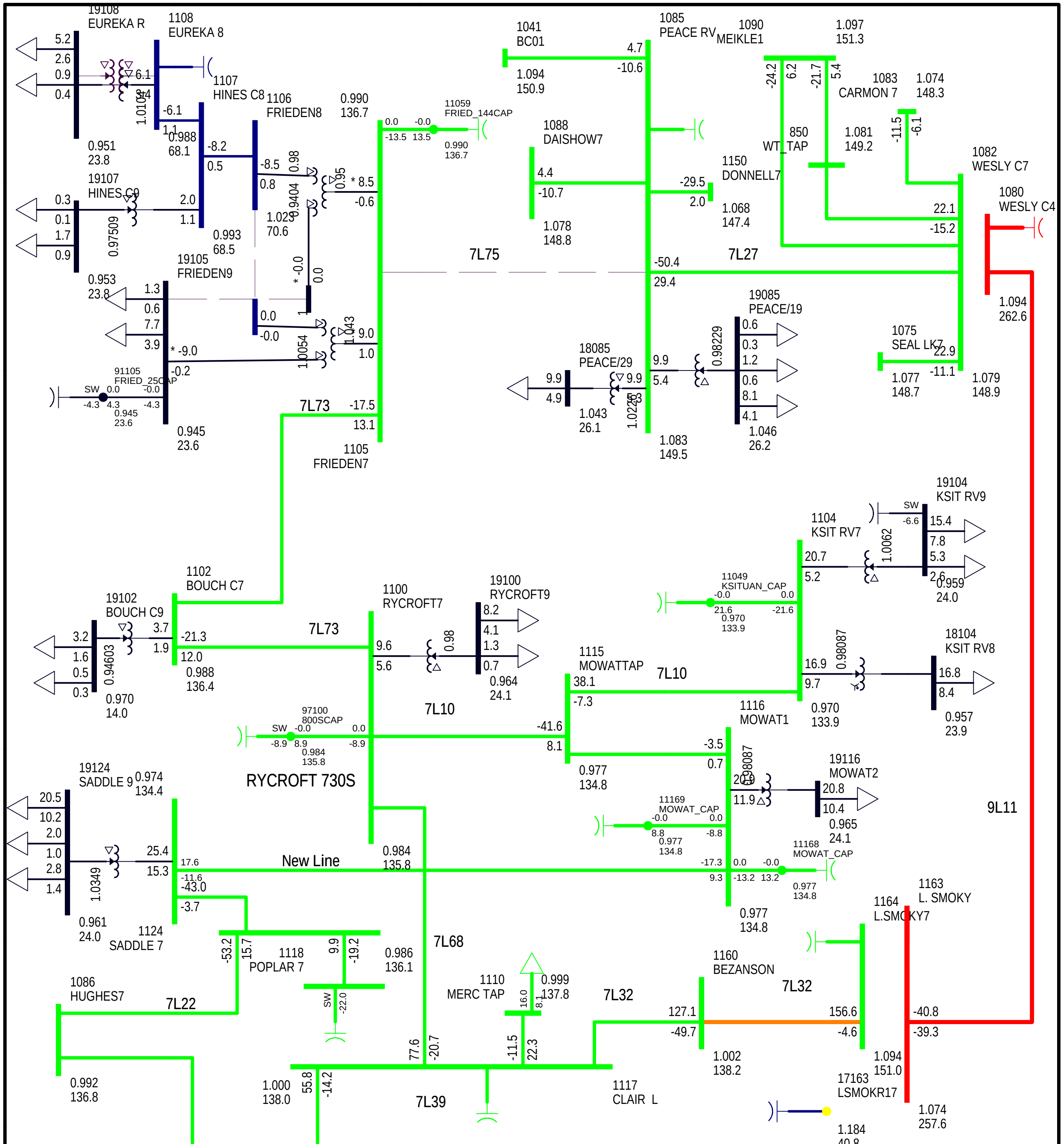
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
9L11 (N-1)
FIG B-155
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 108.2 MW



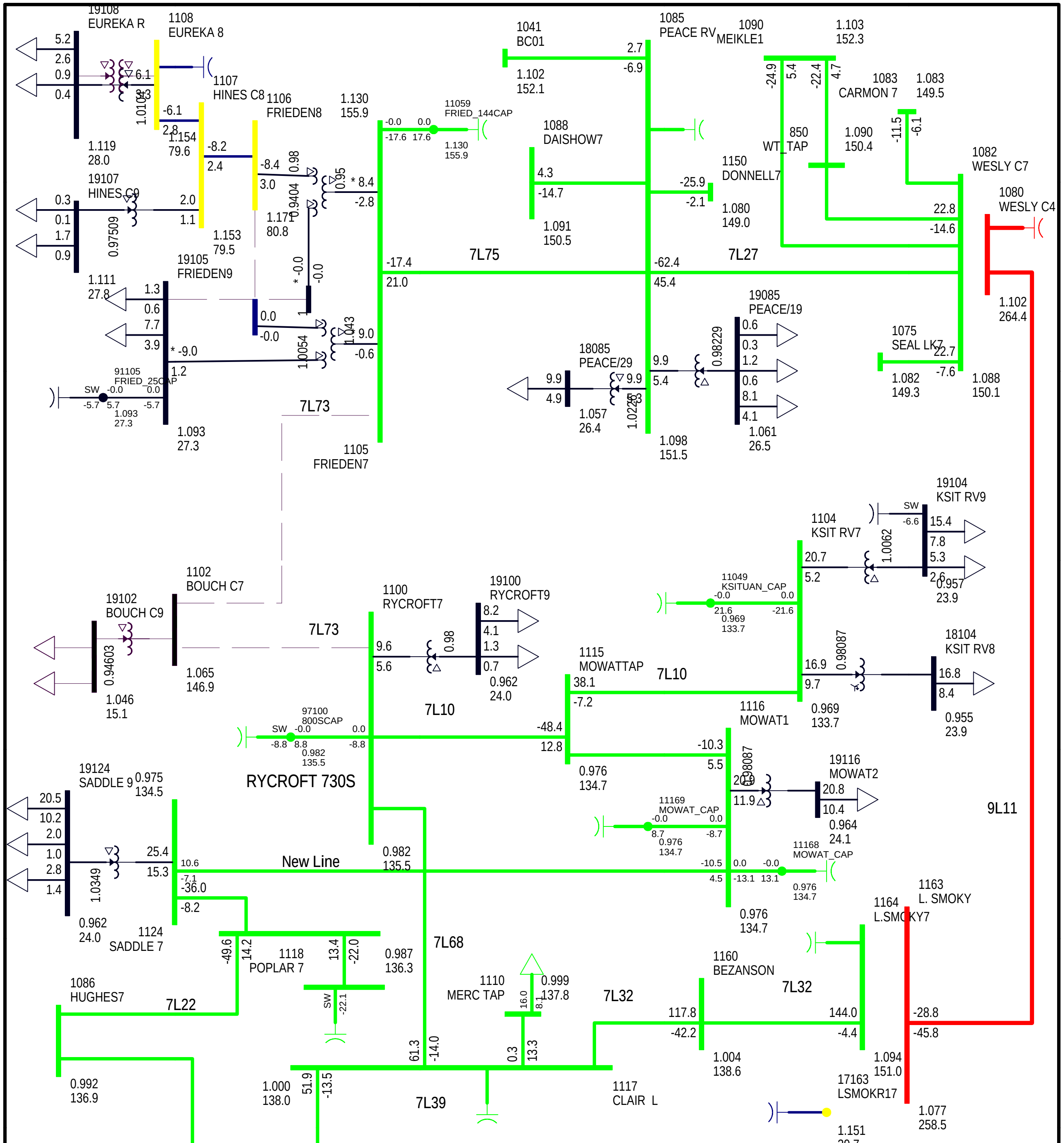
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L75 (N-1)
FIG B-156
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 77.6 MW



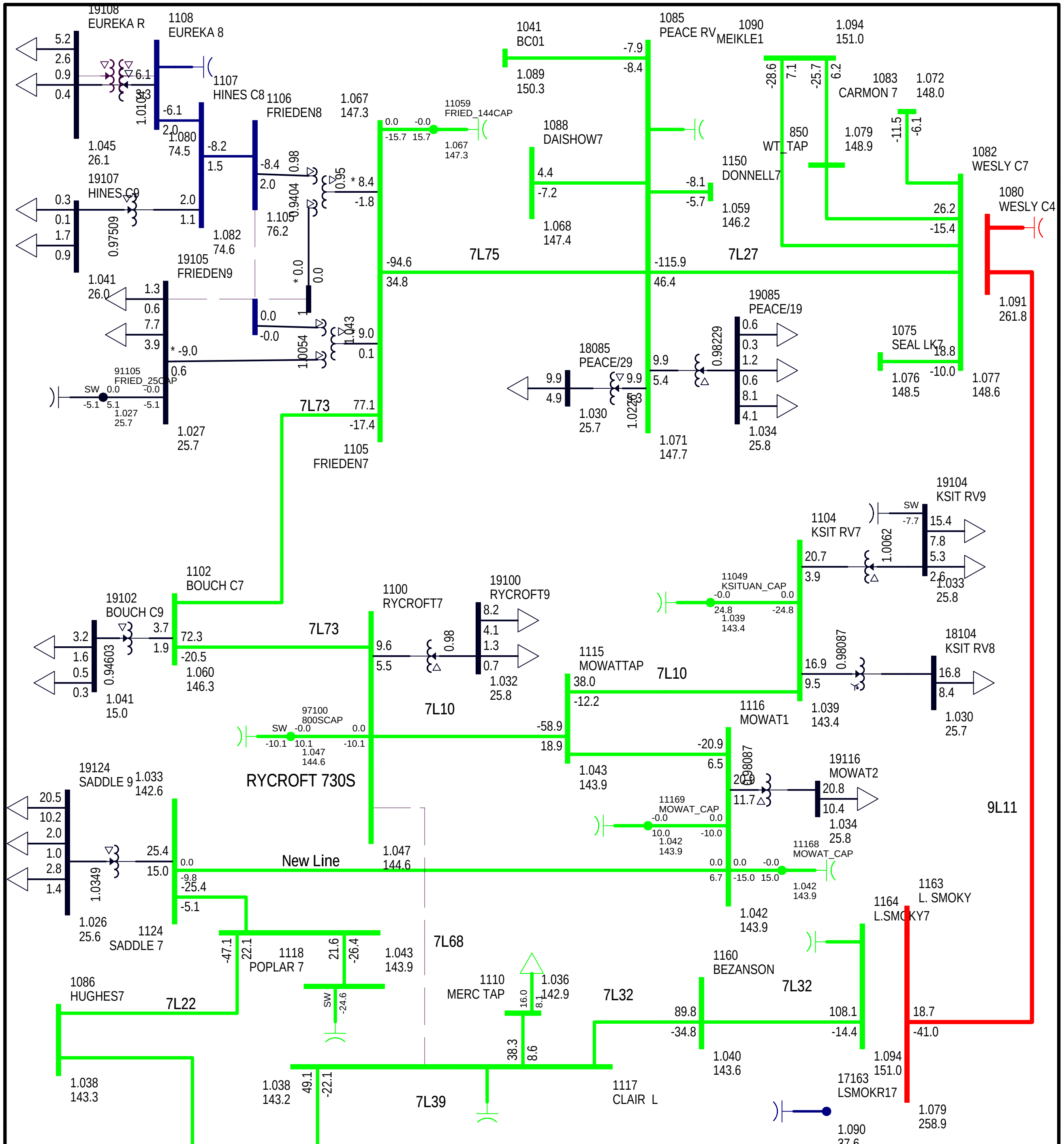
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L73 (N-1)
FIG B-157
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 84.9 MW

TOTAL FLOW INTO RYCROFT AREA: 79.2 MW



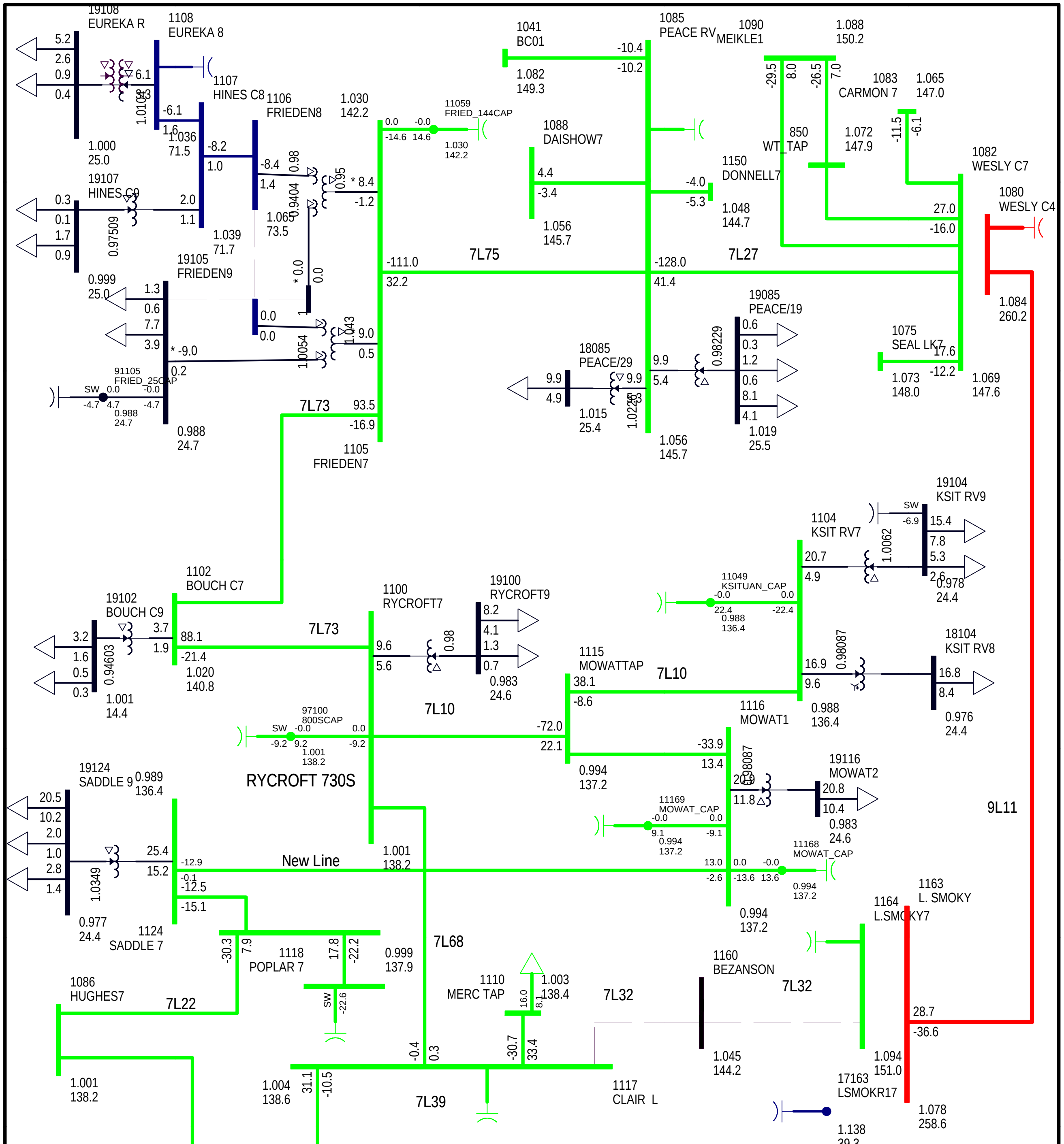
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L68 (N-1)
FIG B-158
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 100.2 MW



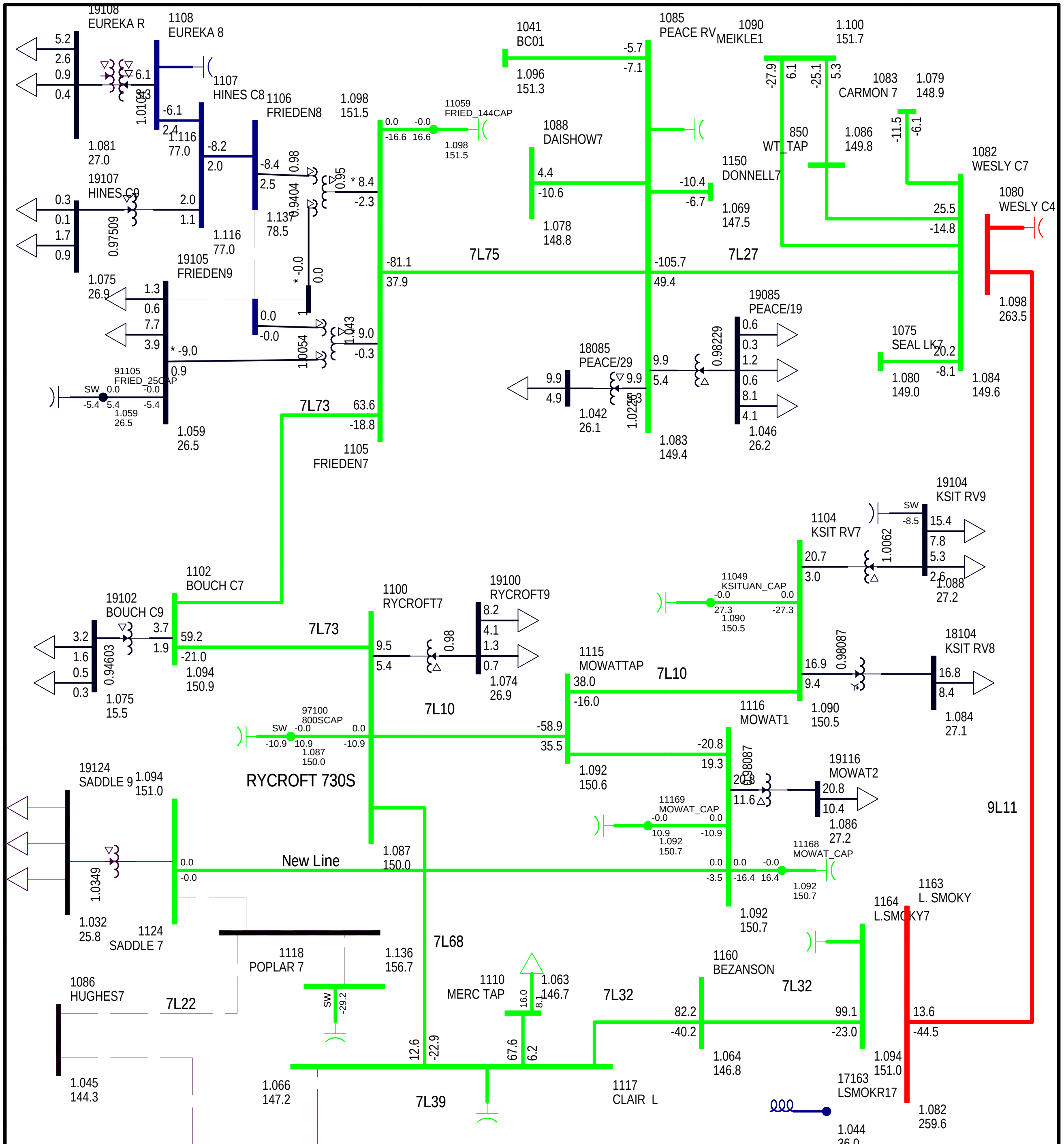
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L32 (N-1)
FIG B-159
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 118.4 MW



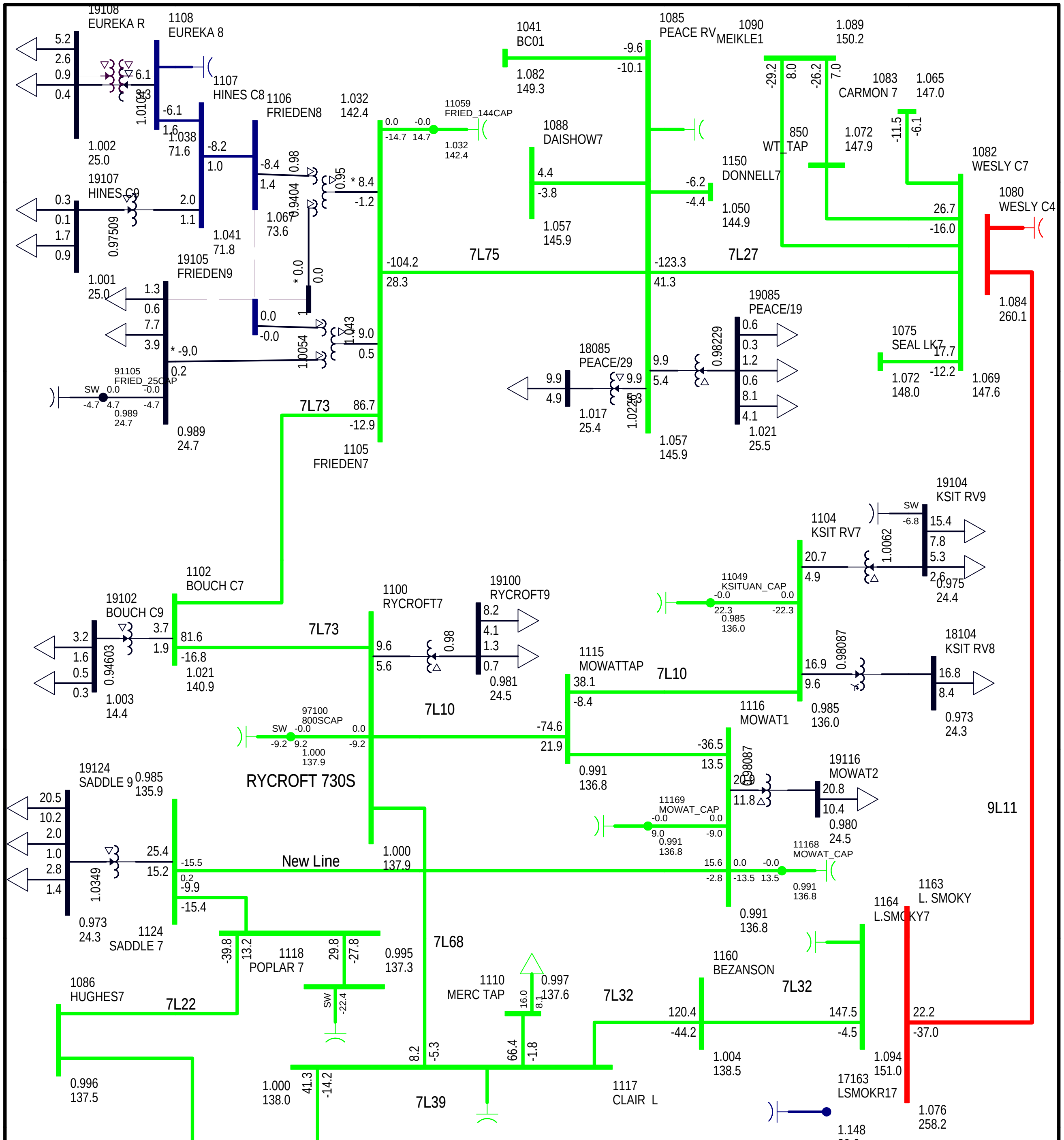
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L22 (N-1)
FIG B-160
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 97.9 MW



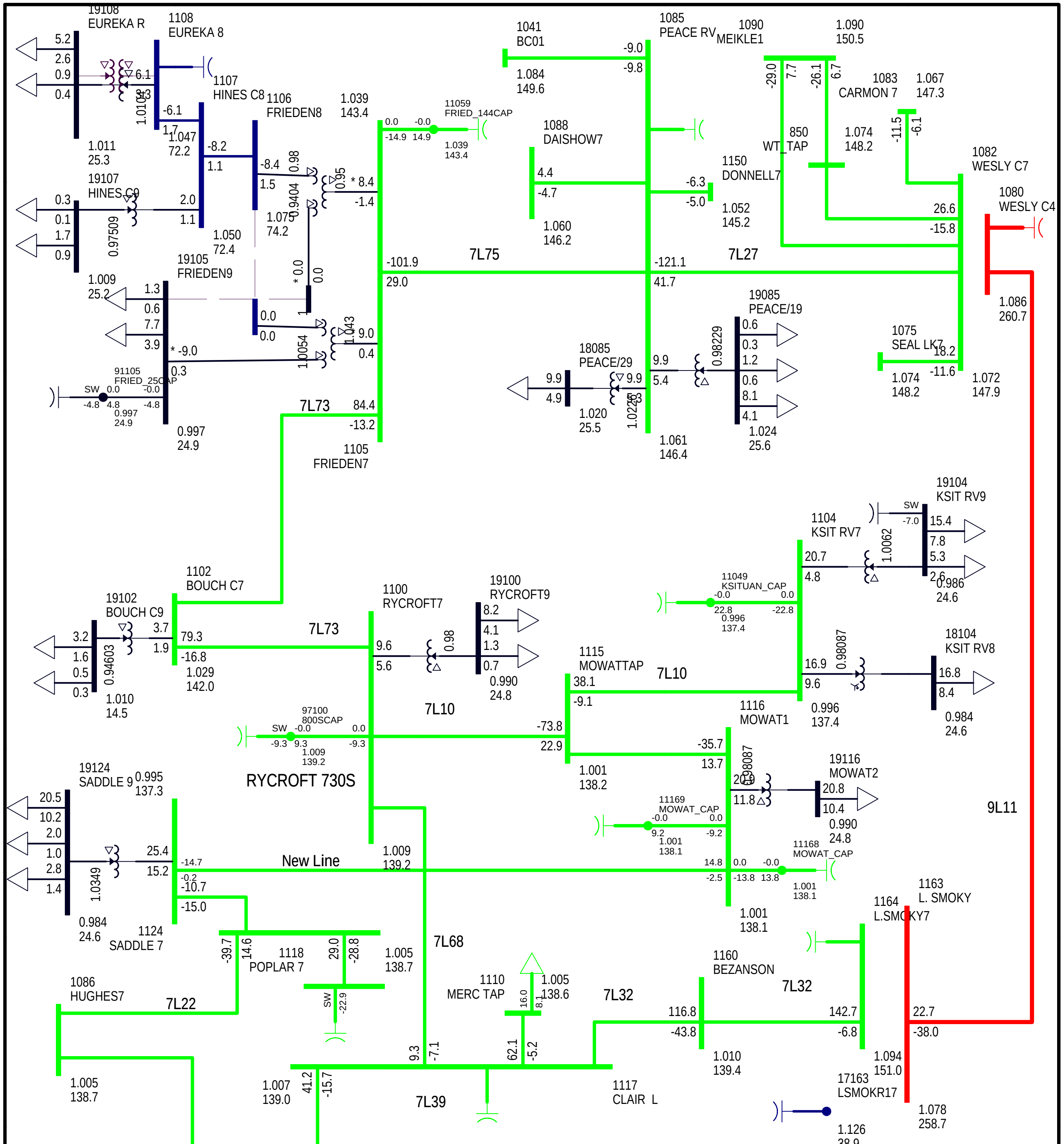
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L46 (N-1)
FIG B-161
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 119.2 MW



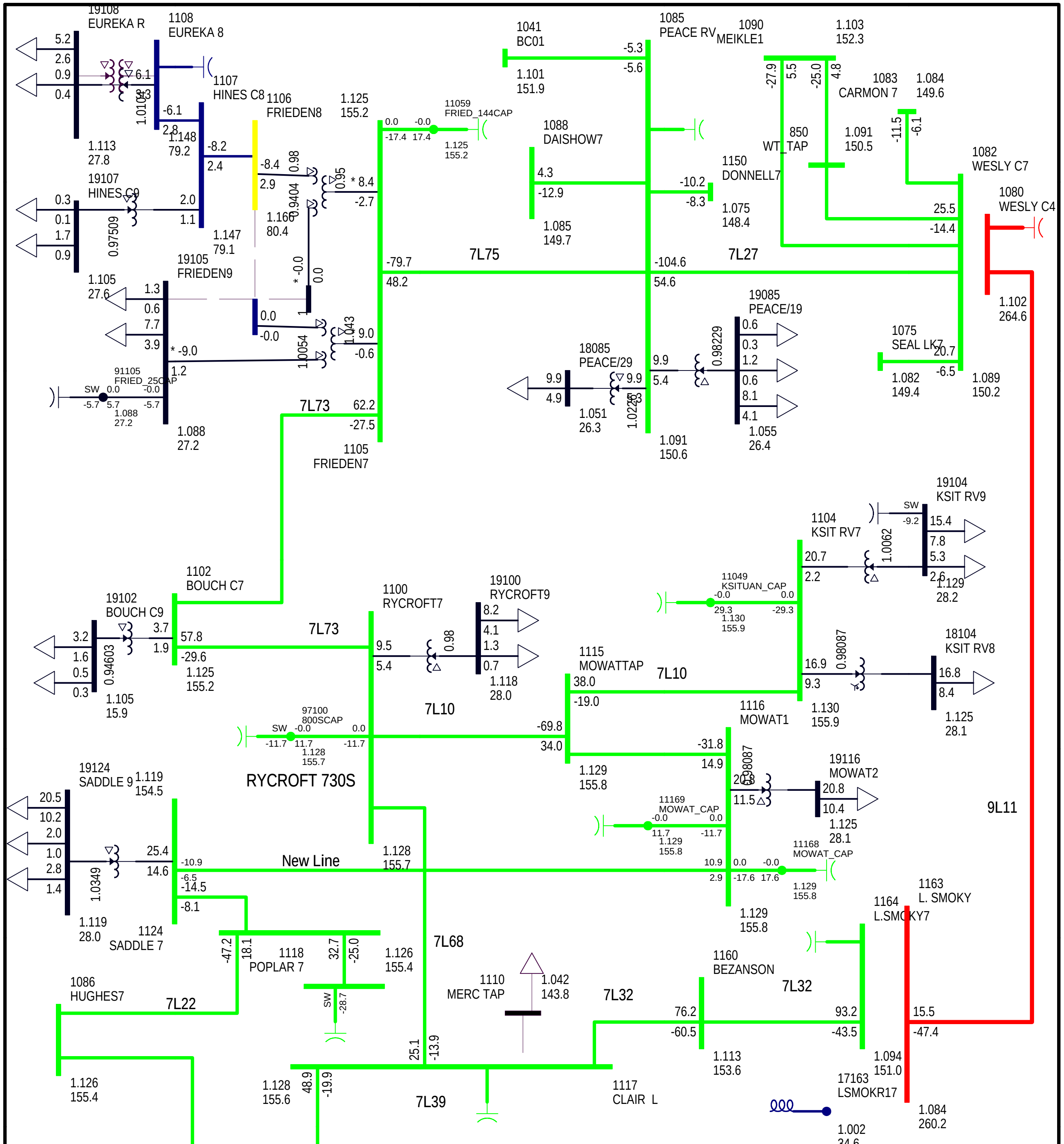
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L45 (N-1)
FIG B-162
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 117.7 MW



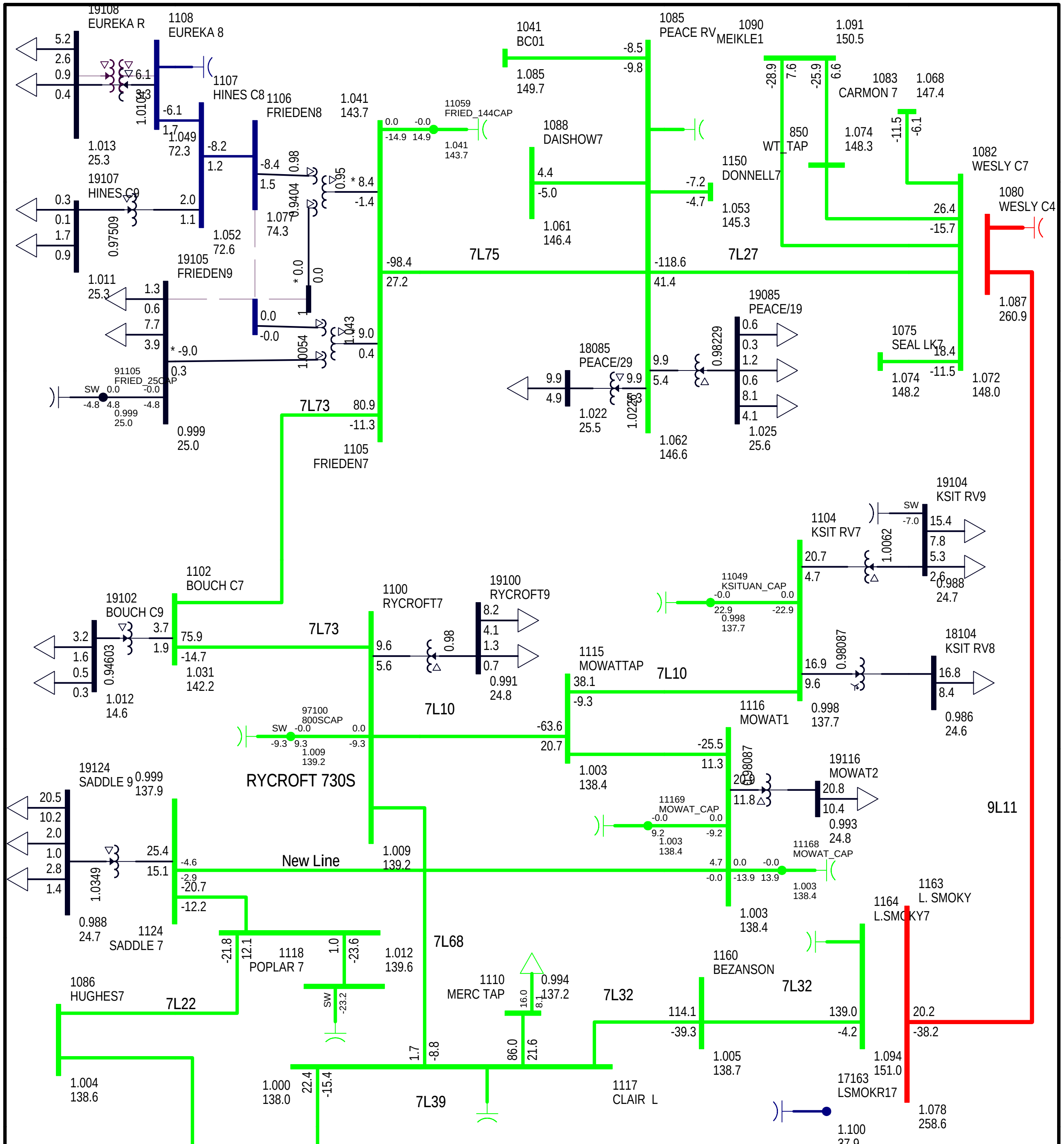
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L39 (N-1)
FIG B-163
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 109.2 MW



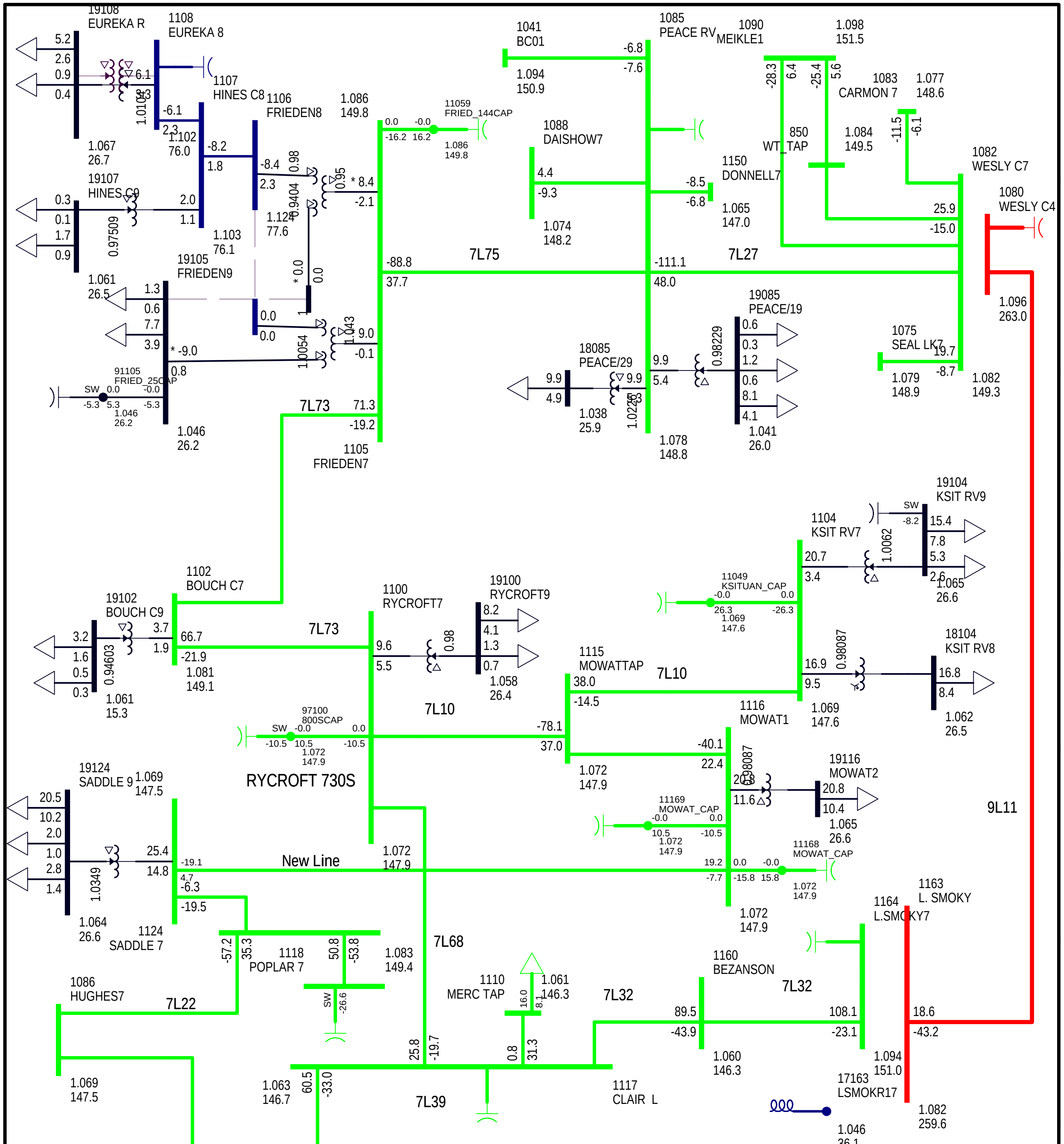
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L84 (N-1)
FIG B-164
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 106.1 MW



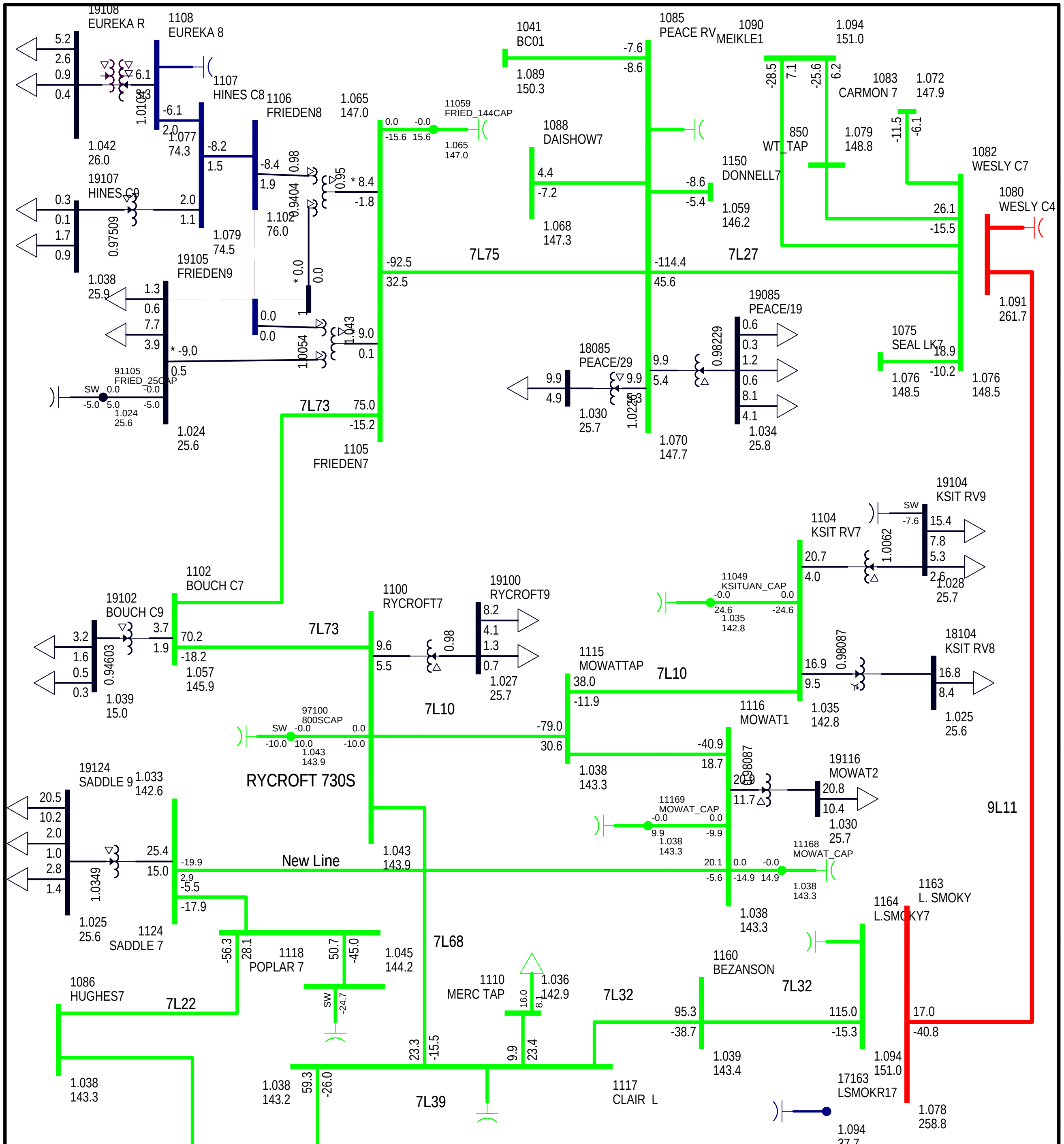
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L03 (N-1)
FIG B-165
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 119.6 MW



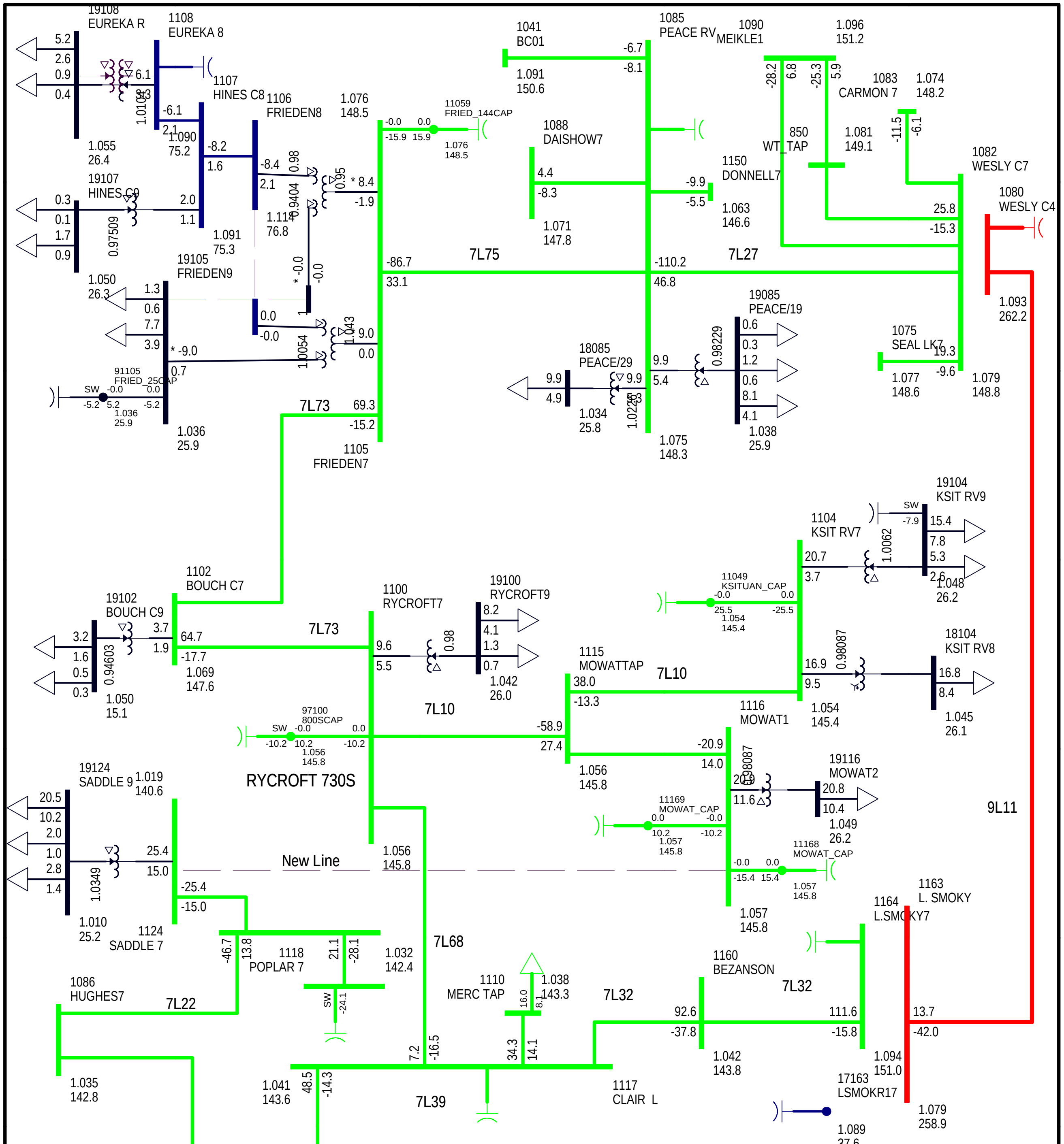
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L69 (N-1)
FIG B-166
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 121.1 MW



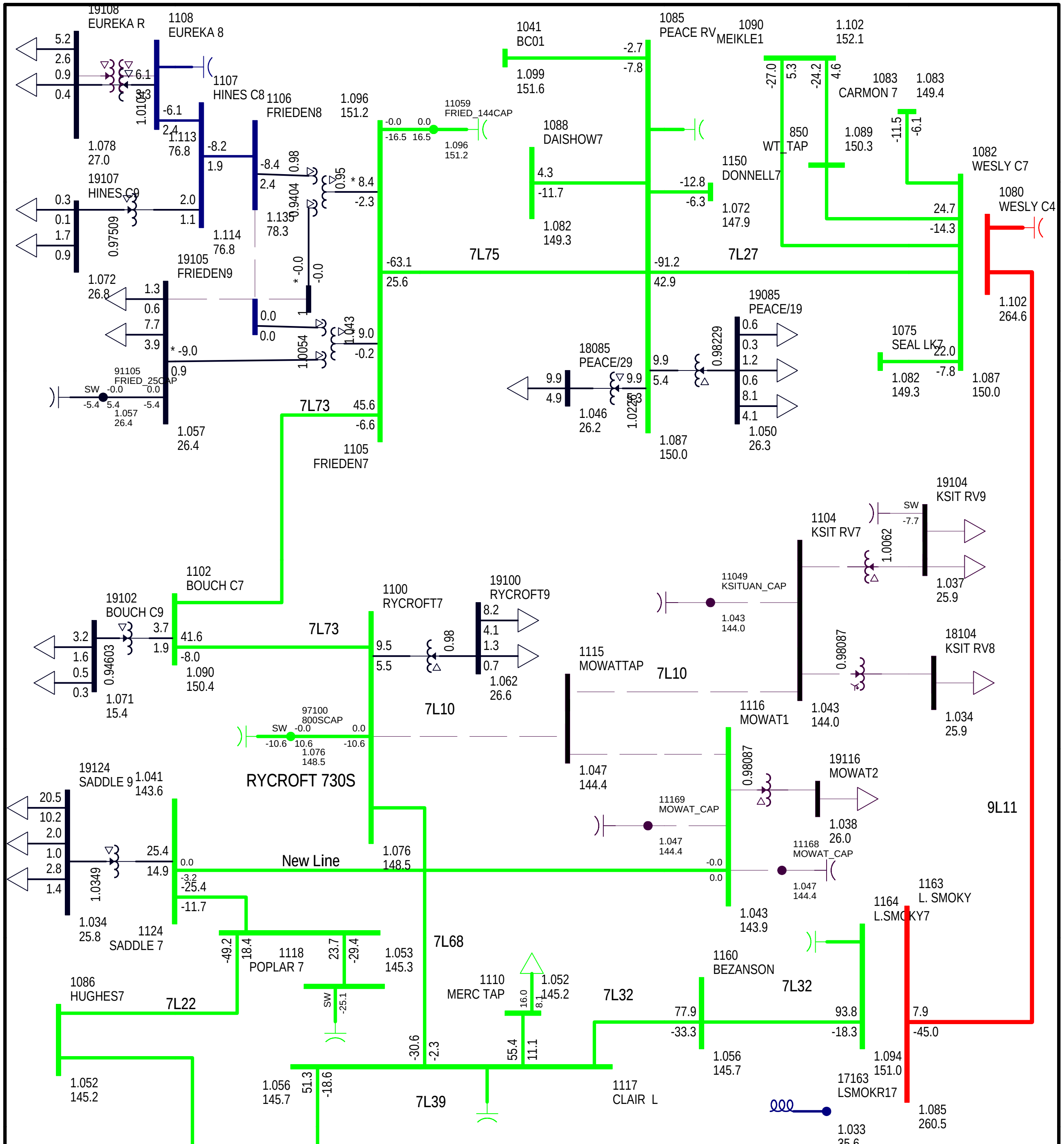
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
NEWLINE_OPT3 (N-1)
FIG B-167
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 88.6 MW

TOTAL FLOW INTO RYCROFT AREA: 98.6 MW



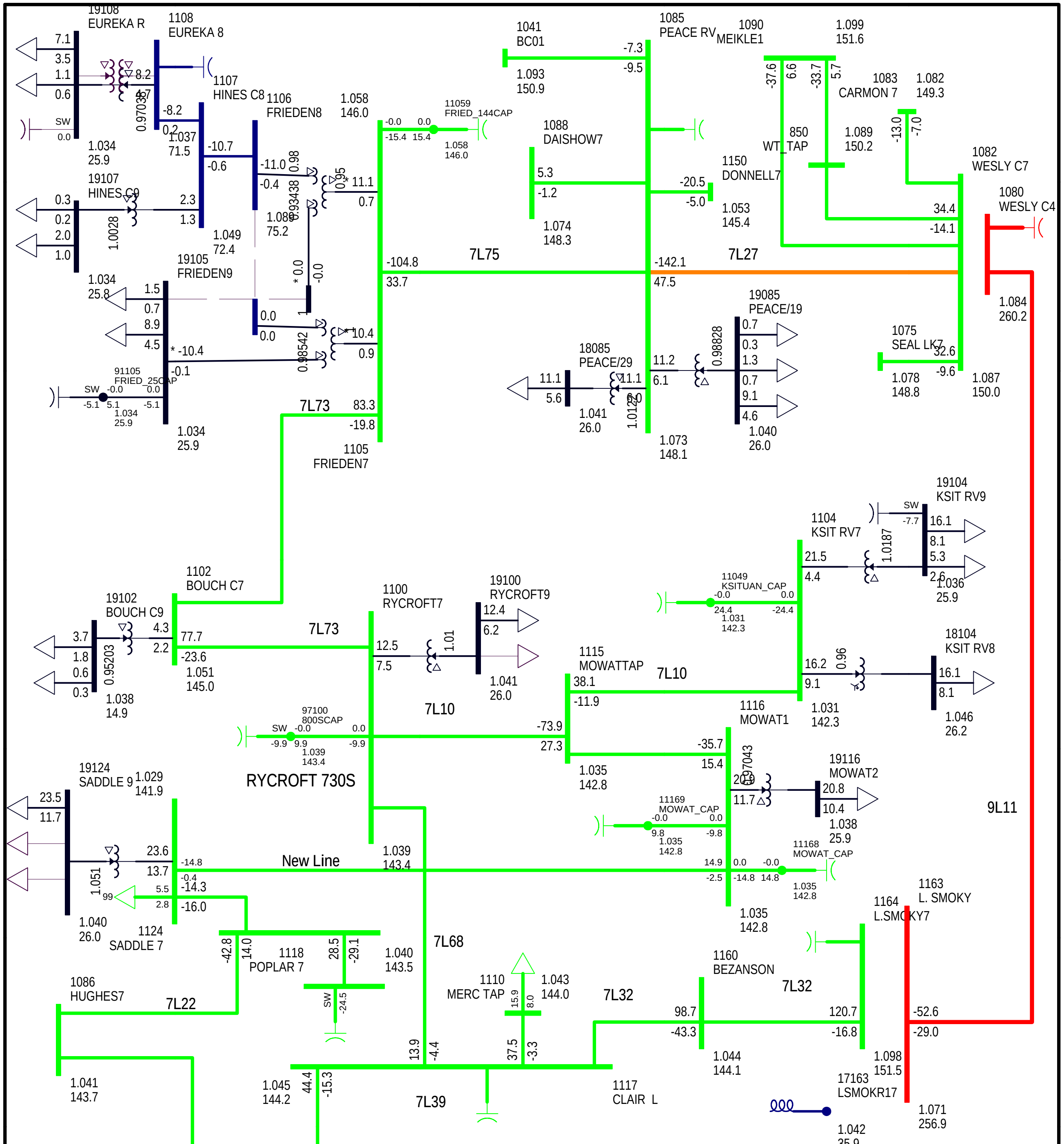
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 3 2026WP
7L10_OPT3 (N-1)
FIG B-168
THU, NOV 09 2017 14:24

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 30.3 MW

TOTAL FLOW INTO RYCROFT AREA: 34.9 MW



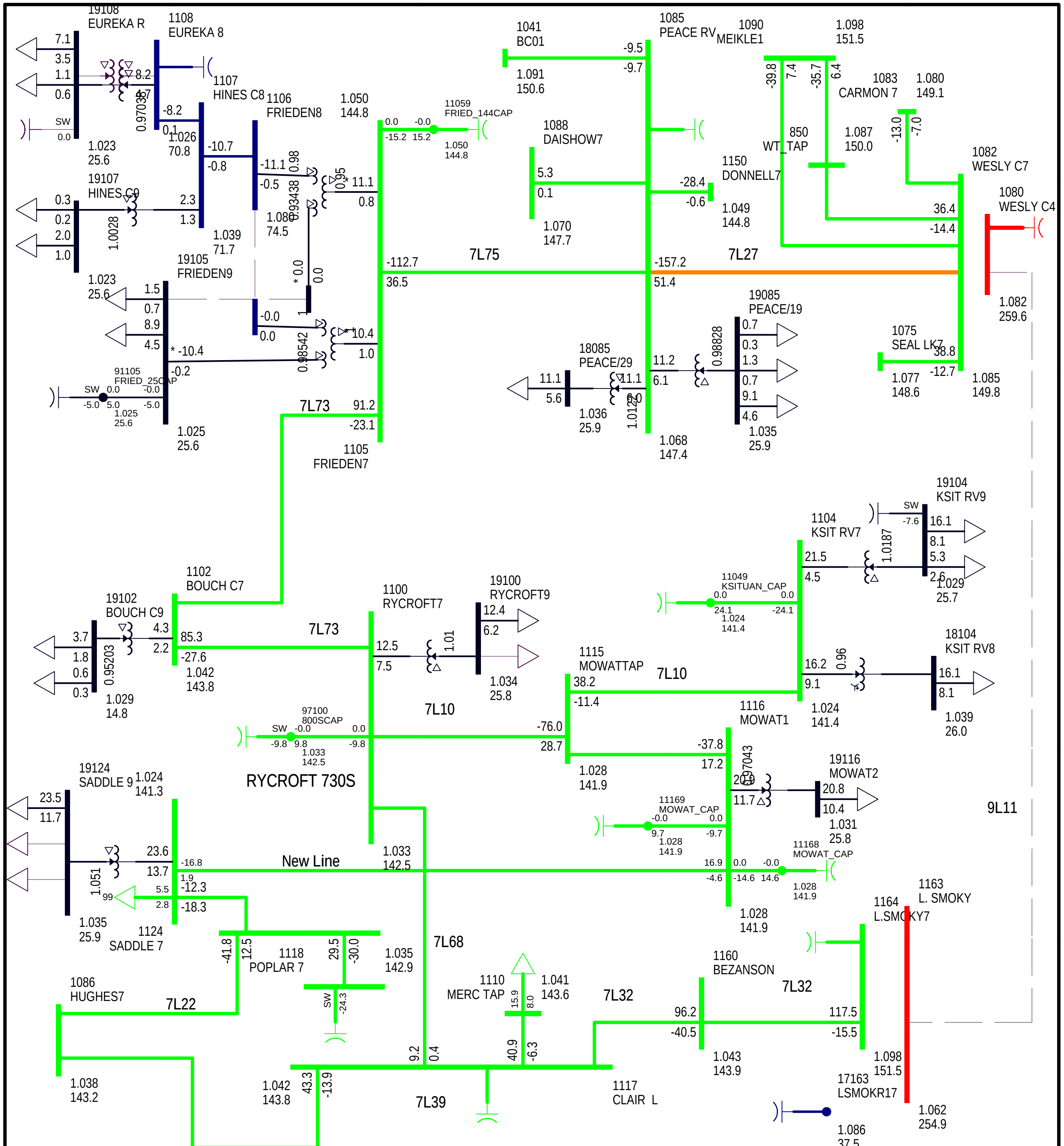
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 5A 2036WP
BASE CASE(N-0)
FIG B-169
THU, NOV 09 2017 14:27

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 125.4 MW



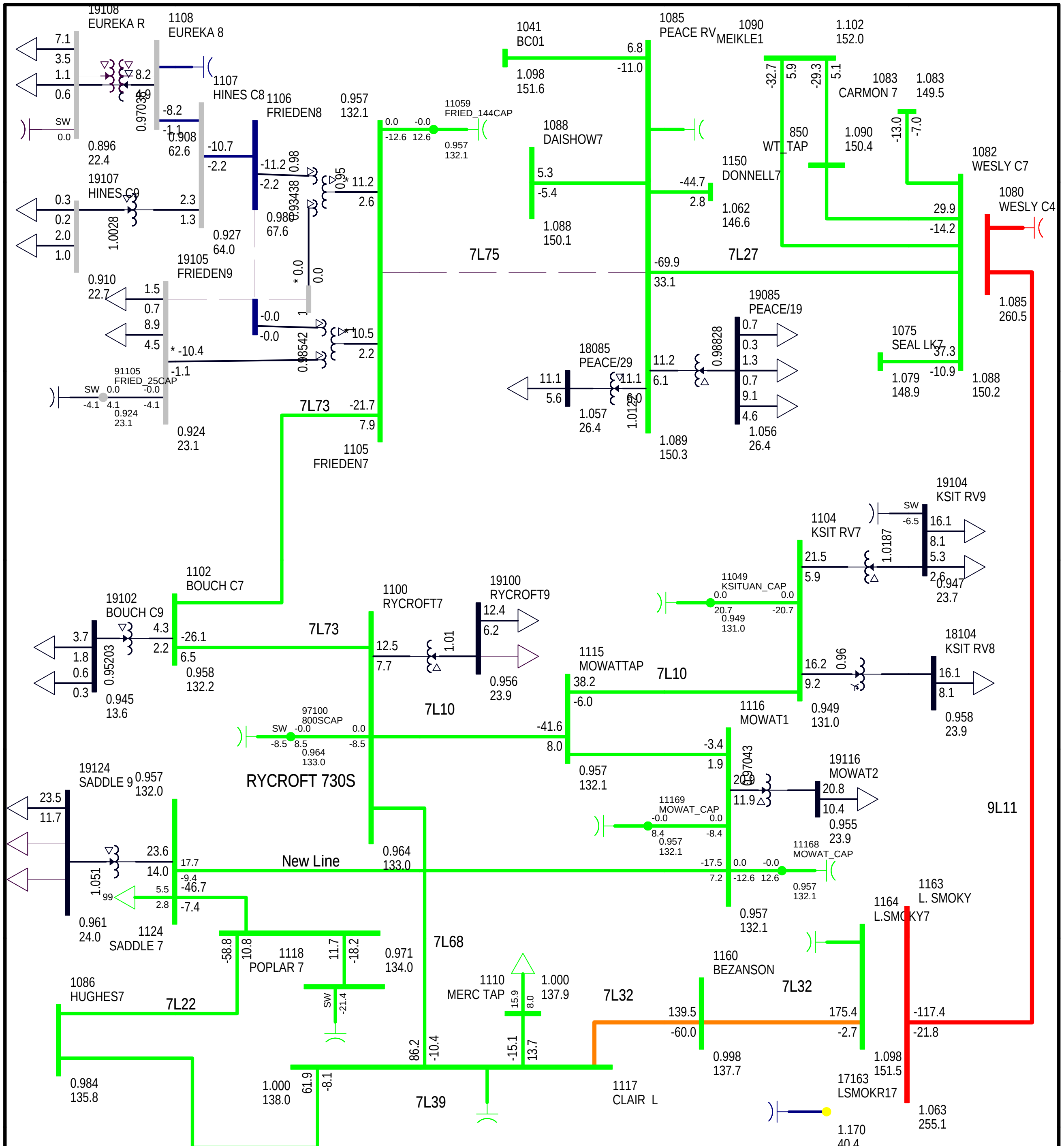
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 5A 2036WP
9L11 (N-1)
FIG B-170
THU, NOV 09 2017 14:27

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 129.9 MW



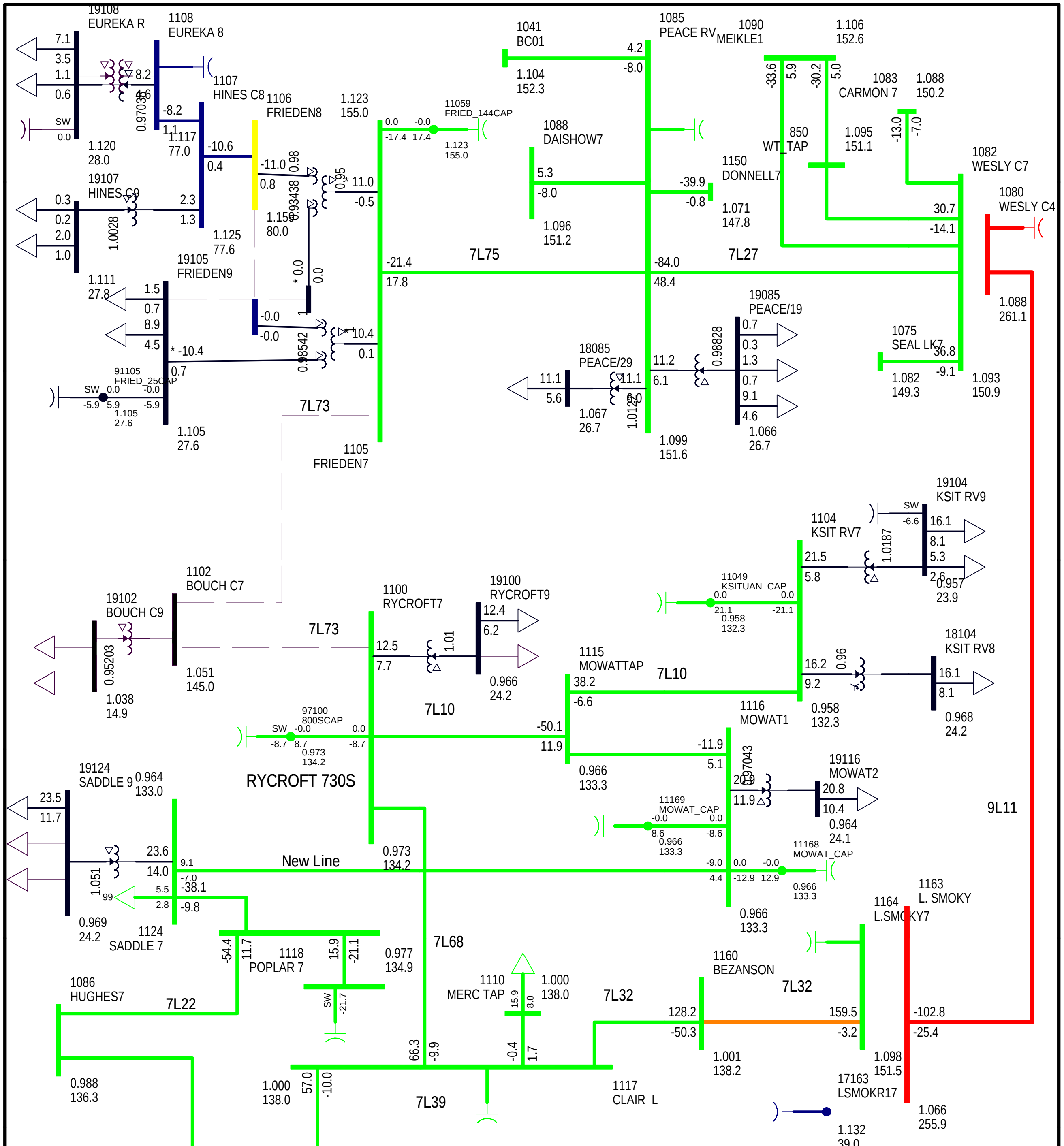
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 5A 2036WP
7L75 (N-1)
FIG B-171
THU, NOV 09 2017 14:27

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 86.2 MW



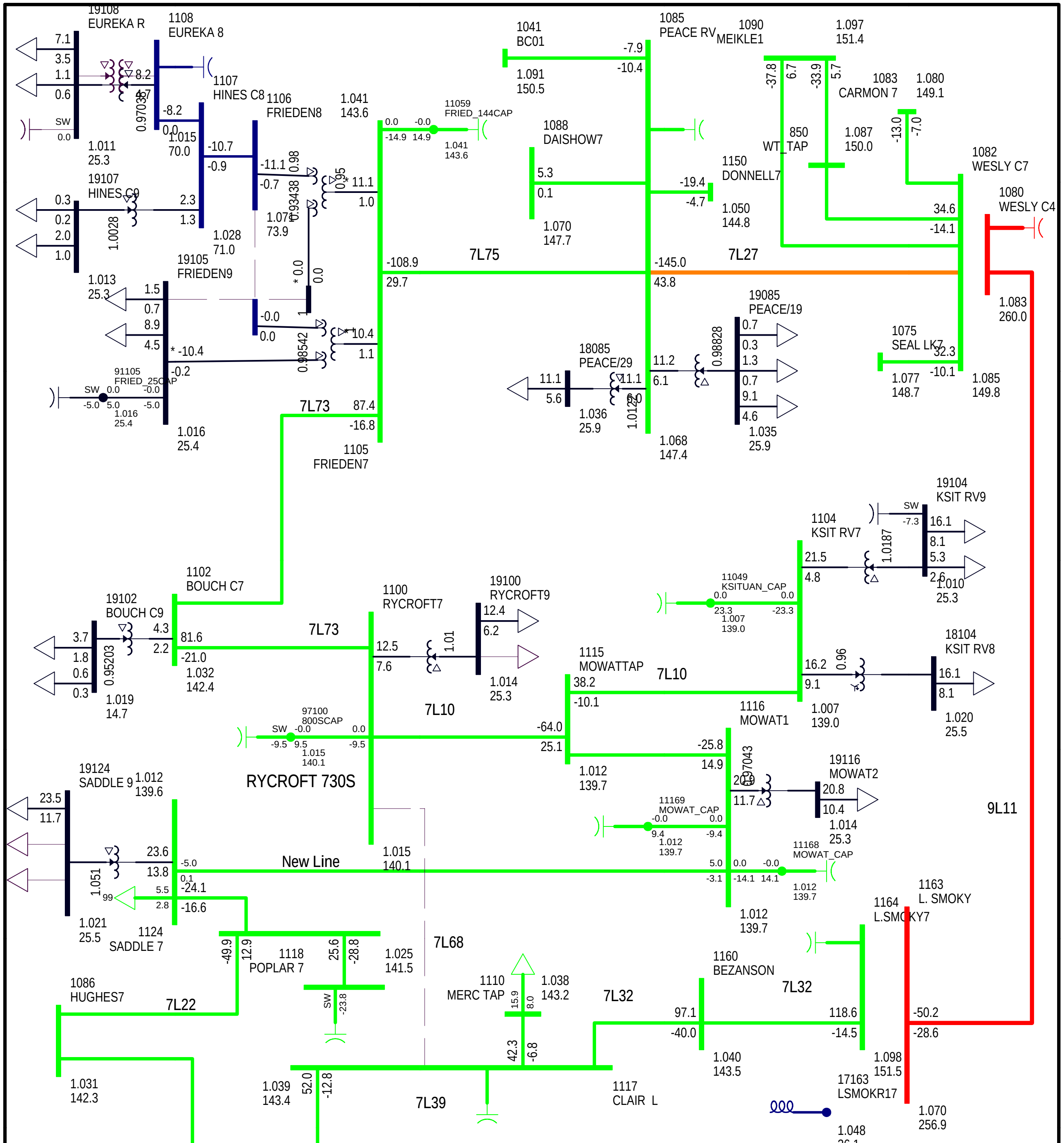
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 5A 2036WP
7L73 (N-1)
FIG B-172
THU, NOV 09 2017 14:27

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 91.7 MW

TOTAL FLOW INTO RYCROFT AREA: 88.2 MW



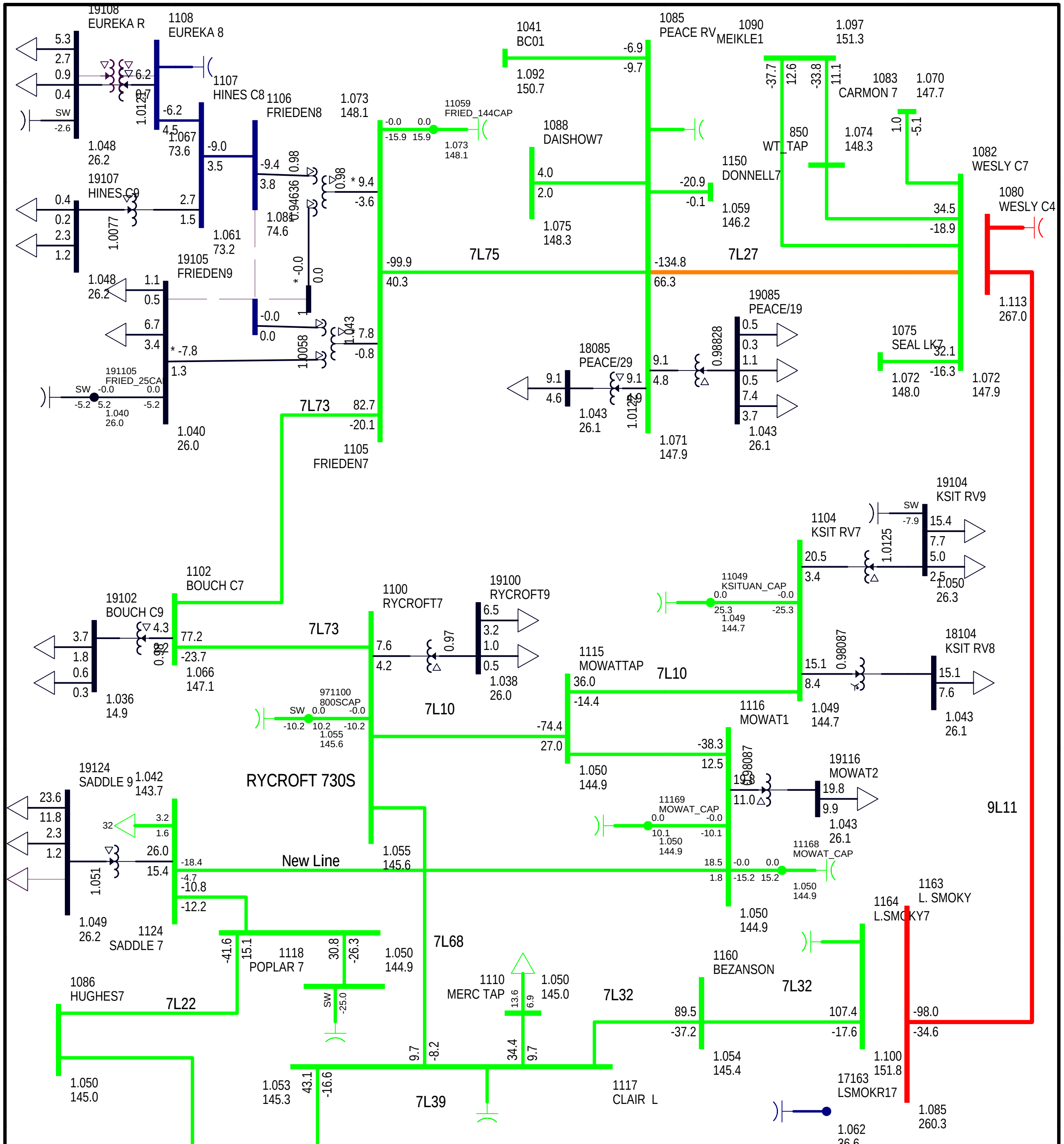
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 5A 2036WP
7L68 (N-1)
FIG B-173
THU, NOV 09 2017 14:27

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 116.3 MW



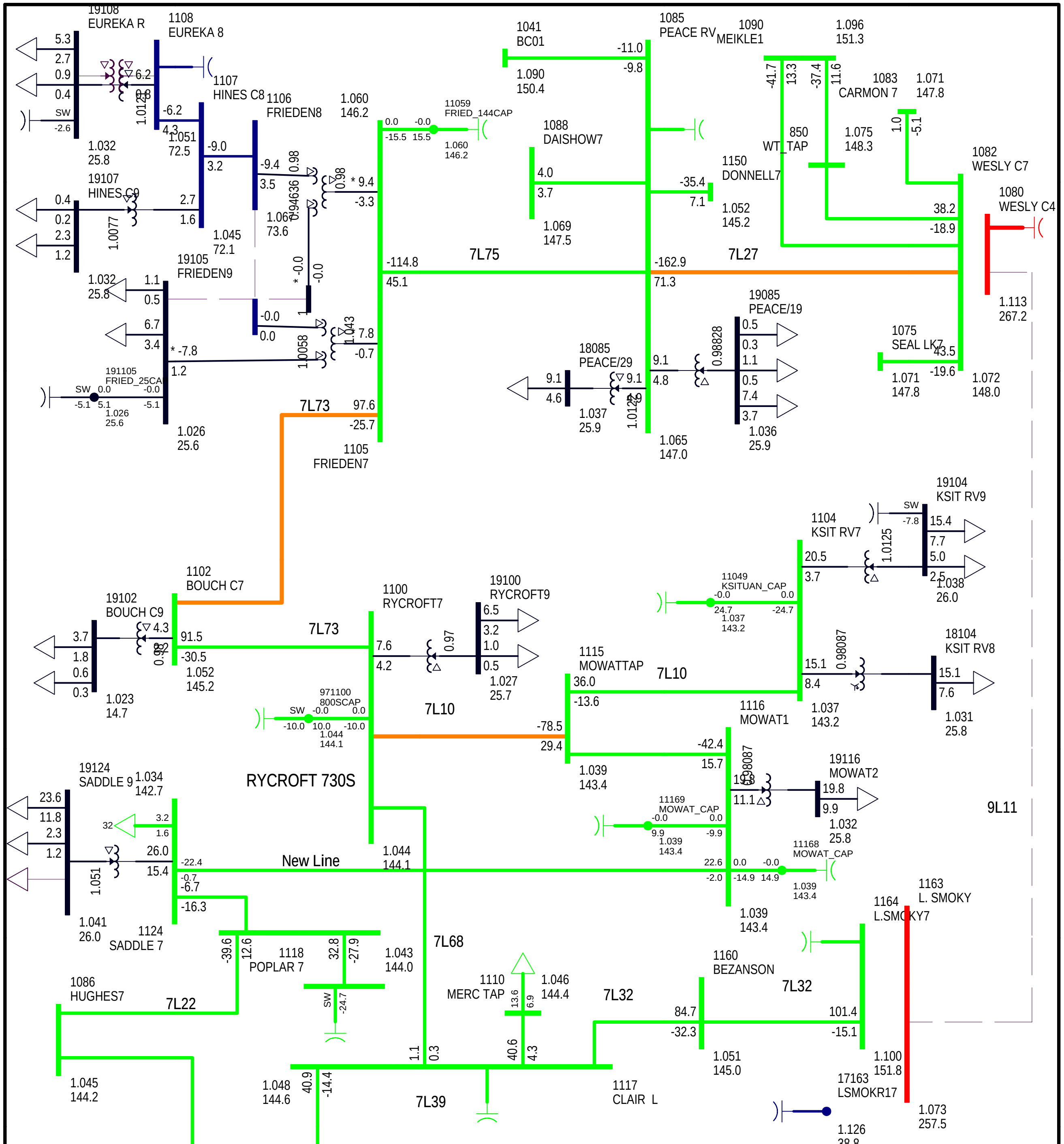
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
BASE CASE(N-0)
FIG B-174
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 115.9 MW



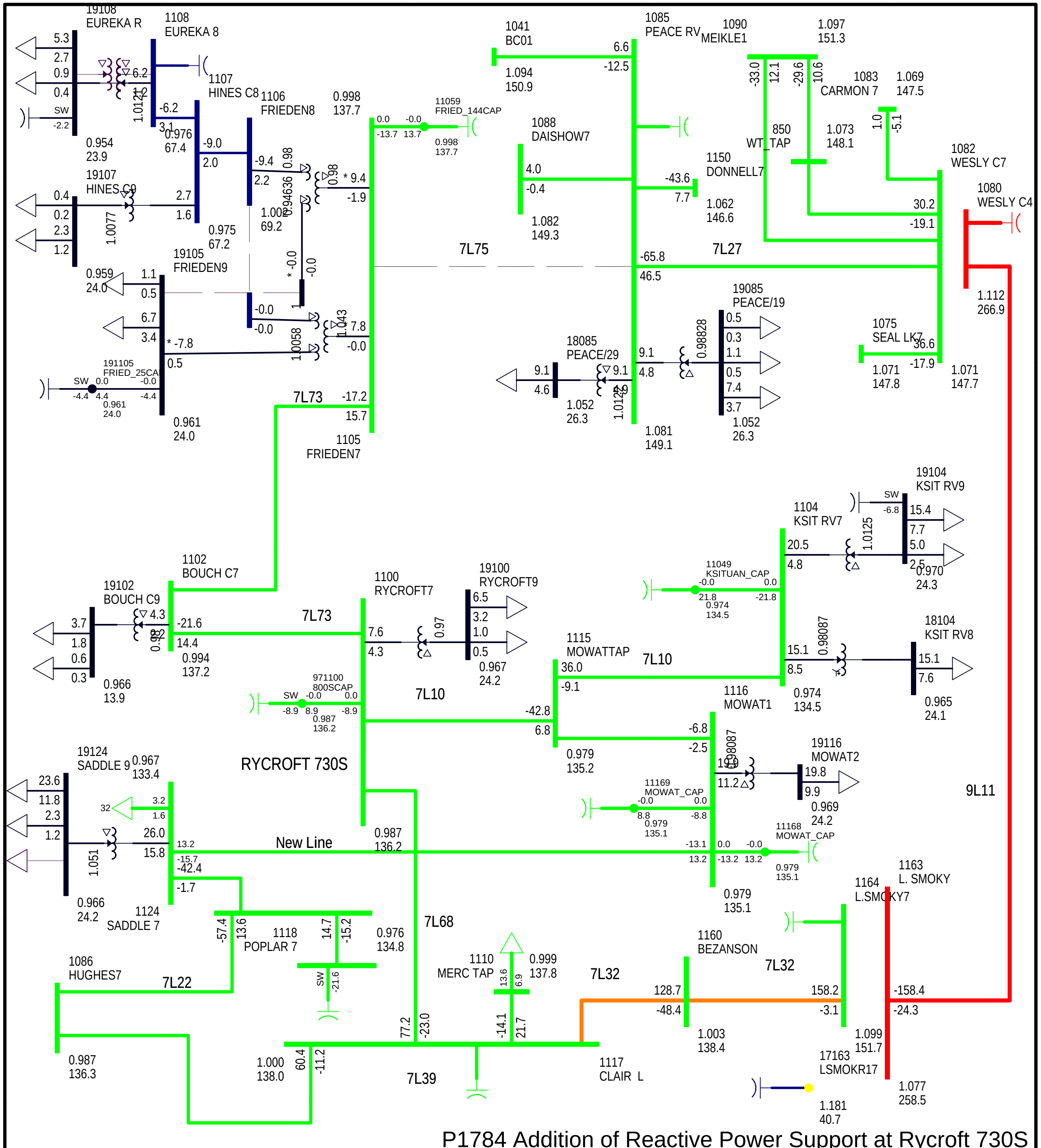
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
9L11 (N-1)
FIG B-175
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 124.4 MW

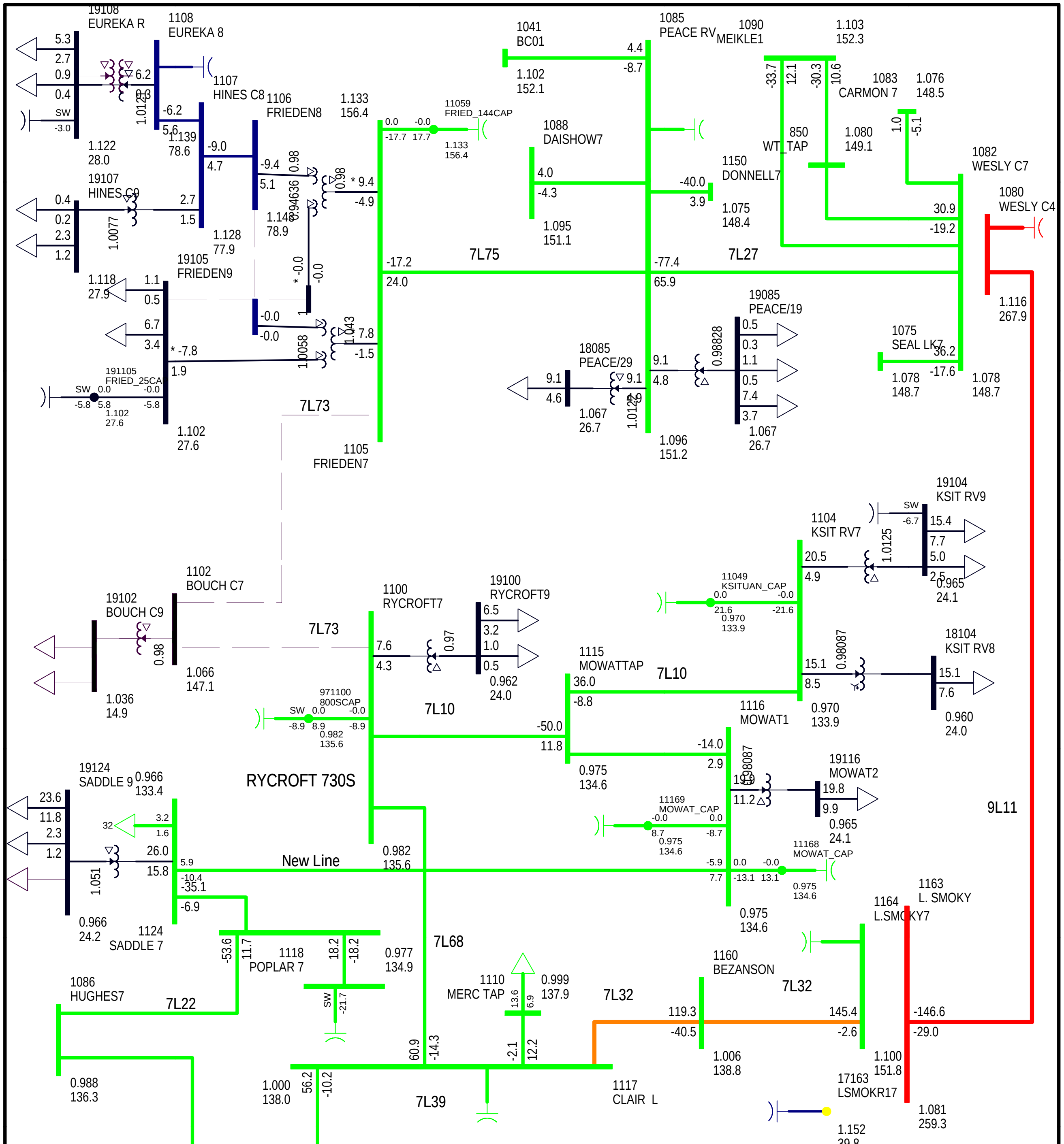


PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L75 (N-1)
FIG B-176
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 77.2 MW



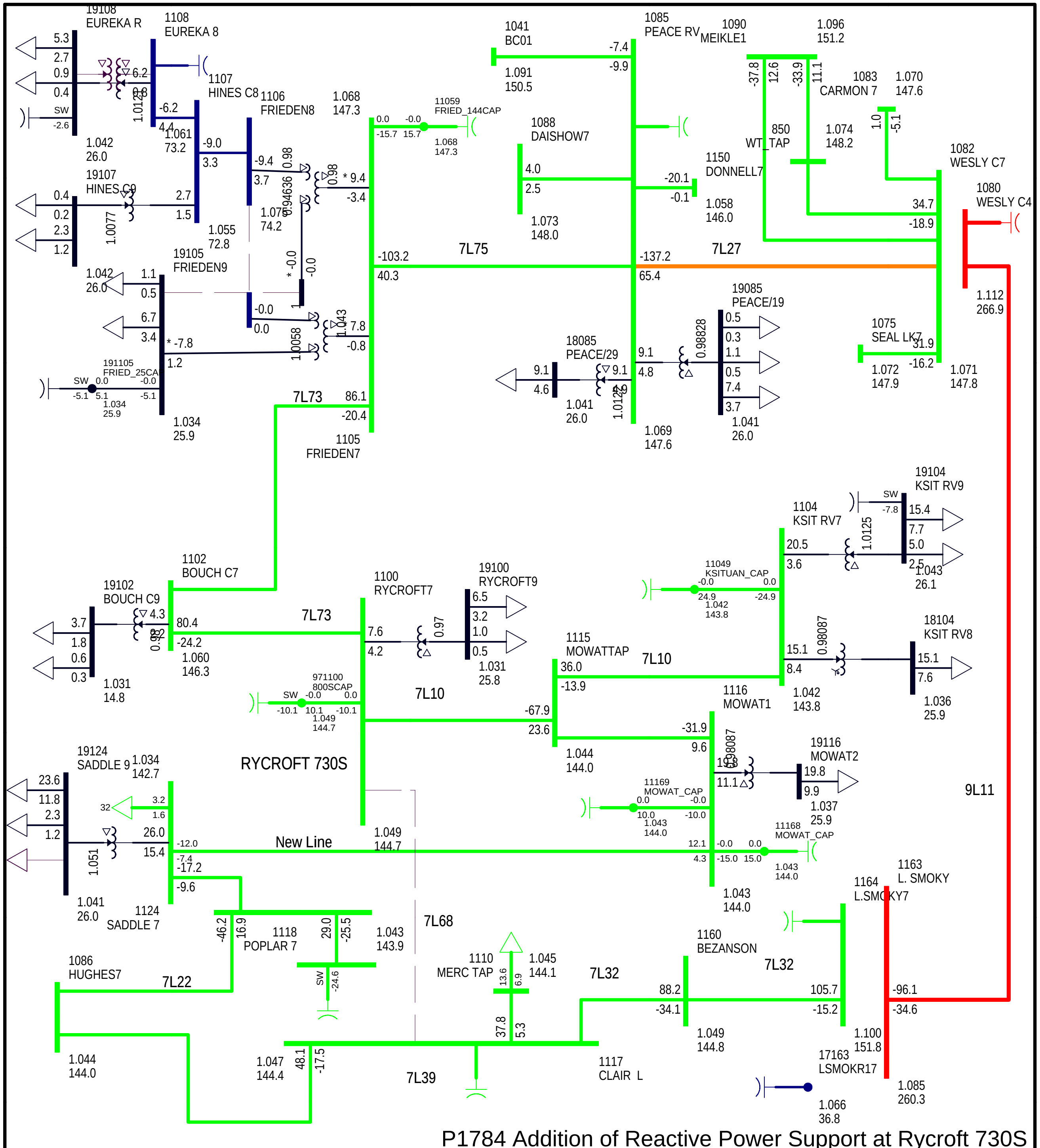
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L73 (N-1)
FIG B-177
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 79.5 MW

TOTAL FLOW INTO RYCROFT AREA: 78.6 MW

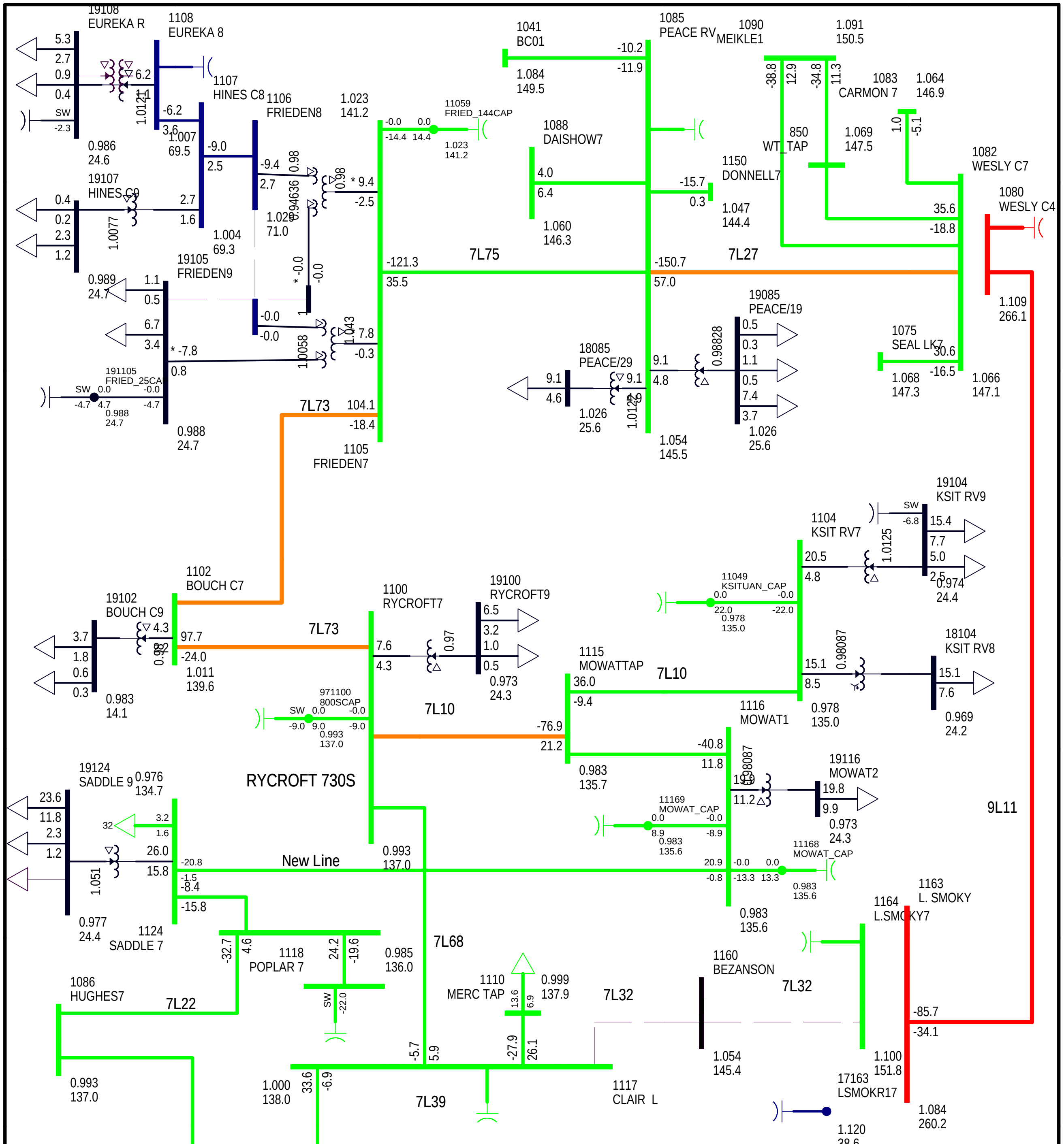


PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L68 (N-1)
FIG B-178
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 110.0 MW



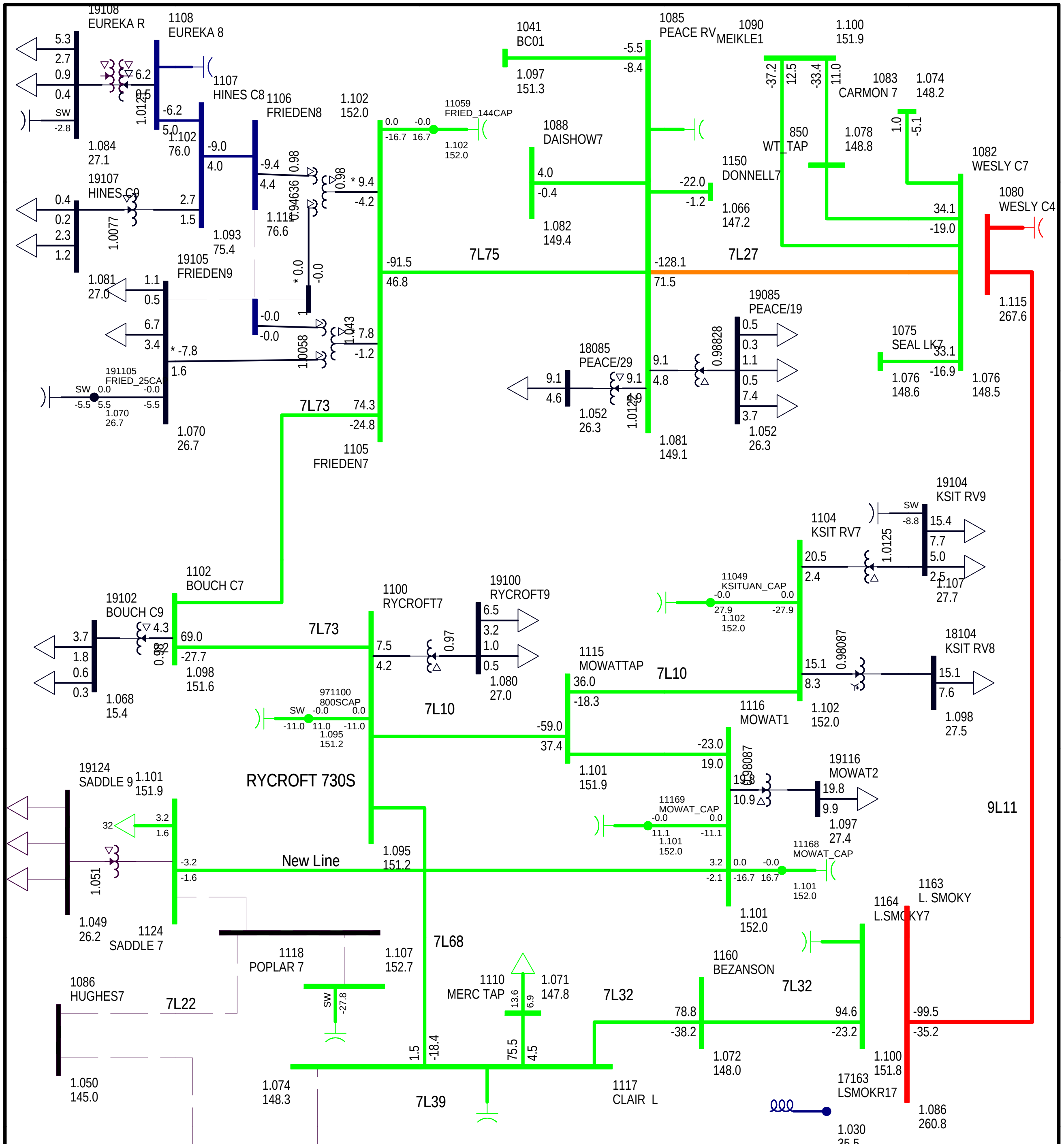
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L32 (N-1)
FIG B-179
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 125.2 MW



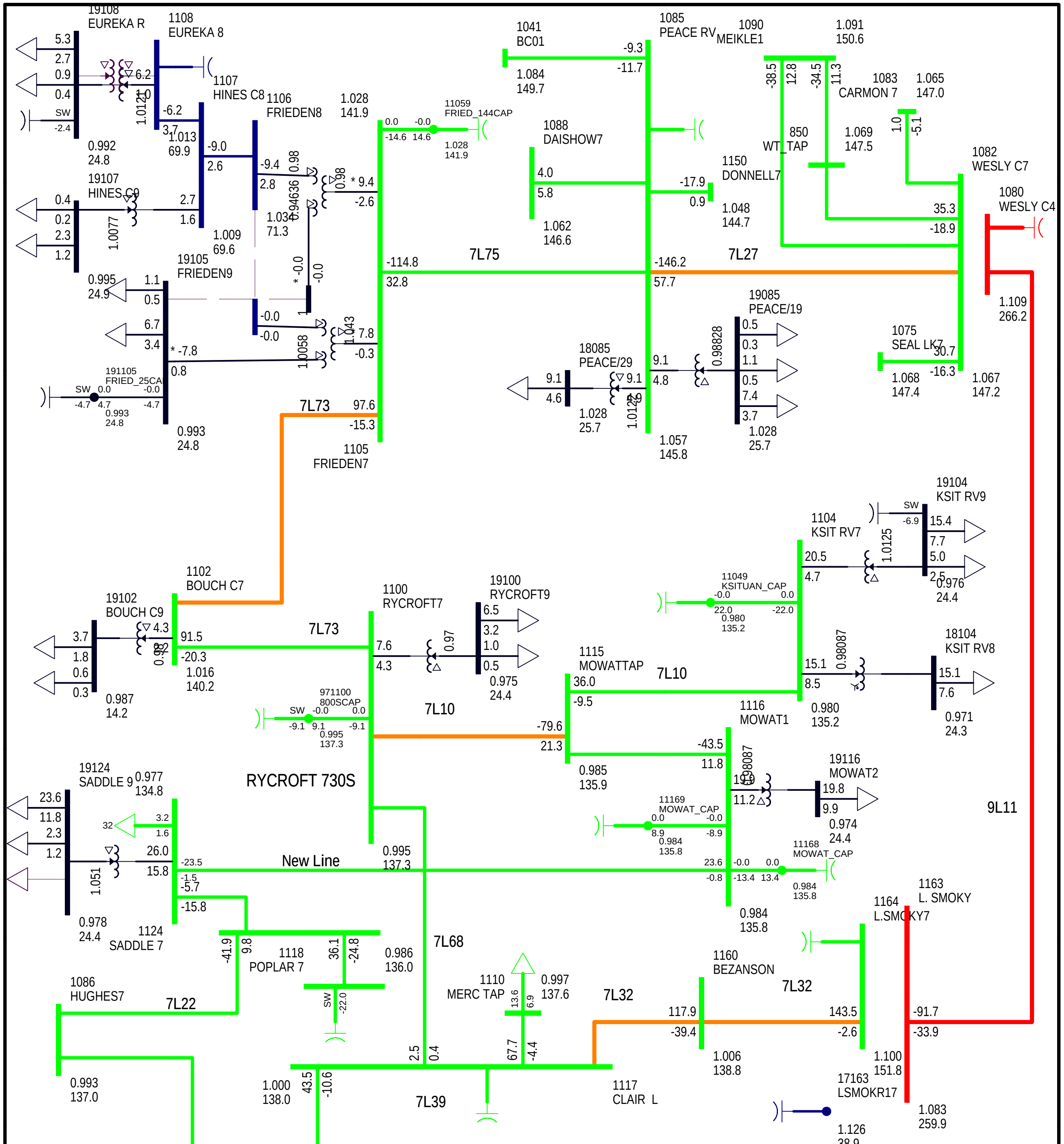
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L22 (N-1)
FIG B-180
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 98.5 MW



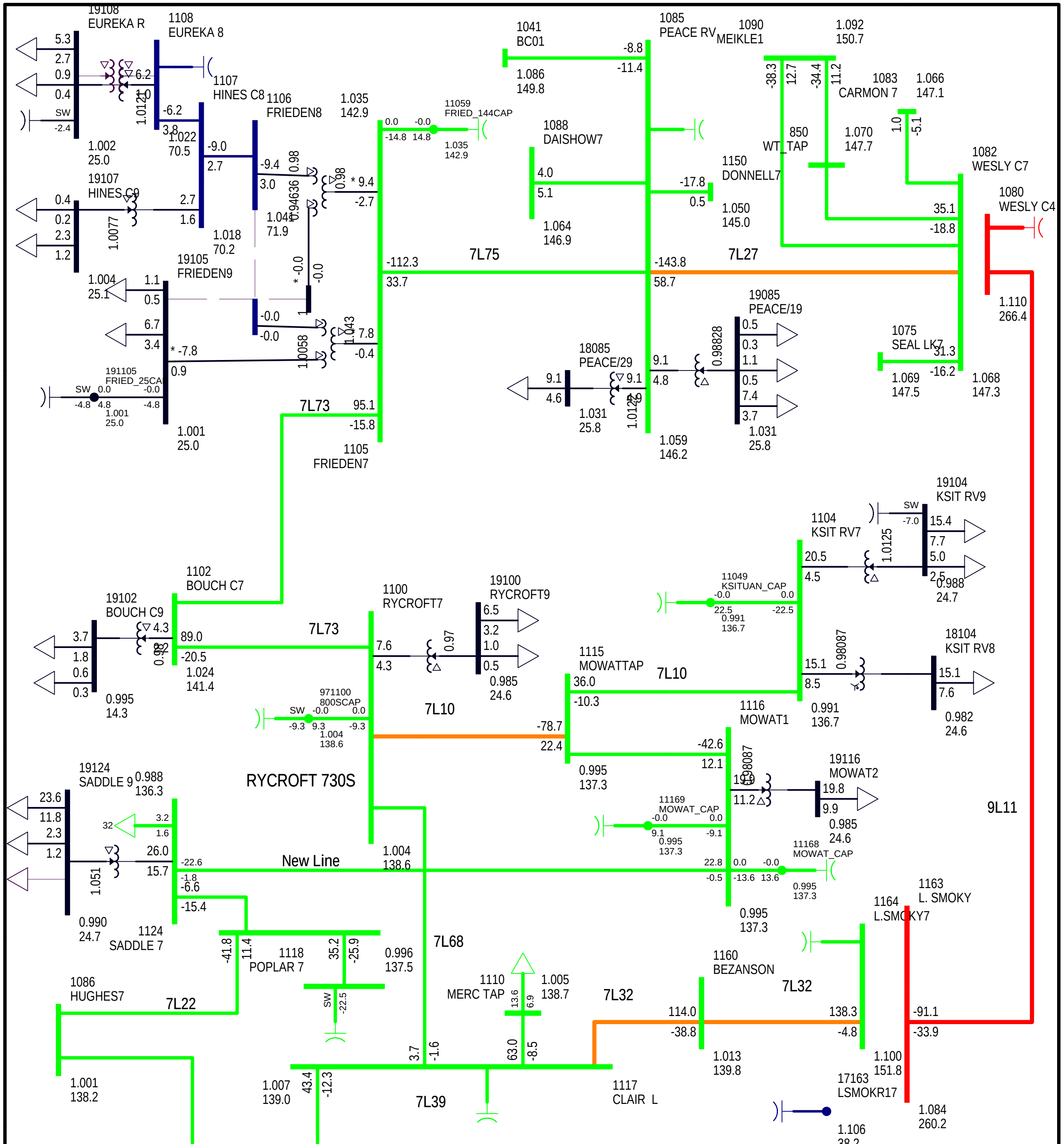
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L46 (N-1)
FIG B-181
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 125.7 MW



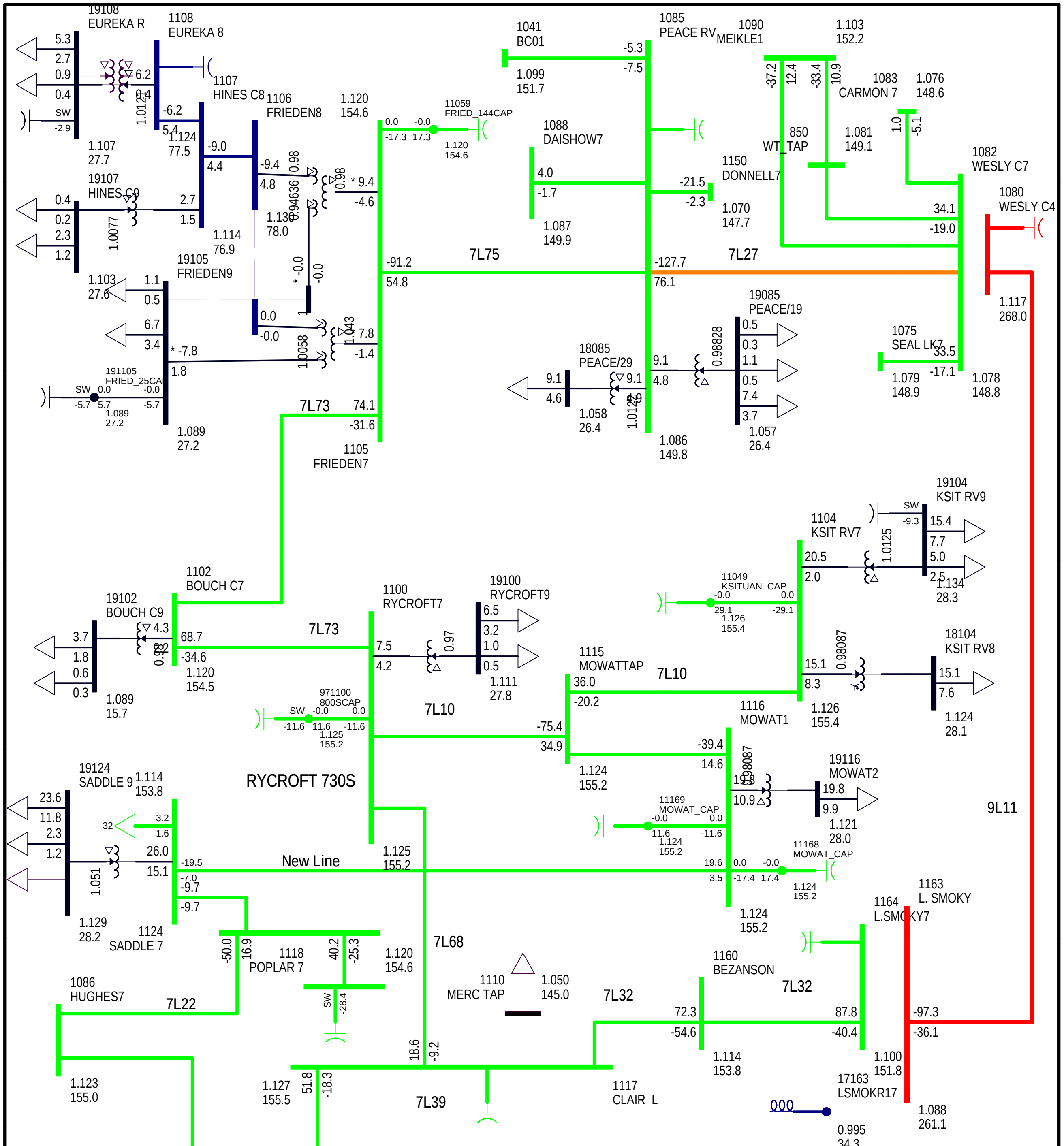
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L45 (N-1)
FIG B-182
THU, NOV 09 2017 14:29

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 124.0 MW



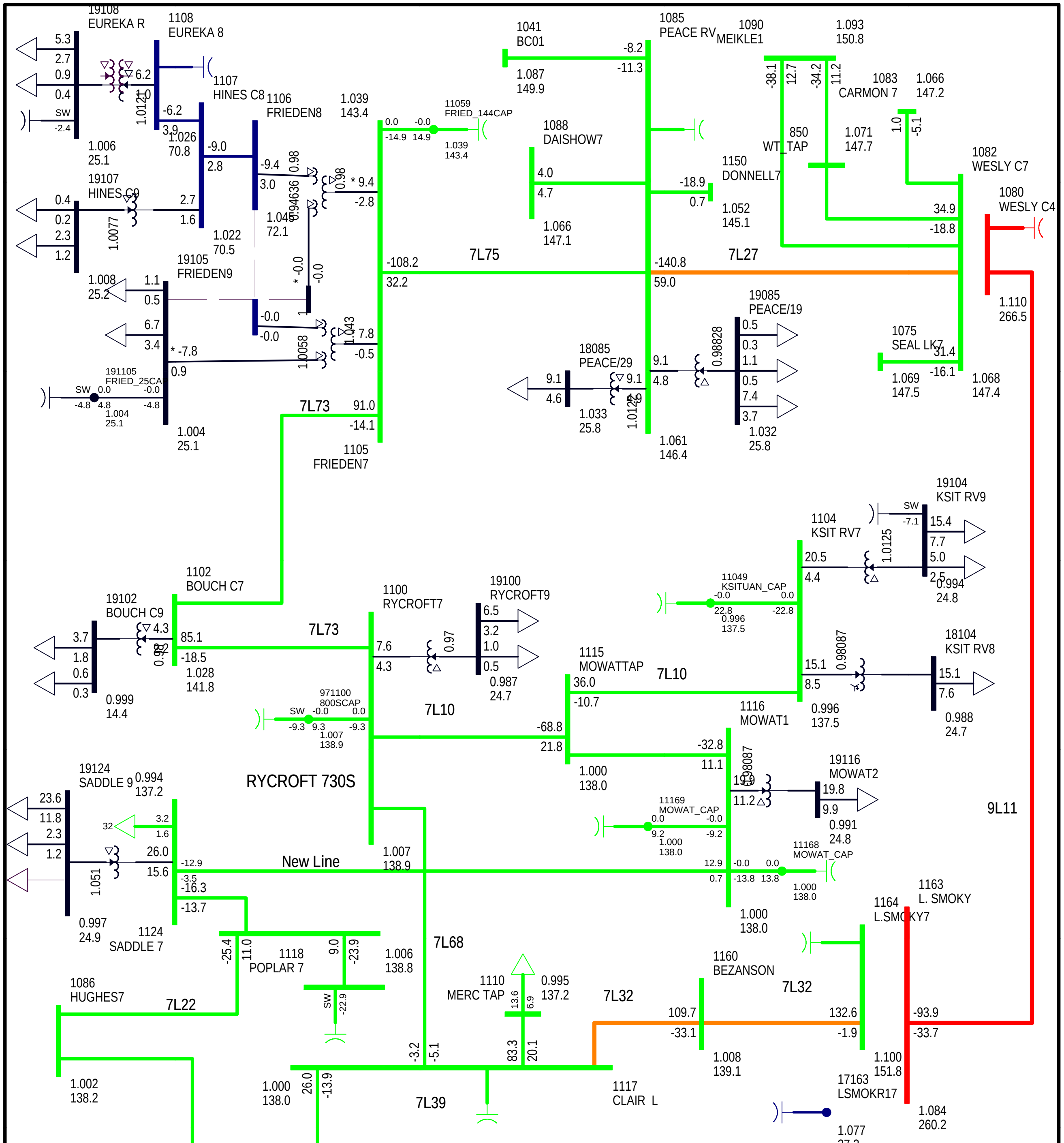
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L39 (N-1)
FIG B-183
THU, NOV 09 2017 14:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 115.6 MW



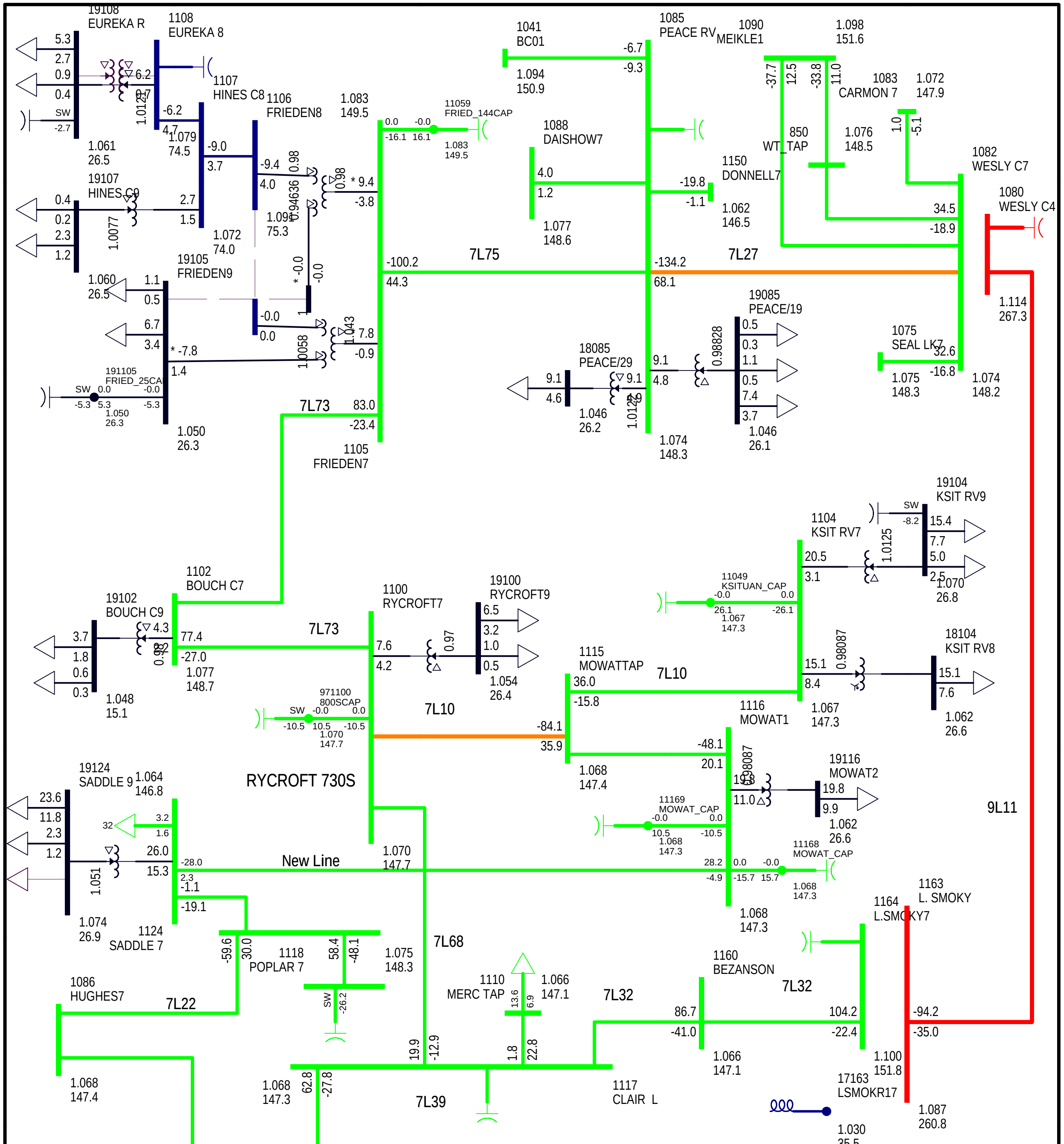
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L84 (N-1)
FIG B-184
THU, NOV 09 2017 14:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 112.4 MW



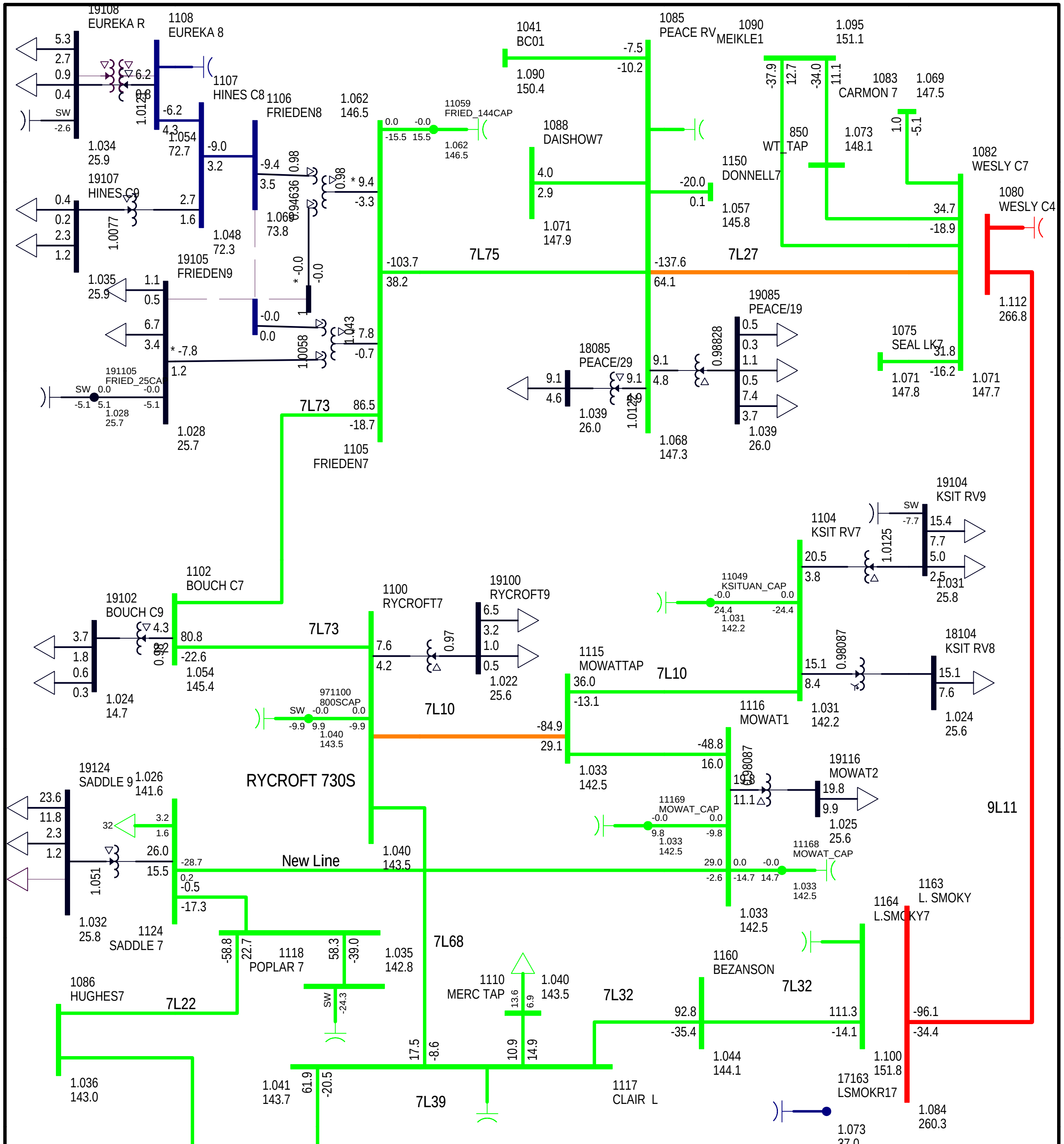
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L03 (N-1)
FIG B-185
THU, NOV 09 2017 14:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 126.5 MW



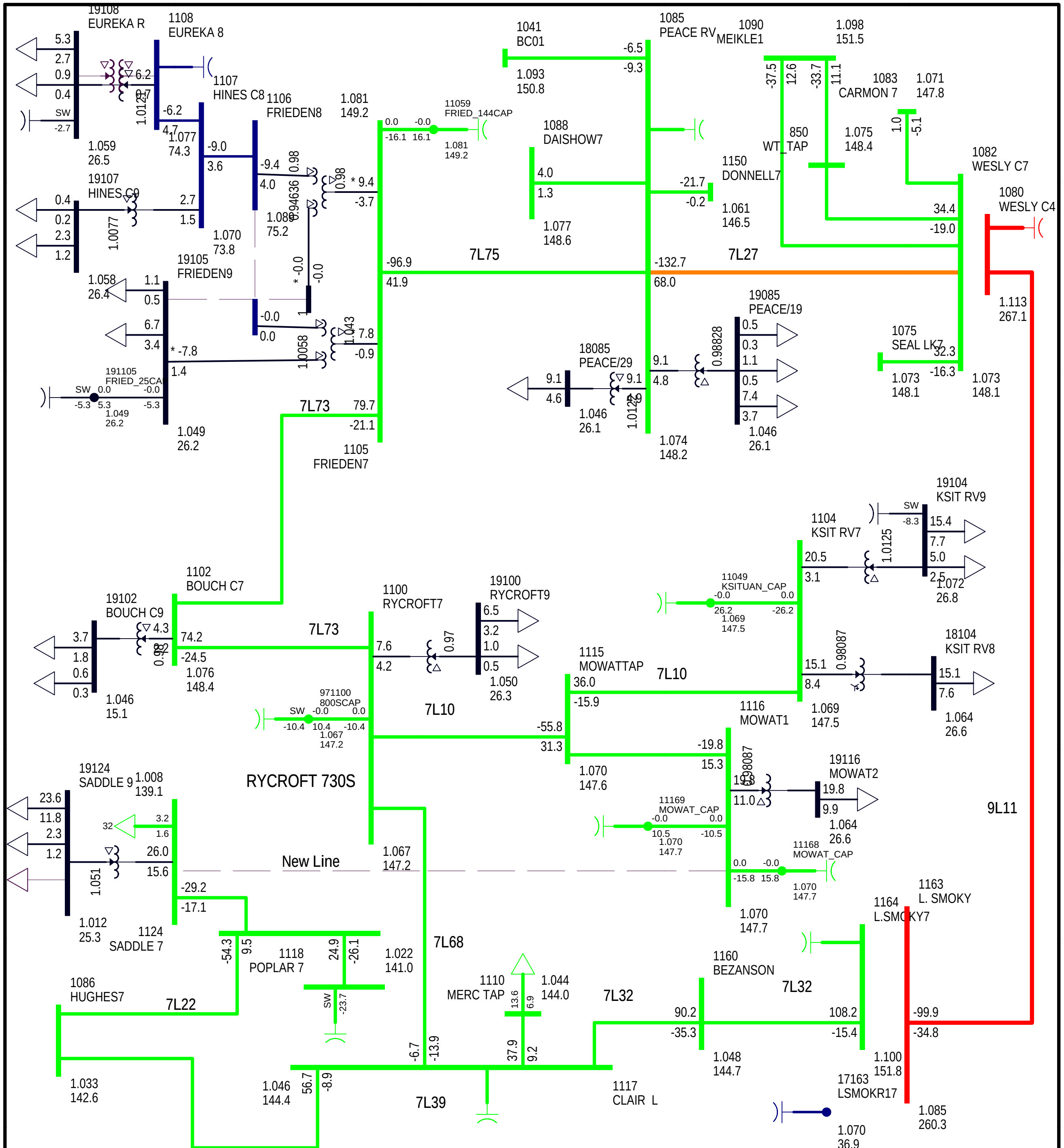
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L69 (N-1)
FIG B-186
THU, NOV 09 2017 14:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 128.1 MW



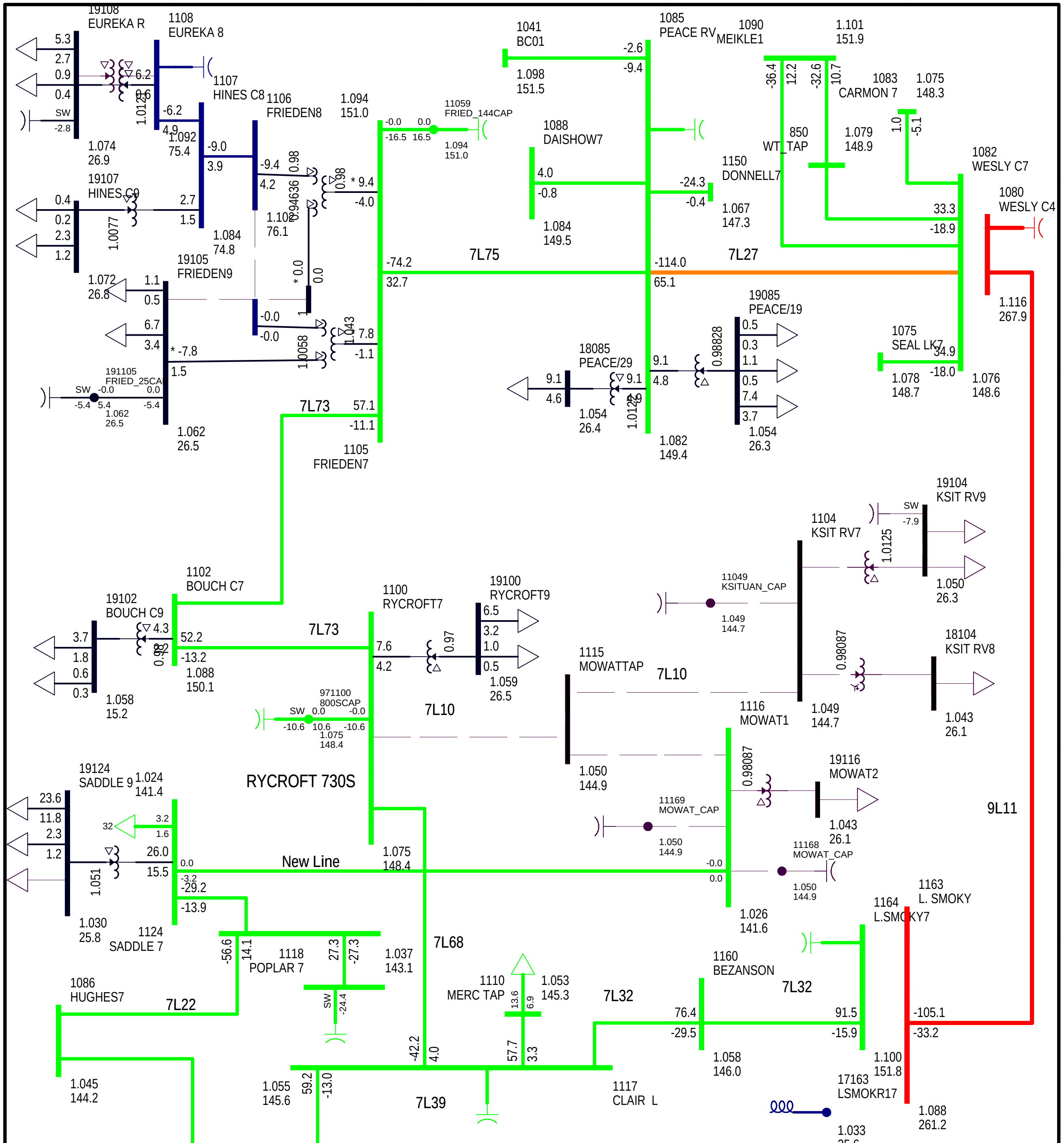
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
NEWLINE_OPT3 (N-1)
FIG B-187
THU, NOV 09 2017 14:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 83.8 MW

TOTAL FLOW INTO RYCROFT AREA: 96.2 MW



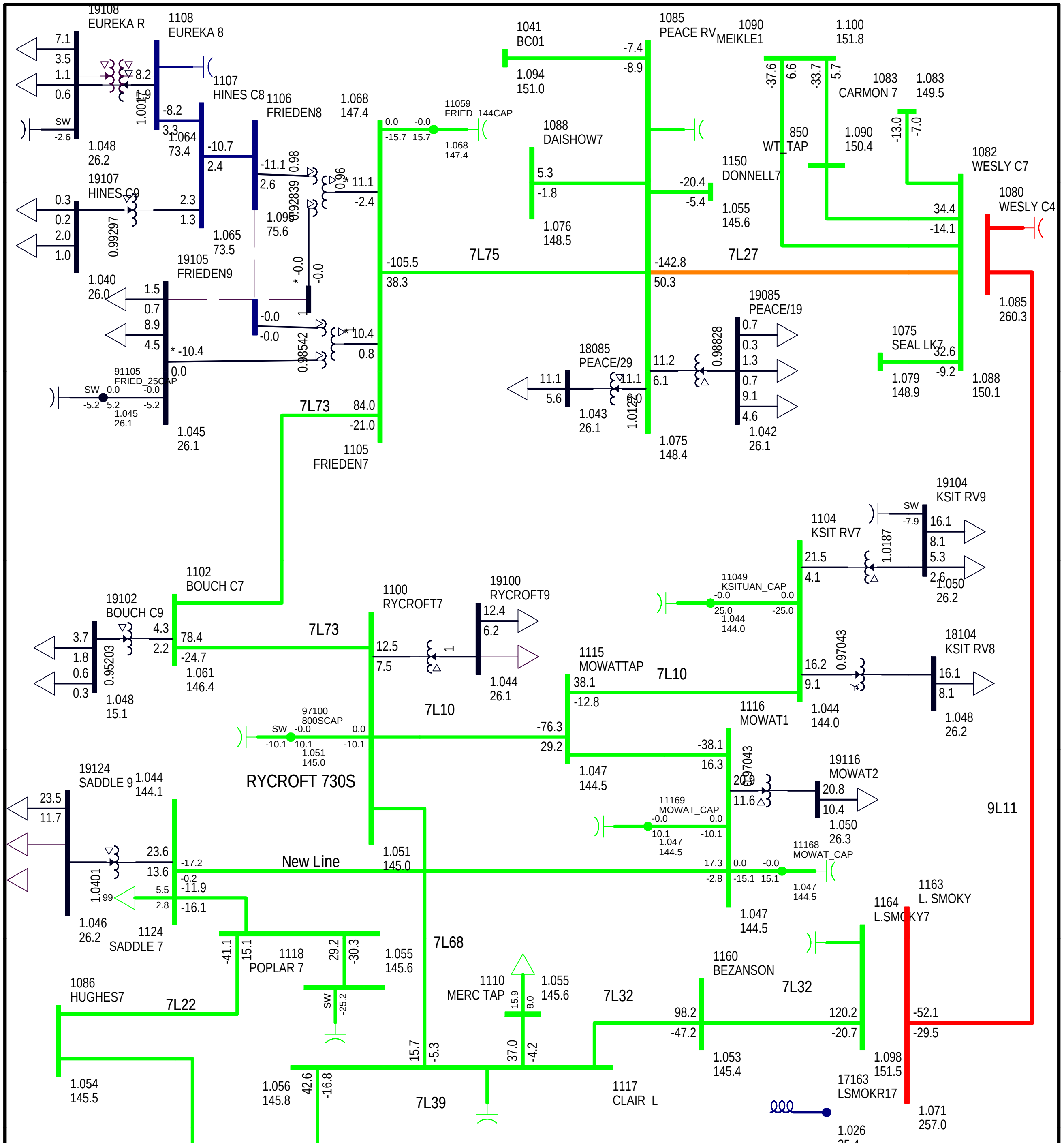
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3: SCENARIO 4 2036SP
7L10_OPT3 (N-1)
FIG B-188
THU, NOV 09 2017 14:30

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 28.5 MW

TOTAL FLOW INTO RYCROFT AREA: 35.6 MW



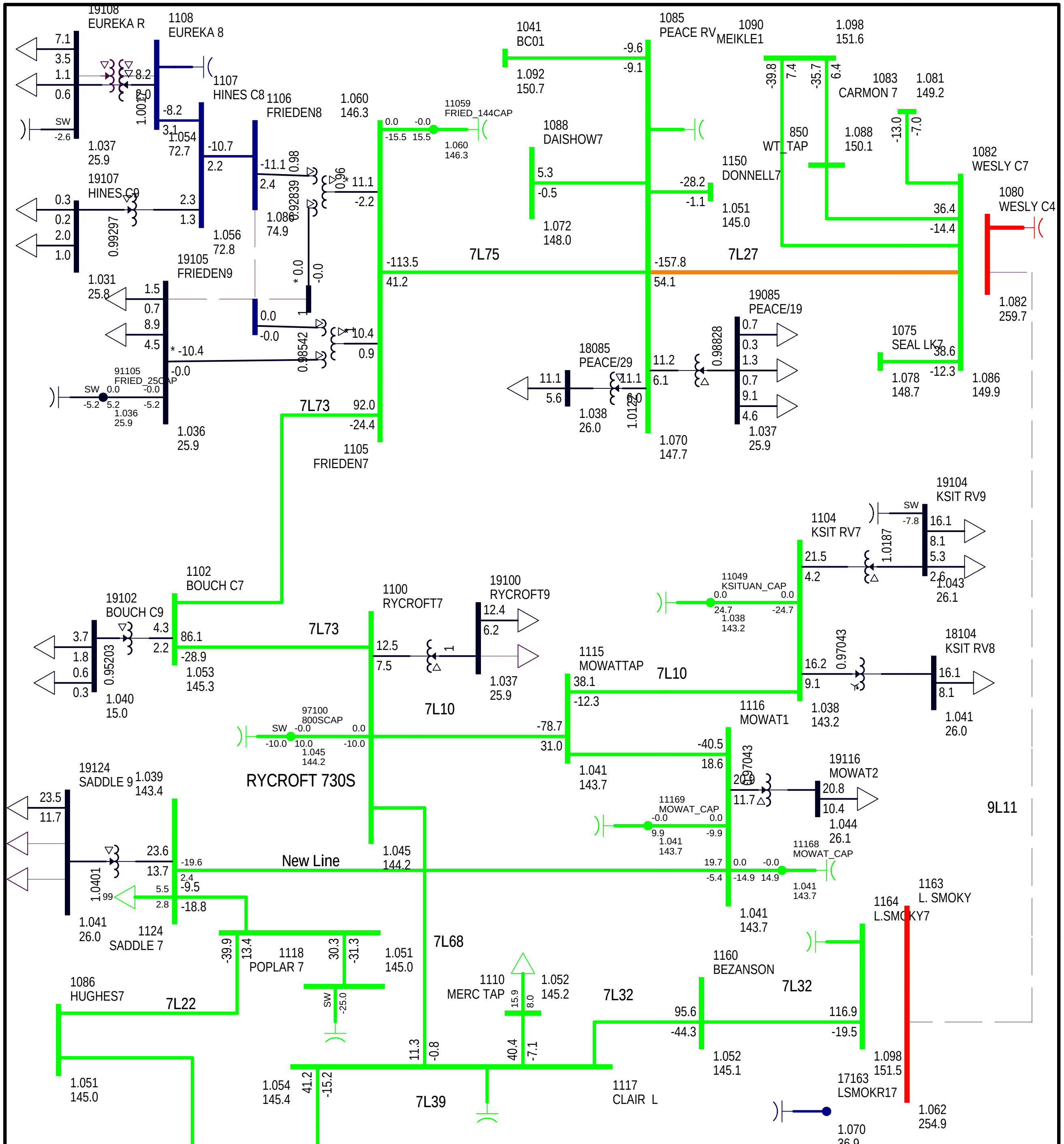
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
BASE CASE(N-0)
FIG B-189
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 128.1 MW



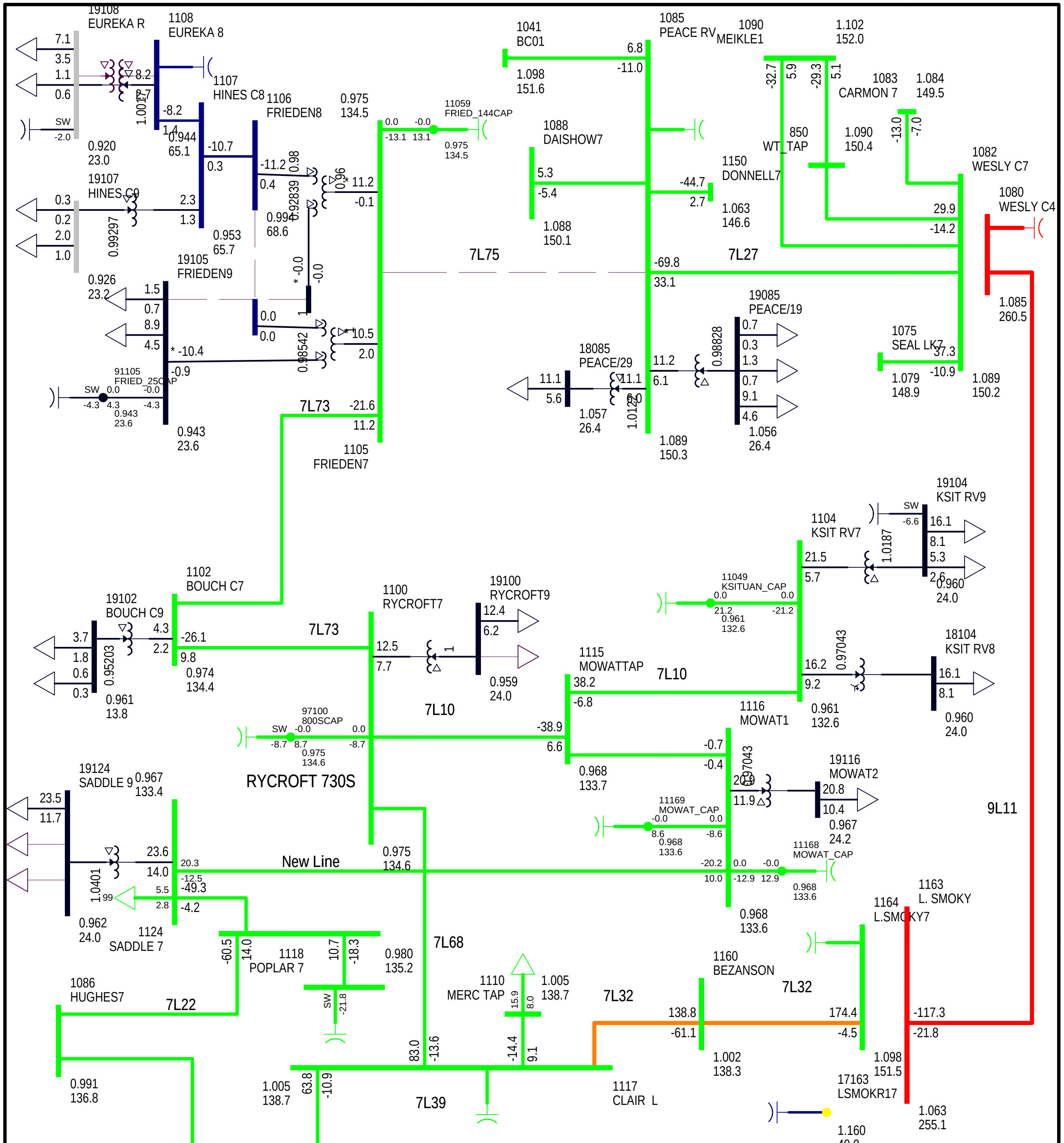
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
9L11 (N-1)
FIG B-190
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 133.0 MW



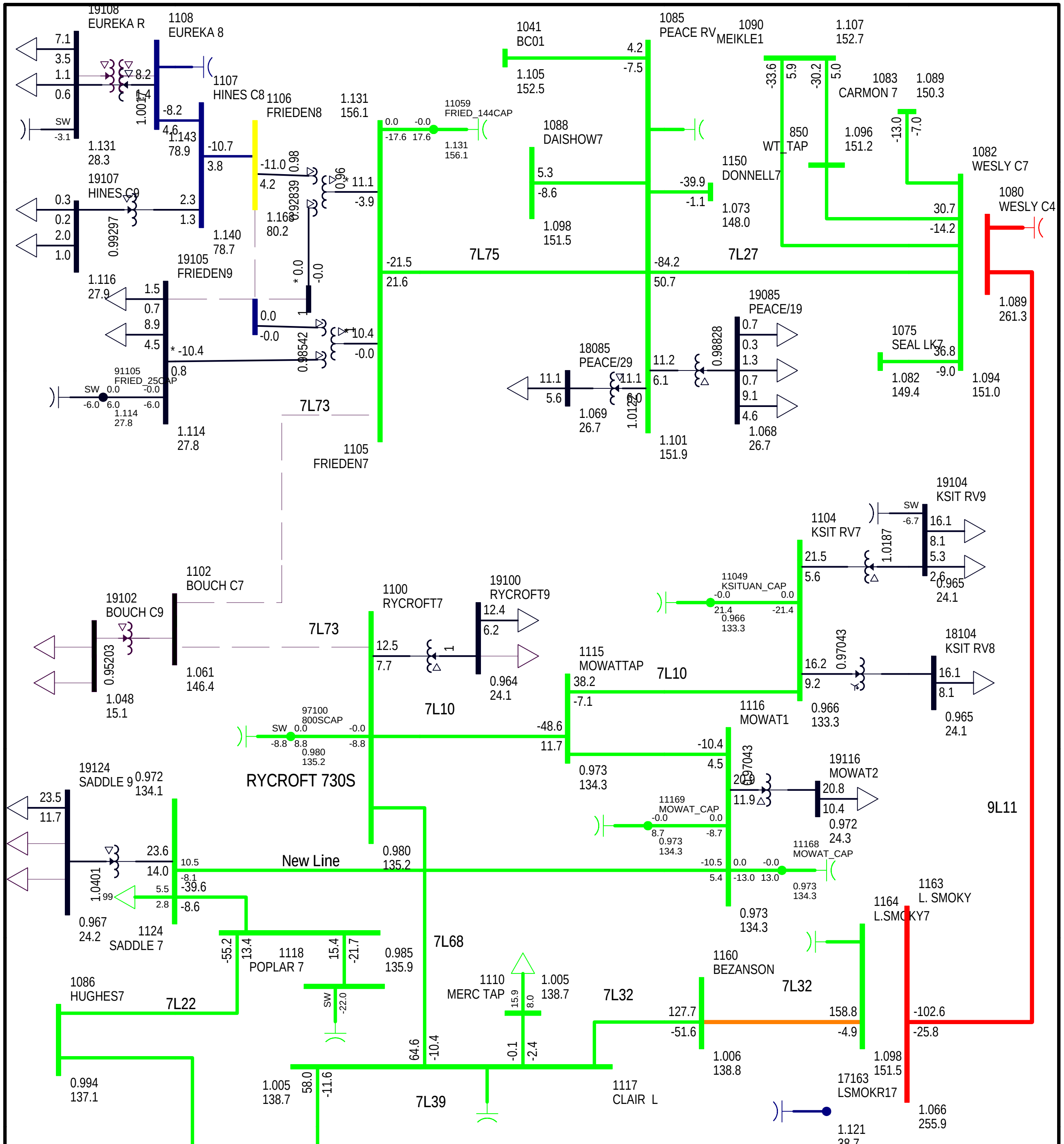
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L75 (N-1)
FIG B-191
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 83.0 MW



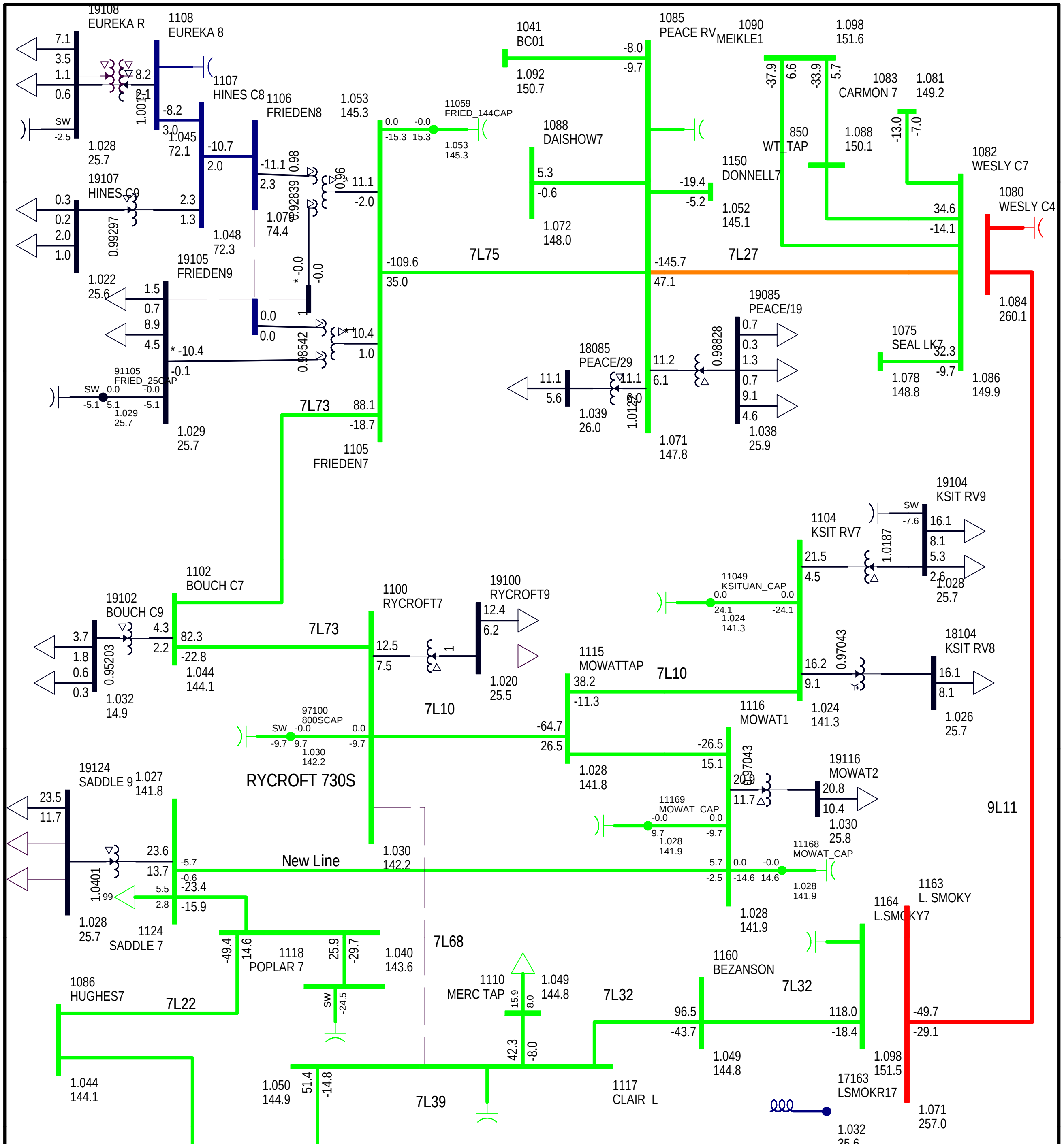
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L73 (N-1)
FIG B-192
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 91.7 MW

TOTAL FLOW INTO RYCROFT AREA: 86.6 MW



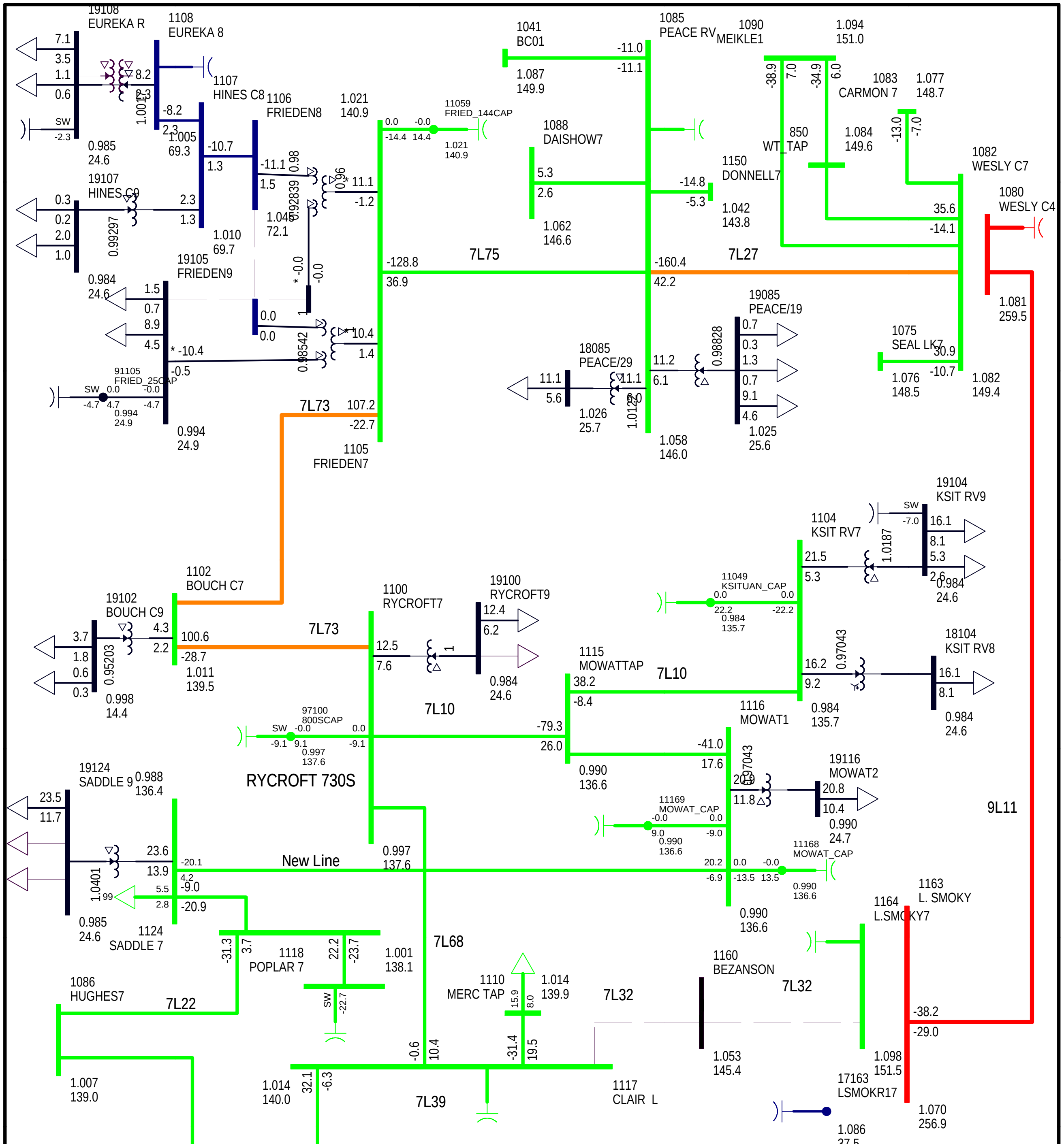
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L68 (N-1)
FIG B-193
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 117.1 MW



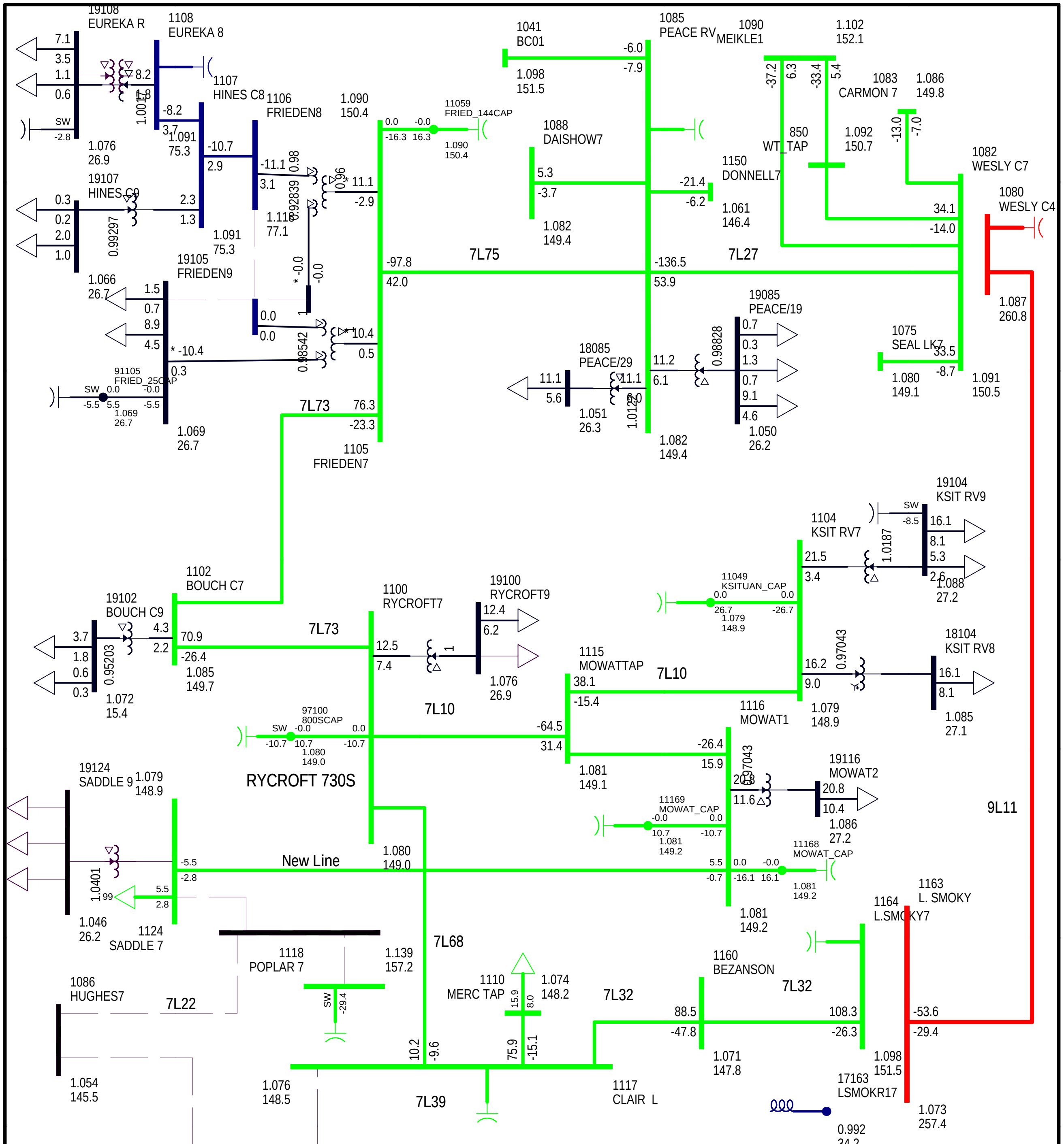
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L32 (N-1)
FIG B-194
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 138.9 MW



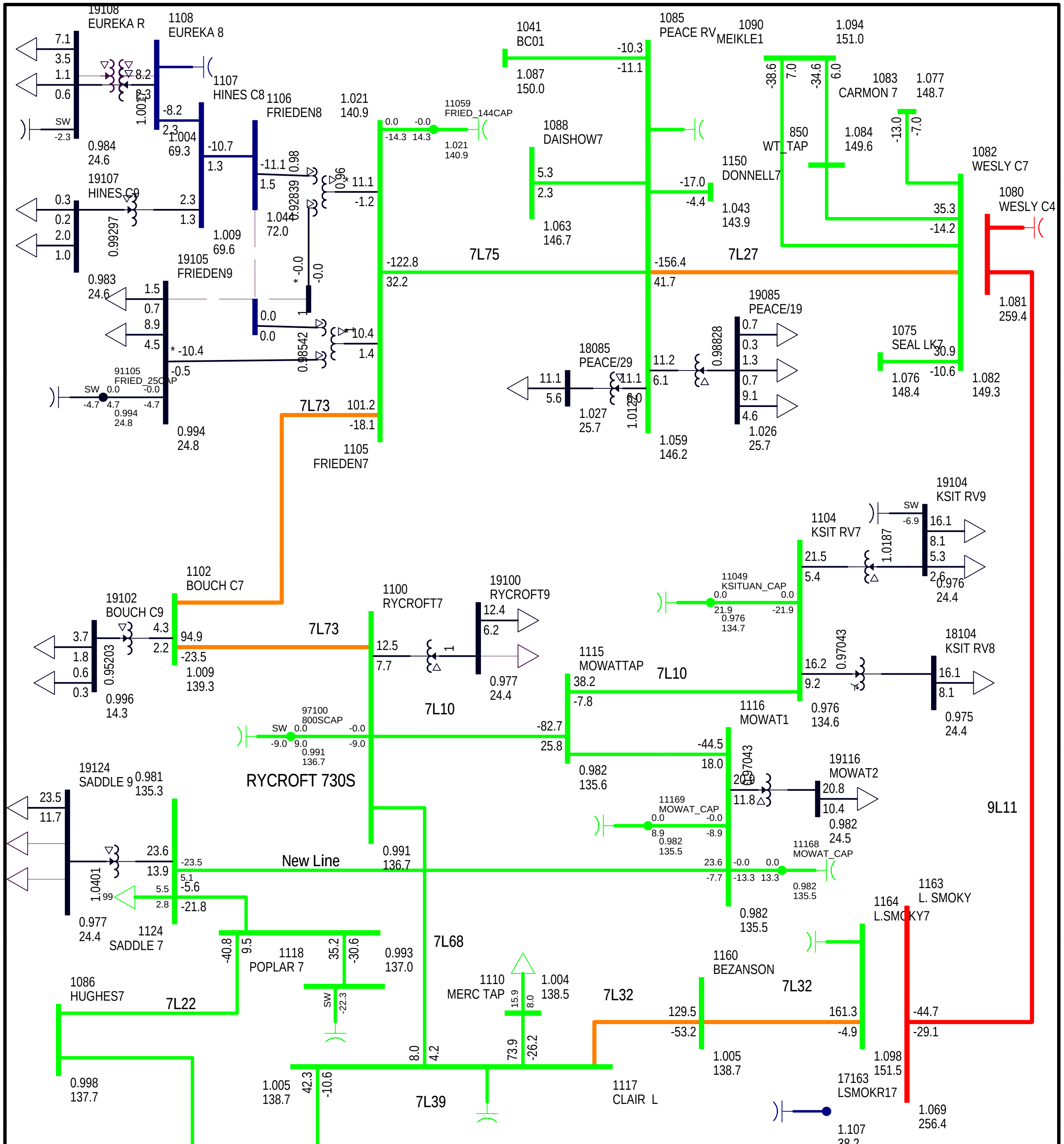
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L22 (N-1)
FIG B-195
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 114.0 MW



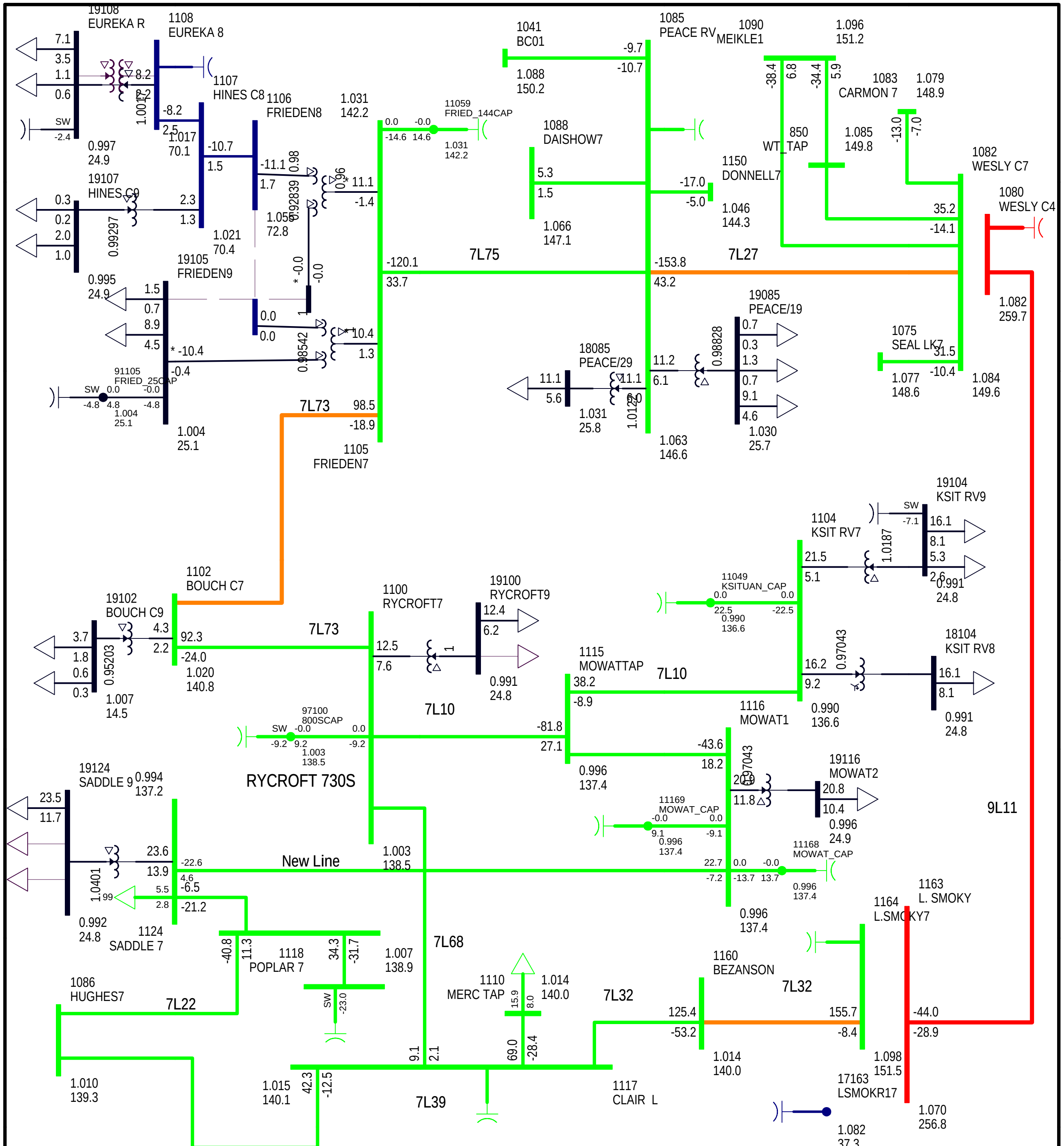
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L46 (N-1)
FIG B-196
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 140.4 MW



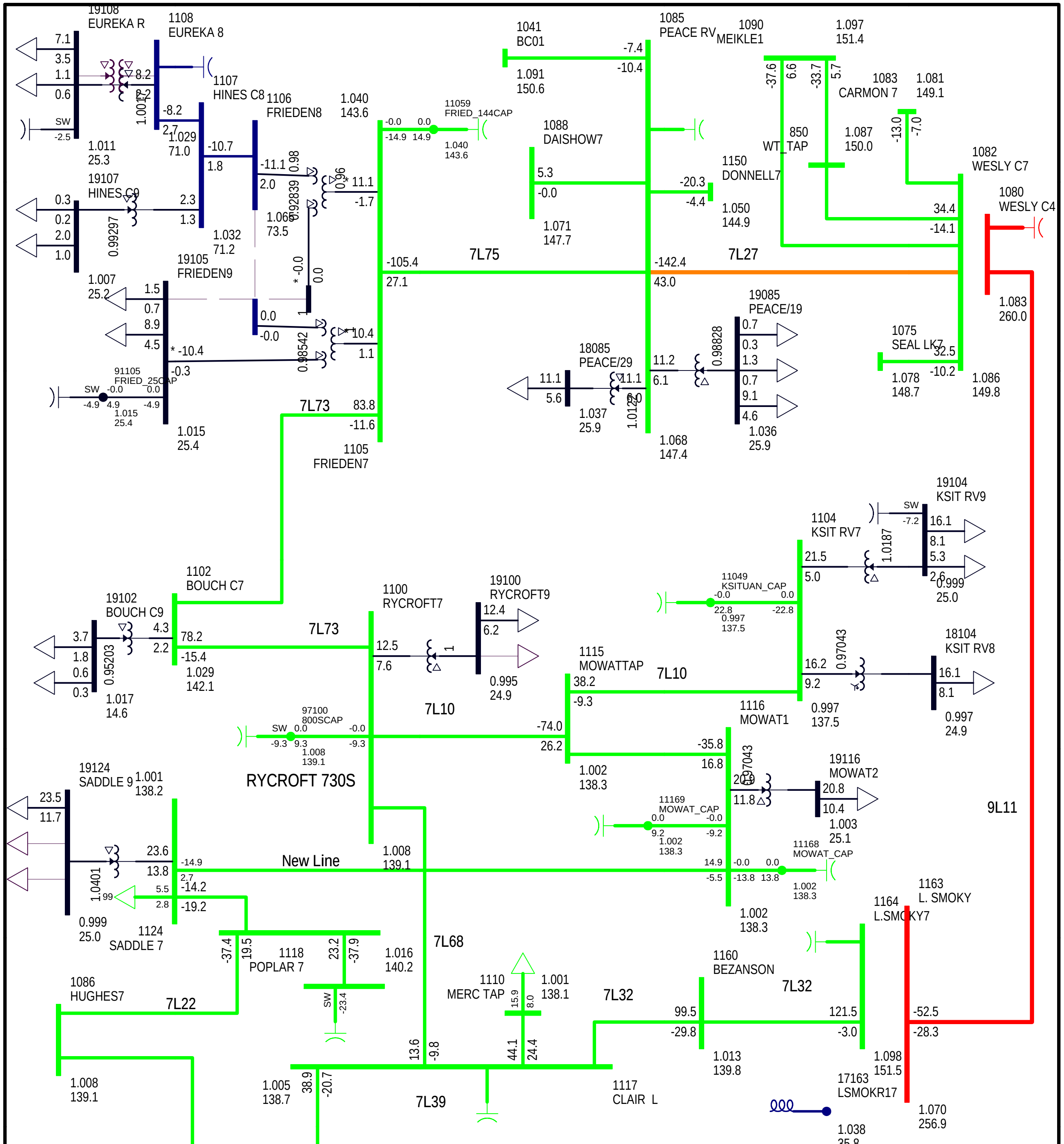
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L45 (N-1)
FIG B-197
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 138.4 MW



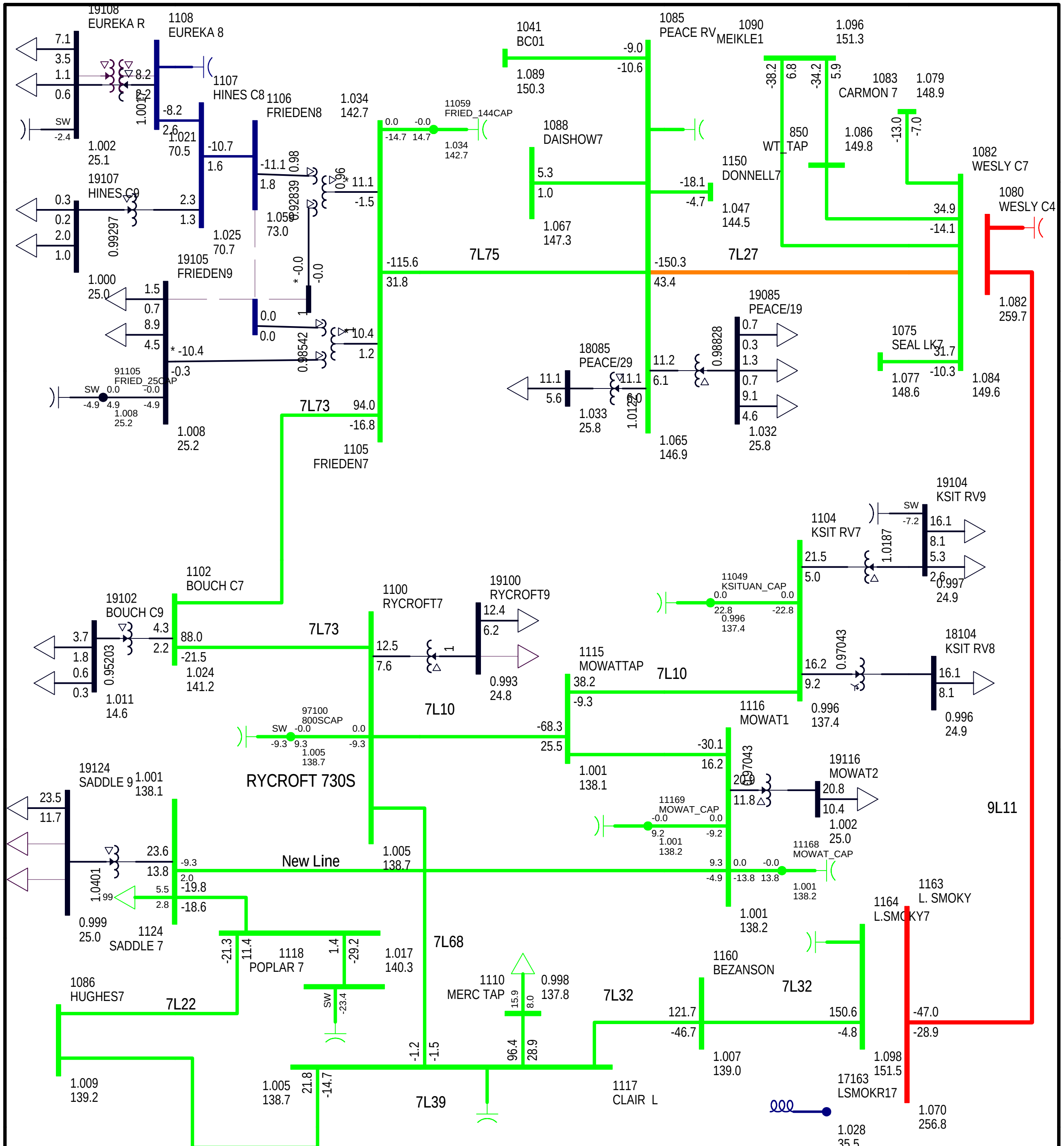
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L39 (N-1)
FIG B-198
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 125.8 MW



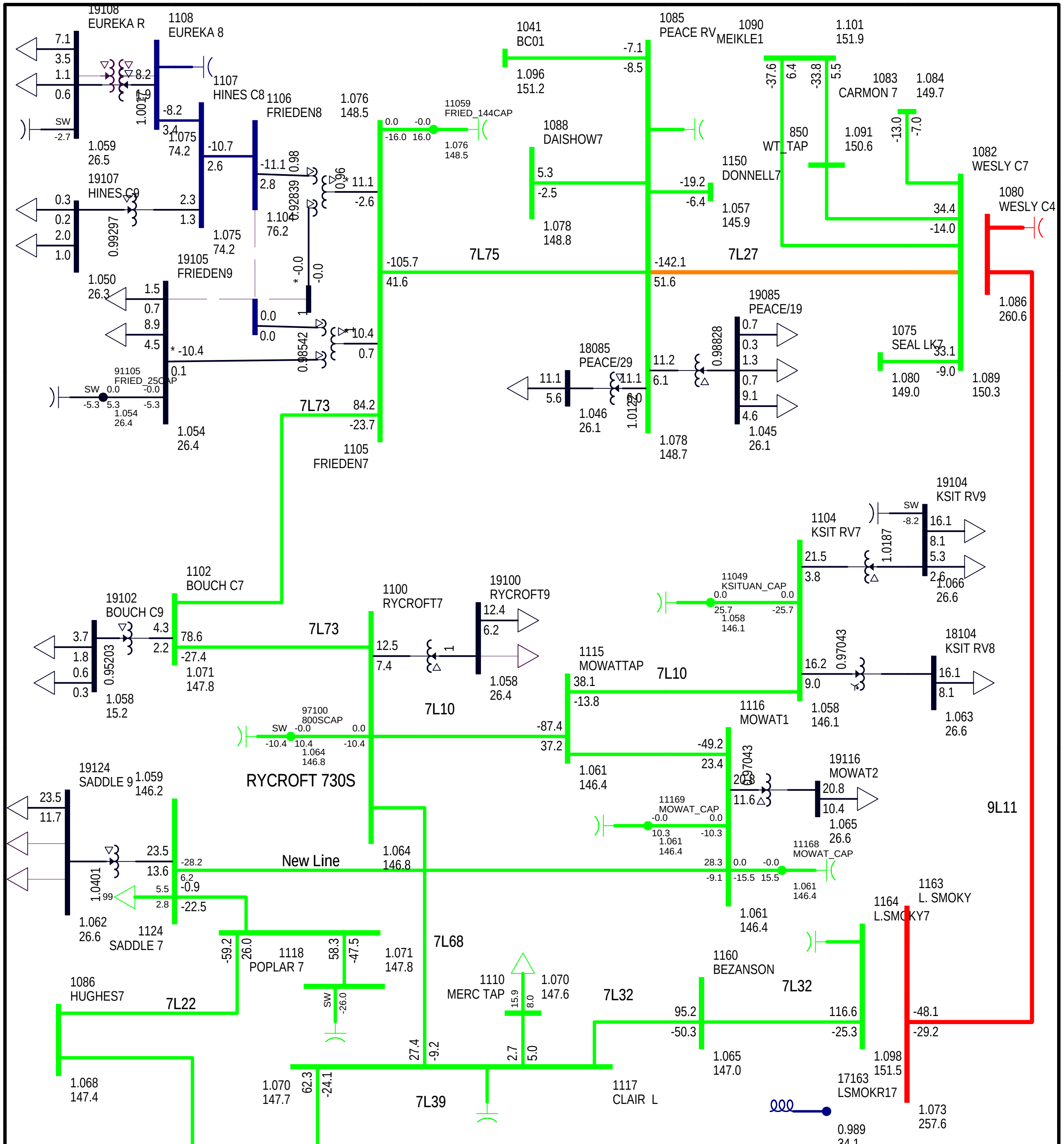
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L84 (N-1)
FIG B-199
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 122.8 MW



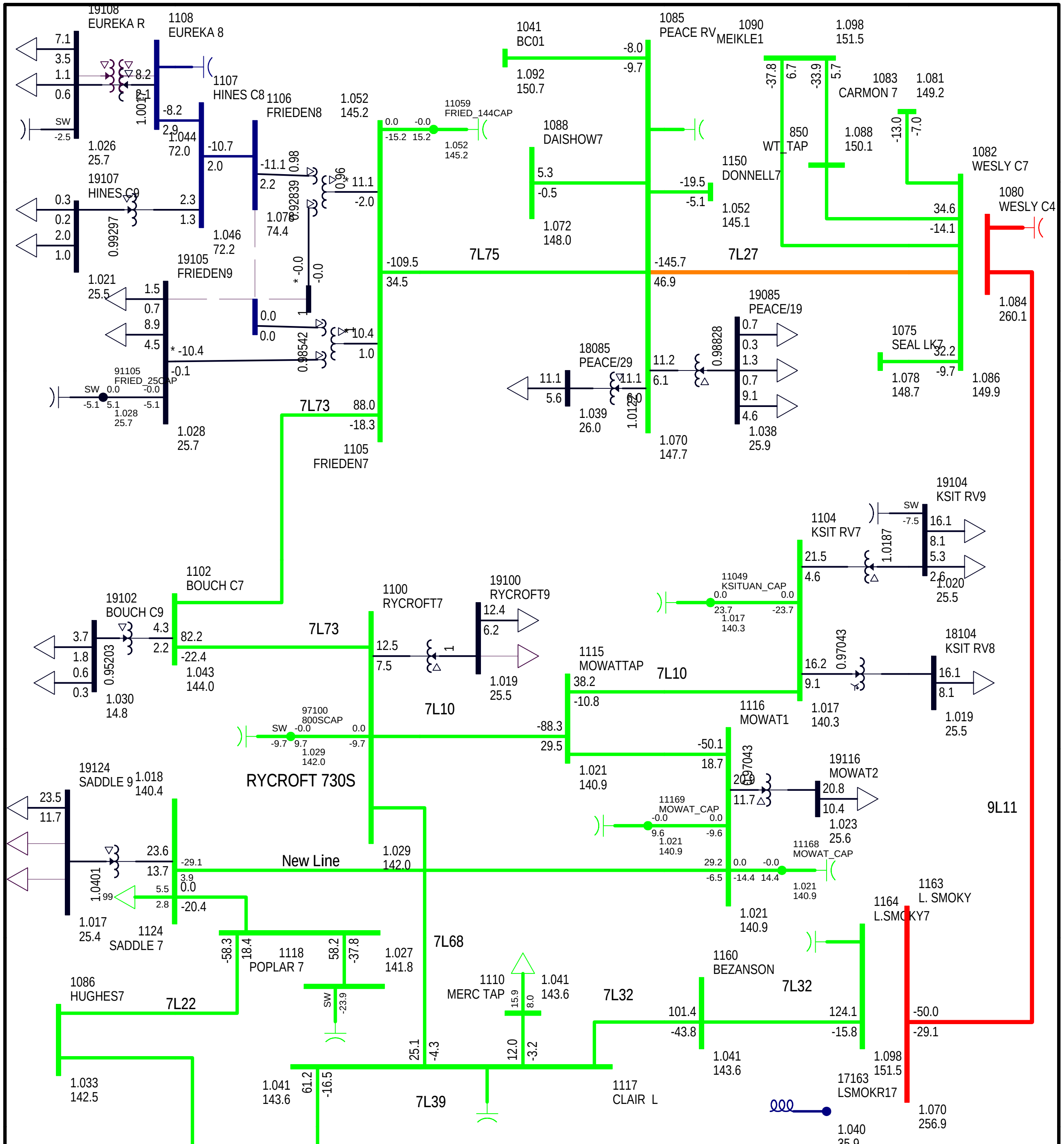
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L03 (N-1)
FIG B-200
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 140.2 MW



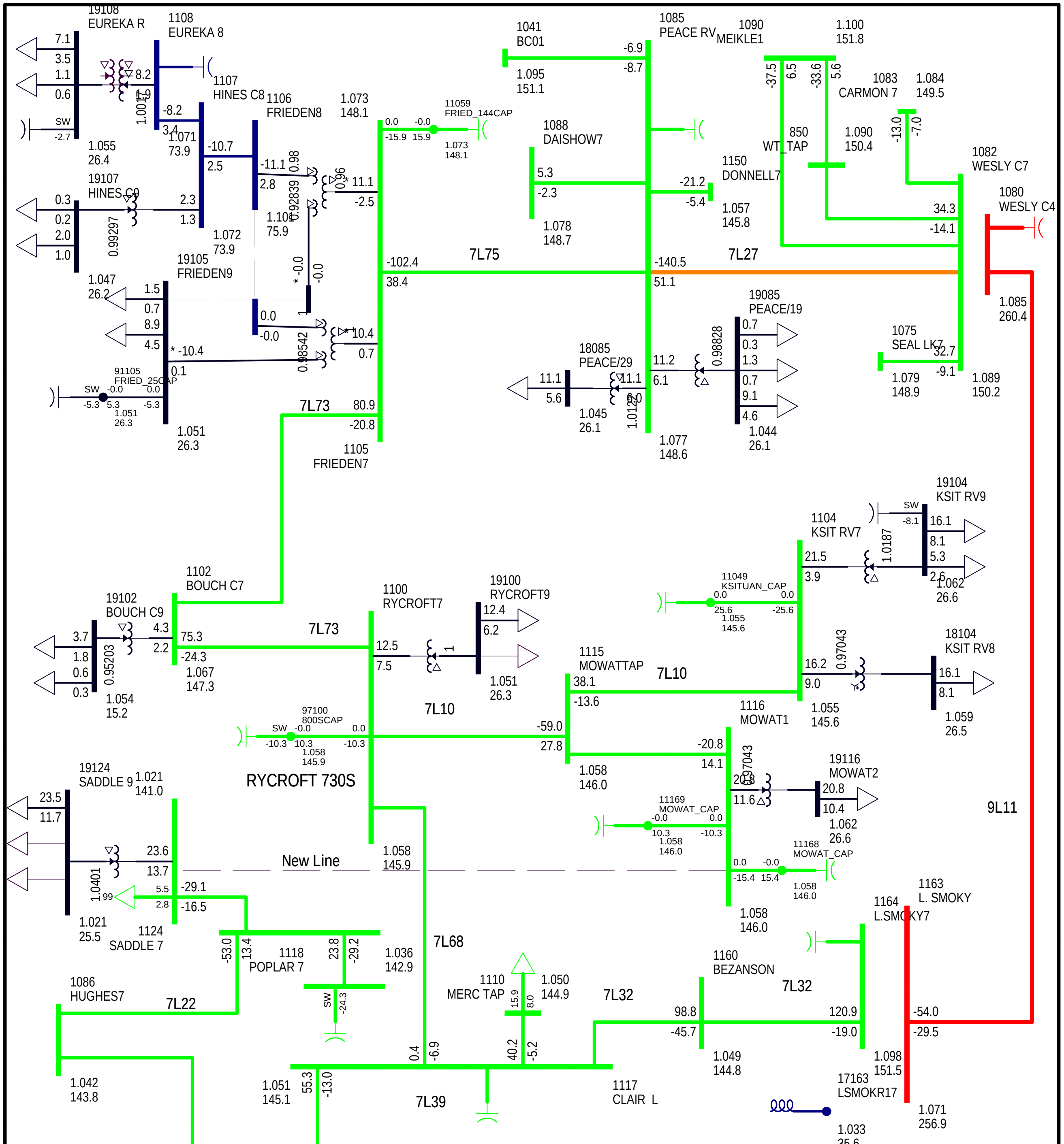
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L69 (N-1)
FIG B-201
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 142.1 MW



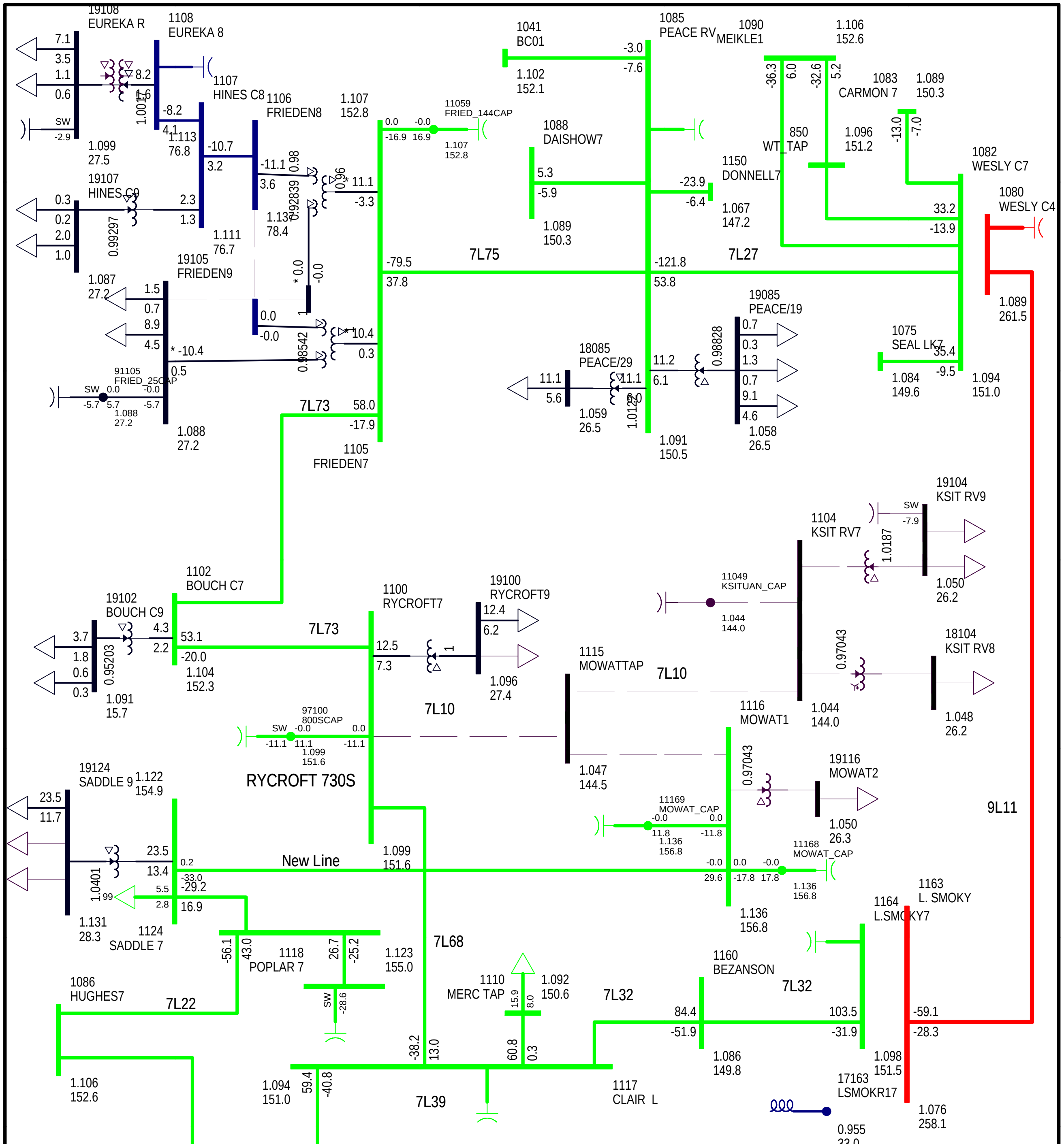
P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
NEWLINE_OPT3 (N-1)
FIG B-202
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 96.0 MW

TOTAL FLOW INTO RYCROFT AREA: 109.3 MW



P1784 Addition of Reactive Power Support at Rycroft 730S

PROJECT 1784 OPT3 SCENARIO 5 2036WP
7L10_OPT3 (N-1)
FIG B-203
THU, NOV 09 2017 14:32

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.150OV 0.942UV
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

TOTAL LOAD IN RYCROFT AREA: 37.6 MW

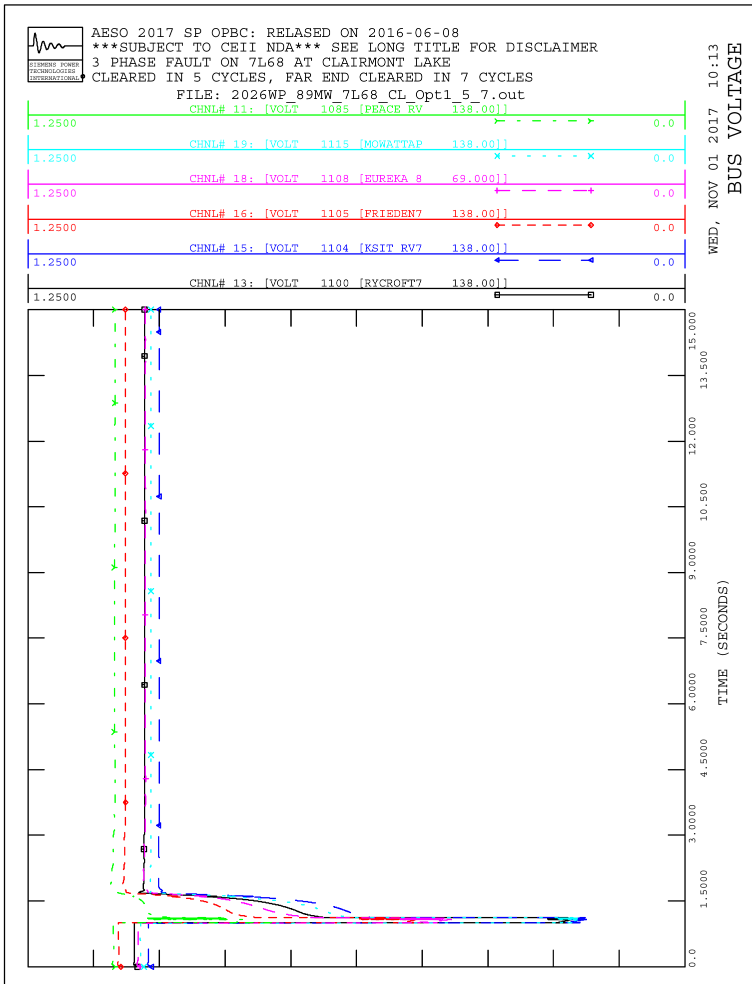
TOTAL FLOW INTO RYCROFT AREA: 45.4 MW

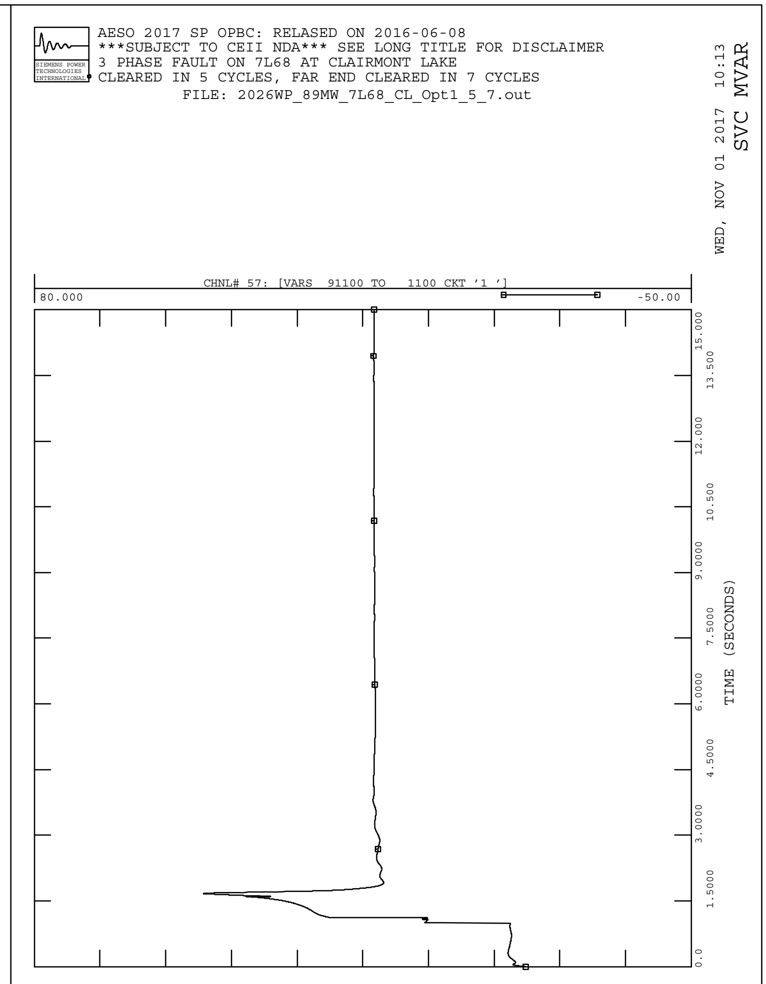
Attachment C: Voltage Recovery Results

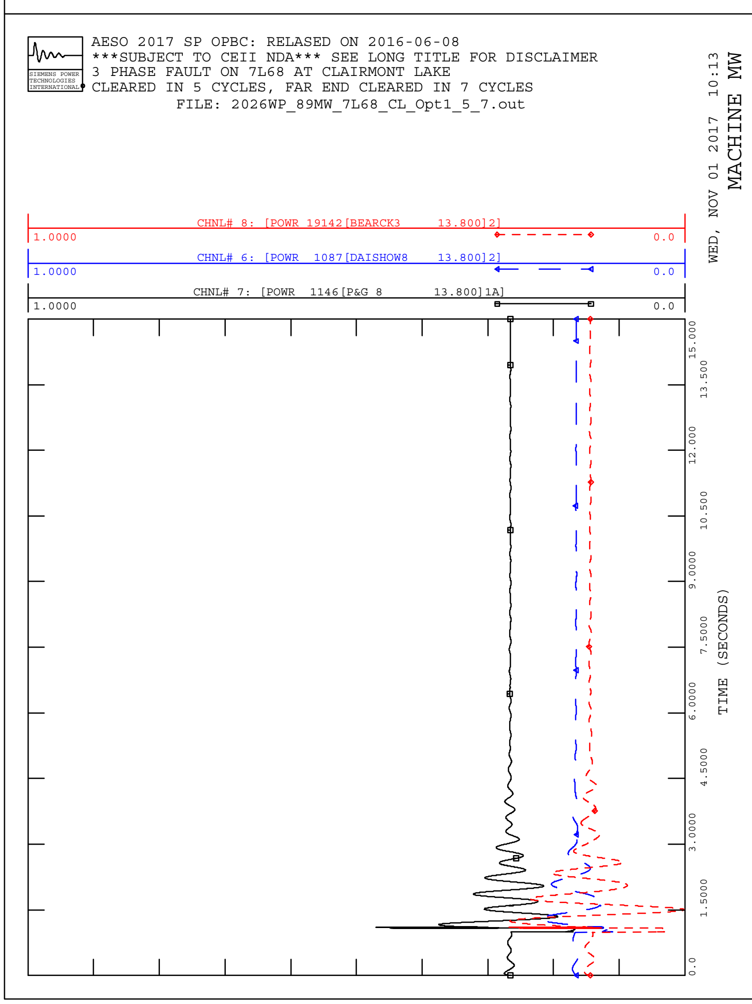
Dynamic Information tables

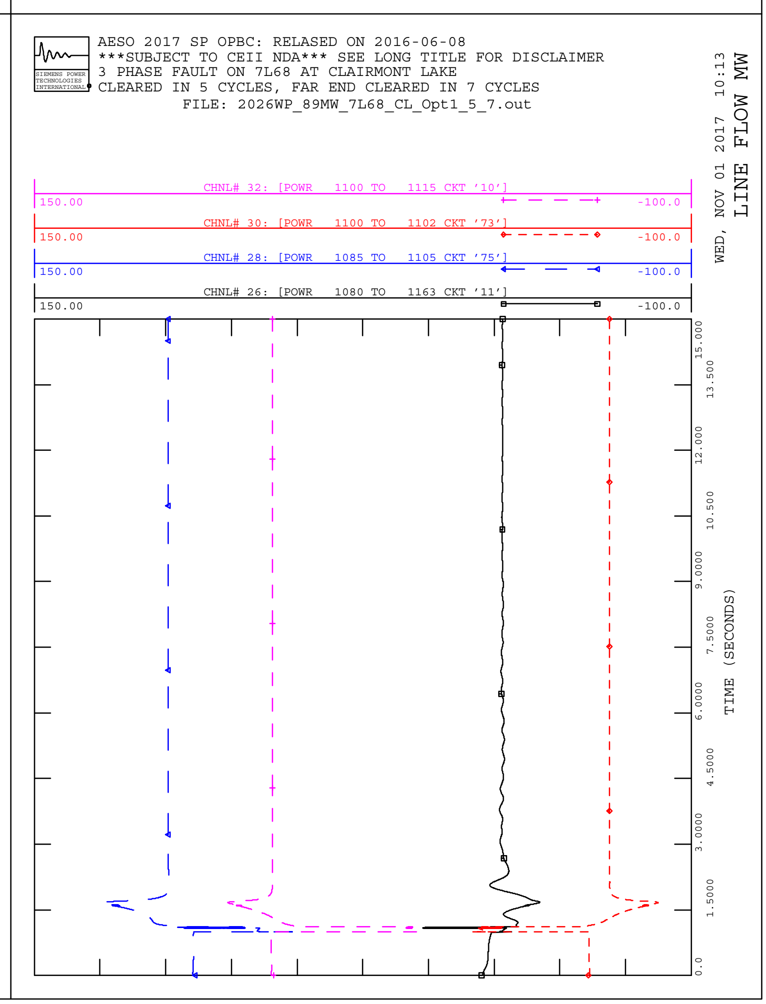
Table C-1. Rycroft SVC Model CSSCST: Control of Rycroft 144 kV bus (bus 1100)

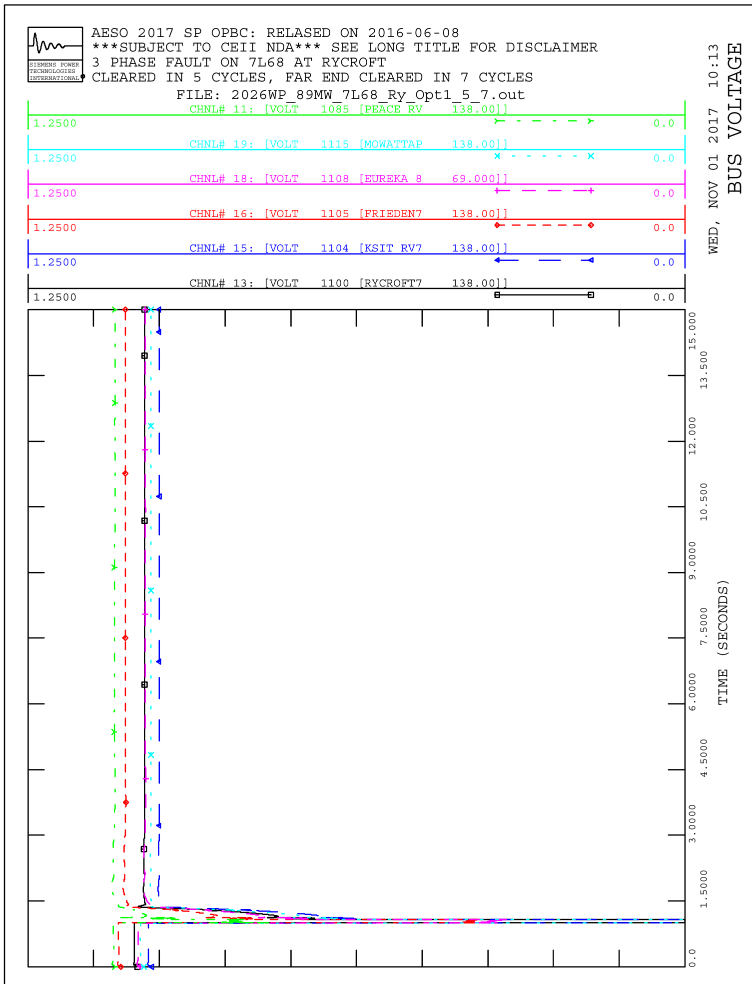
SVC Model for Switched Shunt								
K	T1 (sec)	T2 (sec)	T3 (>0) (sec)	T4 (sec)	T5 (sec)	Vmax, Mvars	Vmin, Mvars	Vov (override voltage) (pu)
1300	0.005	0.0	0.055	0.0	0.02	45.92	-45.92	0.15

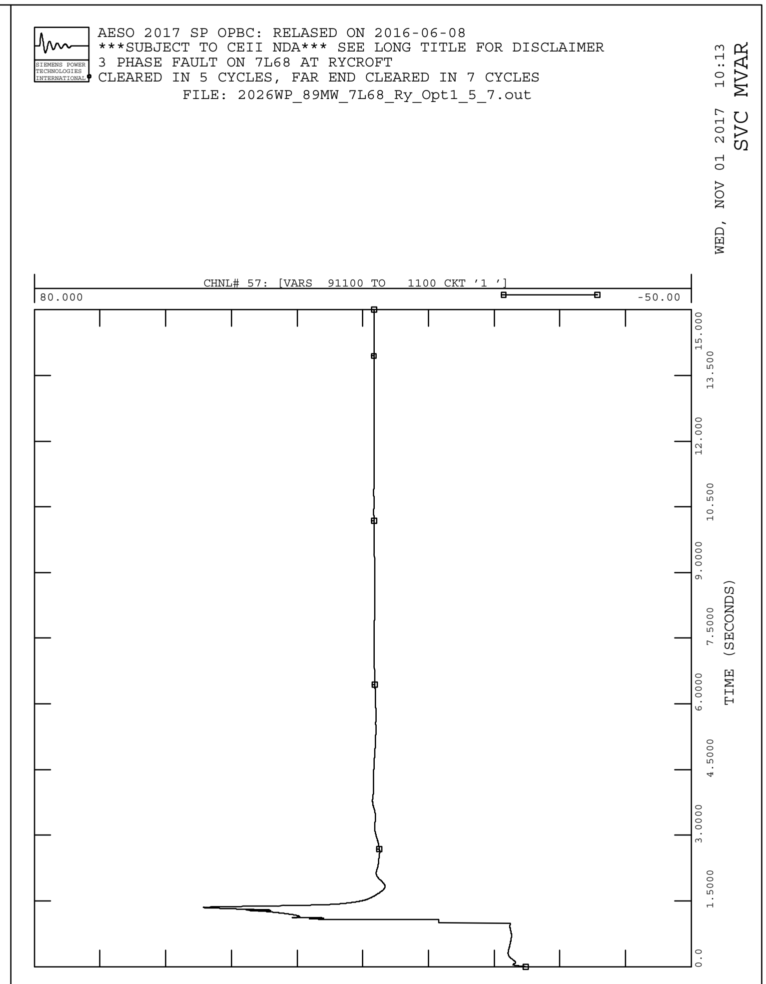

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_CL_Opt1_5_7.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500 0.0
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:13
BUS VOLTAGE

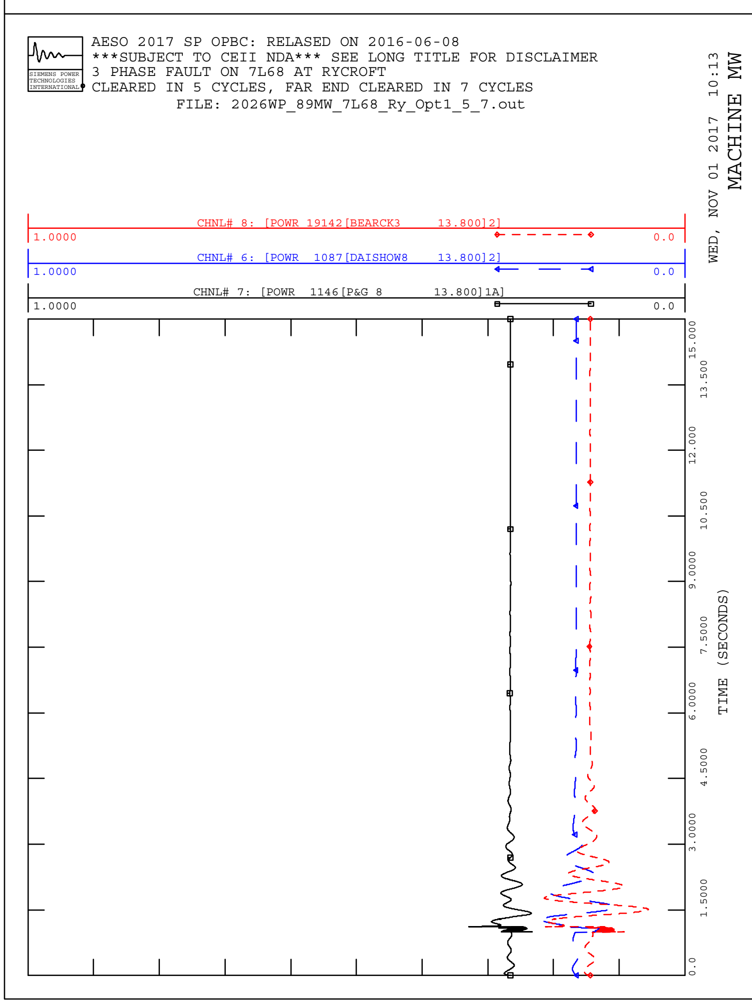

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_CL_Opt1_5_7.out
CHNL# 57: [VARS 91100 TO 1100 CKT '1 ']
80.000 -50.00
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:13
SVC MVAR

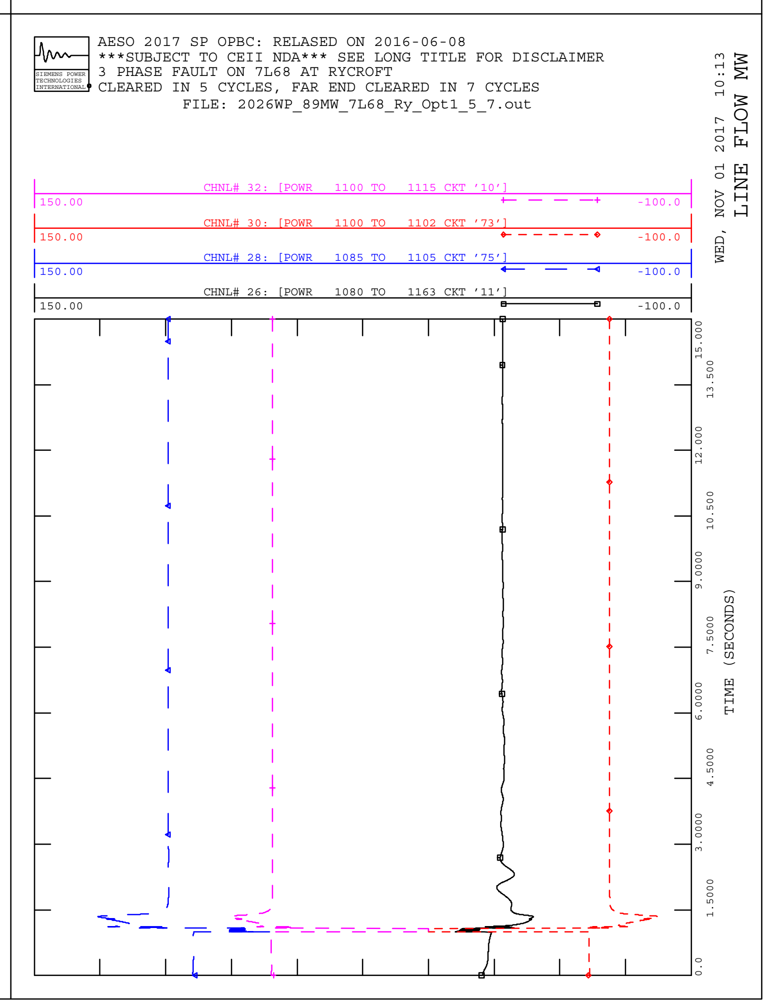

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_CL_Opt1_5_7.out
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000 0.0
CHNL# 6: [POWR 1087[DAISHOW8 13.800]2]
1.0000 0.0
CHNL# 7: [POWR 1146[P&G 8 13.800]1A]
1.0000 0.0
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:13
MACHINE MW

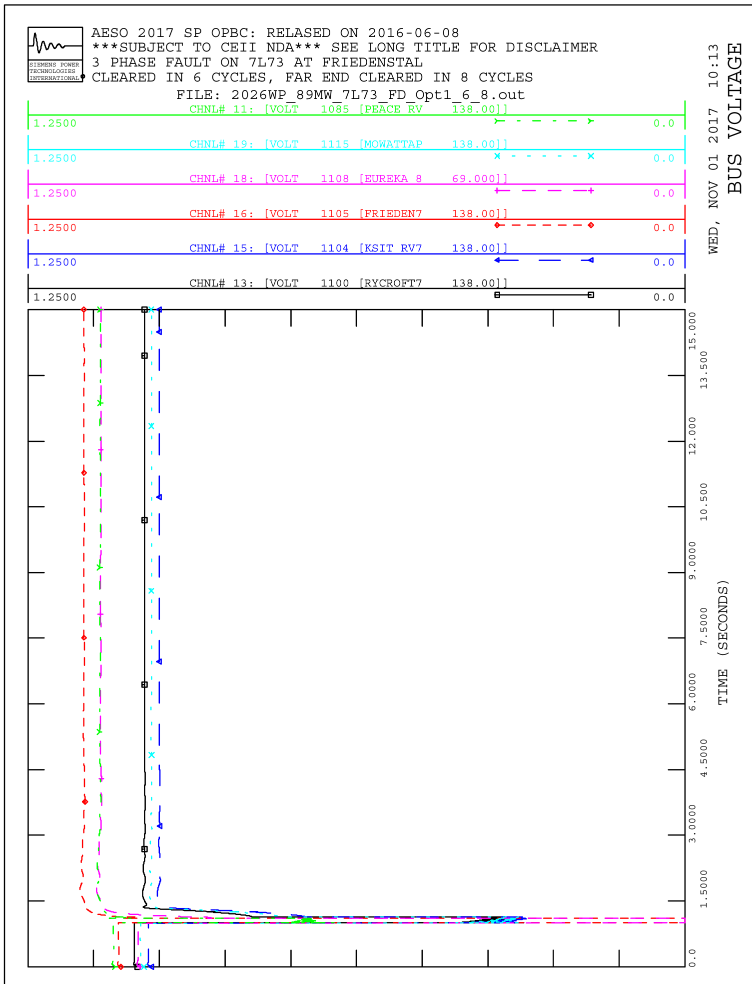

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_CL_Opt1_5_7.out
CHNL# 32: [POWR 1100 TO 1115 CKT '10']
150.00 -100.0
CHNL# 30: [POWR 1100 TO 1102 CKT '73']
150.00 -100.0
CHNL# 28: [POWR 1085 TO 1105 CKT '75']
150.00 -100.0
CHNL# 26: [POWR 1080 TO 1163 CKT '11']
150.00 -100.0
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:13
LINE FLOW MW

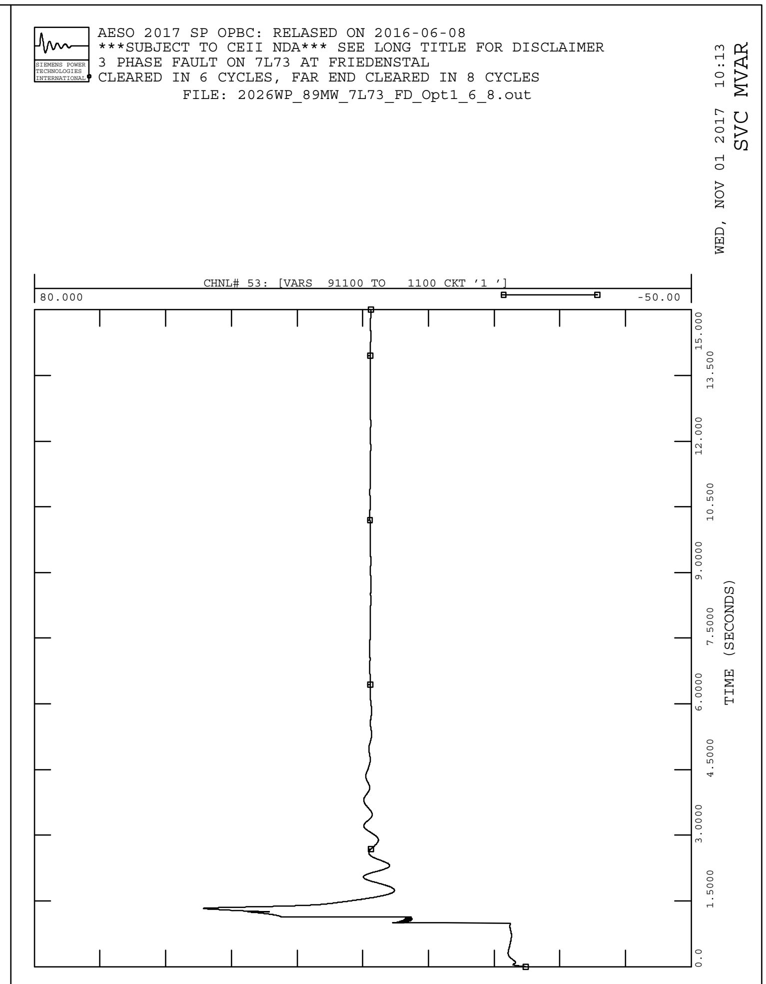

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_Ry_Opt1_5_7.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500
0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500
0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500
0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500
0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500
0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500
0.0
WED, NOV 01 2017 10:13
BUS VOLTAGE
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

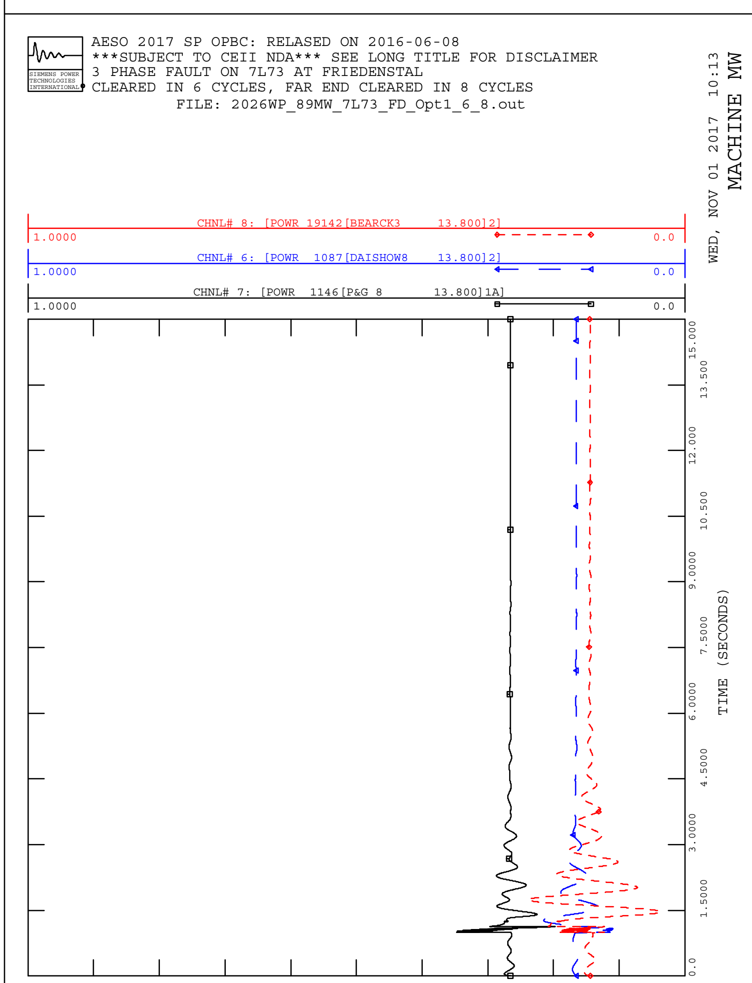

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_Ry_Opt1_5_7.out
CHNL# 57: [VARS 91100 TO 1100 CKT '1 ']
80.000
-50.00
WED, NOV 01 2017 10:13
SVC MVAR
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

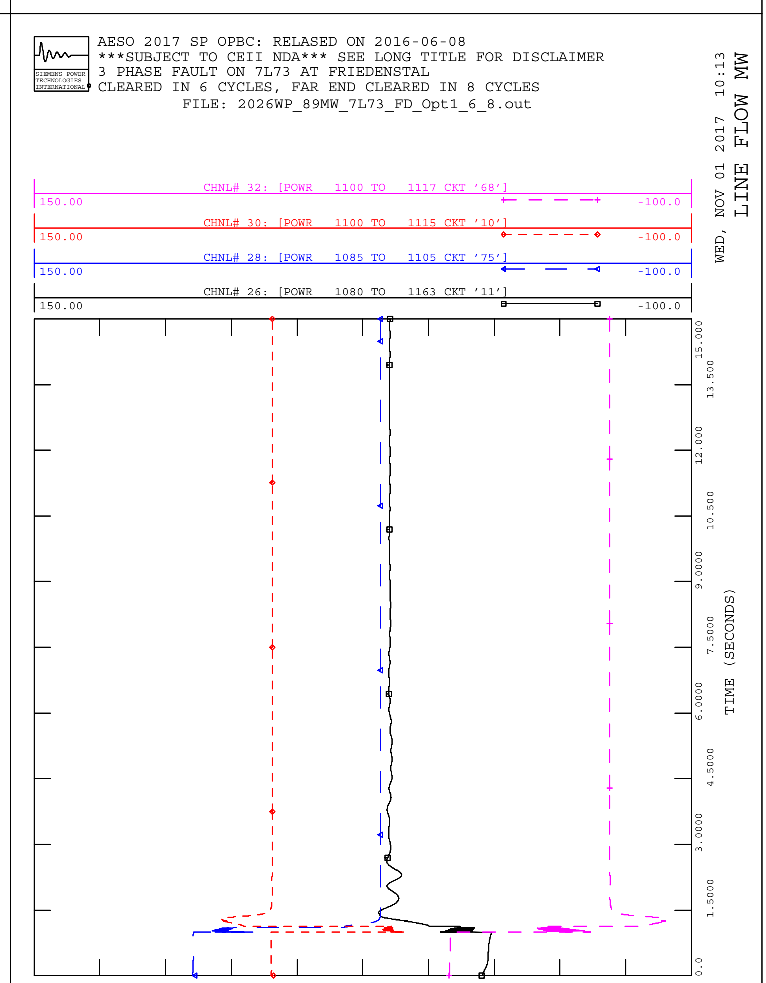

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_Ry_Opt1_5_7.out
CHNL# 8: [POWR 19142 [BEARCK3 13.800]2]
1.0000
0.0
CHNL# 6: [POWR 1087 [DAISHOW8 13.800]2]
1.0000
0.0
CHNL# 7: [POWR 1146 [P&G 8 13.800]1A]
1.0000
0.0
WED, NOV 01 2017 10:13
MACHINE MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2026WP_89MW_7L68_Ry_Opt1_5_7.out
CHNL# 32: [POWR 1100 TO 1115 CKT '10']
150.00
-100.0
CHNL# 30: [POWR 1100 TO 1102 CKT '73']
150.00
-100.0
CHNL# 28: [POWR 1085 TO 1105 CKT '75']
150.00
-100.0
CHNL# 26: [POWR 1080 TO 1163 CKT '11']
150.00
-100.0
WED, NOV 01 2017 10:13
LINE FLOW MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

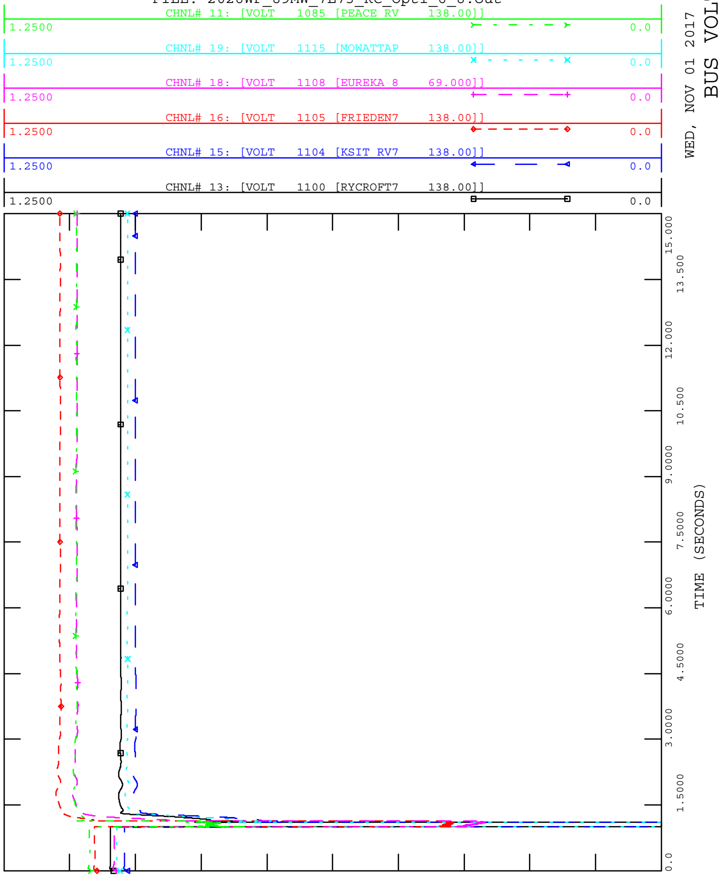

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_FD_Opt1_6_8.out
WED, NOV 01 2017 10:13
BUS VOLTAGE
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500 0.0
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_FD_Opt1_6_8.out
WED, NOV 01 2017 10:13
SVC MVAR
CHNL# 53: [VARS 91100 TO 1100 CKT '1 ']
80.000 -50.00
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

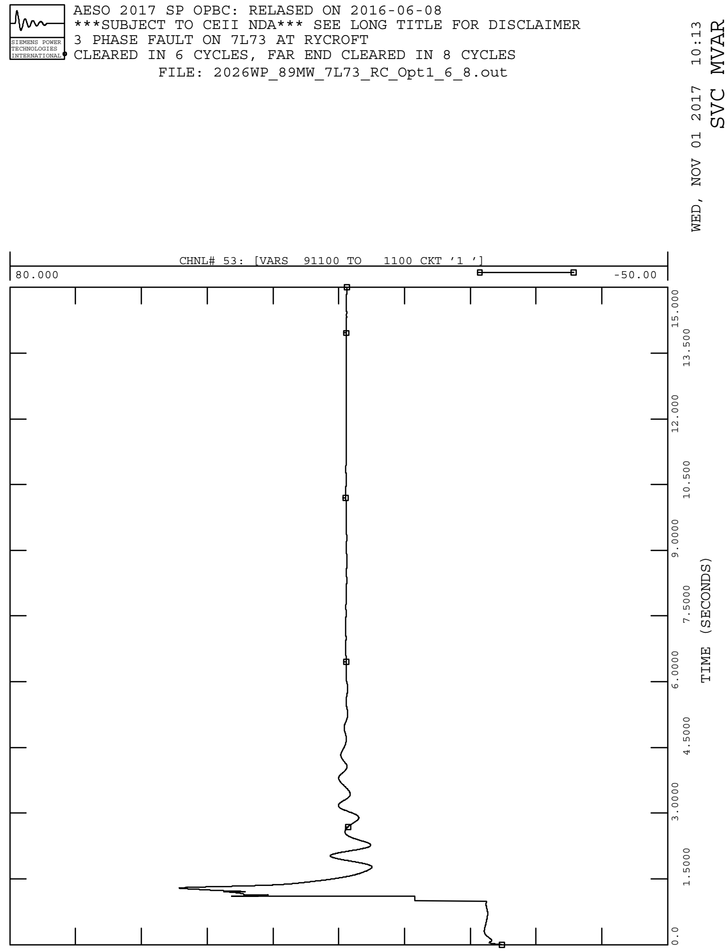

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_FD_Opt1_6_8.out
WED, NOV 01 2017 10:13
MACHINE MW
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000 0.0
CHNL# 6: [POWR 1087[DAISHOW8 13.800]2]
1.0000 0.0
CHNL# 7: [POWR 1146[P&G 8 13.800]1A]
1.0000 0.0
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_FD_Opt1_6_8.out
WED, NOV 01 2017 10:13
LINE FLOW MW
CHNL# 32: [POWR 1100 TO 1117 CKT '68']
150.00 -100.0
CHNL# 30: [POWR 1100 TO 1115 CKT '10']
150.00 -100.0
CHNL# 28: [POWR 1085 TO 1105 CKT '75']
150.00 -100.0
CHNL# 26: [POWR 1080 TO 1163 CKT '11']
150.00 -100.0
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

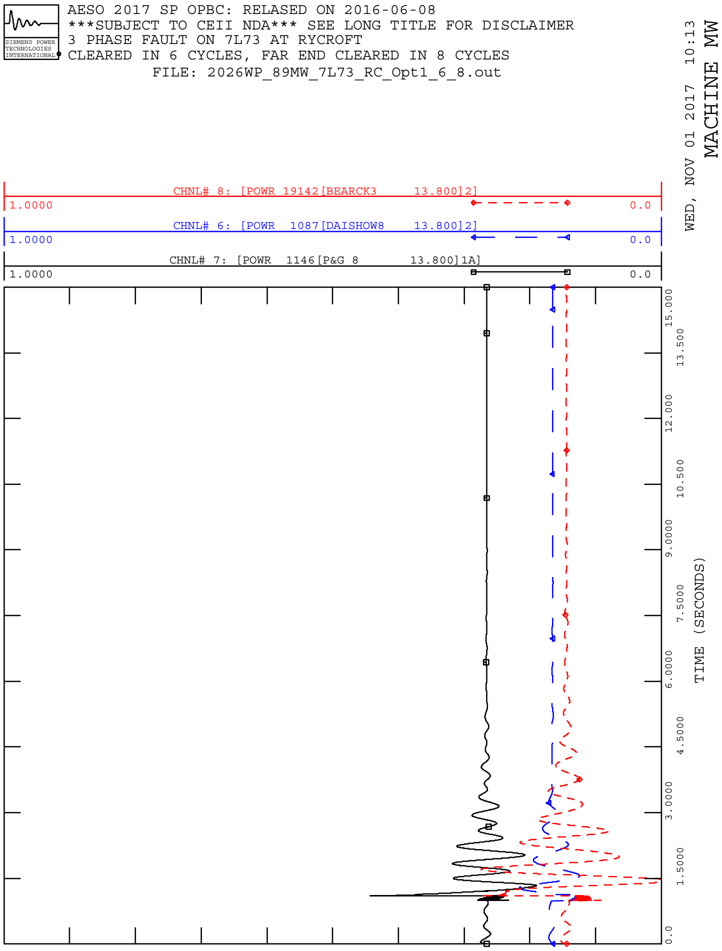
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_RC_Opt1_6_8.out



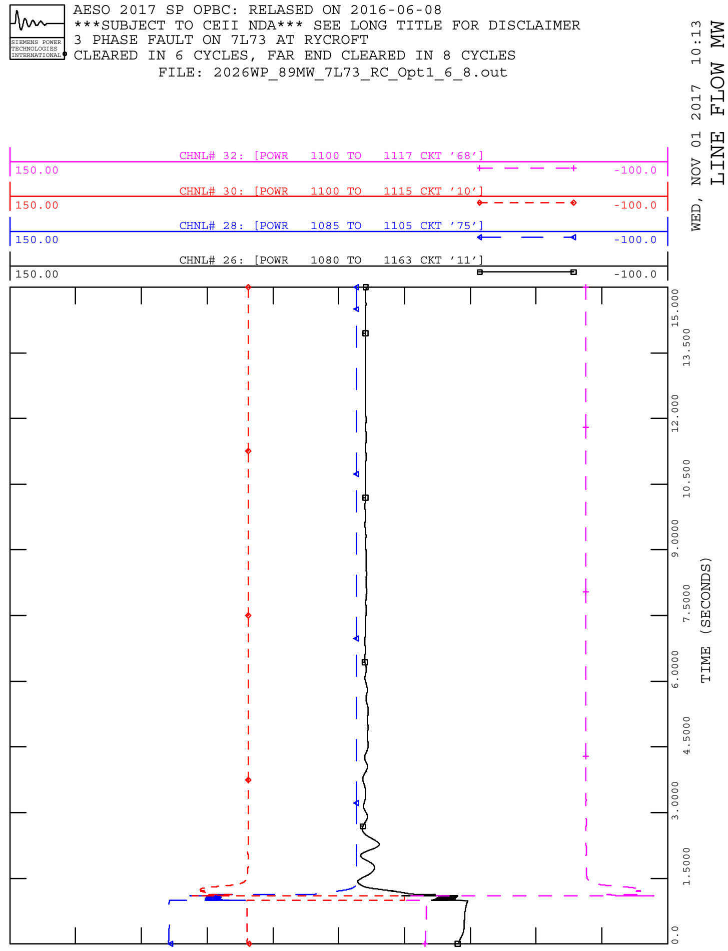
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_RC_Opt1_6_8.out

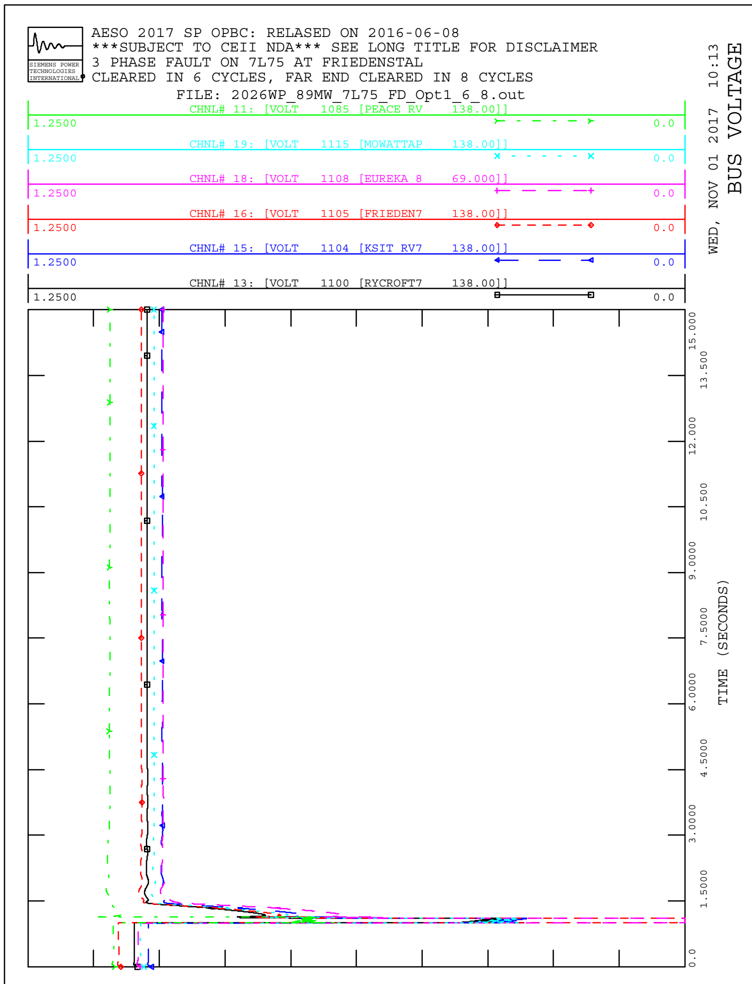


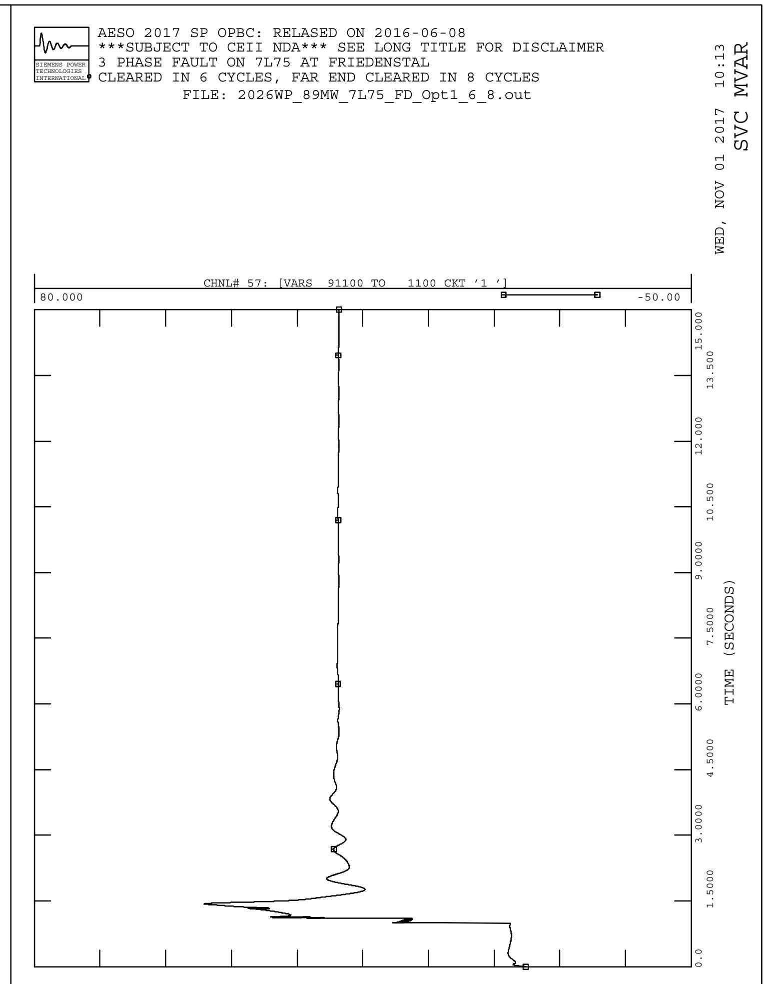
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_RC_Opt1_6_8.out

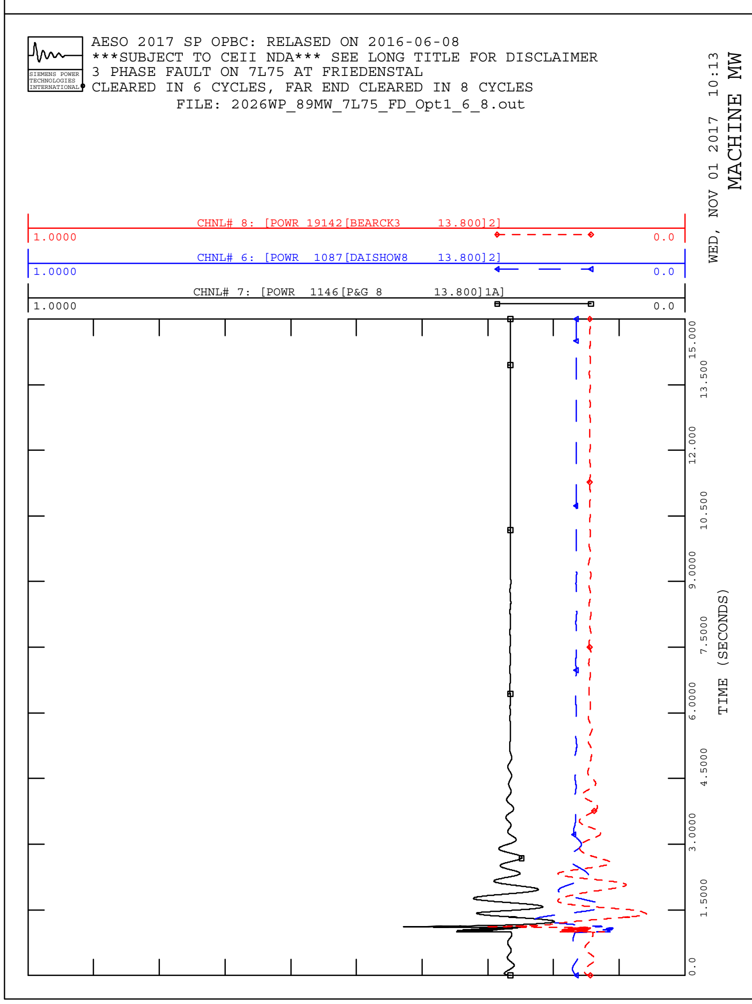


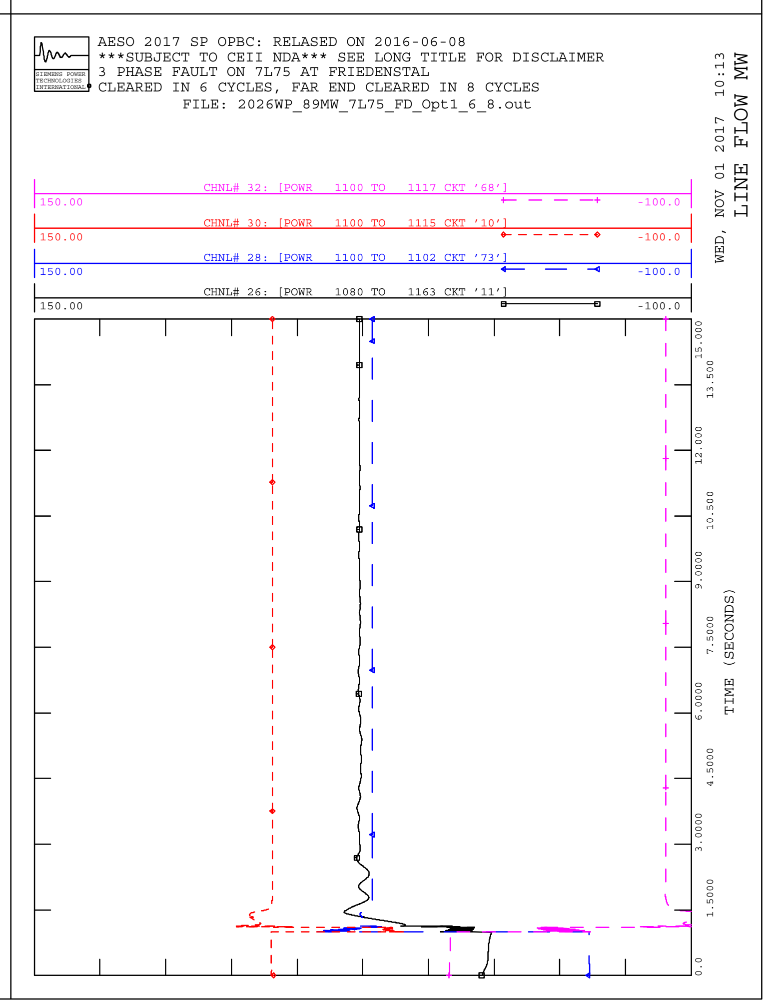
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L73_RC_Opt1_6_8.out




AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_FD_Opt1_6_8.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]] 1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]] 1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]] 1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]] 1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]] 1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]] 1.2500 0.0
WED, NOV 01 2017 10:13
BUS VOLTAGE
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

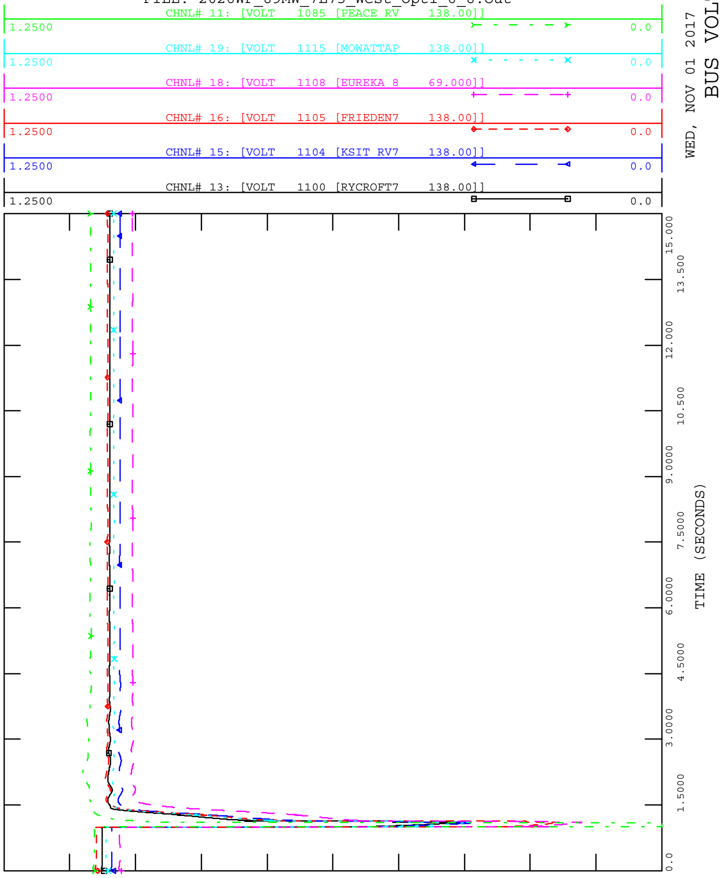

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_FD_Opt1_6_8.out
CHNL# 57: [VARS 91100 TO 1100 CKT '1 '] 80.000 -50.00
WED, NOV 01 2017 10:13
SVC MVAR
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_FD_Opt1_6_8.out
CHNL# 8: [POWR 19142 [BEARCK3 13.800]2] 1.0000 0.0
CHNL# 6: [POWR 1087 [DAISHOW8 13.800]2] 1.0000 0.0
CHNL# 7: [POWR 1146 [P&G 8 13.800]1A] 1.0000 0.0
WED, NOV 01 2017 10:13
MACHINE MW
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_FD_Opt1_6_8.out
CHNL# 32: [POWR 1100 TO 1117 CKT '68'] 150.00 -100.0
CHNL# 30: [POWR 1100 TO 1115 CKT '10'] 150.00 -100.0
CHNL# 28: [POWR 1100 TO 1102 CKT '73'] 150.00 -100.0
CHNL# 26: [POWR 1080 TO 1163 CKT '11'] 150.00 -100.0
WED, NOV 01 2017 10:13
LINE FLOW MW
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

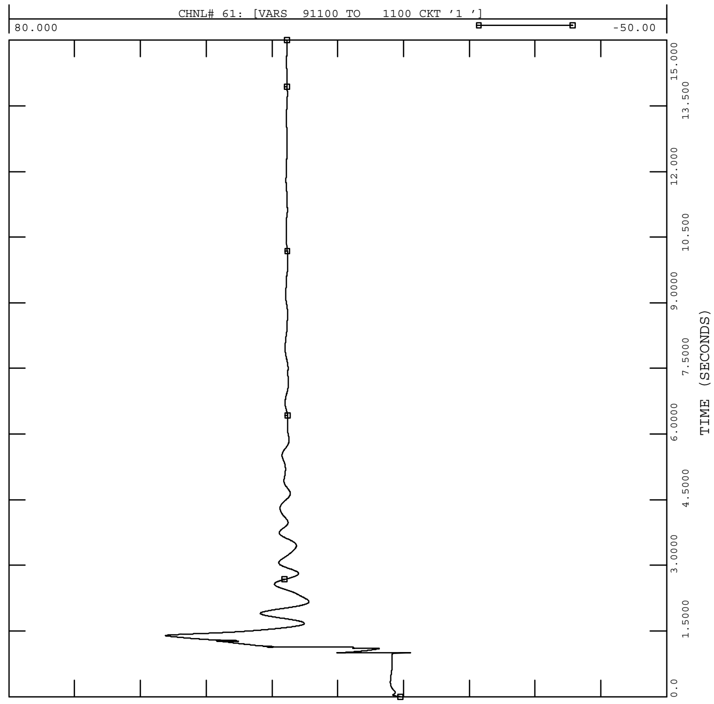
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_West_Opt1_6_8.out

WED, NOV 01 2017 10:47
BUS VOLTAGE



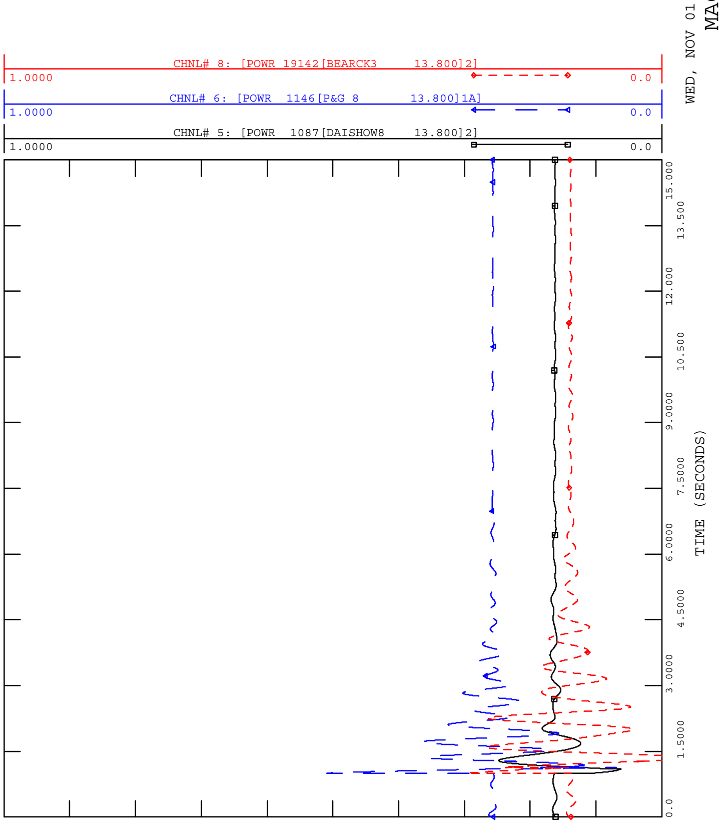
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_West_Opt1_6_8.out

WED, NOV 01 2017 10:47
SVC MVAR



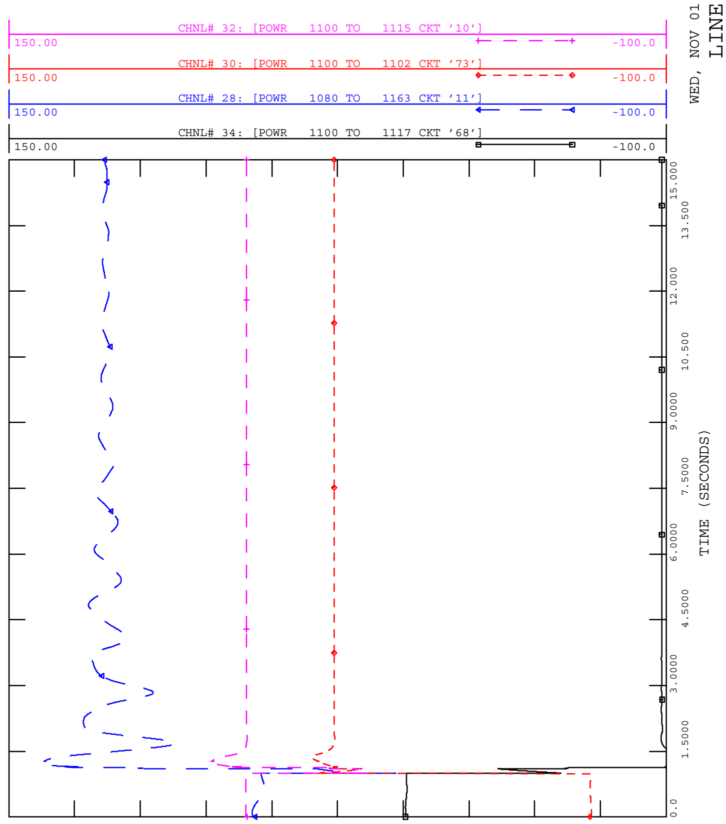
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_West_Opt1_6_8.out

WED, NOV 01 2017 10:47
MACHINE MW



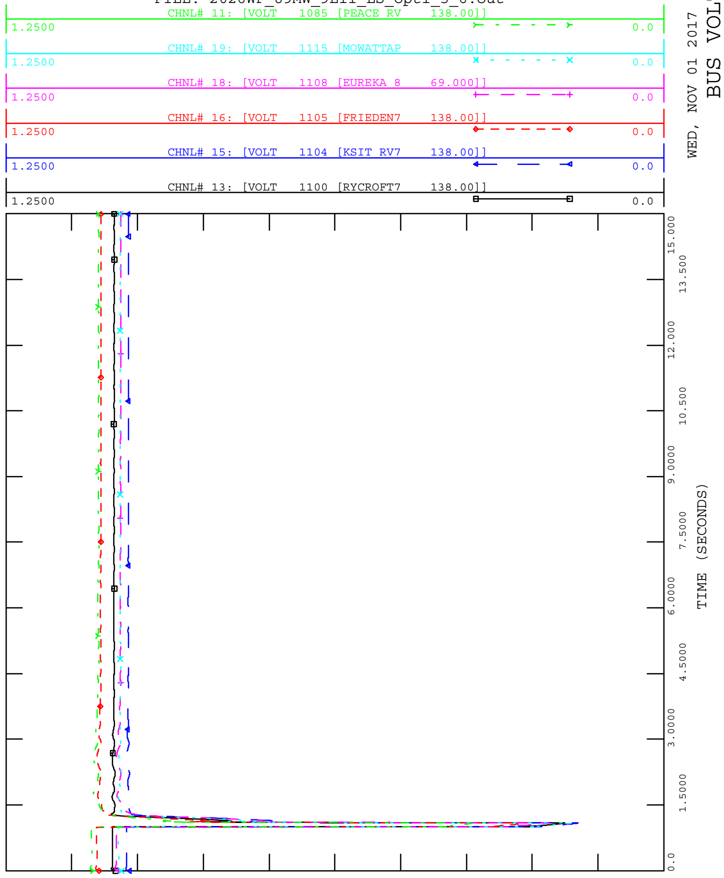
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2026WP_89MW_7L75_West_Opt1_6_8.out

WED, NOV 01 2017 10:47
LINE FLOW MW



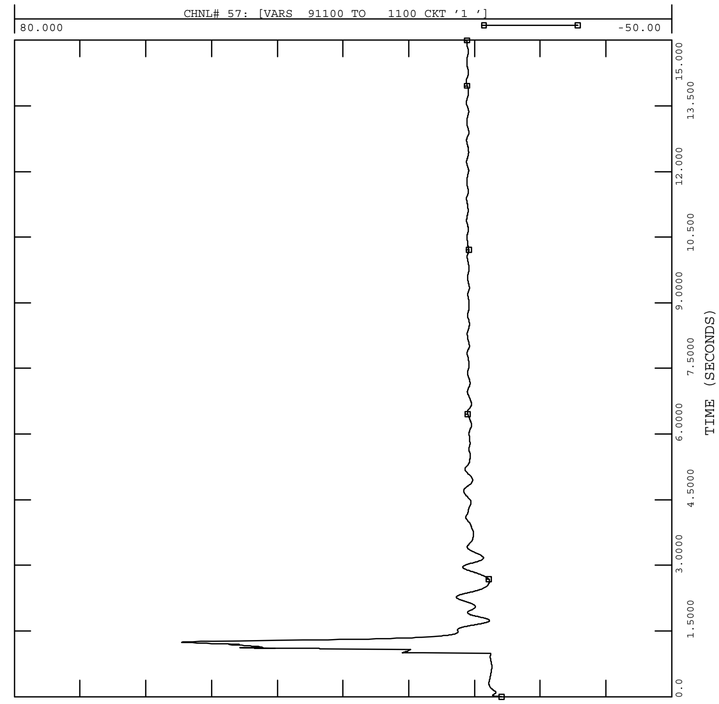
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_LS_Opt1_5_6.out

WED, NOV 01 2017 10:13
BUS VOLTAGE



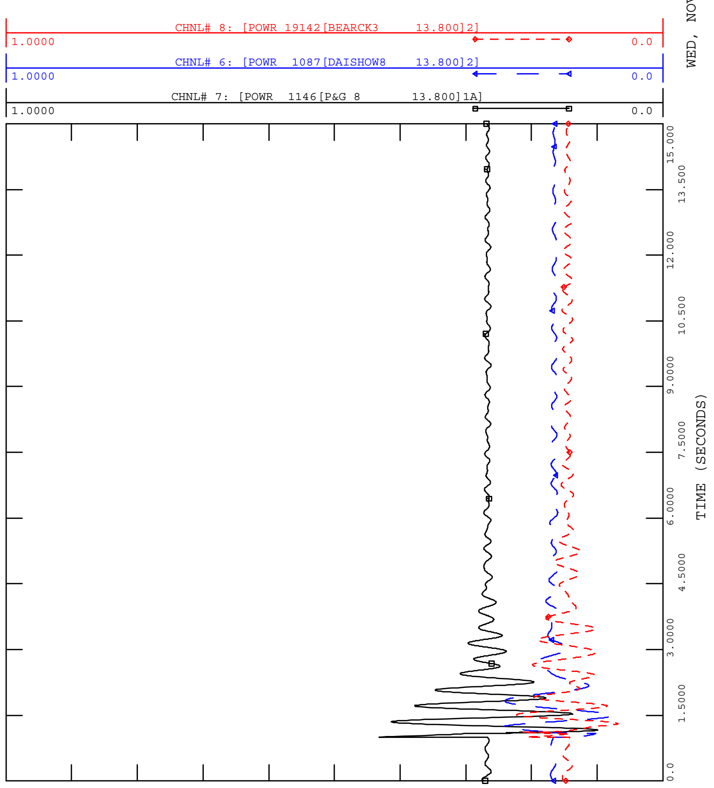
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_LS_Opt1_5_6.out

WED, NOV 01 2017 10:13
SVC MVAR



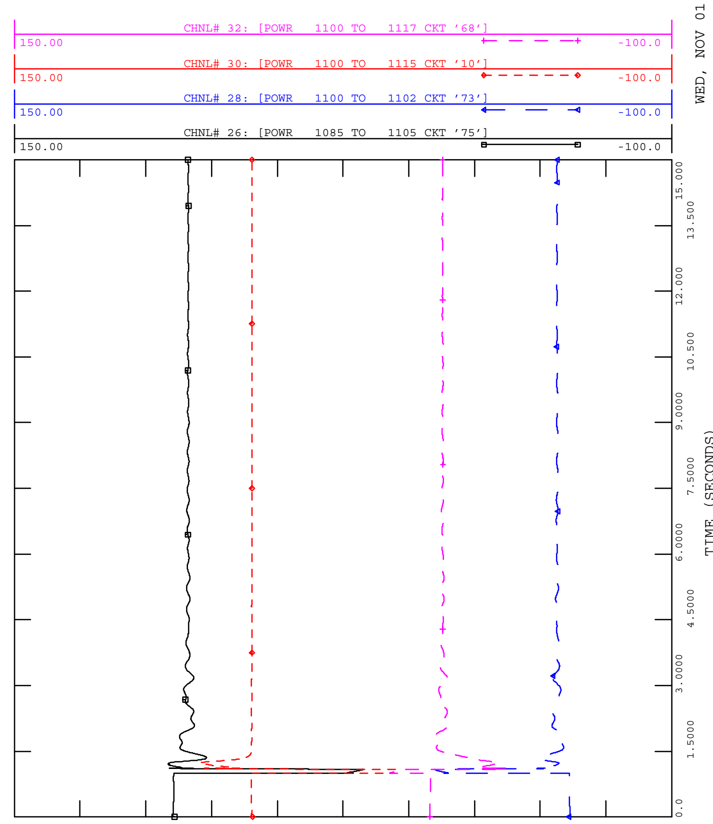
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_LS_Opt1_5_6.out

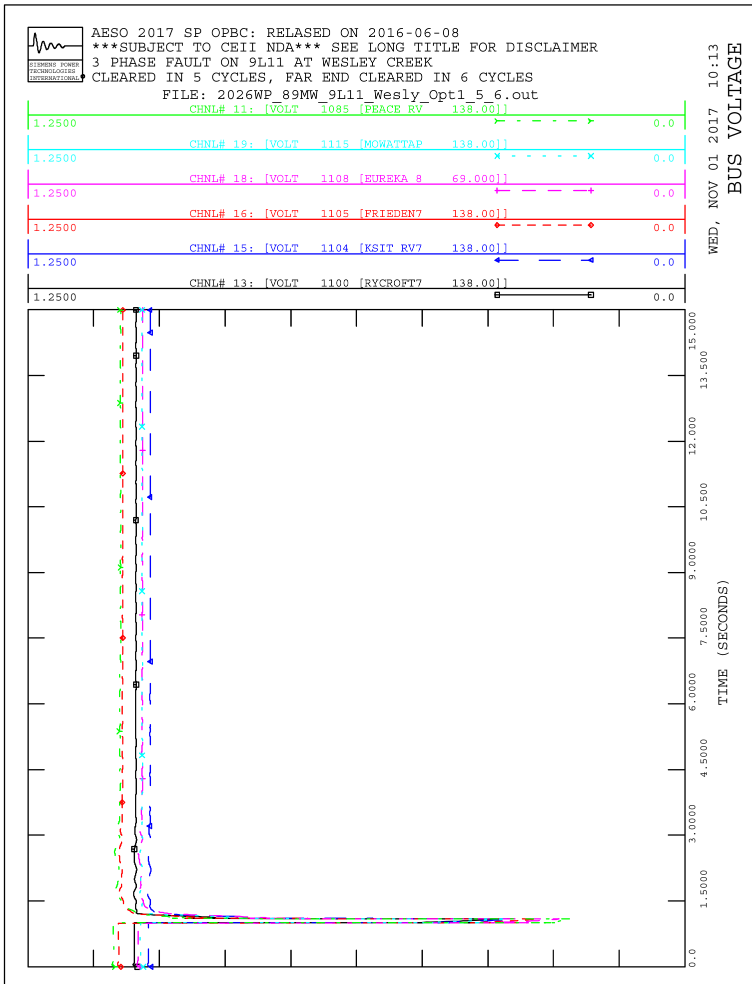
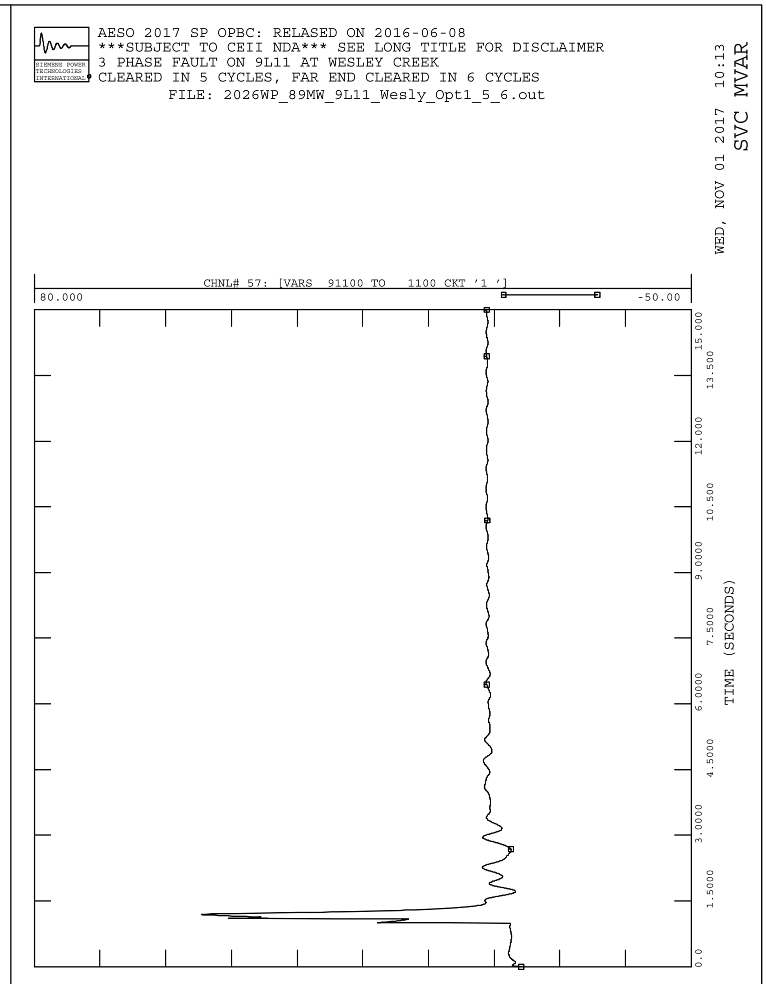
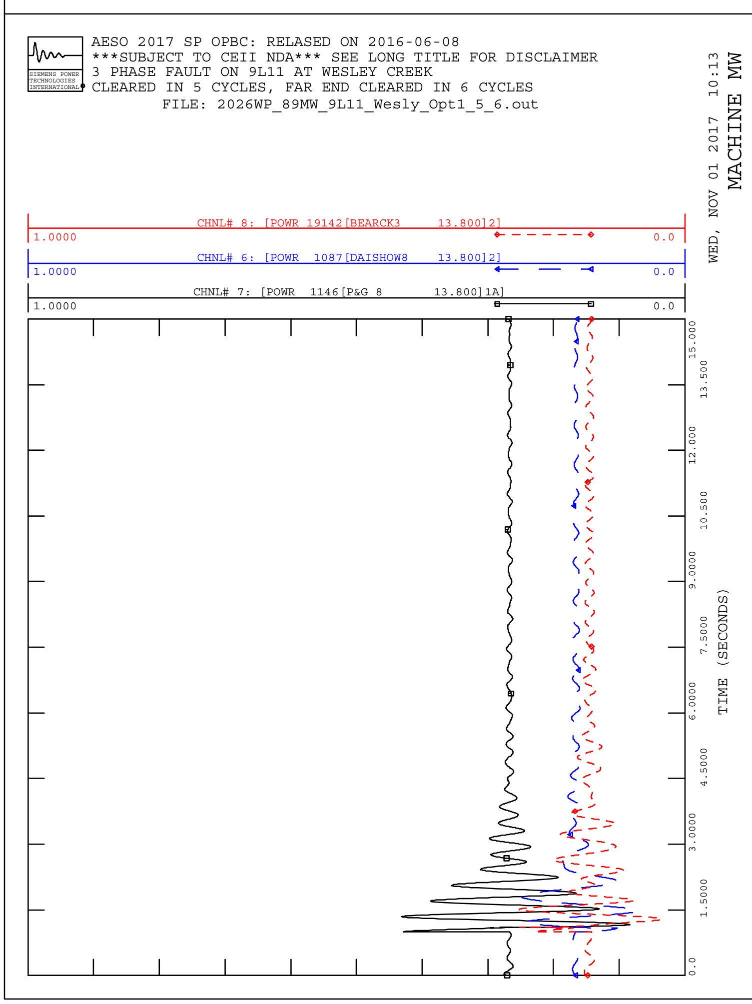
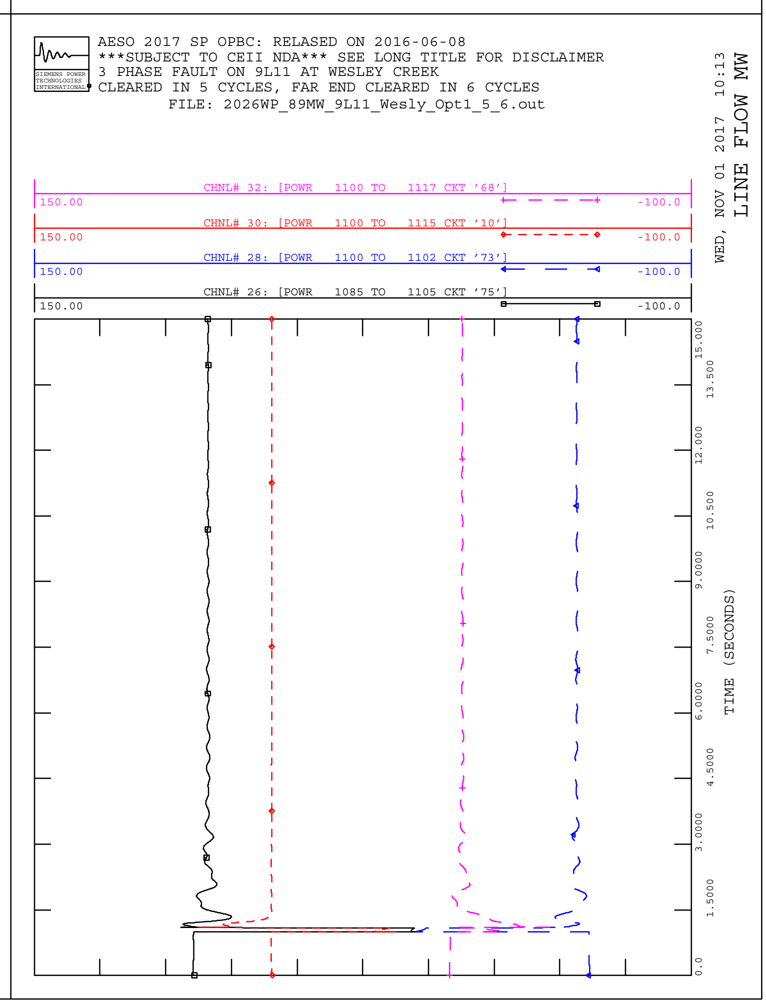
WED, NOV 01 2017 10:13
MACHINE MW

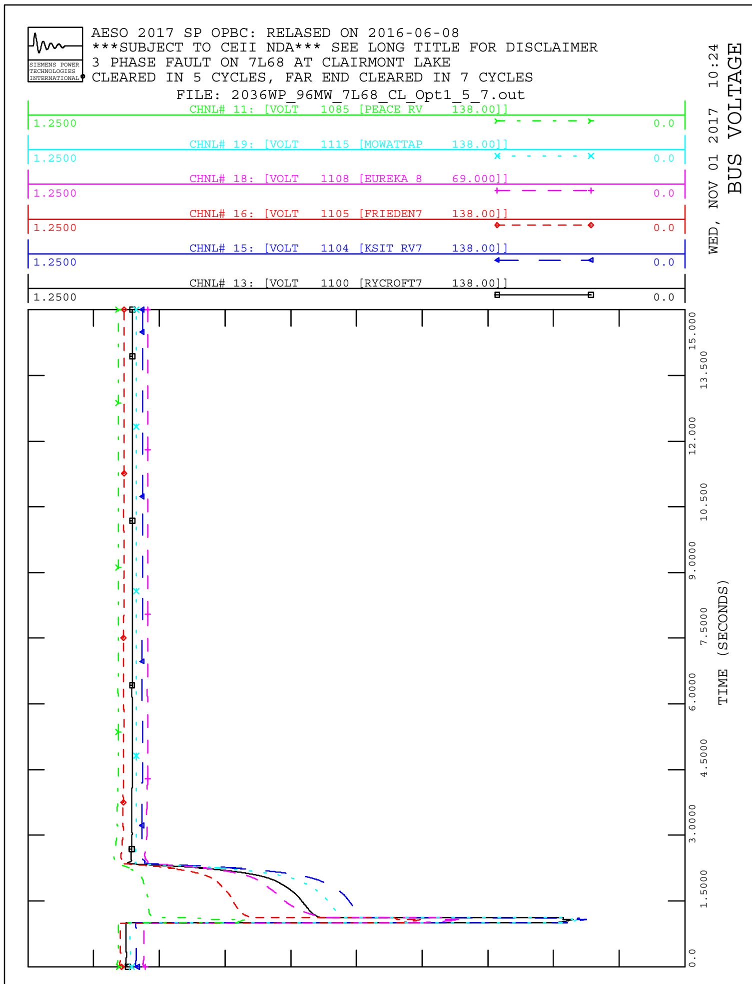


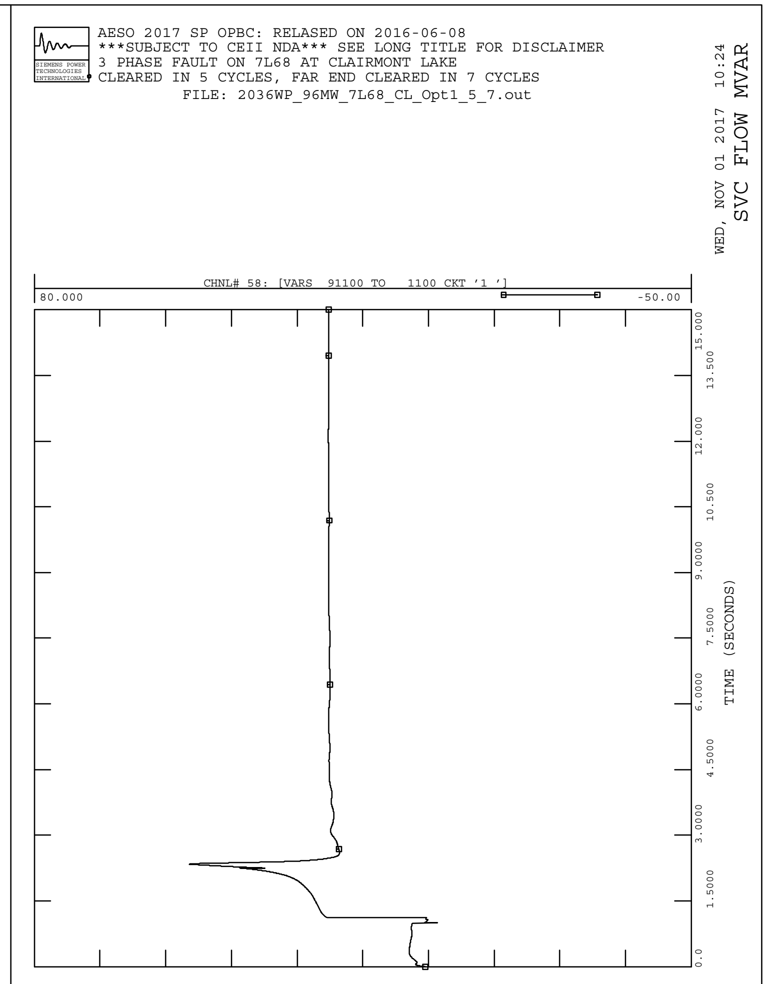
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_LS_Opt1_5_6.out

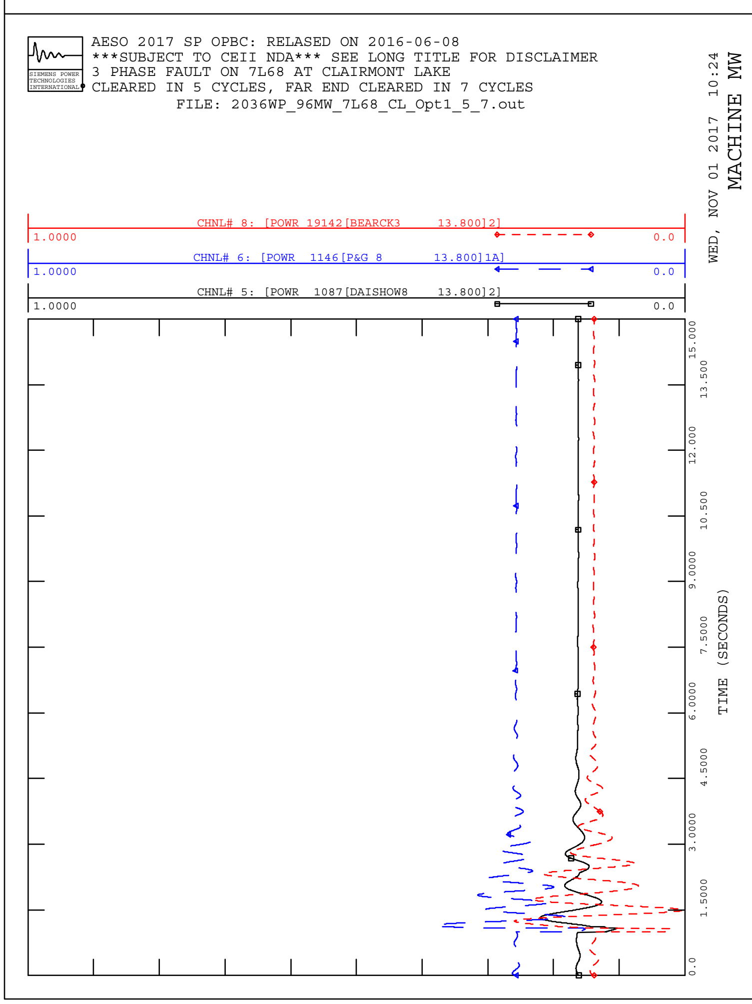
WED, NOV 01 2017 10:13
LINE FLOW MW

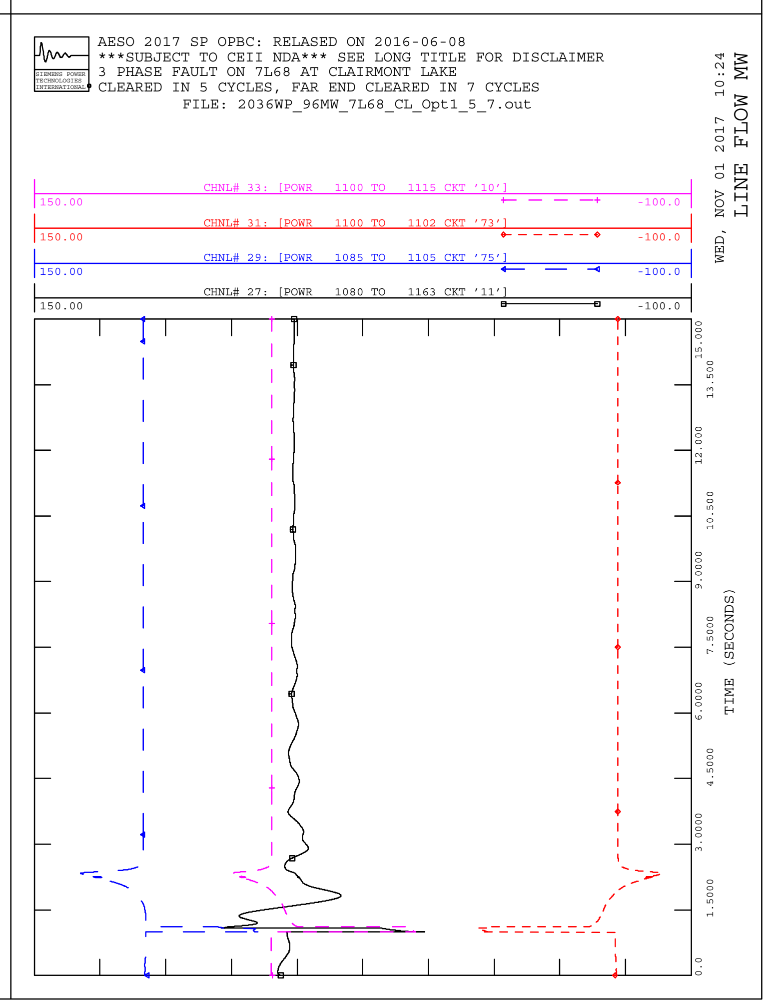


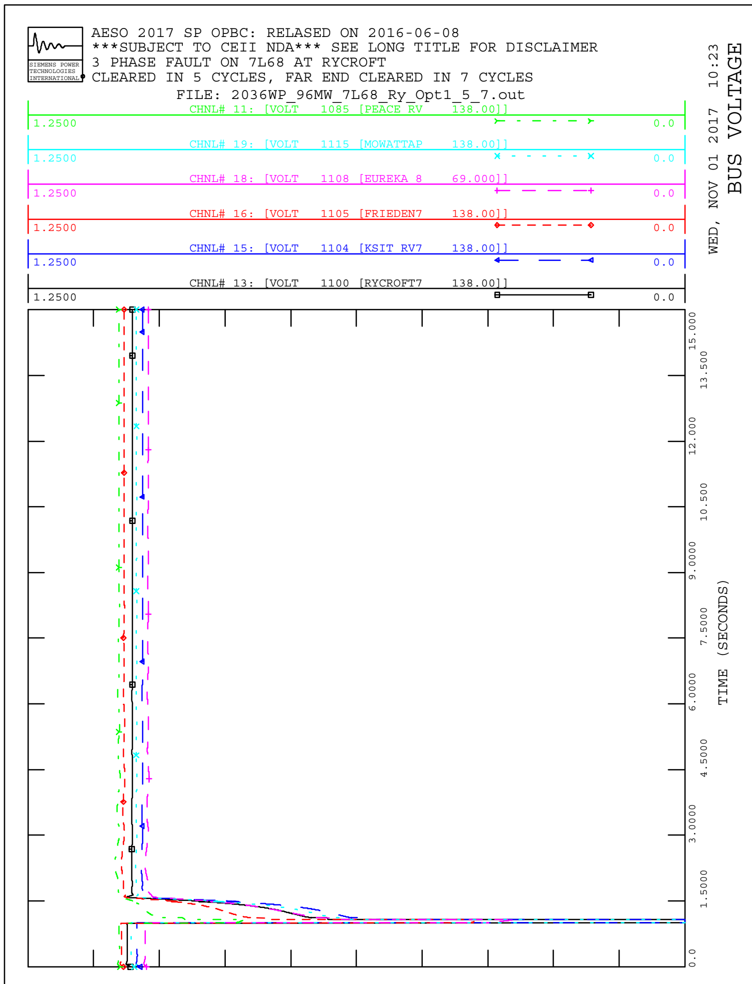

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_Wesly_Opt1_5_6.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500
0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500
0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500
0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500
0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500
0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500
0.0
WED, NOV 01 2017 10:13
BUS VOLTAGE
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_Wesly_Opt1_5_6.out
CHNL# 57: [VARS 91100 TO 1100 CKT '1 ']
80.000
-50.00
WED, NOV 01 2017 10:13
SVC MVAR
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_Wesly_Opt1_5_6.out
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000
0.0
CHNL# 6: [POWR 1087[DAISHOW8 13.800]2]
1.0000
0.0
CHNL# 7: [POWR 1146[P&G 8 13.800]1A]
1.0000
0.0
WED, NOV 01 2017 10:13
MACHINE MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2026WP_89MW_9L11_Wesly_Opt1_5_6.out
CHNL# 32: [POWR 1100 TO 1117 CKT '68']
150.00
-100.0
CHNL# 30: [POWR 1100 TO 1115 CKT '10']
150.00
-100.0
CHNL# 28: [POWR 1100 TO 1102 CKT '73']
150.00
-100.0
CHNL# 26: [POWR 1085 TO 1105 CKT '75']
150.00
-100.0
WED, NOV 01 2017 10:13
LINE FLOW MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

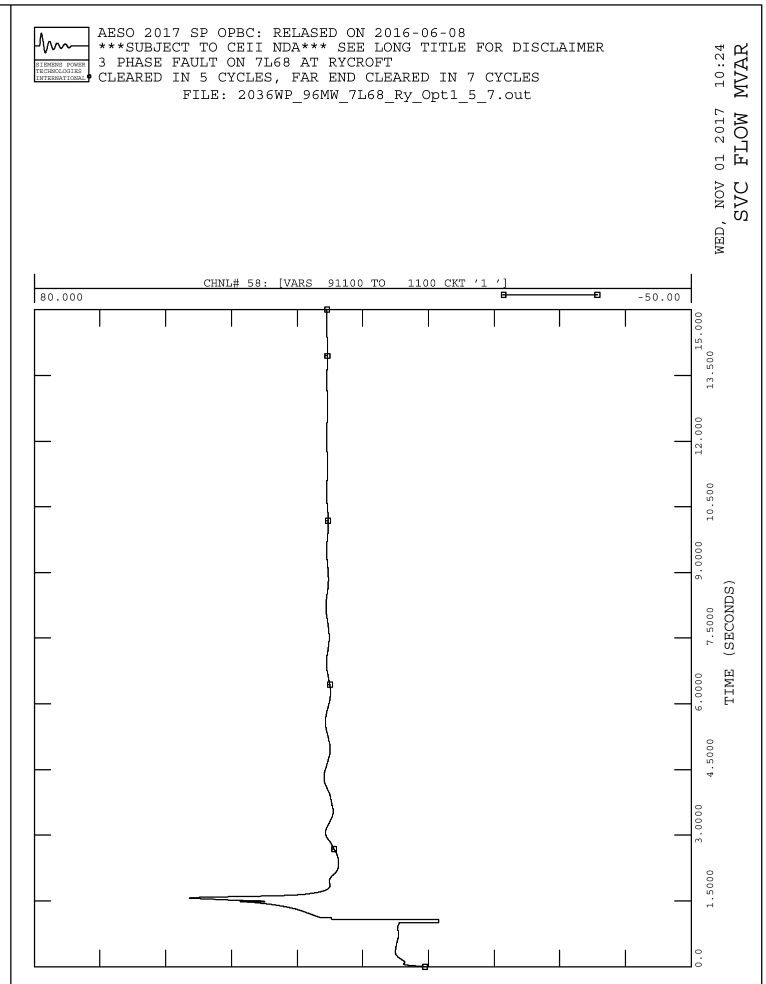

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_CL_Opt1_5_7.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500
0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500
0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500
0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500
0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500
0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500
0.0
WED, NOV 01 2017 10:24
BUS VOLTAGE
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

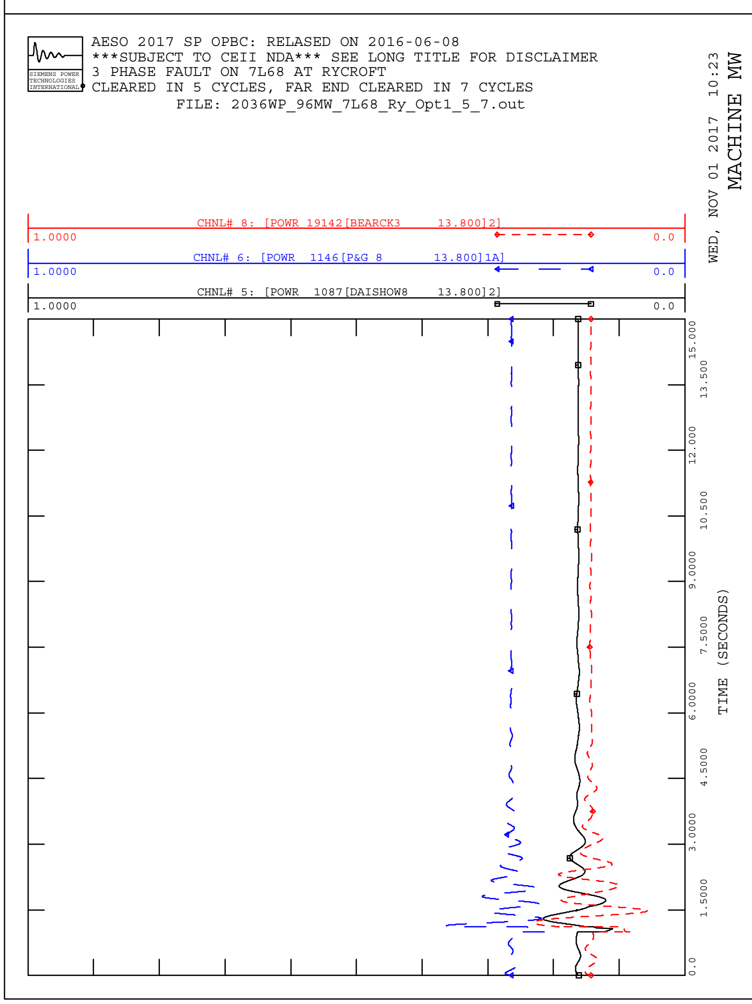

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_CL_Opt1_5_7.out
CHNL# 58: [VARS 91100 TO 1100 CKT '1 ']
80.000
-50.00
WED, NOV 01 2017 10:24
SVC FLOW MVAR
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

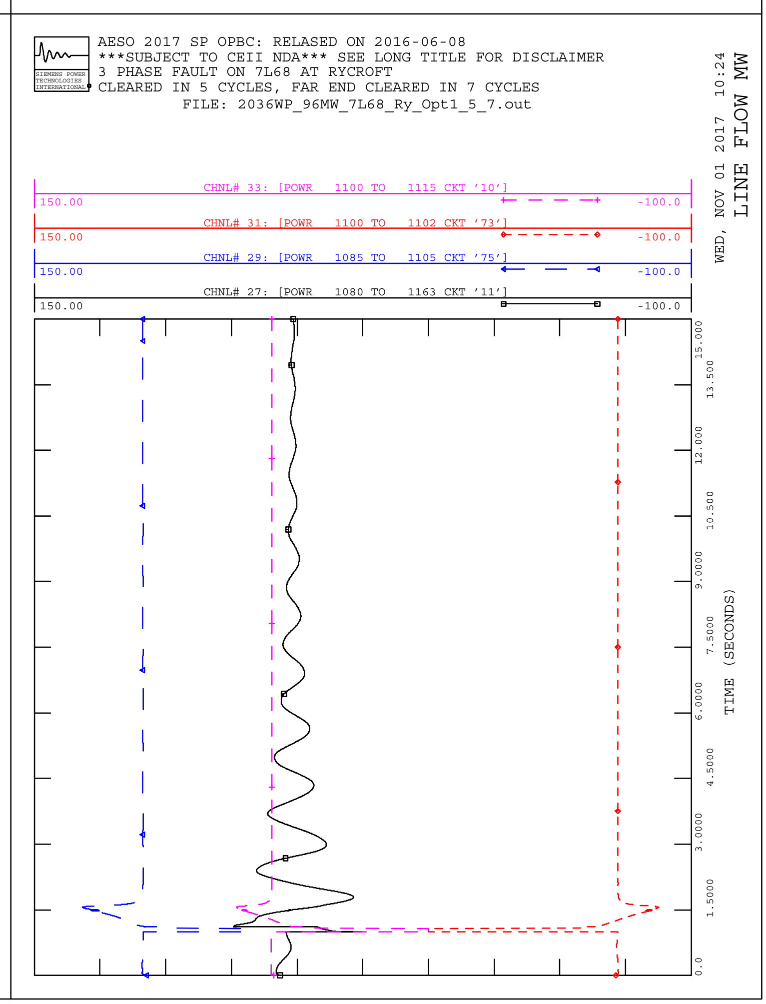

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_CL_Opt1_5_7.out
CHNL# 8: [POWR 19142 [BEARCK3 13.800]2]
1.0000
0.0
CHNL# 6: [POWR 1146 [P&G 8 13.800]1A]
1.0000
0.0
CHNL# 5: [POWR 1087 [DAISHOW8 13.800]2]
1.0000
0.0
WED, NOV 01 2017 10:24
MACHINE MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

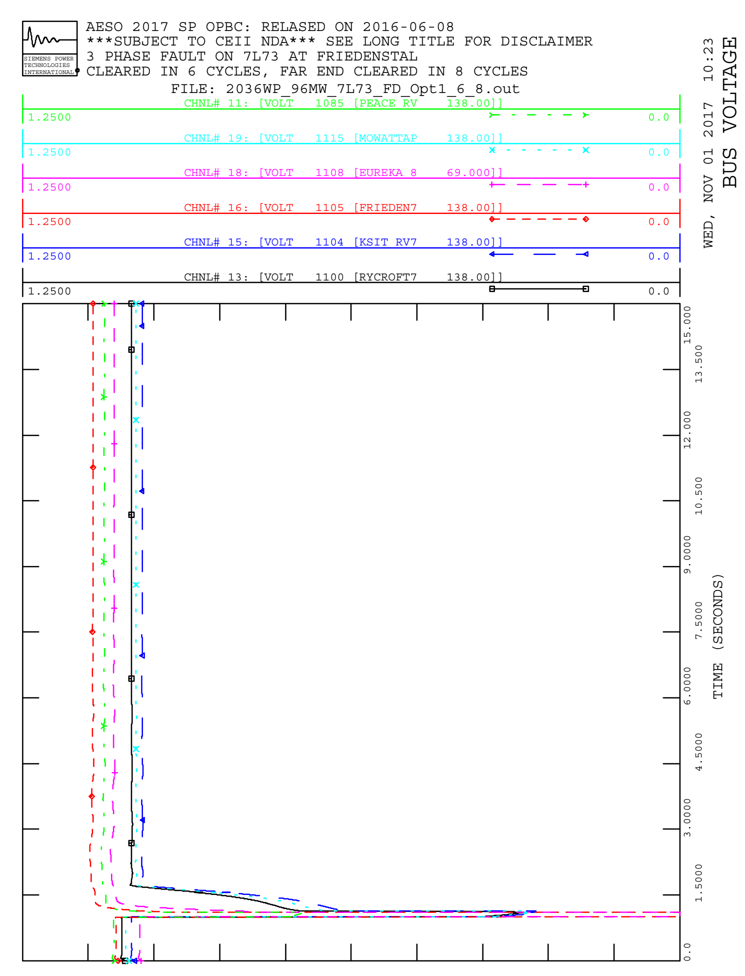

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT CLAIRMONT LAKE
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_CL_Opt1_5_7.out
CHNL# 33: [POWR 1100 TO 1115 CKT '10']
150.00
-100.0
CHNL# 31: [POWR 1100 TO 1102 CKT '73']
150.00
-100.0
CHNL# 29: [POWR 1085 TO 1105 CKT '75']
150.00
-100.0
CHNL# 27: [POWR 1080 TO 1163 CKT '11']
150.00
-100.0
WED, NOV 01 2017 10:24
LINE FLOW MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

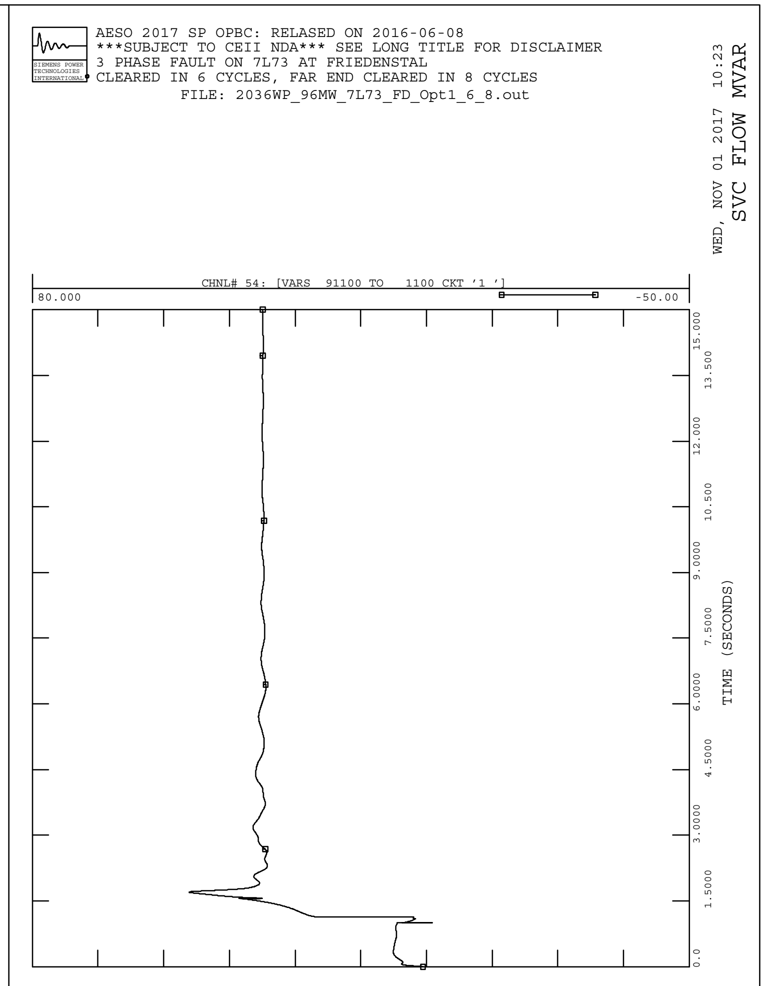

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_Ry_Opt1_5_7.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500 0.0
WED, NOV 01 2017 10:23
BUS VOLTAGE
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

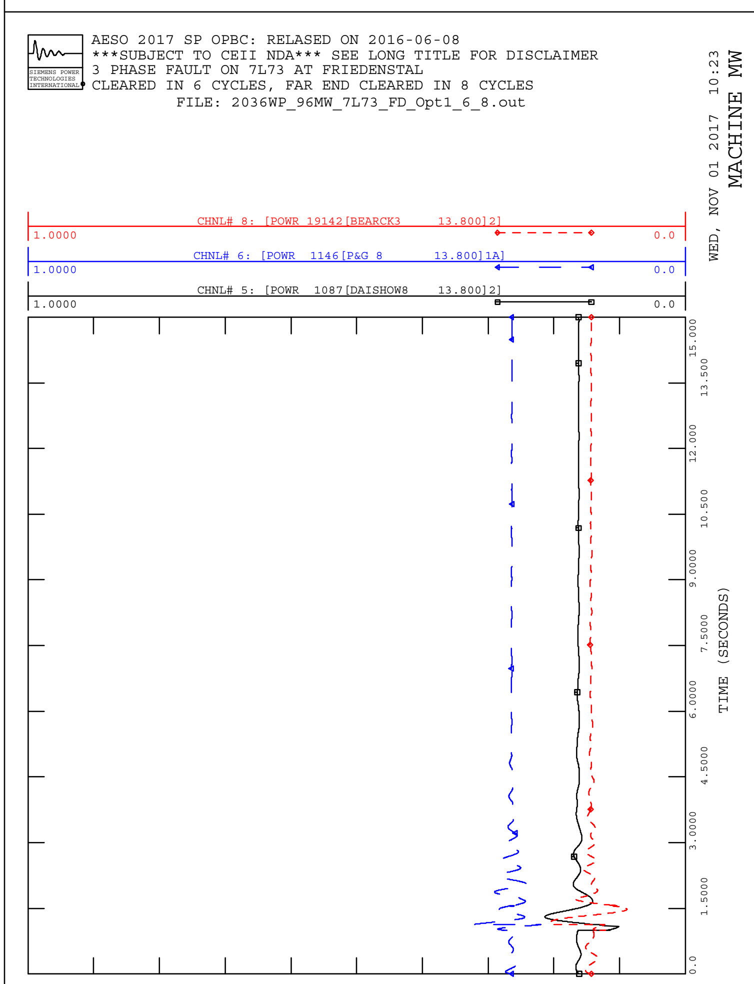

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_Ry_Opt1_5_7.out
CHNL# 58: [VARS 91100 TO 1100 CKT '1 ']
80.000 -50.00
WED, NOV 01 2017 10:24
SVC FLOW MVAR
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

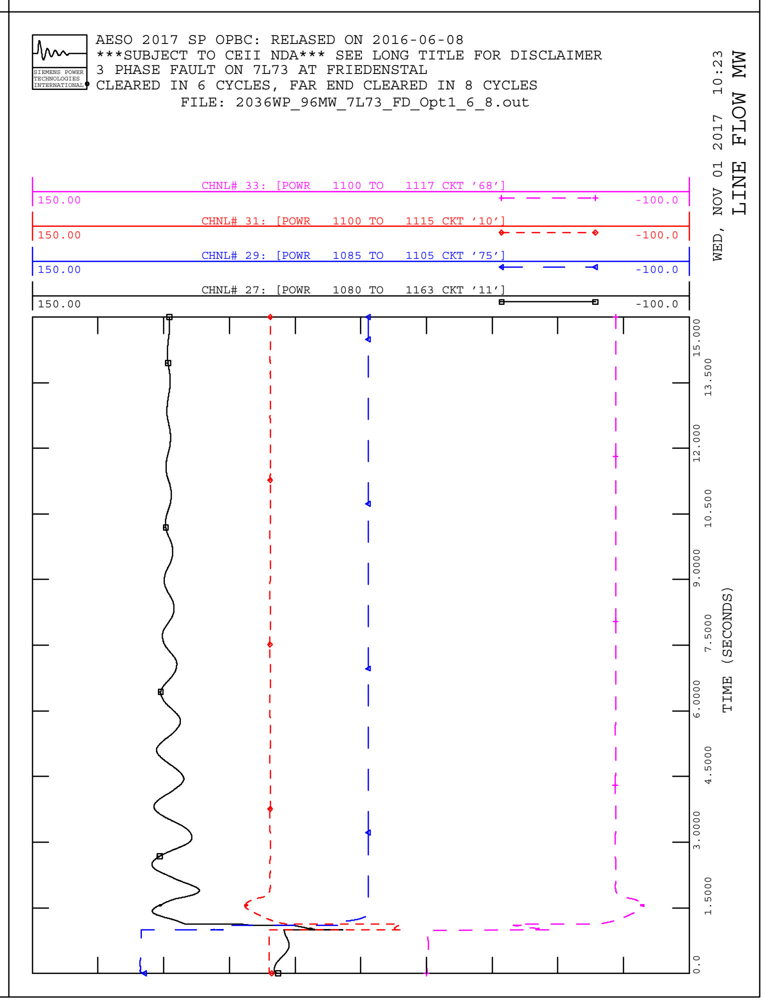

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_Ry_Opt1_5_7.out
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000 0.0
CHNL# 6: [POWR 1146[P&G 8 13.800]1A]
1.0000 0.0
CHNL# 5: [POWR 1087[DAISHOW8 13.800]2]
1.0000 0.0
WED, NOV 01 2017 10:23
MACHINE MW
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

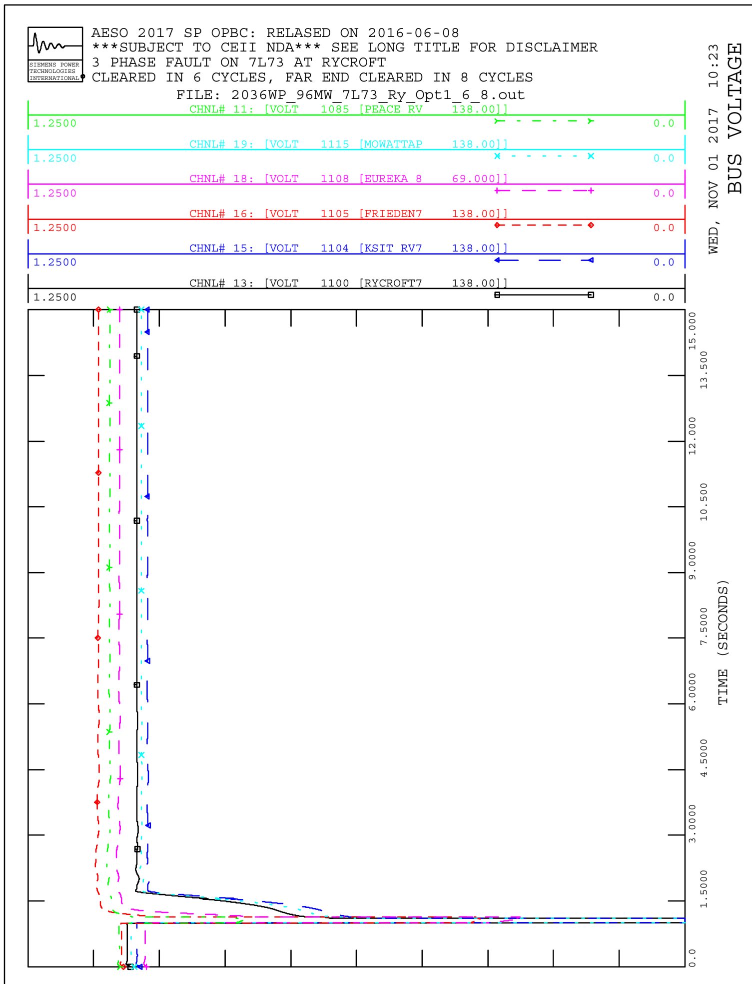

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L68 AT RYCROFT
CLEARED IN 5 CYCLES, FAR END CLEARED IN 7 CYCLES
FILE: 2036WP_96MW_7L68_Ry_Opt1_5_7.out
CHNL# 33: [POWR 1100 TO 1115 CKT '10']
150.00 -100.0
CHNL# 31: [POWR 1100 TO 1102 CKT '73']
150.00 -100.0
CHNL# 29: [POWR 1085 TO 1105 CKT '75']
150.00 -100.0
CHNL# 27: [POWR 1080 TO 1163 CKT '11']
150.00 -100.0
WED, NOV 01 2017 10:24
LINE FLOW MW
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

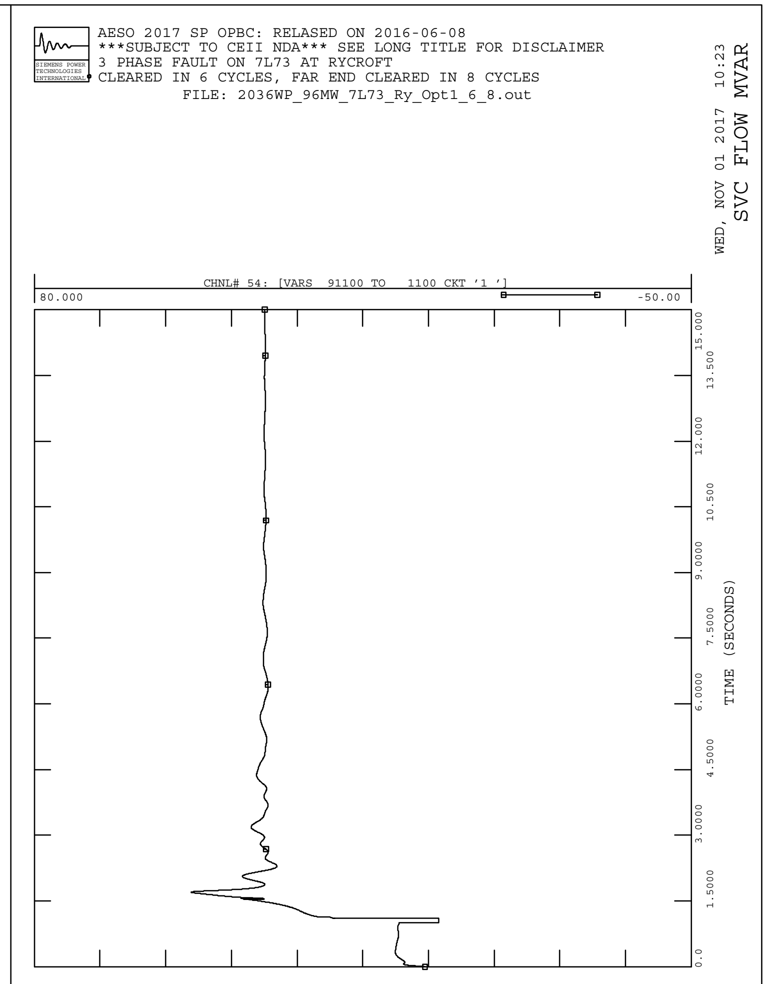

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_FD_Opt1_6_8.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500 0.0
WED, NOV 01 2017 10:23
BUS VOLTAGE
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

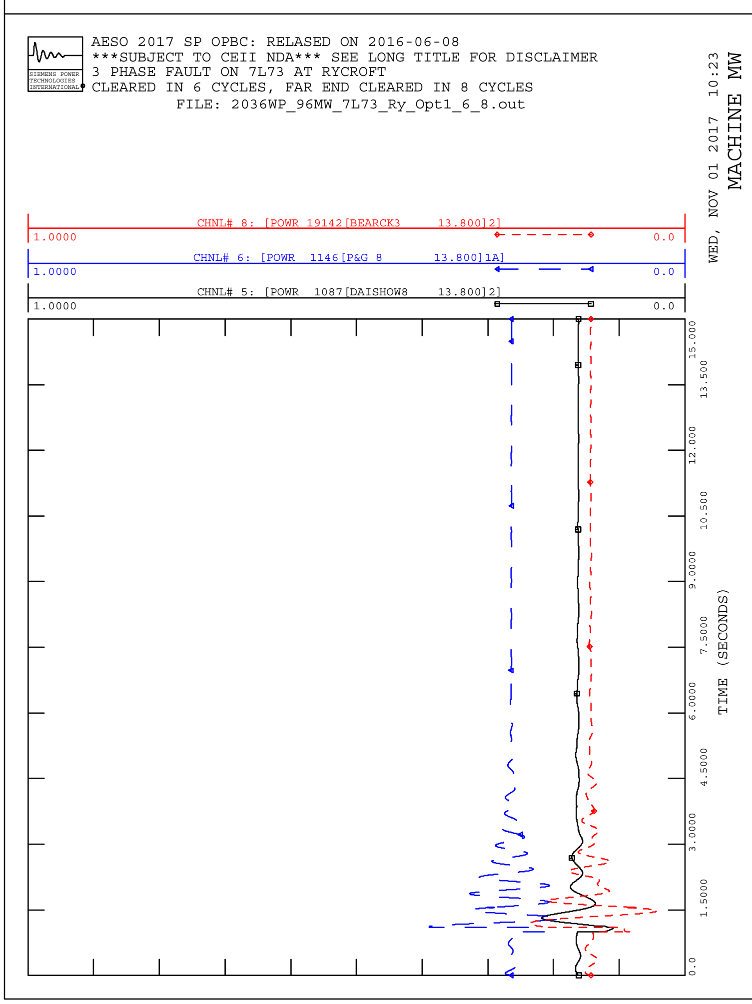

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_FD_Opt1_6_8.out
CHNL# 54: [VARS 91100 TO 1100 CKT '1 ']
80.000 -50.00
WED, NOV 01 2017 10:23
SVC FLOW MVAR
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

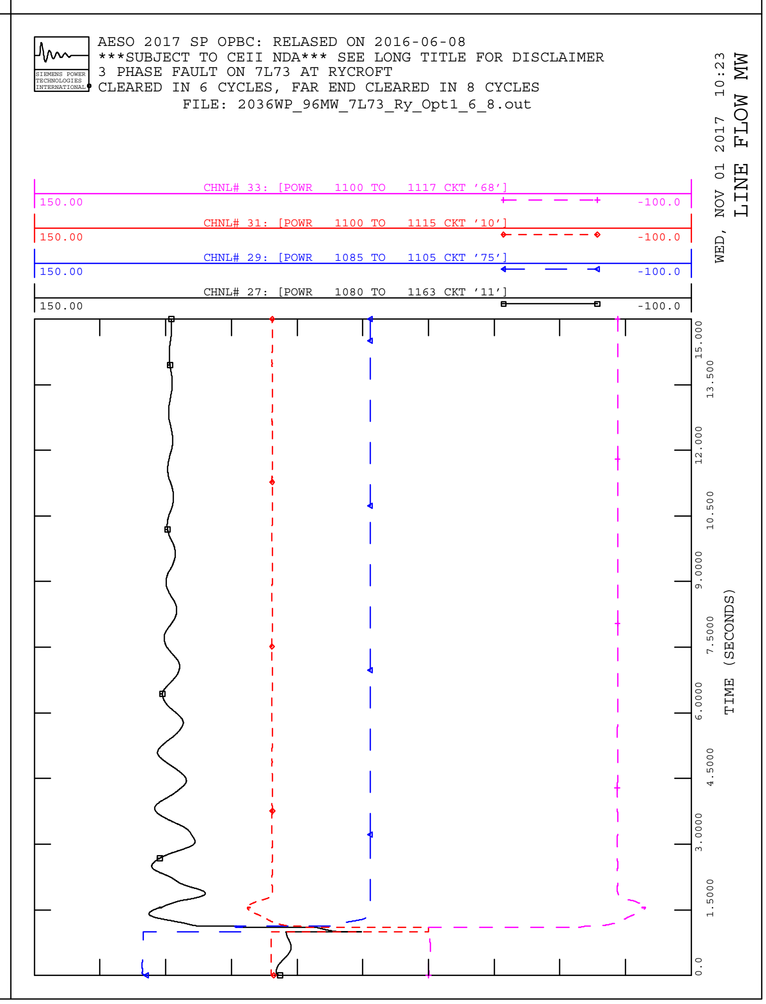

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_FD_Opt1_6_8.out
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000 0.0
CHNL# 6: [POWR 1146[P&G 8 13.800]1A]
1.0000 0.0
CHNL# 5: [POWR 1087[DAISHOW8 13.800]2]
1.0000 0.0
WED, NOV 01 2017 10:23
MACHINE MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_FD_Opt1_6_8.out
CHNL# 33: [POWR 1100 TO 1117 CKT '68']
150.00 -100.0
CHNL# 31: [POWR 1100 TO 1115 CKT '10']
150.00 -100.0
CHNL# 29: [POWR 1085 TO 1105 CKT '75']
150.00 -100.0
CHNL# 27: [POWR 1080 TO 1163 CKT '11']
150.00 -100.0
WED, NOV 01 2017 10:23
LINE FLOW MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_Ry_Opt1_6_8.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500
0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500
0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500
0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500
0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500
0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500
0.0
WED, NOV 01 2017 10:23
BUS VOLTAGE
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

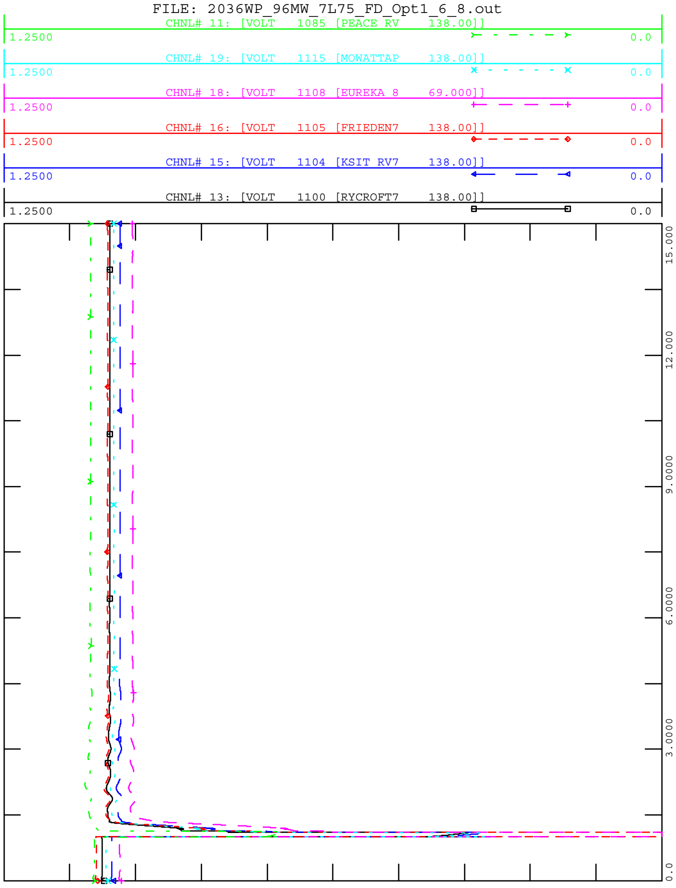

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_Ry_Opt1_6_8.out
CHNL# 54: [VARS 91100 TO 1100 CKT '1 ']
80.000
-50.00
WED, NOV 01 2017 10:23
SVC FLOW MVAR
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_Ry_Opt1_6_8.out
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000
0.0
CHNL# 6: [POWR 1146[P&G 8 13.800]1A]
1.0000
0.0
CHNL# 5: [POWR 1087[DAISHOW8 13.800]2]
1.0000
0.0
WED, NOV 01 2017 10:23
MACHINE MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L73 AT RYCROFT
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L73_Ry_Opt1_6_8.out
CHNL# 33: [POWR 1100 TO 1117 CKT '68']
150.00
-100.0
CHNL# 31: [POWR 1100 TO 1115 CKT '10']
150.00
-100.0
CHNL# 29: [POWR 1085 TO 1105 CKT '75']
150.00
-100.0
CHNL# 27: [POWR 1080 TO 1163 CKT '11']
150.00
-100.0
WED, NOV 01 2017 10:23
LINE FLOW MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

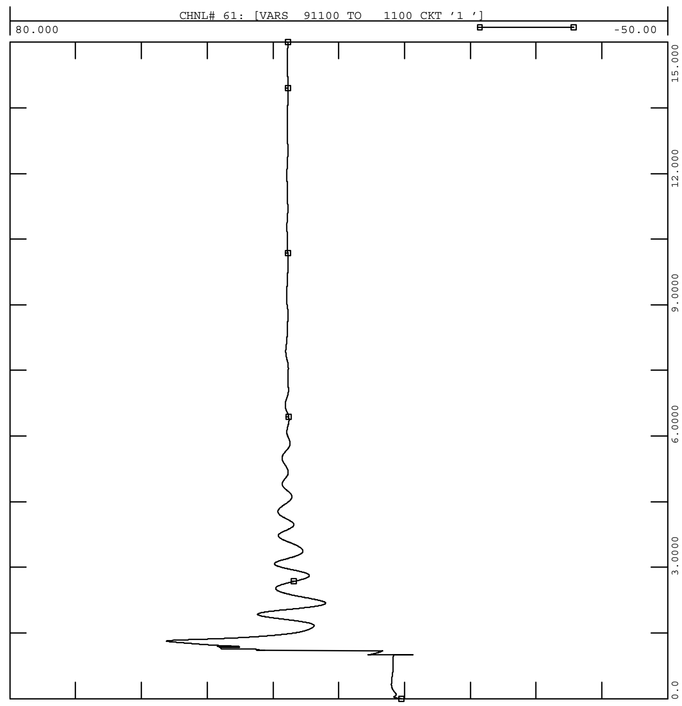
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_FD_Opt1_6_8.out

WED, NOV 01 2017 10:23
BUS VOLTAGE



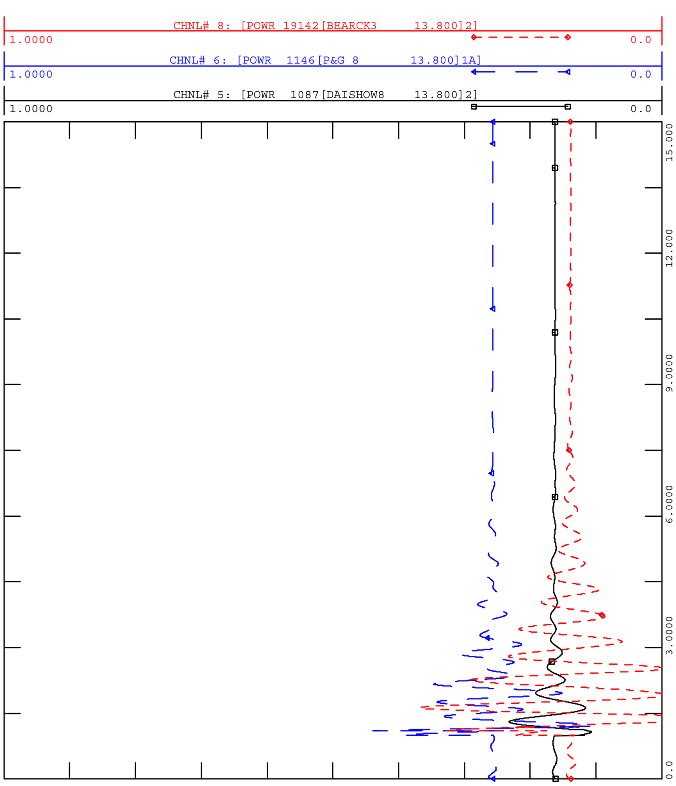
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_FD_Opt1_6_8.out

WED, NOV 01 2017 10:23
SVC FLOW MVAR



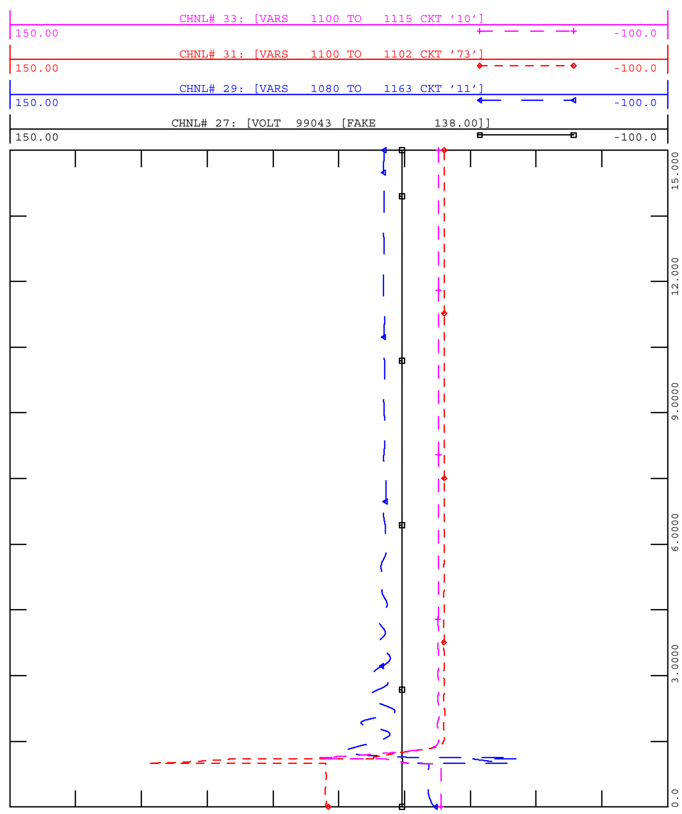
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_FD_Opt1_6_8.out

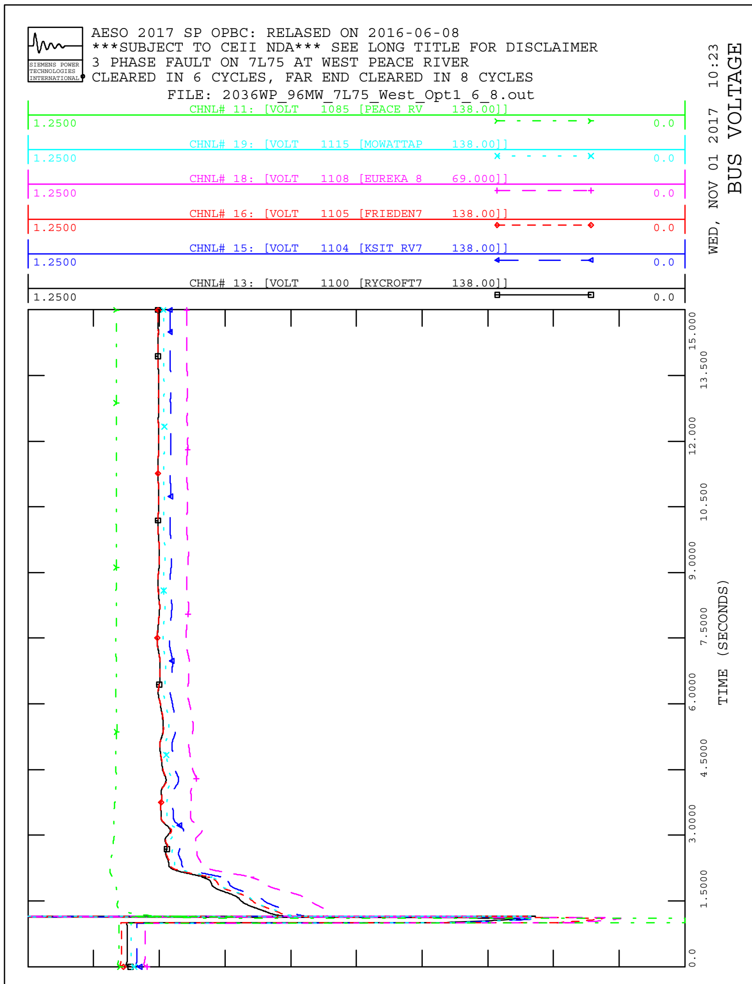
WED, NOV 01 2017 10:23
MACHINE MW



AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT FRIEDENSTAL
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_FD_Opt1_6_8.out

WED, NOV 01 2017 10:23
LINE FLOW MW




AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_West_Opt1_6_8.out
WED, NOV 01 2017 10:23
BUS VOLTAGE
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]] 1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]] 1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]] 1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]] 1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]] 1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]] 1.2500 0.0
TIME (SECONDS)
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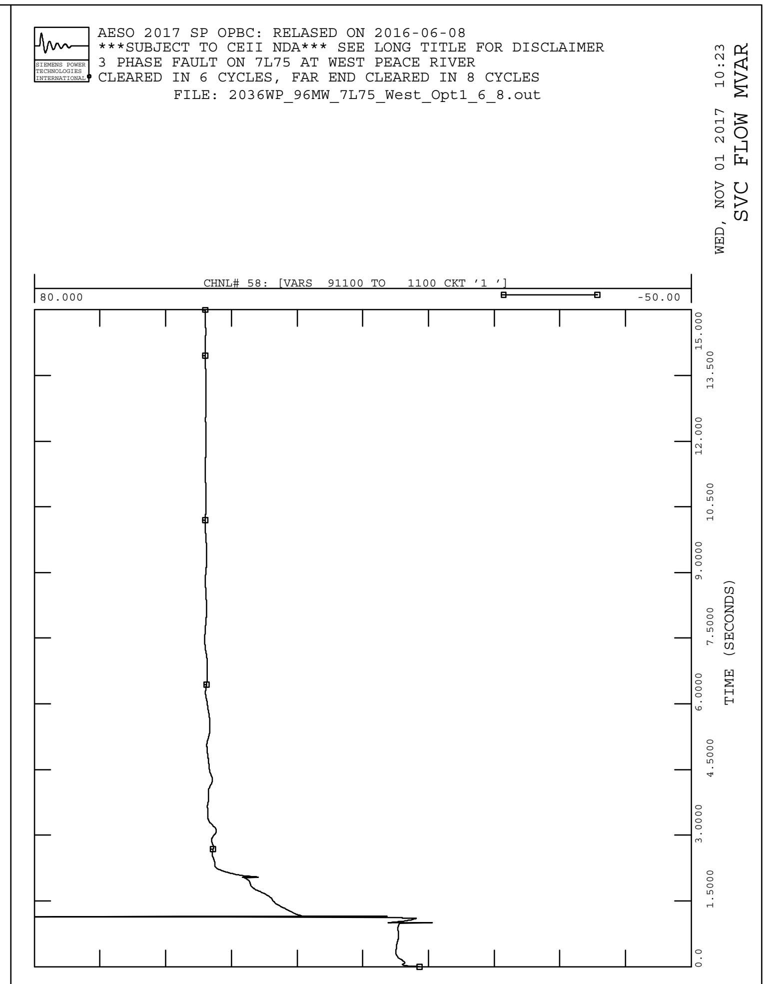
AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_West_Opt1_6_8.out
WED, NOV 01 2017 10:23
SVC FLOW MVAR
CHNL# 58: [VARS 91100 TO 1100 CKT '1 '] 80.000 -50.00
TIME (SECONDS)
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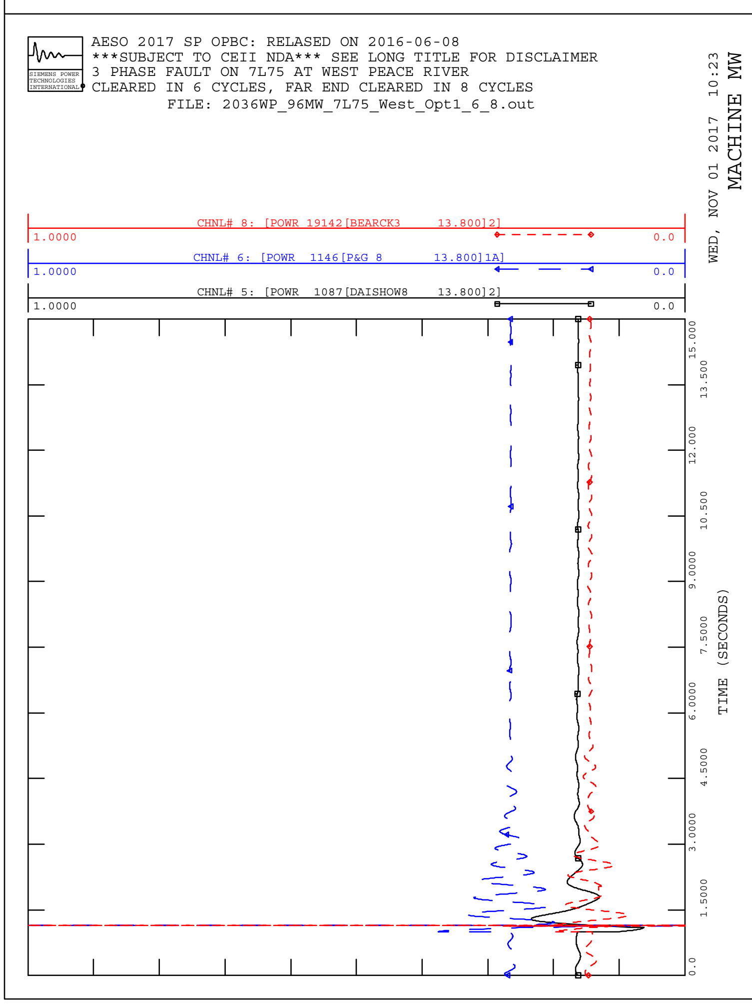
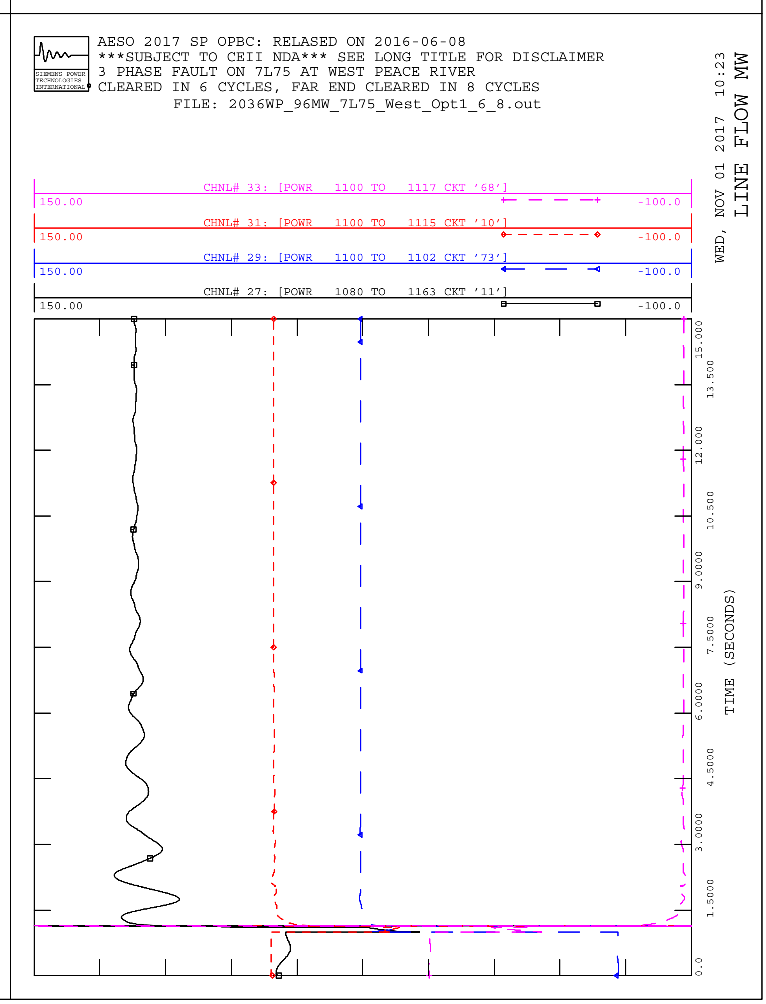
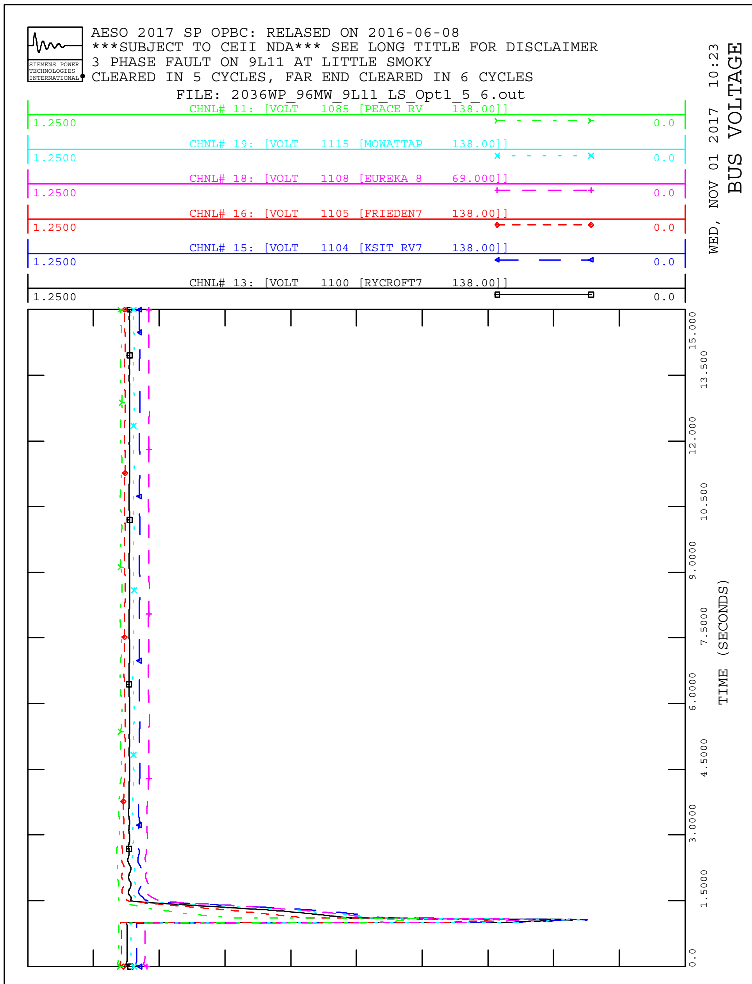
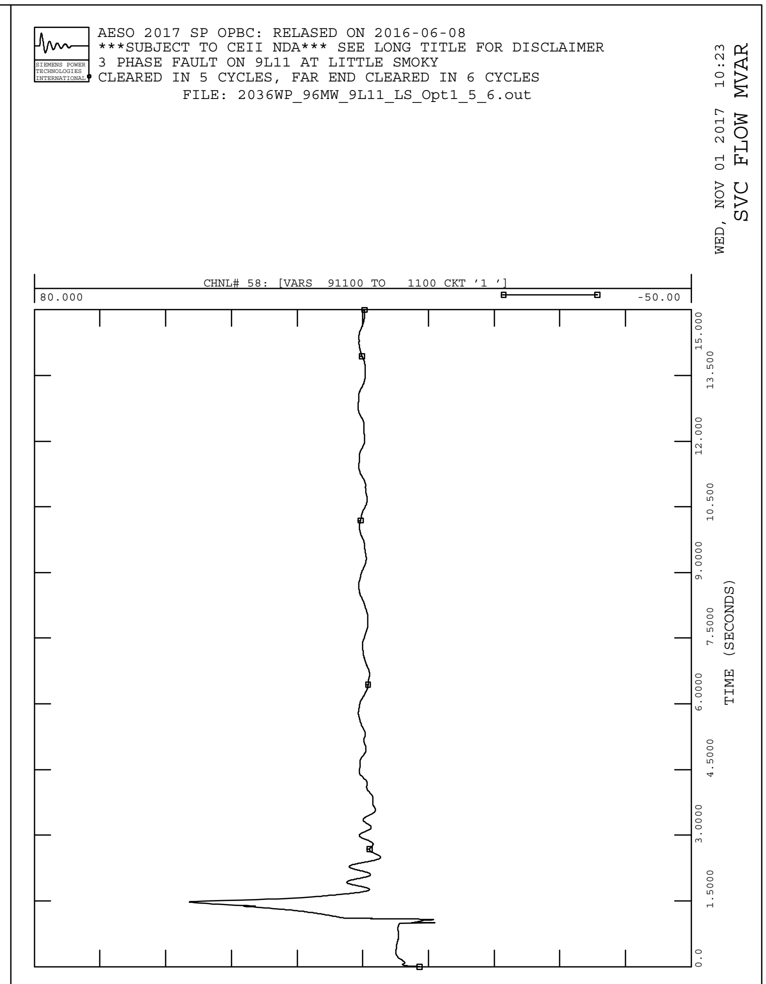
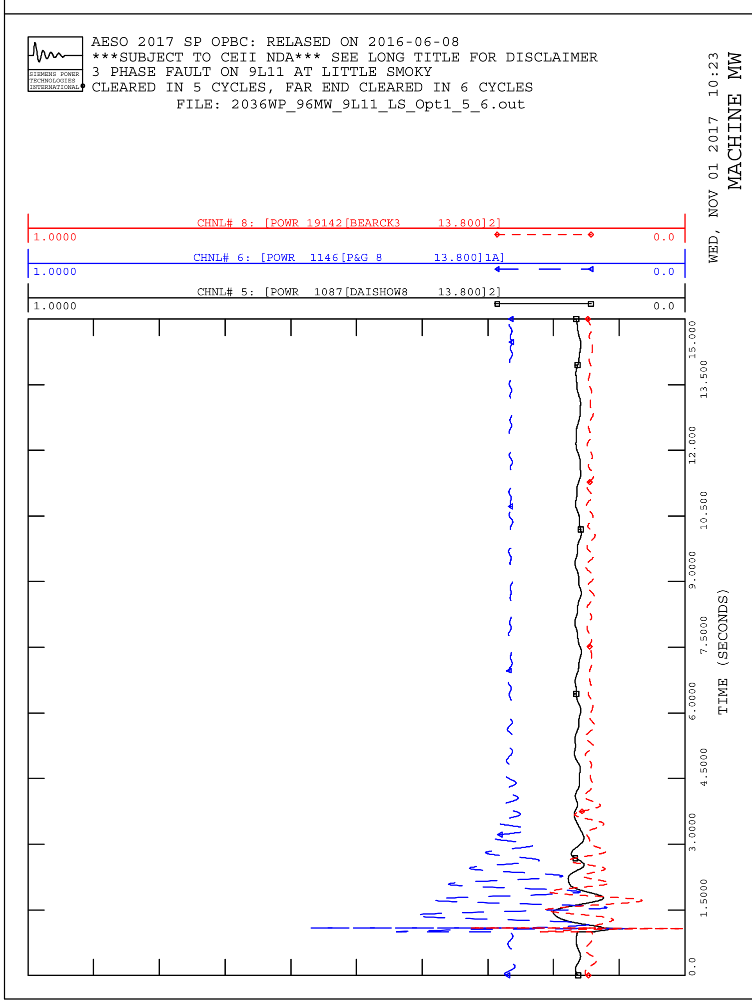
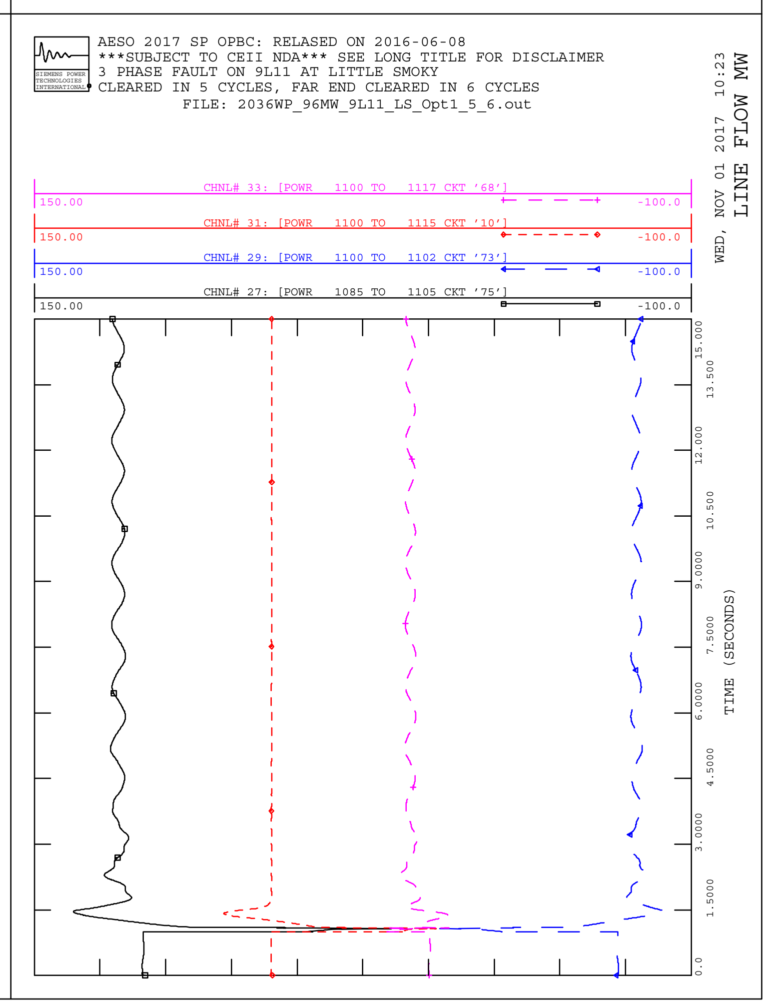

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_West_Opt1_6_8.out
WED, NOV 01 2017 10:23
MACHINE MW
CHNL# 8: [POWR 19142 [BEARCK3 13.800]2] 1.0000 0.0
CHNL# 6: [POWR 1146 [P&G 8 13.800]1A] 1.0000 0.0
CHNL# 5: [POWR 1087 [DAISHOW8 13.800]2] 1.0000 0.0
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

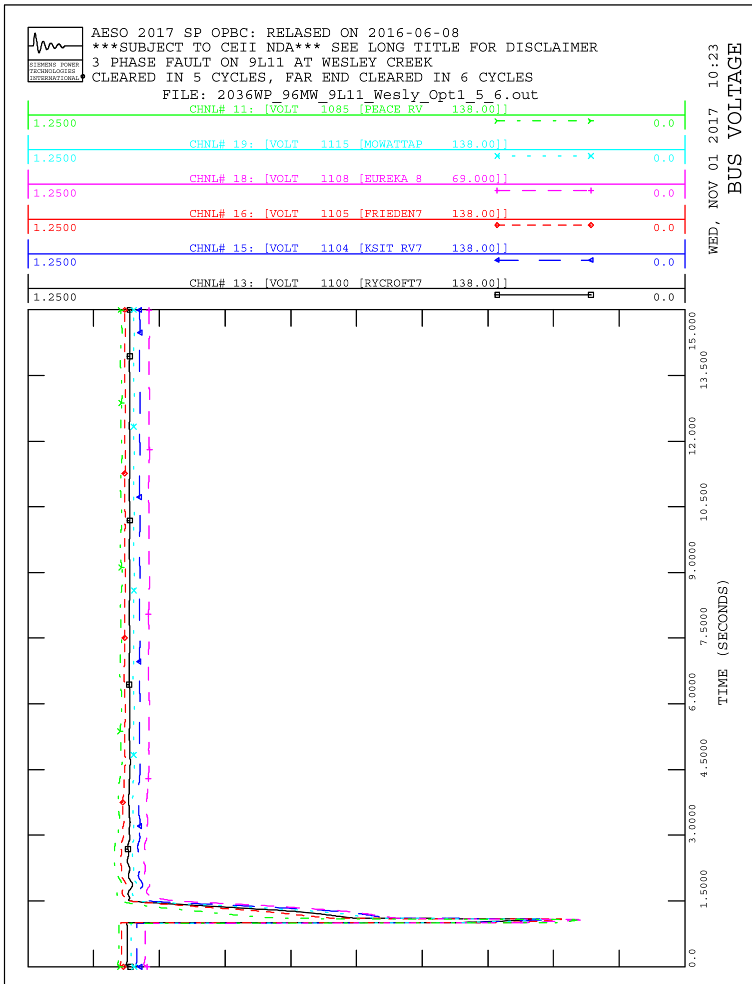

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 7L75 AT WEST PEACE RIVER
CLEARED IN 6 CYCLES, FAR END CLEARED IN 8 CYCLES
FILE: 2036WP_96MW_7L75_West_Opt1_6_8.out
WED, NOV 01 2017 10:23
LINE FLOW MW
CHNL# 33: [POWR 1100 TO 1117 CKT '68'] 150.00 -100.0
CHNL# 31: [POWR 1100 TO 1115 CKT '10'] 150.00 -100.0
CHNL# 29: [POWR 1100 TO 1102 CKT '73'] 150.00 -100.0
CHNL# 27: [POWR 1080 TO 1163 CKT '11'] 150.00 -100.0
TIME (SECONDS)
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000

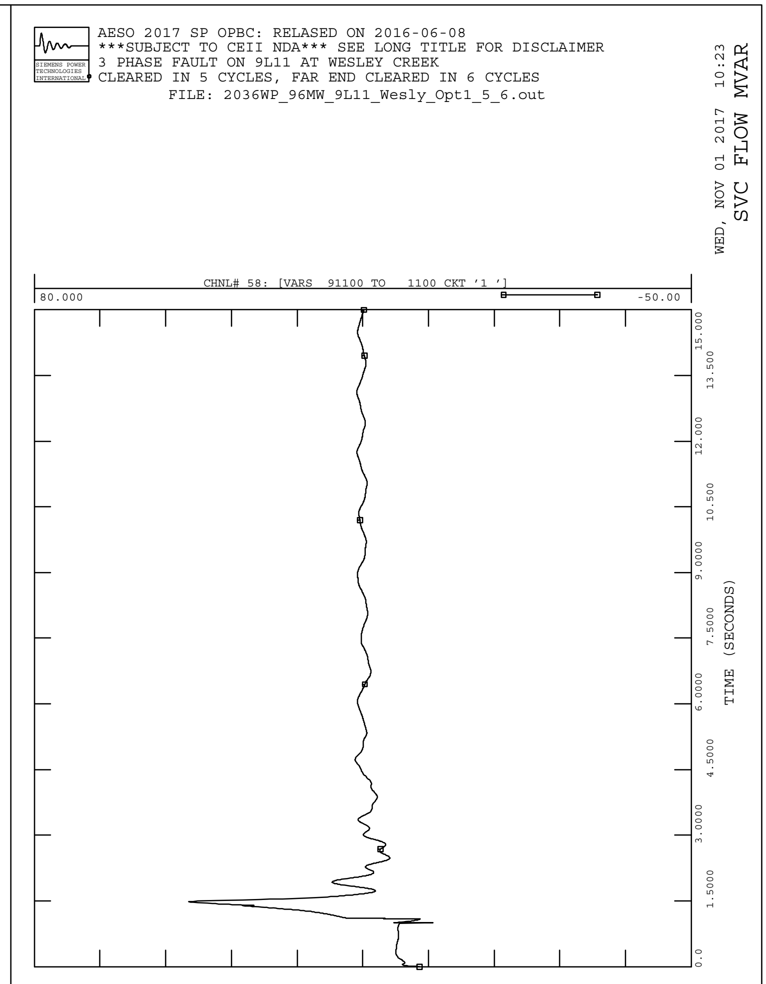

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_LS_Opt1_5_6.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500 0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500 0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500 0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500 0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500 0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500 0.0
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:23
BUS VOLTAGE

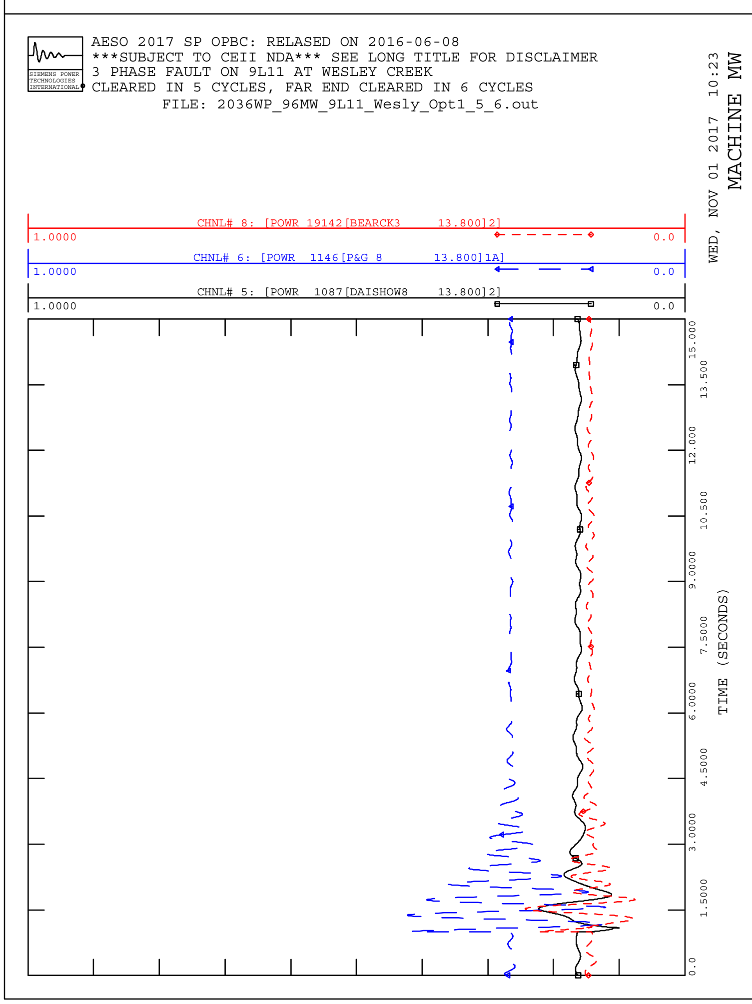

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_LS_Opt1_5_6.out
CHNL# 58: [VARS 91100 TO 1100 CKT '1 ']
80.000 -50.00
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:23
SVC FLOW MVAR

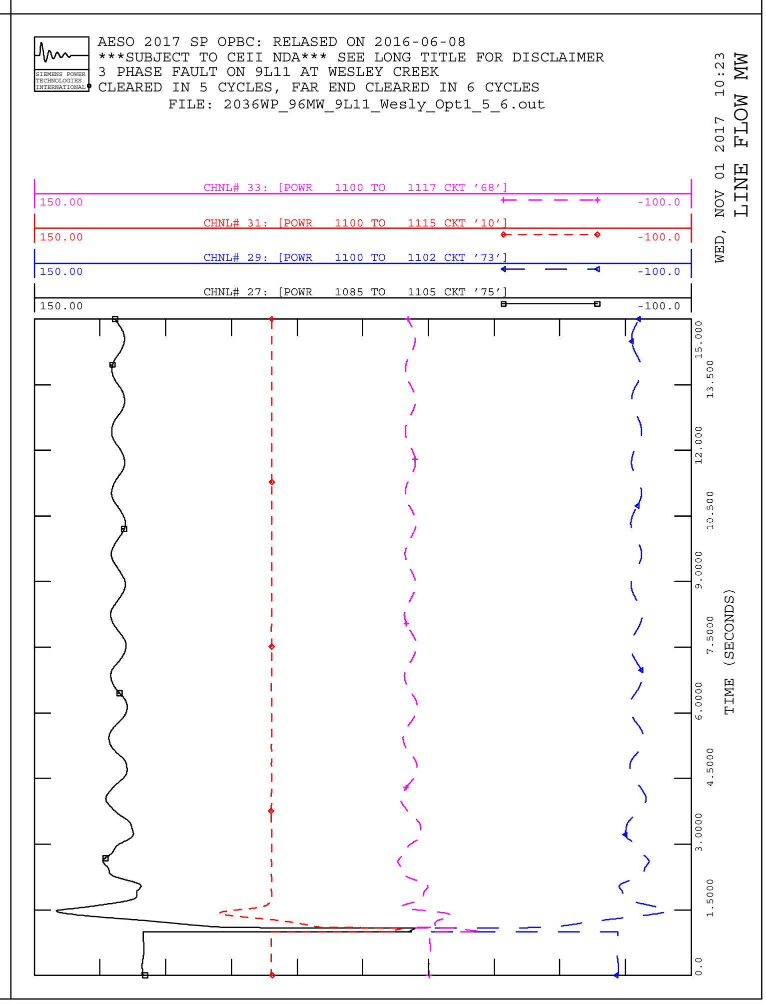

AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_LS_Opt1_5_6.out
CHNL# 8: [POWR 19142[BEARCK3 13.800]2]
1.0000 0.0
CHNL# 6: [POWR 1146[P&G 8 13.800]1A]
1.0000 0.0
CHNL# 5: [POWR 1087[DAISHOW8 13.800]2]
1.0000 0.0
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:23
MACHINE MW


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT LITTLE SMOKY
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_LS_Opt1_5_6.out
CHNL# 33: [POWR 1100 TO 1117 CKT '68']
150.00 -100.0
CHNL# 31: [POWR 1100 TO 1115 CKT '10']
150.00 -100.0
CHNL# 29: [POWR 1100 TO 1102 CKT '73']
150.00 -100.0
CHNL# 27: [POWR 1085 TO 1105 CKT '75']
150.00 -100.0
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME (SECONDS)
WED, NOV 01 2017 10:23
LINE FLOW MW


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_Wesly_Opt1_5_6.out
CHNL# 11: [VOLT 1085 [PEACE RV 138.00]]
1.2500
0.0
CHNL# 19: [VOLT 1115 [MOWATTAP 138.00]]
1.2500
0.0
CHNL# 18: [VOLT 1108 [EUREKA 8 69.000]]
1.2500
0.0
CHNL# 16: [VOLT 1105 [FRIEDEN7 138.00]]
1.2500
0.0
CHNL# 15: [VOLT 1104 [KSIT RV7 138.00]]
1.2500
0.0
CHNL# 13: [VOLT 1100 [RYCROFT7 138.00]]
1.2500
0.0
WED, NOV 01 2017 10:23
BUS VOLTAGE
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_Wesly_Opt1_5_6.out
CHNL# 58: [VARS 91100 TO 1100 CKT '1 ']
80.000
-50.00
WED, NOV 01 2017 10:23
SVC FLOW MVAR
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_Wesly_Opt1_5_6.out
CHNL# 8: [POWR 19142 [BEARCK3 13.800]2]
1.0000
0.0
CHNL# 6: [POWR 1146 [P&G 8 13.800]1A]
1.0000
0.0
CHNL# 5: [POWR 1087 [DAISHOW8 13.800]2]
1.0000
0.0
WED, NOV 01 2017 10:23
MACHINE MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000


AESO 2017 SP OPBC: RELASED ON 2016-06-08
SUBJECT TO CEII NDA SEE LONG TITLE FOR DISCLAIMER
3 PHASE FAULT ON 9L11 AT WESLEY CREEK
CLEARED IN 5 CYCLES, FAR END CLEARED IN 6 CYCLES
FILE: 2036WP_96MW_9L11_Wesly_Opt1_5_6.out
CHNL# 33: [POWR 1100 TO 1117 CKT '68']
150.00
-100.0
CHNL# 31: [POWR 1100 TO 1115 CKT '10']
150.00
-100.0
CHNL# 29: [POWR 1100 TO 1102 CKT '73']
150.00
-100.0
CHNL# 27: [POWR 1085 TO 1105 CKT '75']
150.00
-100.0
WED, NOV 01 2017 10:23
LINE FLOW MW
TIME (SECONDS)
0.0
1.5000
3.0000
4.5000
6.0000
7.5000
9.0000
10.500
12.000
13.500
15.000

Attachment D: Short Circuit Results

Short-circuit Analysis

The objective of the short-circuit analysis was to estimate the maximum short-circuit fault levels for the substations in the Study Area for before and after transmission reinforcement. Short-circuit analysis was performed based on system data[3] available to the AESO.

Listed below are the basic assumptions adopted in the short-circuit analysis:

Study Years

The system model consists of facilities assumed to be in service as of 2017

Study Cases Used for 2017SP

Study Component	Assumption
Generation dispatch	All generators in and around Grande Prairie and Peace River Areas dispatched
All transmission elements	In service
Series capacitors	In service
HVDC	Blocked
PSS/E Version used	Version 33

Three-phase faults and single line-to-ground faults were applied at the 144 kV and 72 kV substations for the aforementioned study years and system conditions. The tables below present the computed three-phase and single-phase fault currents as well as the associated positive sequence and zero sequence impedances at these substations for before and after the identified transmission reinforcement. The proposed transmission reinforcement would not have any material impact on the short-circuit levels in the Study Area.

It should be noted that the short-circuit levels change as new facilities are added to the system and are sensitive to any generation additions or retirements in the area of interest. The short-circuit levels provided in this study are not intended to be used as the sole source of information for electrical equipment specification or the design of public safety or worker safety grounding systems.

[3] Short-circuit current calculation is based on modeling information provided to the AESO by third parties. Short-circuit estimation is subject to change.

Table D-1: Short-circuit Current Levels – Pre- and Post-Rycroft 730S Substation Reactive Power Addition (Year 2017)

Substation Name	Base Voltage (kV)	Pre-Fault Voltage (p.u.)	3-Φ Fault (kA)	1- Φ Fault (kA)	Positive Sequence Impedance (R1 + j X1) (p.u.)	Zero Sequence Impedance (R0 + j X0) (p.u.)
Rycroft 730S	138	1.070	2.67	2.64	0.079189+j0.147705	0.034352+j0.176366
Ksituan River 754S	138	1.049	1.49	1.70	0.151909+j0.253142	0.029821+j0.196248
Mowat 2033S	138	1.062	1.88	2.16	0.119340+j0.203873	0.022908+j0.151617
Boucher Creek 829S	138	1.082	2.40	1.76	0.081002+j0.170335	0.102974+j0.384404
Friedenstal 800S	138	1.087	2.48	1.75	0.076153+j0.167060	0.109131+j0.399769
Friedenstal 800S	69	1.081	2.13	1.88	0.094264+j0.413258	0.114976+j0.584170
Eureka River 861S	69	1.065	0.68	0.74	0.716127+j1.107957	0.136716+j1.031855
Hines Creek 724S	69	1.063	0.98	0.89	0.501748+j0.754282	0.296245+j1.179148
Clairmont Lake 811S	138	1.081	5.32	4.93	0.031904+j0.078833	0.024299+j0.103568
West Peace River 793S	138	1.071	5.56	4.69	0.029193+j0.075162	0.031047+j0.122542

Note 1: pu calculated using 138 kV and 69 kV voltage and 100 MVA