APPENDIX A AESO PLANNING STUDIES

807L Capacity Increase

Planning Study Report

Aug 19, 2016

Role	Name	Signature	Date
Prepared	Ting Zhang, P. Eng		Aug 19, 2016
Reviewed	Pawan Vohra, P.Eng.		Aug 19, 2016
Reviewed/Approved	Sami Abdulsalam, P.Eng		Aug 19, 2016

2500, 330-5th Avenue SW, Calgary, Alberta T2P 0L4 Phone: 403-539-2450 Fax: 403-539-2949
www.aeso.ca www.poweringalberta.com

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Executive Summary

The AESO performs system planning studies regularly to assess transmission system reliability in the near-term (5 years), and medium-term (10 years). The AESO's planning studies had identified that the existing 138 kV transmission system supplying load in the northeast of the Fort Saskatchewan Planning Area ("Area 33") will be subject to constraints under certain system conditions. This report presents detailed planning studies that have since been performed based on the AESO's latest forecast to assess the transmission system constraints in this area, and propose a preferred transmission development option to address the identified constraints. The *AESO 2016 Long-term Outlook* ("2016 LTO") was used for the planning studies.

The study area, which is a sub-area of the Fort Saskatchewan Planning Area, comprises four substations, Beamer 233S, Redwater 171S, Weasel Creek 947S, Abee 993S, and all the 138 kV transmission lines connected to these substation (the "Beamer Study Area"). The Beamer Study Area is a load centre, supplied through three existing 138 kV transmission lines, 708L (Lamoureux 71S – Beamer 233S), 807L (Josephburg 410S – 807AL t-tap – Beamer 233S), 808L (Deerland 13S – Redwater 171S). Planning studies has indicated thermal constraints to supply load in the Beamer Study Area. Therefore, studies were performed assuming summer conditions due to lower transmission line ratings as compared to winter conditions.

Planning study results demonstrate that the existing transmission network in the Beamer Study Area does not have sufficient capacity to reliably supply the forecast load growth in 2017 and is prone to overloading under a single contingency. Specifically, these studies indicated thermal overload on a section of the existing 807L from the Beamer 233S substation to the 807AL t-tap under single contingency events. Further, the planning study results indicate the identified thermal overload in the Beamer Area will aggravate following the assumed generation connections in the Fort Saskatchewan Planning Area, which affects the capacity requirements. Therefore, there is a need for transmission system development to enhance reliability of the power supply in the Beamer Study Area by mitigating thermal overload under certain system conditions. The studies also confirmed that the driver of the need for transmission system development in this area is the forecast load growth in the area and assumed generation connections in the Fort Saskatchewan Planning Area.

Based on the study results, the AESO recommends to increase the capacity of the existing 807L transmission line between the Beamer 233S substation and the 807AL t-tap to alleviate the identified thermal constraint. The 807L transmission line (Josephburg 410S – 807AL t-tap – Beamer 233S) is approximately 7 km long. The current summer/winter rating of 807L between the Beamer 233S substation and the 807AL t-tap is 85/90 MVA. The AESO is recommending to increase the capacity of this section of the line to 175/217 MVA summer/winter rating, consistent with the rating of the remaining sections of this line. System study results demonstrate the proposed transmission development will address the identified constraints in the Beamer Study Area for the 20-year planning horizon, and no new constraints arise as a result of the proposed transmission development. AltaLink Management Ltd. ("AltaLink") is the transmission facility owner ("TFO") in this area. AltaLink has advised the AESO that approximately 1 km of 807L between the Beamer 233S substation and the 807AL t-tap needs to be rebuild to increase the summer/winter rating to 175/217 MVA.

The AESO has not considered any other options given that the proposed transmission development option is the minimum development required to address the identified need in the 20-year planning horizon. The proposed transmission development is independent of any other transmission developments that are currently planned within the Alberta transmission system in this timeframe. Future generation additions in the Fort Saskatchewan Planning Area may rely on the 807L capacity increase for their constraint-free connection to the grid depending on their impact on the 807L loading. Additionally, load

growth in the Beamer Study Area will rely on the proposed transmission development for reliable access to the grid.

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1 Introduction

The AESO performs system planning studies regularly to assess transmission system reliability in the near-term (5 years), and medium-term (10 years). The AESO's planning studies had identified that the existing 138 kV transmission system supplying load in the northeast of the Fort Saskatchewan Planning Area will be subject to constraints under certain system conditions. This report presents detailed planning studies that have since been performed based on the AESO's latest forecast, i.e., 2016 LTO, to assess the transmission system constraints in this area, and propose a preferred transmission development option to address the identified constraints.

The Beamer Study Area, the focus of the studies described in this report, is located within the AESO's Fort Saskatchewan Planning Area. For the purposes of the planning studies described in this report, the Beamer Study Area is defined as:

Beamer 233S substation,

Redwater 171S substation,

Weasel Creek 947S substation,

Abee 993S substation, and

All the 138 kV transmission lines that connect to the above mentioned substations.

Figure 1 illustrates the Beamer Study Area. There are three existing 138 kV transmission lines, 708L (Lamoureux 71S – Beamer 233S), 807L (Josephburg 410S – 807AL t-tap – Beamer 233S), 808L (Deerland 13S – Redwater 171S), supplying load in this area. Load in the Beamer Study Area is forecast to grow due to the industrial expansions. Abee 993S and Weasel Creek 947S substations were energized in 2013 to mainly serve pipeline load. In addition to the load growth in the area, there are several future generation additions in the vicinity of the Beamer Study Area, including 485 MW Heartland Generating Station connection to Josephburg 410S, that would increase power flow on the existing 138 kV transmission lines in this area. Study results indicate that the local network in the Beamer Study Area can experience thermal overload following a single contingency due to imminent load growth in the area. Additional load growth in the area as well as future generation connection in the Fort Saskatchewan Planning Area will exacerbate thermal overload in the Beamer Study Area. The existing transmission system in the Fort Saskatchewan Planning Area is depicted in Figure 2. The objectives of the planning studies in the Beamer Study Area and the scope of the studies are described below.

Figure 1: Transmission system in the Beamer Study Area

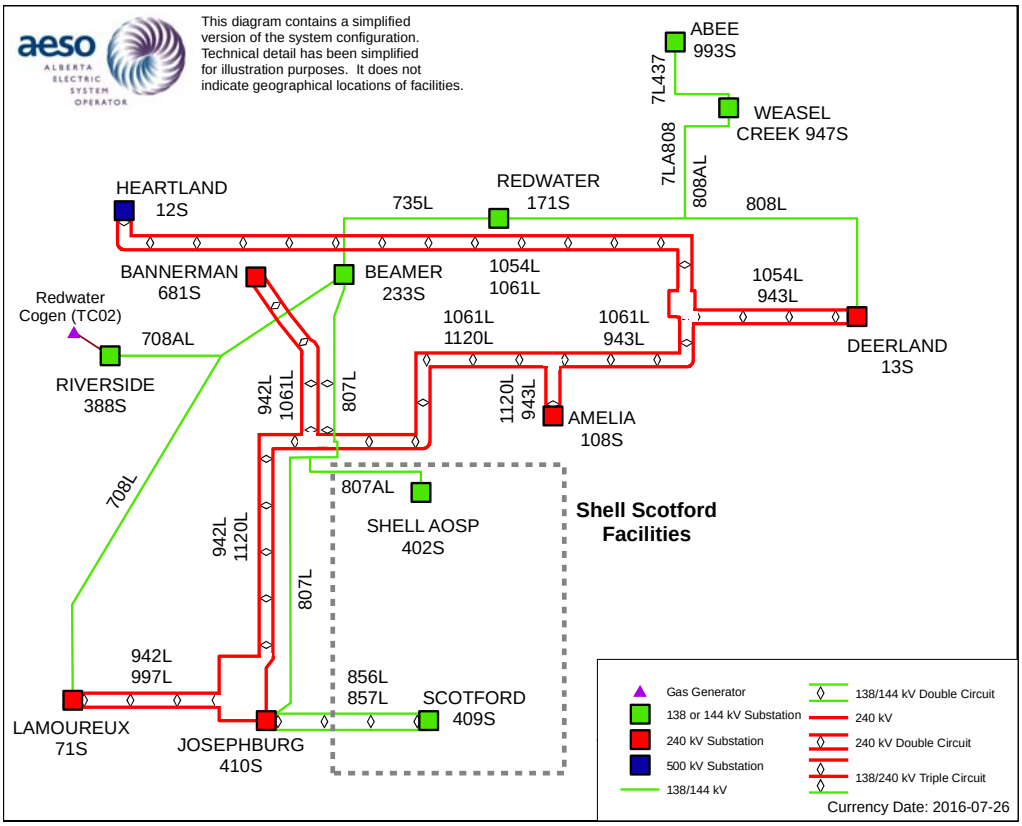
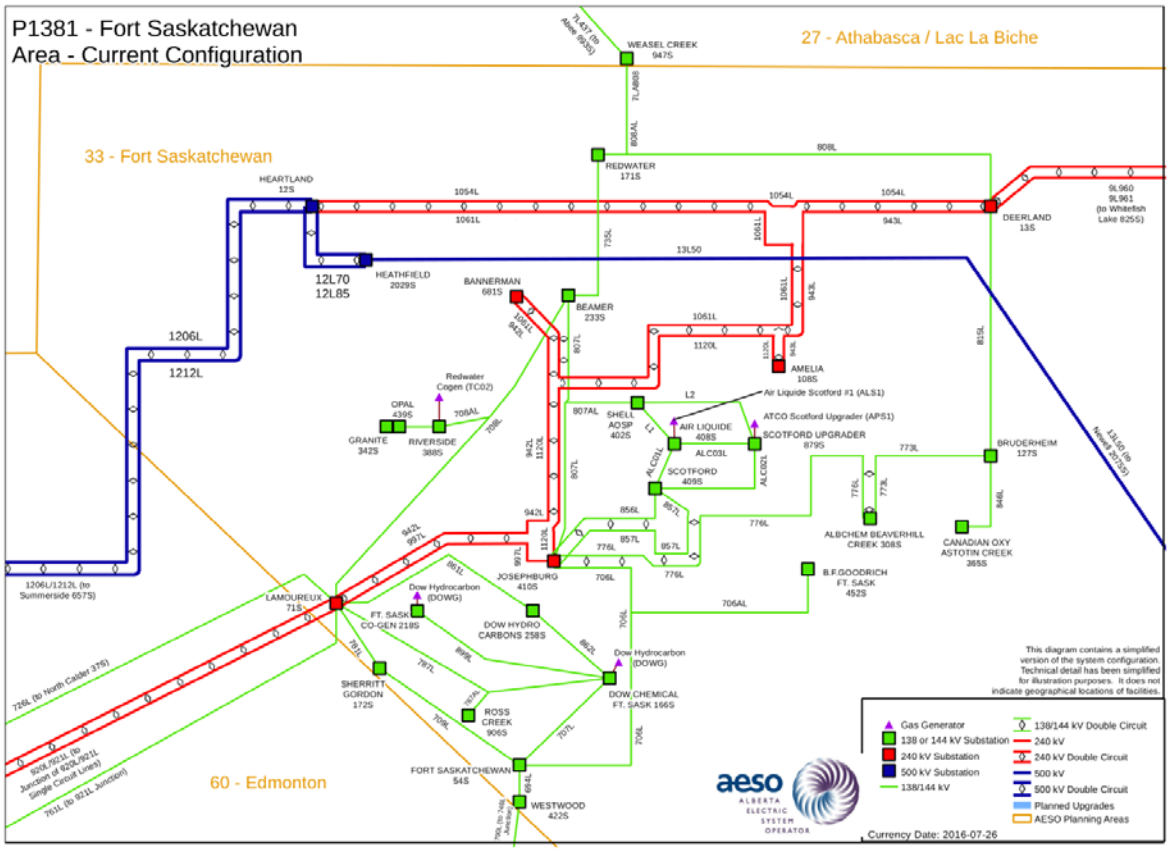


Figure 2: Fort Saskatchewan Planning Area existing transmission system



1.1 Study Objectives

The study objectives were as follows:

Determine the timing of the need for transmission system developments (“Need Year”) based on the forecast load growth.

Assess the performance of existing transmission system in the near-term (Need Year and 2020) and medium-term (2025) using Alberta Reliability Standards to identify any violations and system constraints under Category A system conditions (all transmission elements in service) and Category B contingencies (a single element out of service).

Determine transmission system development option(s) to address the identified need for transmission reinforcements.

Assess transmission system development options based on the Alberta Reliability Standards in the near-term, medium-term, and long-term (2035) planning horizon under Category A system conditions, and Category B contingencies.

1.2 Study Scope

The following planning studies were performed in the study area to achieve the study objectives:

Power flow analyses were performed in various timeframes (Need Year, 2020 and 2025) to assess system performance prior to implementation of any system development in the Beamer Study Area under Category A system conditions and Category B contingencies. Such studies are referred to in this report as the Need Assessment, which establishes the need for transmission development in the Beamer Study Area through identification of system constraints.

Considering the Need Assessment study results, a transmission development option was planned to alleviate the identified constraints.

Power flow studies were performed following implementation of the identified transmission development option to assess its performance in various timeframes (Need Year, 2020, 2025, and 2035).

Short-circuit analyses were performed before and after transmission system developments in the near-term (Need Year).

1.2.1 Studies not included in the Study Scope

The following studies were not undertaken as part of the planning studies:

Voltage stability (PV) analyses were excluded given that there are significant reactive power supports in the vicinity of the Beamer Study Area, and therefore, voltage stability is not a concern.

Dynamic stability analyses were not performed as the Beamer Study Area is a load centre and there are no transient stability issues in this area.

Identification of any system constraints in the Fort Saskatchewan Planning Area, outside the Beamer Study Area, was excluded from the scope of the studies presented in this report.

The AESO may develop operational procedures and mitigation plans, including system reconfiguration or generation re-dispatch, to ensure reliable system operation until the proposed transmission developments are implemented. The investigation or the development of specific operational measures that could be applied in future by the AESO is beyond the scope of this planning report.

1.3 Report Overview

This planning report summarizes the studies conducted to assess system performance and capacity requirements in the Beamer Study Area. The transmission development option considered by the AESO to address the identified system constraints is evaluated and the study results are discussed. The report is structured as follows:

- The Executive Summary summarizes the report and its conclusions.
- Section 1 provides an introduction that includes the scope of the studies.
- Section 2 describes the reliability standards, criteria, and study assumptions.
- Section 3 presents the planning methodology.
- Section 4 discusses the Need Assessment.

- Section 5 presents the development of the transmission development option to address the identified constraints and the technical assessment of this option.
- Section 6 discusses project interdependencies.
- Section 7 presents the summary and conclusions.

2 Reliability Standards, Criteria, and Study Assumptions

This section discusses the applicable reliability standards, criteria, and study assumptions applied in the planning studies. Applicable 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.

2.1 Transmission Reliability Standards and Criteria

2.1.1 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 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.

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 rating.
- Applicable voltage limits are the normal minimum and maximum limits as specified in Table 2-1 for Category A conditions, while the extreme minimum and maximum limits are used to identify Category B and Category C system violations.

[1] A complete description of these standards are available on the AESO website: http://www.aeso.ca/rulesprocedures/17004.html

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

2.2 Load Forecast and Generation Assumptions

The system planning studies were conducted using the AESO 2016 LTO. Historically load in the Beamer Study Area peaks in winter. However, considering that the most limiting factor in the area is thermal constraints, only summer peak load were studied as summer ratings of the transmission lines are typically lower than their winter ratings.

Load in the Beamer Study Area is primarily industrial load and forecast to grow. In 2013 two new substations, Abee 993S and Weasel Creek 947S, were energized to mainly serve pipeline load. Additionally, in 2014 and 2015, FortisAlberta increased its DTS contract by 29 MW at the Redwater 171S substation in two phases. Detailed load and generation assumptions for each of the study cases are provided in Section 3.1 of this report.

Appendix B to the *138 kV Transmission Line 807L Capacity Increase* Needs Identification Document contains further detail regarding the forecast information.

2.3 HVDC Assumptions

The Western Alberta Transmission Line (WATL) and Eastern Alberta Transmission Line (EATL) High-voltage Direct Current (HVDC) lines were dispatched economically in the study models to achieve minimum system losses under system normal conditions.

2.4 Transmission Facilities Assumptions

2.4.1 Transmission System and Customer Connection Projects

Table 2-2 outline system projects that were modeled in the study cases based on their estimated in-service date ("ISD"). Table 2-3 list the customer connection projects located in the Fort Saskatchewan area that have been included in the study models to represent future system topology in the corresponding years.

Table 2-2: List of Transmission System Projects

Project No	Project Name	Planning Area	Estimated ISD
1590	Fort McMurray West 500 kV line	25, 33	2019
-	Fort McMurray East 500 kV line	25, 33	2025

Table 2-3: List of Customer Connection Projects Applied for in Area 33

Project No.	Project Name	Planning Area	Customer Requested ISD
1421	ATCO Power Heartland Generating Station	33	November 2019 energization & Q1 2020 commercial operation
1289	Maxim Power Deerland Peaking Station	33	December 2017 energization
1666	TransCanada Redwater ISD DTS Increase	33	July 2017
1647	Williams Strathcona Cogeneration	33	November 2017 energization & January 2018 commercial operation

2.4.2 Facility Ratings

Table 2-4 summarizes the facility ratings in the Beamer Study Area. The current summer/winter rating of 807L from the Beamer 233S substation to the 807AL t-tap is limited to 85/90 MVA although sections of this line that are on a common tower with the 240 kV transmission lines 942L/1061L is already upgraded using Hawk 477 MCM conductors with a higher summer/winter rating of 175/217 MVA. The remaining sections of this line, from Josephburg 410S to the 807AL t-tap, is also upgraded using Hawk 477 MCM conductors with a summer/winter rating of 175/217 MVA.

Table 2-4: Summary of Ratings of Transmission Lines in the Study Area

Line ID	Line Description	Voltage Class (kV)	Nominal Rating (MVA)	
			Summer	Winter
807L	Beamer 233S to 807AL Tap	138	85	90
807L	Josephburg 410S to 807AL Tap	138	175	217
708L	Lamoureux 71S to Beamer 233S	138	121	148
808L	Deerland 13S to Redwater 171S	138	98	114
735L	Beamer 233S to Redwater 171S	138	96	94
808AL/7LA808	808L to Weasel Creek 947S	138	121	150
437L	Weasel Creek 947S to Abee 993S	138	121	150

3 Planning Methodology

The planning process included the following:

1. Develop credible stressed study cases considering the load and generation forecast. Summer peak load and high area generation dispatches were assumed in order to create stressed scenarios for the planning studies.
2. Perform Need Assessment studies in the near-term (Need Year and 2020) and medium-term (2025) to identify potential transmission system constraints in various timeframes.
3. Assess the sensitivity of study results and recommendations to uncertainty of key study assumptions, as required.
4. Develop transmission development option(s) to address the identified constraints.
5. Assess the transmission development option(s) to evaluate its performance and to ensure all identified constraints in the 20-year planning horizon are addressed.

The selected study years, system conditions, and methodology used for the study are described below.

3.1 Study Cases

Study scenarios were developed using the system conditions listed in Table 3-1 to stress the study area. Based on the 2016 LTO, there is a significant load growth in 2017 in the Beamer Study Area. Therefore, studies included a 2017 scenario. As explained earlier in Section 2.2, only summer peak loading conditions are considered in these studies to represent stressed conditions in the area. Detailed generation assumptions in the Area 33 that was used for each study scenario is provided in Attachment A. One of the Mahkeses units was assumed off-line in 2017 study scenario to model N-G condition for N-G-1 power flow studies. Similarly, the Redwater ISD unit was assumed off-line in the 2020, 2025 and 2035 study scenarios for N-G-1 power flow studies. Given assumptions creates a stressed system condition by increasing power flow on the transmission lines in the Beamer Study Area.

Table 3-1: Summary of Study Scenarios

Case	Year	Season	Area 33		
			Load	Beamer Area Load (MW)	Generation Condition
17_1a	2017	Summer	659	109	High generation
20_1a	2020	Summer	737	110	Co-gen high, Peaking units low*
25_1a	2025	Summer	756	112	High generation
35_1a	2035	Summer	785	115	High generation

- A variation of generation condition, assuming Redwater ISD in-service, was also considered as detailed in Appendix A.

3.2 Power Flow Analysis

Power flow analyses were performed under Category A system conditions with all transmission elements in service and Category B contingencies (N-1). These analyses were performed for all the study scenarios listed in Table 3-1 to identify any violation of the Reliability Standards, including thermal overloads and voltage issues in the Beamer Study Area. The contingency list included all the 138 kV and above transmission elements in the Fort Saskatchewan Planning Area to assess the impact on the Beamer Study Area.

3.3 Short-circuit Analysis

The objective of short-circuit analysis is to assess the impact of the proposed transmission development on the short-circuit levels by assessing the maximum fault currents before and after implementation of the proposed transmission development. To evaluate the maximum fault current under three-phase-to-ground faults and single-line-to-ground faults, all transmission elements were in service and all generators in and around the Fort Saskatchewan area were dispatched.

4 Need Assessment

The main objective of the Need Assessment studies was to determine transmission system constraints in various timeframes: 2017, 2020 and 2025. It is important to study system constraints in different timeframes to investigate if the nature of the constraint remains unaffected by planned changes in the system as well as to gain an understanding of the system capacity requirements through observing how the severity of the constraints changes over the time. Further, the Need Assessment indicates when the constraints in the Beamer Study Area arise based on the given load and generation assumptions.

4.1 Power Flow Analysis

Power flow studies for Category A (N-0) and Category B (N-1) contingencies were performed to identify any thermal or voltage violations in the Beamer Study Area for all the study scenarios listed in Table 3-1. The study results are discussed below.

4.1.1 2017 Summer Peak (2017SP):17_1a

The Power flow diagrams for 2017SP are provided in Attachment B.

Category A (N-0) Conditions – 2017SP

No voltage or thermal criteria violations were observed in this scenario.

Category B (N-1) Conditions – 2017SP

No voltage criteria violations were observed in this scenario. The overload on 807L (233S Beamer to 807AL t-tap) occurs under the contingency of 708L (Beamer 233S to Lamoureux 71S) as presented in Table 4-1. Considering the study results, the need for transmission development in the Beamer Study Area arises in 2017 if forecast load materializes in this timeframe. However, the reported thermal overload is minor and as such will not arise if the actual load is lower than the forecast load in 2017. Therefore, the timing of the need for transmission development in the Beamer Study Area is dependent on when the area load reaches 109 MW.

Table 4-1: 2017SP, Category B (N-1) Thermal Loading

Contingency	Overloaded Branch	Nominal Line Rating (MVA)	17_1a	
			Power Flow (MVA)	% Loading
708L (233S Beamer to 71S Lamoureux)	807L (Beamer 233S to 807AL t-tap)	85	87	101

4.1.2 2020 Summer Peak (2020SP):20_1a

The power flow diagrams for 2020SP are provided in Attachment C.

Category A (N-0) Condition - 2020SP

No voltage or thermal criteria violations were observed in this scenario.

Category B (N-1) Condition - 2020SP

No voltage criteria violations were observed in this scenario. The overloads on 807L (Beamer 233S to 807AL t-tap) occur under the contingencies of 708L and 808L as indicated in Table 4-2.

Table 4-2: 2020SP, Category B (N-1) Thermal Loading

Contingency	Overloaded Branch	Nominal Line Rating (MVA)	20_1a	
			Power Flow (MVA)	% Loading
808L (Redwater 171S to Deerland 13S)	807L (233S Beamer to 807AL (Shell) Tap)	85	92	106
708L (Beamer 233S to Lamoureux 71S)	807L (Beamer 233S to 807AL t-tap)	85	87	101

4.1.3 2020 Summer Peak Sensitivity (2020SP):20_1a_Sen

Sensitivity studies were performed to assess the impact of the future Heartland Generating Station on the Beamer Study Area. The customer's requested ISD for generation connection is Q4 2019. The power flow diagrams for 2020SP sensitivity scenario are provided in Attachment D.

Category A (N-0) Condition – 2020SP_Sensitivity

Voltage criteria violations were not observed in this scenario. Due to load growth and the Heartland Generating Station connection, there is significantly higher power flow on the 138 kV transmission system in the Area 33. Specifically, overload on 807L line occurs under Category A conditions as presented in Table 4-3.

Table 4-3: 2020SP Sensitivity, Category A (N-0) Thermal Loading

System Condition	Branch	Nominal Line Rating (MVA)	20_1a_Sen	
			Power Flow (MVA)	% Loading
All elements in-service (N-0)	807L (Beamer 233S to 807AL t-tap)	85	88	101

Category B (N-1) Condition – 2020SP_Sensitivity

No voltage criteria violations were observed in this scenario. Due to load growth and the Heartland Generating Station connection, there is significantly higher power flow on 807L resulting in thermal overload under several Category B contingency events as presented in Table 4-4.

Table 4-4: 2020SP_Sensitivity, Category B (N-1) Thermal Loading

Contingency	Branch	Nominal Line Rating (MVA)	20_1a_Sen	
			Power Flow (MVA)	% Loading
706L (Josephburg 410S to Fort Saskatchewan 54S)	807L (Beamer 233S to 807AL t-tap)	85	97	112
808L (Redwater 171S to Deerland 13S)	807L (Beamer 233S to 807AL t-tap)	85	105	121
776L (Josephburg 410S to Albchem Beaverhill Creek 308S)	807L (Beamer 233S to 807AL t-tap)	85	96	110
773L (Bruderheim 127S to Albchem Beaverhill Creek 308S)	807L (Beamer 233S to 807AL t- tap)	85	96	110
997L (Lamoureux 71S to Josephburg 410S)	807L (Beamer 233S to 807AL t- tap)	85	133	153
943L (Deerland 13S to Amelia 108S)	807L (Beamer 233S to 807AL t- tap)	85	94	107
1120L (Josephburg 410S to Amelia 108S)	807L (Beamer 233S to 807AL t- tap)	85	98	112

4.1.4 2025 Summer Peak (2025SP):25_1a

The power flow diagrams for 2025SP are provided in Attachment E.

Category A (N-0) Condition - 2025SP

No voltage criteria violations were observed in this scenario. Due to load growth and the Heartland Generating Station connection, there is significantly higher power flow on the 138 kV transmission system in Area 33. Specifically, overload on 807L line occurs under Category A conditions as presented in Table 4-5.

Table 4-5: 2025SP, Category A (N-0) Thermal Loading

Contingency	Branch	Nominal Line Rating (MVA)	25_1a	
			Power Flow (MVA)	% Loading
Category A Thermal Violation	807L (Beamer 233S to 807AL t- tap)	85	93	106

Category B (N-1) Condition – 2025SP

No voltage criteria violations were observed in this scenario. The overload on 807L (Beamer 233S to 807AL t-tap) occurs under several contingencies as presented in Table 4-6.

Table 4-6: 2025SP, Category B (N-1) Thermal Loading

Contingency	Branch	Nominal Line Rating (MVA)	25_1a	
			Power Flow (MVA)	% Loading
706L (Fort Saskatchewan 54S to Josephburg 410S)	807L (Beamer 233S to 807AL t- tap)	85	109	124
808L (Redwater 171S to Deerland 13S)	807L (Beamer 233S to 807AL t- tap)	85	129	148
EXI-01L (Scotford Upgrader 879S to Shell AOSP1 402S)	807L (Beamer 233S to 807AL t- tap)	85	87	100
997L (Lamoureux 71S to Josephburg 410S)	807L (Beamer 233S to 807AL t- tap)	85	145	166
621L (Deerland 13S to Deerland Peaking Station 109S)	807L (Beamer 233S to 807AL t- tap)	85	100	115

4.2 Summary of the Need Assessment

The Need Assessment included power flow studies in the near-term (2017 and 2020) and medium-term (2025) using the study scenarios described in Table 3-1 in Section 3.1 under Category A system conditions (N-0) and Category B (N-1) contingencies.

The study results demonstrated that the existing 138 kV 807L transmission line (Beamer 233S – 807AL t-tap) will experience thermal overload under Category B events in all studied timeframes due to load growth in the Beamer Study Area. Further, these studies indicated power flow on the existing transmission system in the Beamer Study Area will increase significantly due to the assumed generation additions in the Fort Saskatchewan Planning Area, resulting in thermal overloads on 807L to arise under N-0 system conditions. Additionally, such generation additions will significantly increase thermal

overloads on 807L under N-1 contingency events. Therefore, there is a need for transmission system developments in the Beamer Study Area to alleviate the identified constraints. Additionally, different generation assumptions studied in different scenarios have an impact on the severity of the identified constraints and therefore, affect the capacity requirements. The driver of the need for transmission developments in this area is the forecast load growth in the area and assumed generation connections in the Fort Saskatchewan Planning Area.

Based on the study results, timing of the need will be dependent on the load growth in the Beamer Study Area reaching 109 MW and/or generation addition(s) in the Fort Saskatchewan Planning Area that would cause thermal overloads on the 807L transmission line. Considering the Need Assessment, Section 5 describes transmission development option that is required to address the identified constraint in the Beamer Study Area.

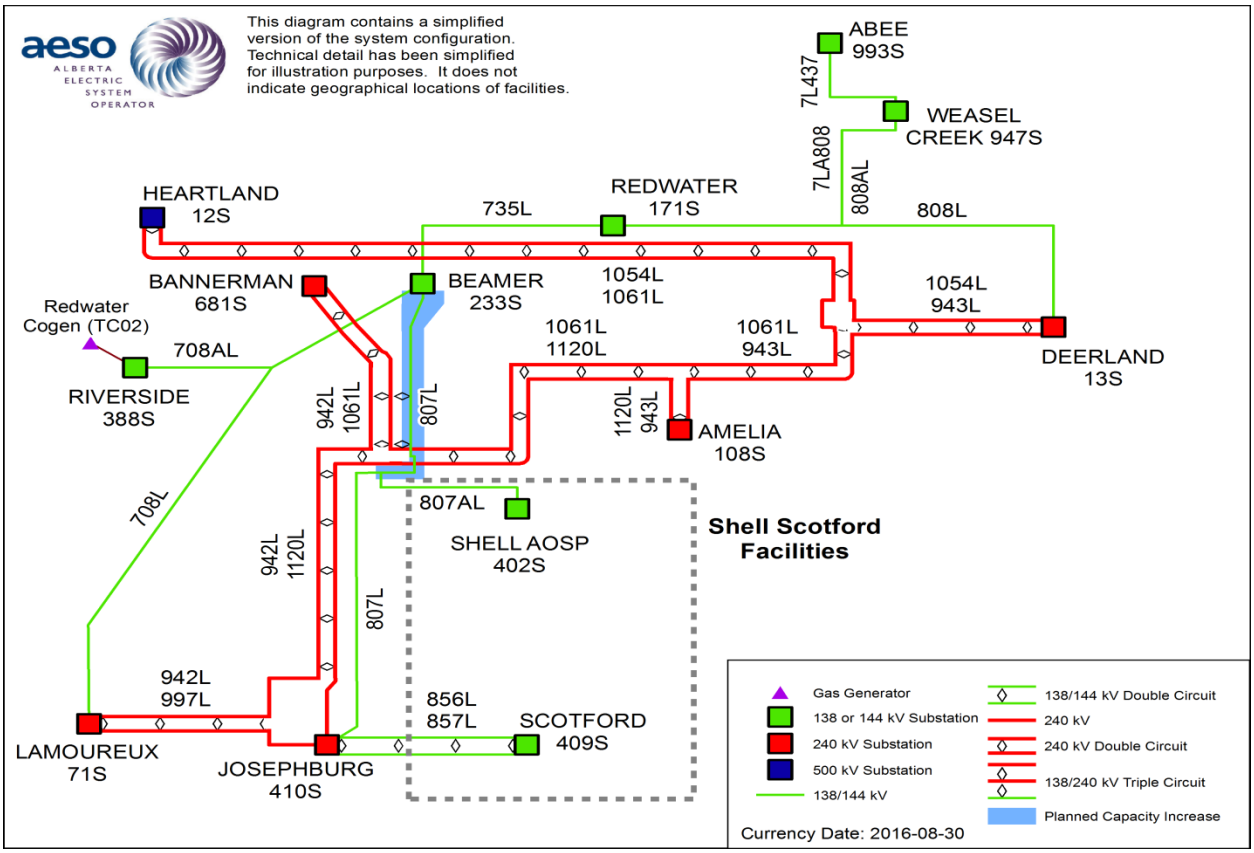
5 Proposed Development

Based on the Need Assessment, the AESO proposes to increase the capacity of sections of the existing 807L transmission line between the Beamer 233S substation and the 807AL t-tap from 85/90 MVA to 175/217 MVA (summer/winter rating) to alleviate the identified thermal constraint. The proposed capacity is consistent with the current capacity of the remaining sections of the 807L line. AltaLink has advised the AESO that approximately 1 km of 807L between the Beamer 233S substation and the 807AL t-tap needs to be rebuild to increase the summer/winter rating of the line to 175/217 MVA. Figure 3 presents the proposed transmission development, which will not result in any changes to the existing transmission network configuration or any changes to the existing layout of the Beamer 233S substation.

The AESO did not consider any other transmission development options given that the proposed transmission system development option is the minimum development required to address the identified need.

The proposed transmission development option is assessed in near-term (2017, 2020), medium-term (2025), and long-term (2035) using study scenarios presented in Table 3-1. Study results are reported in the following sections.

Figure 3: 807L Capacity Increase



5.1 Technical Assessment of the Preferred Transmission Development Option

5.1.1 Power Flow Analysis

The Power flow diagrams for the proposed transmission development for all study years are provided in Attachment F.

Near-term (2017) Assessment
No overloads or voltage violations were observed in 2017 under the Category A (N-0) condition and Category B events for all studied scenarios assuming the proposed transmission development option is implemented.

Near-term (2020) Assessment
No overloads or voltage violations were observed in 2020 under the Category A (N-0) condition and Category B events for all studied scenarios assuming the proposed transmission development option is implemented.

Medium-term (2025) Assessment

No overloads or voltage violations were observed in 2025 under the Category A (N-0) condition and Category B events for all studied scenarios assuming the proposed transmission development option is implemented.

Long-term (2035) Assessment

No overloads or voltage violations were observed in 2035 under the Category A (N-0) condition and Category B events for all studied scenarios assuming the proposed transmission development option is implemented.

5.1.2 Short-circuit Analysis

Short-circuit analysis was performed using the near-term (2017) study case to determine the maximum short-circuit fault levels in the Beamer Study Area before and after the proposed transmission development option. The proposed transmission development does not have any material impact on the short-circuit levels in the study area.

Three-phase and single-phase (line-to-ground) fault currents were calculated.

The results of the short-circuit studies revealed that all fault levels were below the individual circuit breaker capabilities.

Short-circuit study results are provided in Attachment G.

5.2 Alignment with the AESO Long-term Plans

The AESO's *2015 Long-term Transmission Plan* (2015 LTP) was prepared using 2014 LTO forecast, and it includes increasing the capacity of 138 kV line between Beamer and Shell substations. Therefore, the proposed transmission development is aligned with the AESO's 2015 LTP.

6 Transmission Interdependencies

The proposed transmission development will alleviate the identified need in the 20-year planning horizon and is independent of any other transmission developments that are currently planned within the Alberta transmission system. Future generation additions in the Fort Saskatchewan Planning Area may rely on the 807L capacity increase for their constraint-free connection to the grid depending on their impact on the 807L loading. Additionally, future load growth in the Beamer Study Area will rely on the 807L capacity increase for reliable access to the grid.

7 Conclusions and Recommendation

The AESO performs system planning studies regularly to assess transmission system reliability in the near-term (5 years), and medium-term (10 years). The AESO's planning studies had identified that the existing 138 kV transmission system supplying load in the northeast of the Fort Saskatchewan Planning Area will be subject to constraints under certain system conditions.

Planning study results demonstrate that the existing transmission network in the Beamer Study Area does not have sufficient capacity to reliably supply the forecast load growth in 2017 and is prone to overloading under a single contingency. Specifically, these studies indicated thermal overload on a section of the existing 807L between Beamer 233S and 807AL t-tap under single contingency events. Further, the studies also confirmed that the assumed generation additions in the Fort Saskatchewan Planning Area will aggravate the identified thermal overloads. Therefore, there is a need for transmission development in the Beamer Study Area to alleviate the identified constraints. The driver of the need for transmission system development is the forecast load growth in the Beamer Study Area and major generation additions in the Fort Saskatchewan Planning area. Based on the study results, timing of the need will be dependent on the load growth in the Beamer Study Area reaching 109 MW and/or generation addition(s) in the Fort Saskatchewan Planning Area that would impact thermal overloads on the 807L transmission line.

Based on the study results, the AESO recommends to increase the capacity of sections of the existing 807L transmission line between the Beamer 233S substation and the 807AL t-tap from 85/90 MVA to 175/217 MVA (summer/winter rating) to alleviate the identified thermal constraint. The proposed capacity is consistent with the current capacity of the remaining sections of the 807L line. AltaLink has advised the AESO that approximately 1 km of 807L between the Beamer 233S substation and the 807AL t-tap needs to be rebuild to increase the summer/winter rating of the line to 175/217 MVA.

The AESO has not considered any other options given that the proposed transmission system development option is the minimum development required to address the identified need in the 20-year planning horizon.

The proposed transmission development will alleviate the identified need in the 20-year planning horizon and is independent of any other transmission developments that are currently planned within the Alberta transmission system. Future generation additions in the Fort Saskatchewan Planning Area may rely on the 807L capacity increase for their constraint-free connection to the grid depending on their impact on the 807L loading. Additionally, load growth in the Beamer Study Area will rely on the proposed transmission development for reliable access to the grid.

Attachment A

Summary of Generation Dispatch in the Study Area

Table A-1: Summary of Generation Dispatch in the Study Area

Generator	2017SP Unit Net Generation (MW)	2020SP Unit Net Generation (MW)	2020SP Sensitivity Unit Net Generation (MW)	2025SP Unit Net Generation (MW)	2035SP Unit Net Generation (MW)
Scotford GT	70	70	70	70	70
Scotford ST	68	68	68	68	68
Air Liquide G1	68	68	68	68	68
Dow GTG	80	80	80	80	80
Dow STG	37	37	37	37	37
Dow Gen1	52	52	52	52	52
Dow Gen2	52	52	52	52	52
Redwater ISD	34	34[1]	34[2]	34[2]	34[2]
P1289 Deerland	0	0	0	163	163
P1421 Heartland	0	0	448	430	430[3]
P1647 William Strathcona	0	72	72	72	72

1. Redwater ISD was assumed off-line to model N-G condition. A variation of this scenario was also studied, which assumed Redwater ISD at 34 MW, as explained previously in Section 3.1.

2. Redwater ISD was assumed off-line to model N-G condition, as explained previously in Section 3.1.

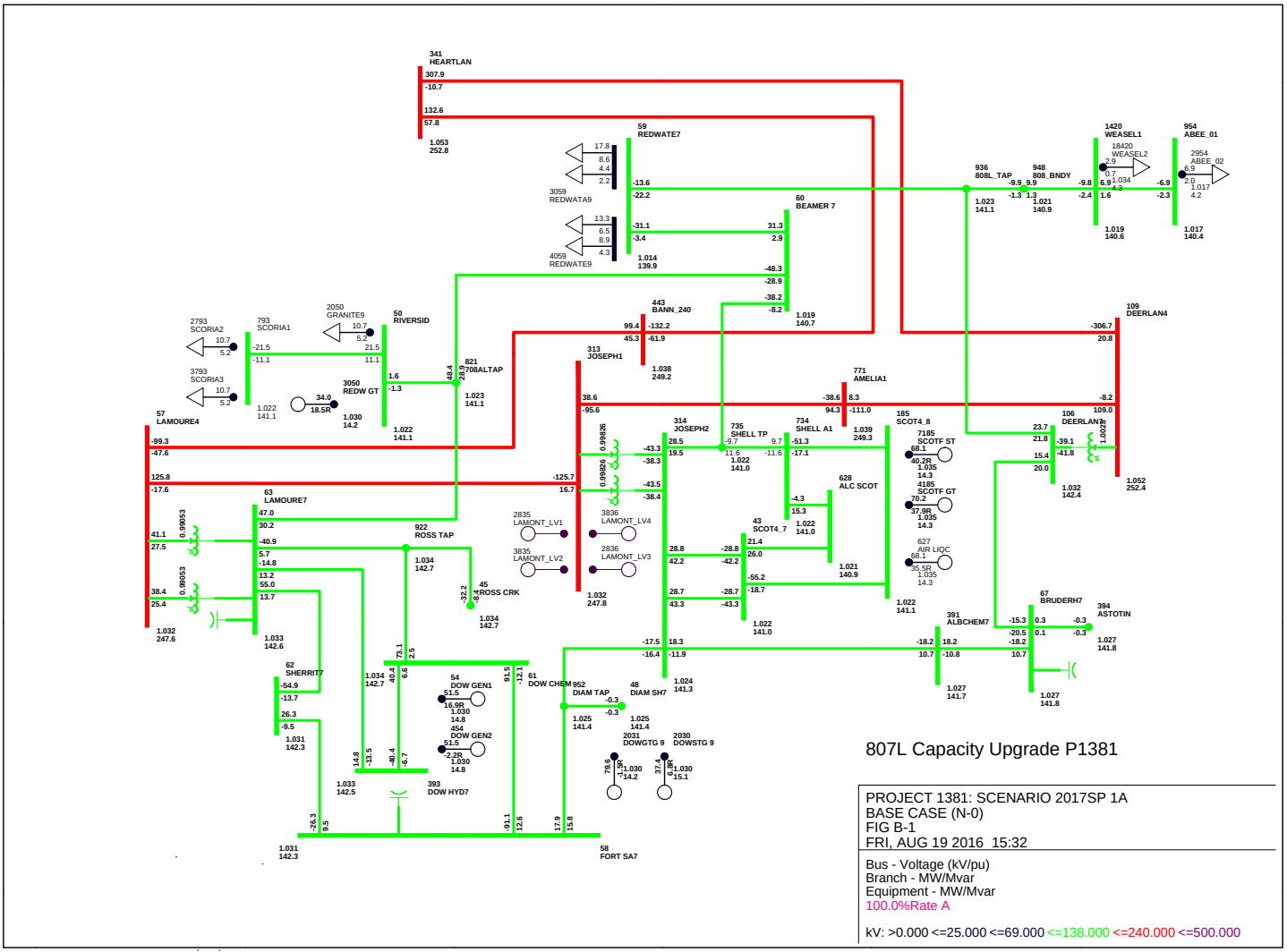
3. In addition to 430 MW dispatched generation, another 430 MW forecast generation was modelled at Josephburg 410S 240 kV in 2035SP scenario with the assumption of 942L terminated In&Out at Josephburg 410S 240 kV.

Attachment B

2017SP Power Flow Diagrams

Table B-1: 2017SP Contingency Lists

Figure #	Scenario	Condition	
B-1	17_1a	Base Case (N-0)	
B-2	17_1a	942L (N-1)	71S Lamoureux to 681S Bannerman
B-3	17_1a	1061L (N-1)	681S Bannerman to 12S Heartland
B-4	17_1a	997L (N-1)	71S Lamoureux to 410S Josephburg
B-5	17_1a	1120L (N-1)	410S Josephburg to 108S Amelia
B-6	17_1a	943L (N-1)	13S Deerland to 108S Amelia
B-7	17_1a	1054L (N-1)	12S Heartland to 13S Deerland
B-8	17_1a	9L960 (N-1)	13S Deerland to 825S Whitefish Lake
B-9	17_1a	9L961 (N-1)	13S Deerland to 825S Whitefish Lake
B-10	17_1a	920L (N-1)	71S Lamoureux to 557S Castle Downs
B-11	17_1a	921L (N-1)	71S Lamoureux to 987S Clover Bar
B-12	17_1a	708L (N-1)	233S Beamer to 71S Lamoureux
B-13	17_1a	807L (N-1)	410S Josephburg to 233S Beamer
B-14	17_1a	735L (N-1)	233S Beamer to 171S Redwater
B-15	17_1a	808L (N-1)	171S Redwater to 13S Deerland
B-16	17_1a	621L (N-1)	13S Deerland to 109S Skaro
B-17	17_1a	815L (N-1)	13S Deerland to 127S Bruderheim
B-18	17_1a	846L (N-1)	127S Bruderheim
B-19	17_1a	773L (N-1)	127S Bruderheim to 308S Albchem Beaverhill Creek
B-20	17_1a	776L (N-1)	410S Josephburg to 308S Albchem Beaverhill Creek
B-21	17_1a	856L (N-1)	410S Josephburg to 409S Shell Scotford
B-22	17_1a	857L (N-1)	410S Josephburg to 409S Shell Scotford
B-23	17_1a	ALCO2L (N-1)	879S Scotford Upgrader to 409S Shell Scotford
B-24	17_1a	EXI-01L (N-1)	879S Scotford Upgrader to 402S Scotford Expansion 1
B-25	17_1a	ALC03L (N-1)	402S Scotford Expansion 1 to Air Liquide
B-26	17_1a	ALC01L (N-1)	Air Liquide to 409S Shell Scotford
B-27	17_1a	706L (N-1)	410S Josephburg to 54S Fort Saskatchewan
B-28	17_1a	707L (N-1)	233S Beamer to 71S Lamoureux
B-29	17_1a	787L (N-1)	71S Lamoureux to 166S Dow Chemical
B-30	17_1a	862L (N-1)	166S Dow Chemical to 258S Dow HydroCarbons
B-31	17_1a	861L (N-1)	71S Lamoureux to 258S Dow HydroCarbons
B-32	17_1a	781L (N-1)	172S Sherritt to 71S Lamoureux
B-33	17_1a	709L (N-1)	233S Beamer to 71S Lamoureux
B-34	17_1a	694L (N-1)	54S Fort Saskatchewan to 422S Westwood
B-35	17_1a	700L (N-1)	422S Westwood to 746S Sherwood Park

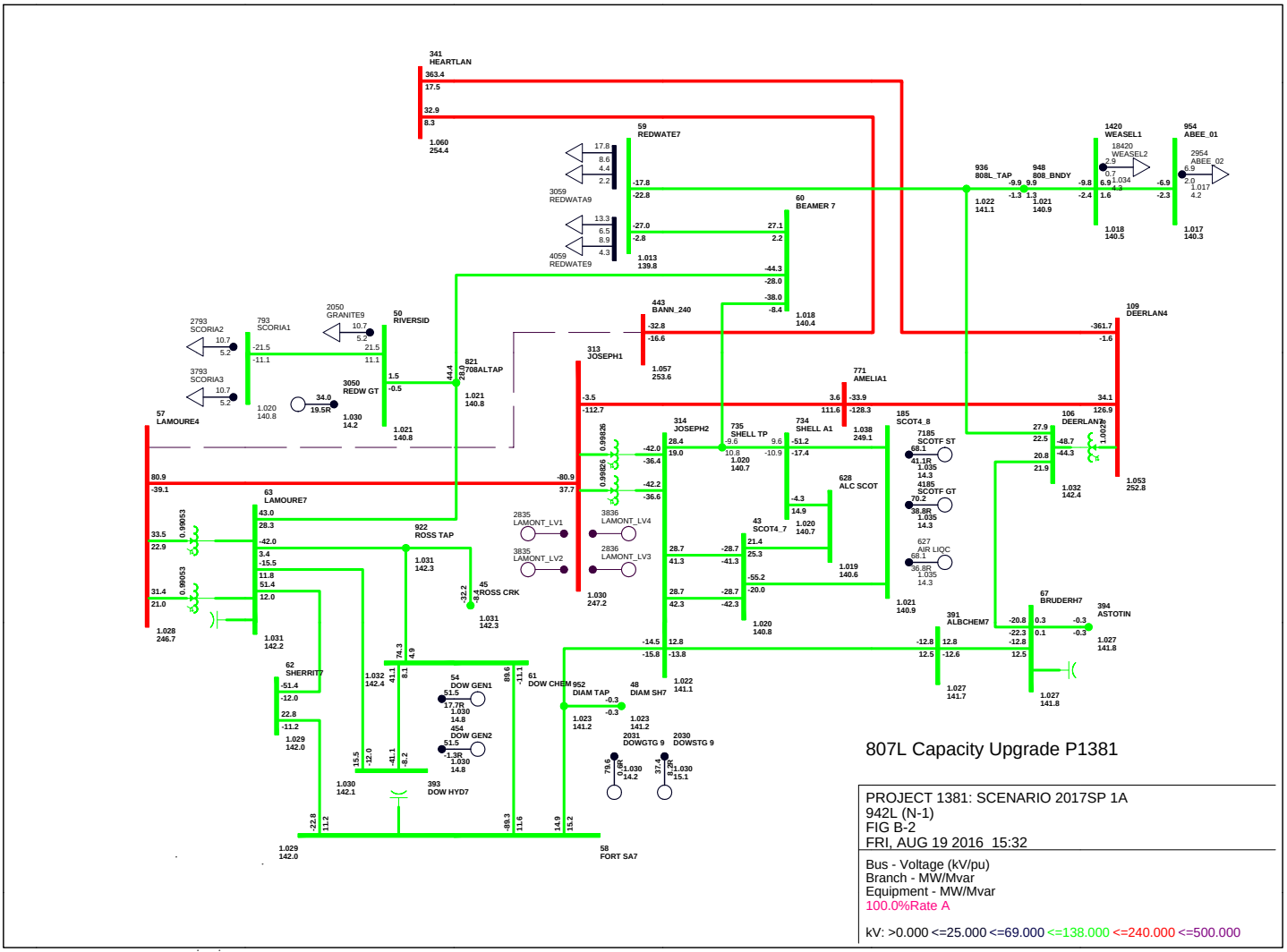


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
BASE CASE (N-0)
FIG B-1
FRI, AUG 19 2016 15:32

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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1.060
254.4
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REDWATE7
17.8
8.6
4.4
2.2
3059
REDWATA9
-17.8
-22.8
13.3
6.5
8.9
4.3
4059
REDWATE9
-27.0
-2.8
27.1
2.2
1.013
139.8
-44.3
-28.0
-38.0
-8.4
60
BEAMER 7
1.018
140.4
936
808L_TAP
948
808_BNDY
1420
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18420
WEASEL2
954
ABEE_01
2954
ABEE_02
1.022
141.1
1.021
140.9
1.018
140.5
1.017
140.3
2050
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10.7
5.2
21.5
11.1
50
RIVERSID
2793
SCORIA2
3793
SCORIA3
793
SCORIA1
-21.5
-11.1
1.020
140.8
3050
REDW GT
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19.5R
1.030
14.2
1.5
-0.5
44.4
28.0
821
708ALTAP
1.021
140.8
443
BANN_240
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-16.6
1.057
253.6
313
JOSEPH1
-3.5
-112.7
771
AMELIA1
3.6
111.6
-33.9
-128.3
109
DEERLAN4
-361.7
-1.6
34.1
126.9
1.053
252.8
57
LAMOURE4
80.9
-39.1
63
LAMOURE7
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28.3
-42.0
3.4
-15.5
11.8
51.4
12.0
1.031
142.2
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0.99053
33.5
22.9
31.4
21.0
1.028
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922
ROSS TAP
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142.3
45
ROSS CRK
-32.2
-8.4
1.031
142.3
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LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
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0.99826
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-36.4
-42.2
-36.6
1.030
247.2
314
JOSEPH2
28.4
19.0
735
SHELL TP
-9.6
9.6
10.8
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140.7
734
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1.038
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SCOT4_8
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SCOTF ST
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41.1R
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14.3
4195
SCOTF GT
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38.8R
1.035
14.3
627
AIR LIQC
68.1
36.8R
1.035
14.3
106
DEERLAN7
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142.4
27.9
22.5
20.8
21.9
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-44.3
-4.3
14.9
1.020
140.7
628
ALC SCOT
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140.6
43
SCOT4_7
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25.3
-55.2
-20.0
28.7
41.3
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28.7
42.3
-28.7
-42.3
1.020
140.8
1.021
140.9
391
ALBCHEM7
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-0.3
-22.3
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12.5
-12.8
12.5
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1.027
141.7
67
BRUDERH7
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141.8
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ASTOTIN
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12.8
-13.8
1.022
141.1
952
DIAM TAP
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-0.3
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DIAM SH7
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141.2
1.023
141.2
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DOW CHEM
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-11.1
74.3
4.9
1.032
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44.1
8.1
54
DOW GEN1
51.5
17.7R
1.030
14.8
454
DOW GEN2
51.5
1.3R
1.030
14.8
15.5
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-41.1
-8.2
1.030
142.1
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DOW HYD7
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SHERRIT7
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22.8
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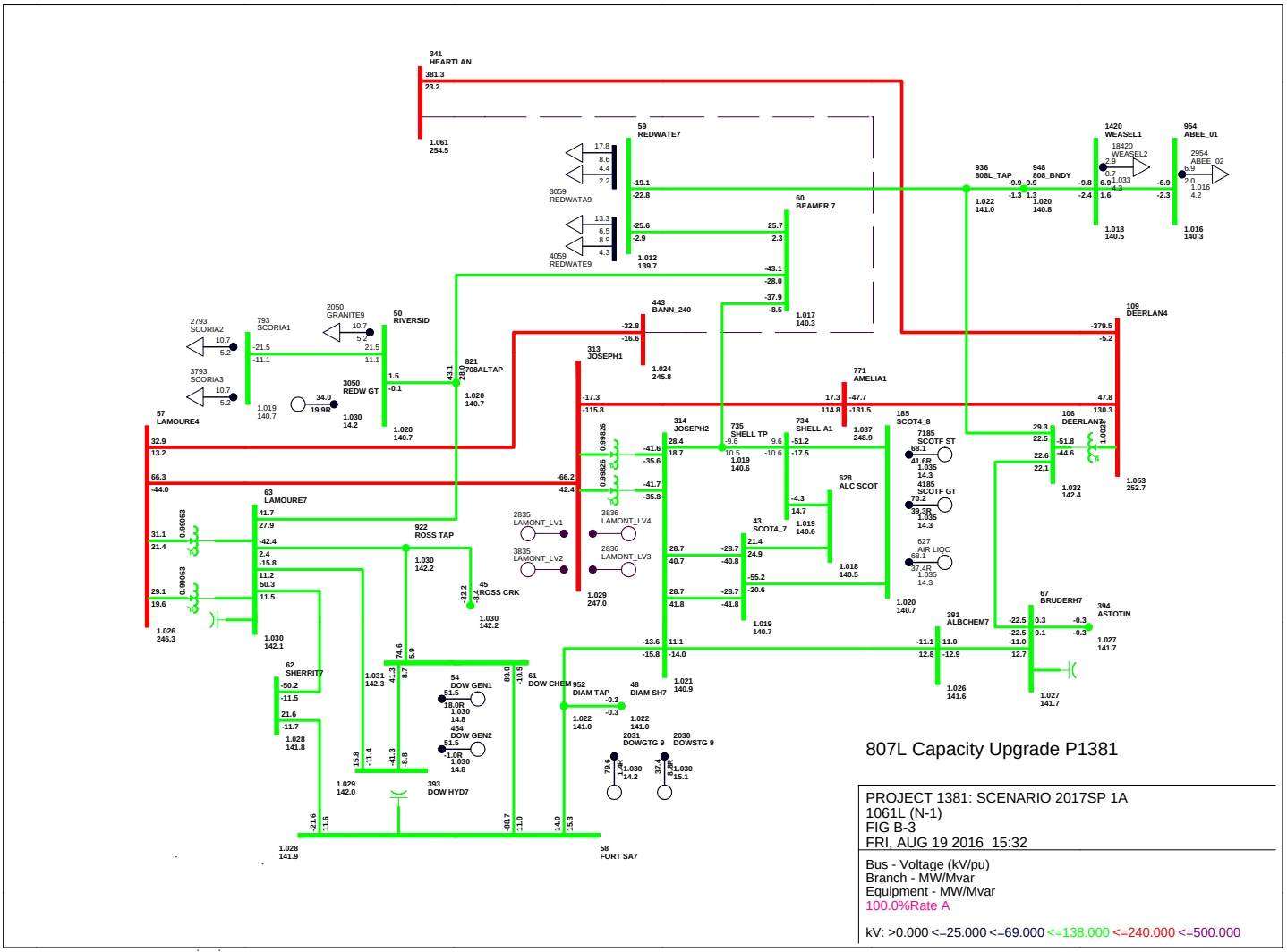
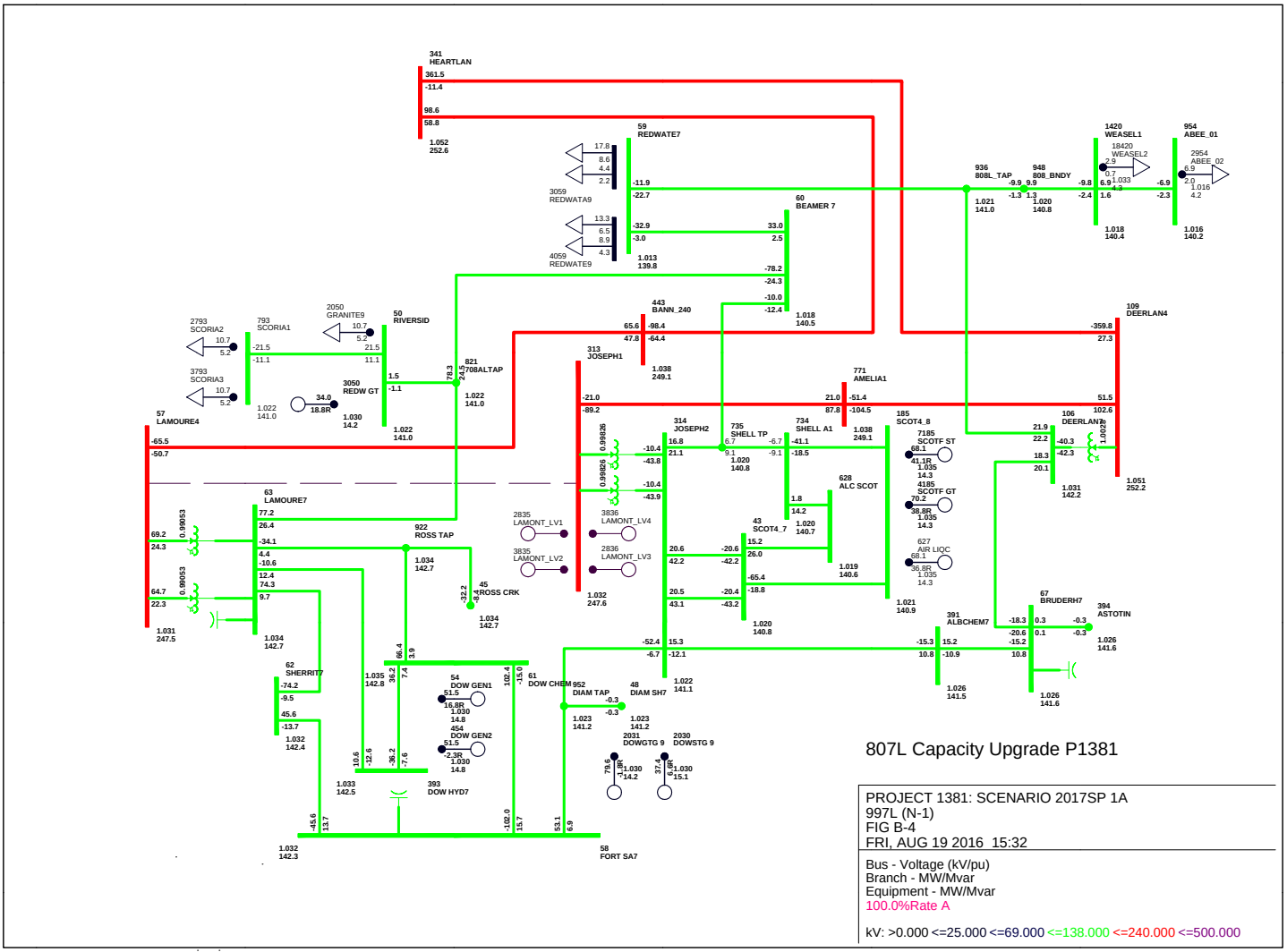
1.029
142.0
-22.8
11.2
1.029
142.0
-38.3
11.6
14.9
15.2
58
FORT SA7
2031
DOWGTG 9
78.6
1R
1.030
14.2
2030
DOWSTG 9
37.4
2R
1.030
15.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
942L (N-1)
FIG B-2
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
1061L (N-1)
FIG B-3
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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8.9
4.3
4059
REDWATE9
-32.9
-3.0
33.0
2.5
1.013
139.8
60
BEAMER 7
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-10.0
-12.4
1.018
140.5
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WEASEL2
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RIVERSID
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SCORIA2
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SCORIA1
3793
SCORIA3
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11.1
1.022
141.0
3050
REDW GT
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18.8R
1.030
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24.5
821
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AMELIA1
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LAMOURE7
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ROSS TAP
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AIR LIQC
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BRUDERH7
394
ASTOTIN
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1.035
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16.8R
1.030
14.8
454
DOW GEN2
51.5
2.3R
1.030
14.8
102.4
-15.0
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DOW CHEM
952
DIAM TAP
48
DIAM SH7
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15.3
-12.1
1.023
141.2
1.023
141.2
2031
DOWGTG 9
2030
DOWSTG 9
78.6
18R
1.030
14.2
37.4
18R
1.030
15.1
10.6
-12.6
36.2
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142.5
393
DOW HYD7
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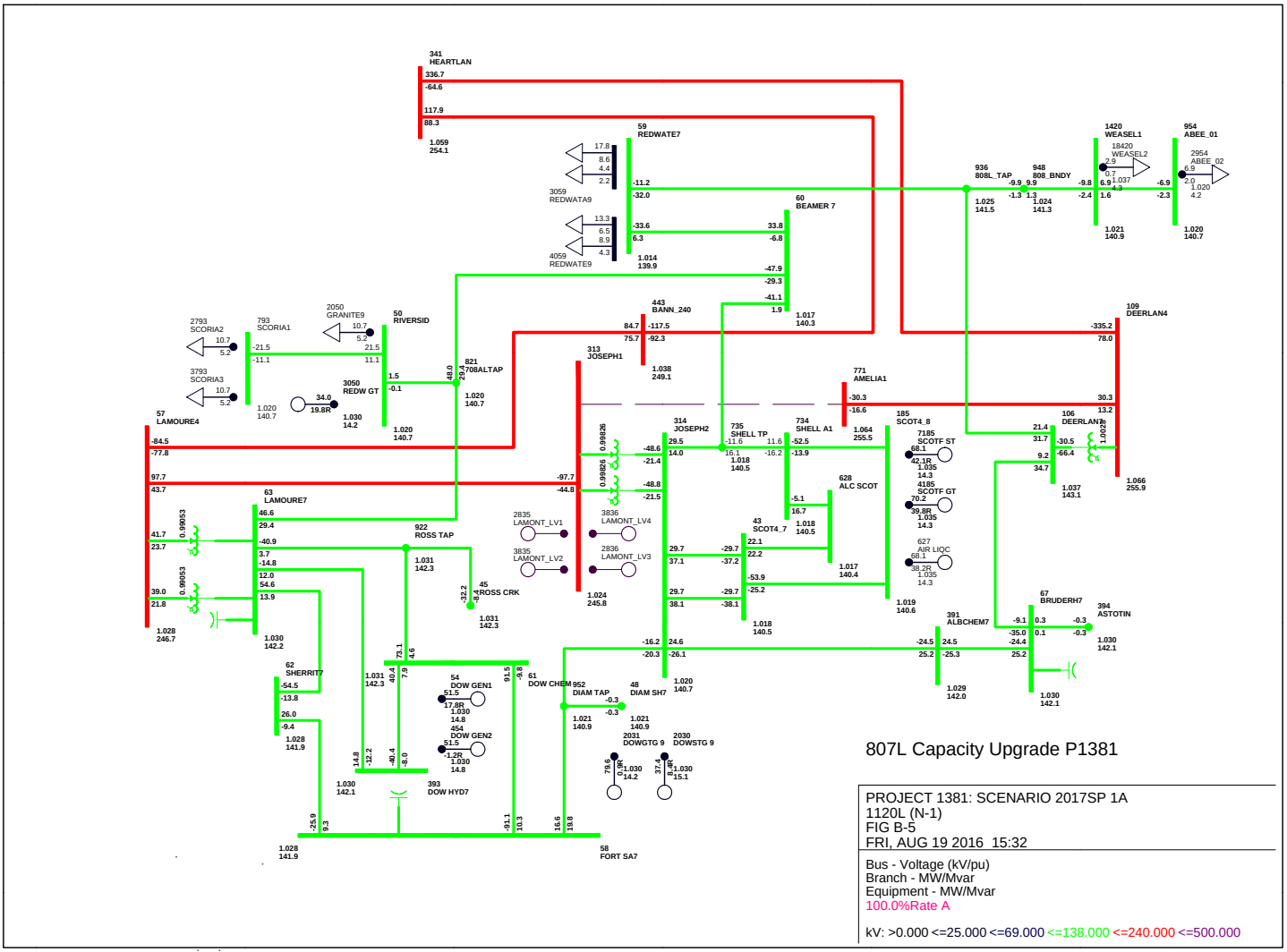
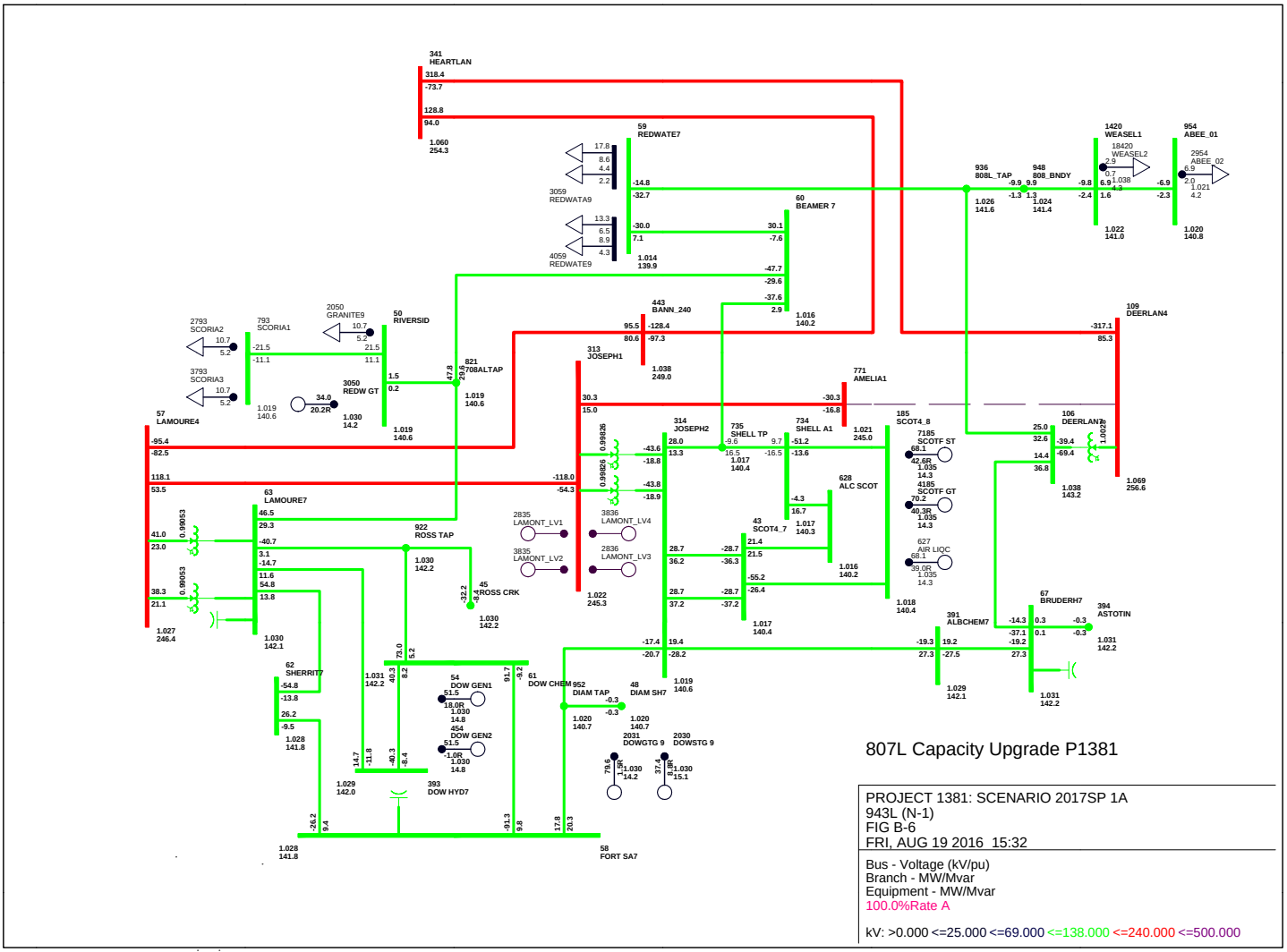
13.7
102.0
-15.7
53.1
6.9
1.032
142.3
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
997L (N-1)
FIG B-4
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
1120L (N-1)
FIG B-5
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

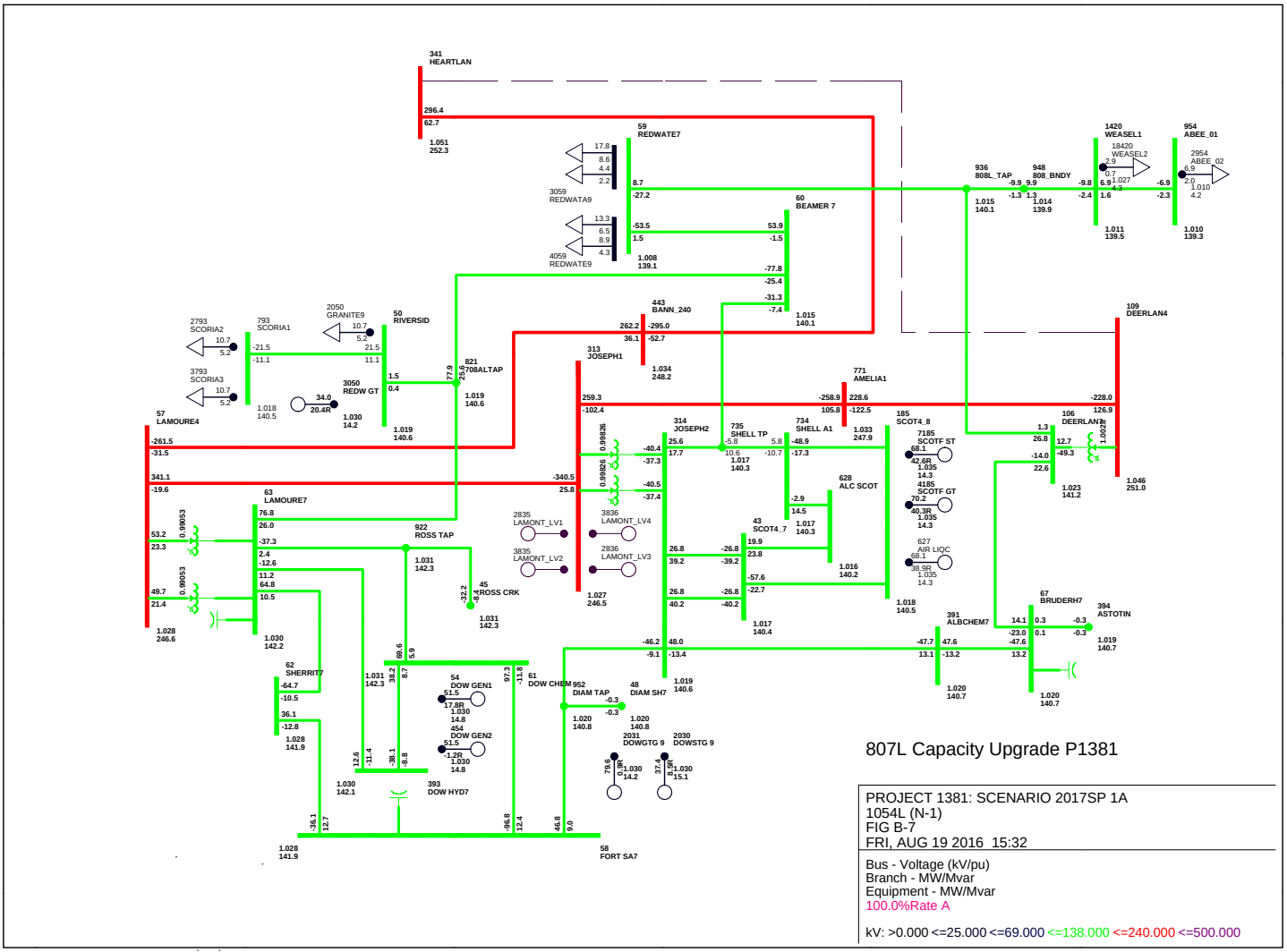


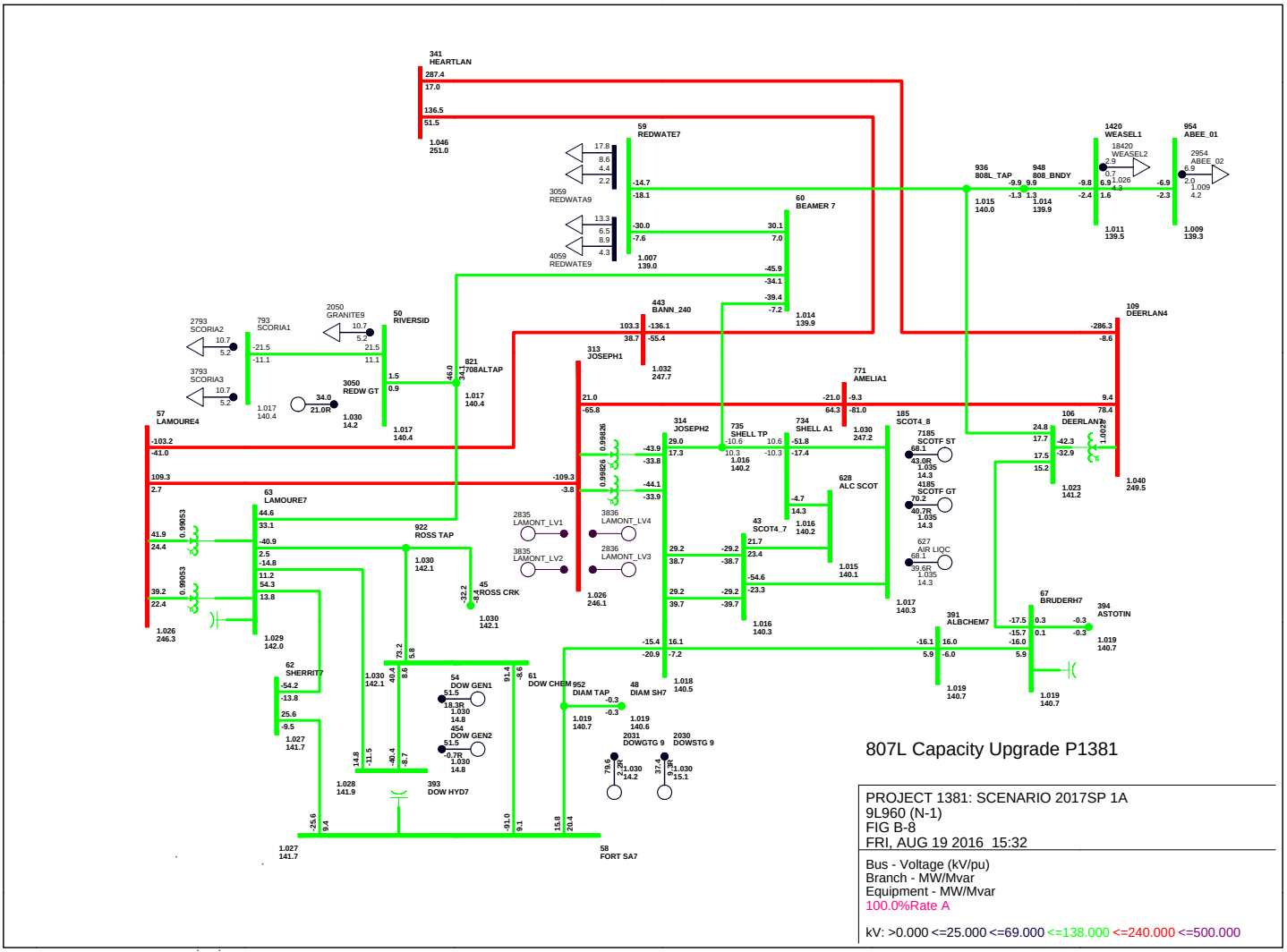
807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
943L (N-1)
FIG B-6
FRI, AUG 19 2016 15:32

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
1054L (N-1)
FIG B-7
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

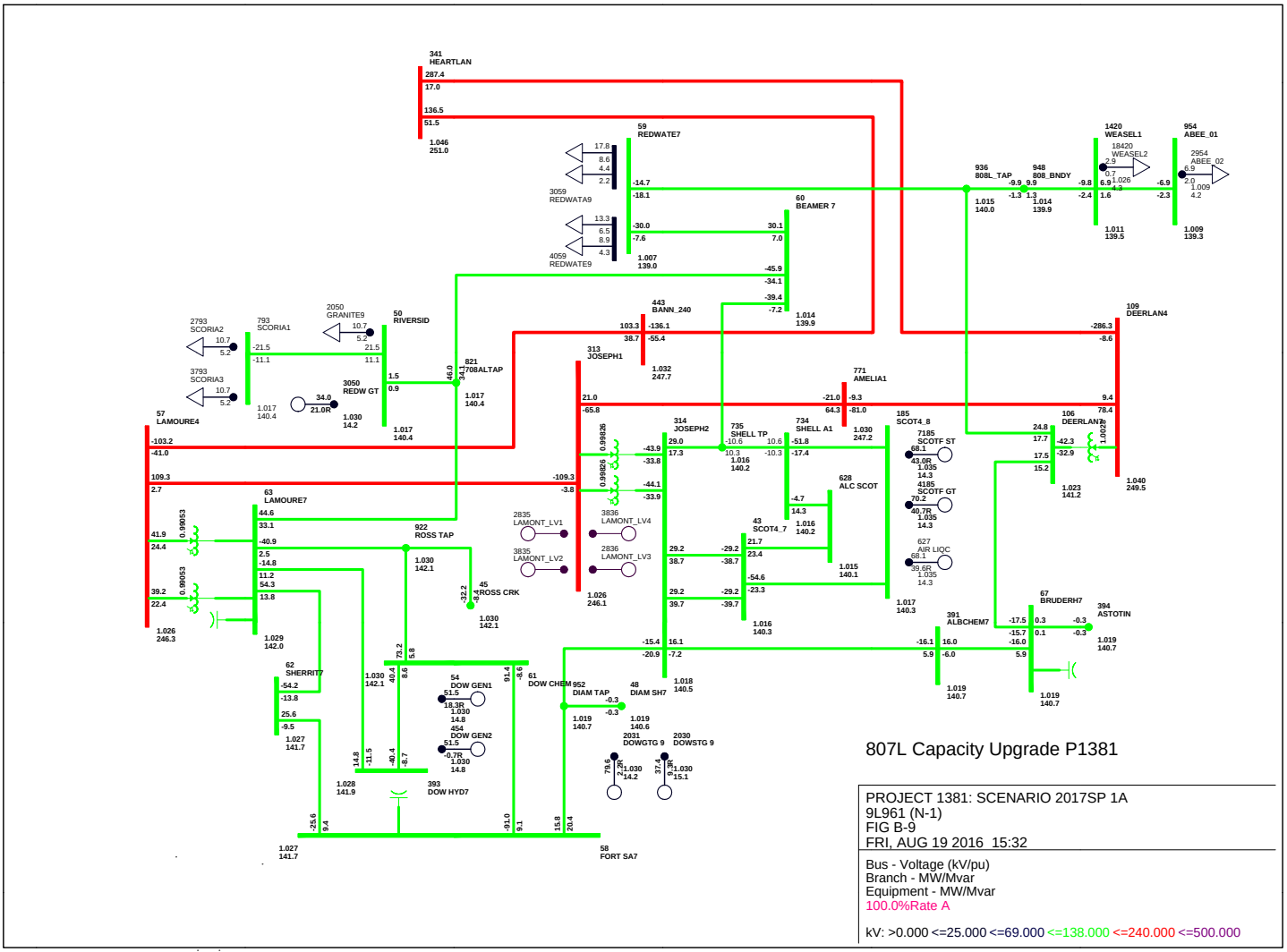


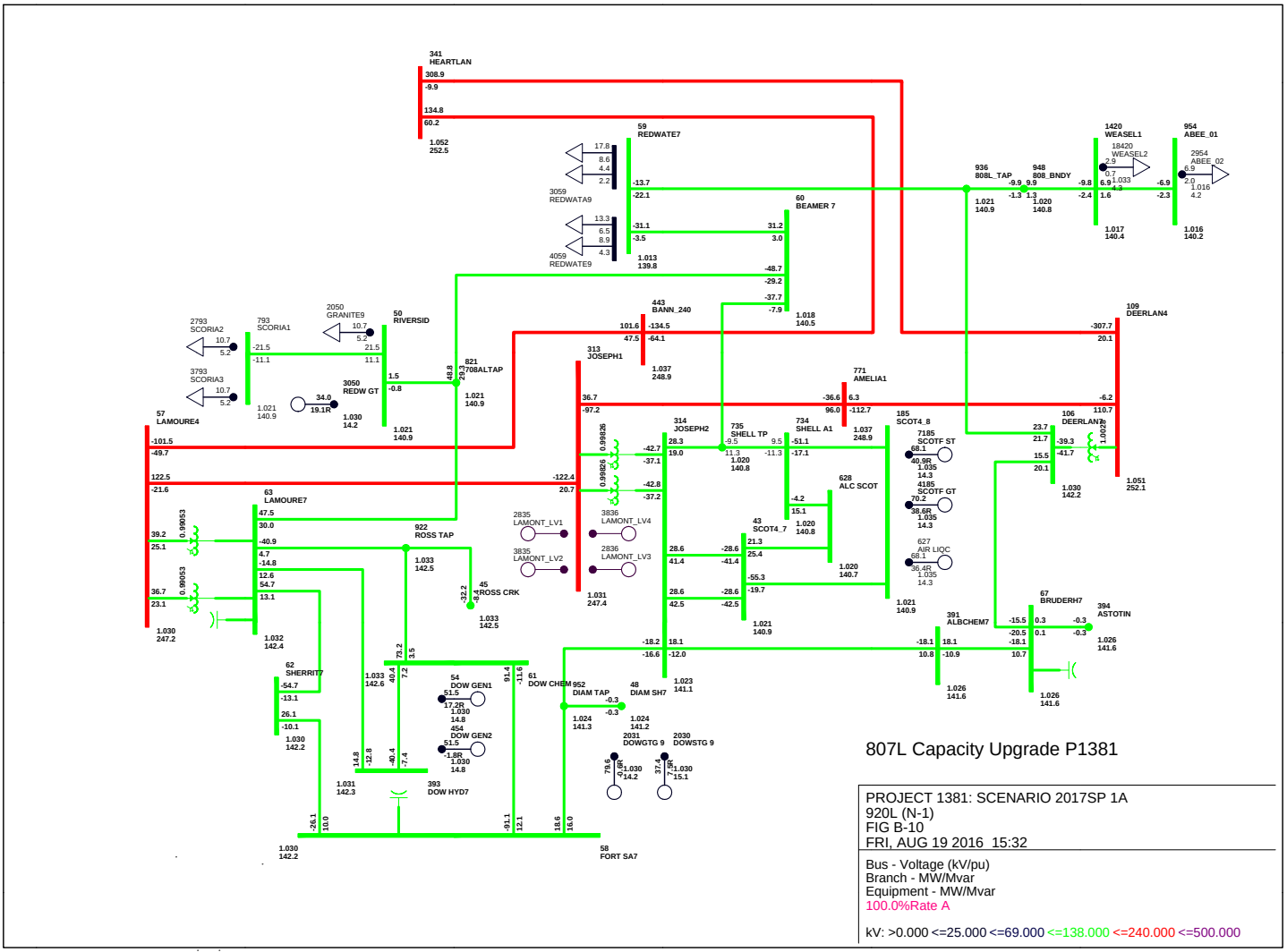
807L Capacity Upgrade P1381

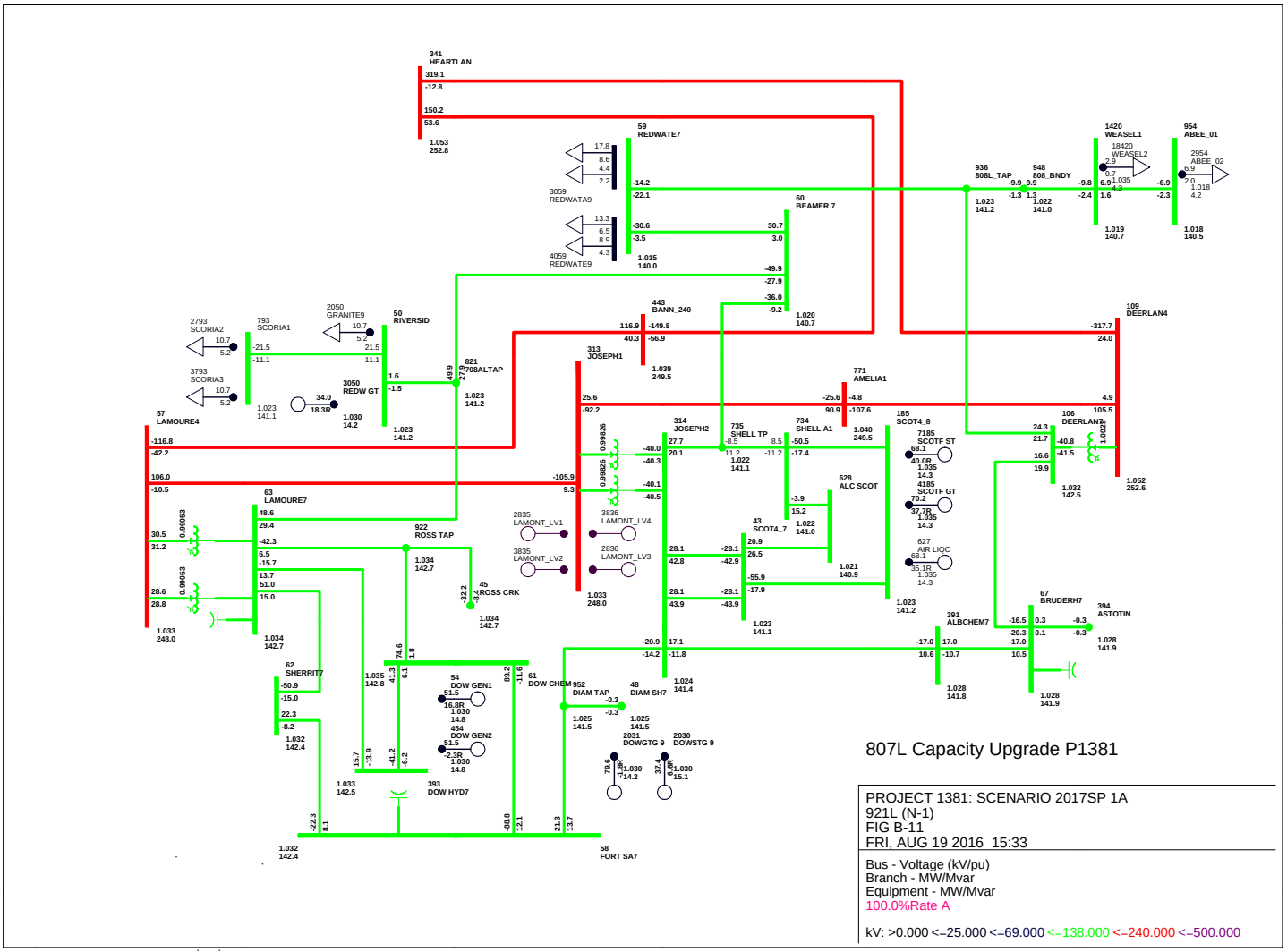
PROJECT 1381: SCENARIO 2017SP 1A
9L960 (N-1)
FIG B-8
FRI, AUG 19 2016 15:32

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
9L961 (N-1)
FIG B-9
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
920L (N-1)
FIG B-10
FRI, AUG 19 2016 15:32
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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HEARTLAN
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REDWATE7
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8.6
4.4
2.2
3059
REDWATA9
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-22.1
13.3
6.5
8.9
4.3
4059
REDWATE9
1.015
140.0
60
BEAMER 7
30.7
3.0
-30.6
-3.5
-49.9
-27.9
-36.0
-9.2
1.020
140.7
1420
WEASEL1
18420
WEASEL2
2.9
0.7
1.035
4.3
954
ABEE_01
2954
ABEE_02
6.9
2.0
1.018
4.2
936
808L_TAP
948
808_BNDY
-9.9
9.9
-1.3
1.3
1.022
141.0
-9.8
-2.4
6.9
1.6
-6.9
-2.3
1.023
141.2
1.019
140.7
1.018
140.5
2793
SCORIA2
10.7
5.2
793
SCORIA1
-21.5
-11.1
21.5
11.1
2050
GRANITE9
10.7
5.2
50
RIVERSID
3793
SCORIA3
10.7
5.2
1.023
141.1
34.0
18.3R
3050
REDW GT
1.030
14.2
1.6
-1.5
49.9
27.9
821
708ALTAP
1.023
141.2
443
BANN_240
116.9
40.3
-149.8
-56.9
1.039
249.5
313
JOSEPH1
25.6
-92.2
771
AMELIA1
-25.6
90.9
-4.8
-107.6
109
DEERLAN4
-317.7
24.0
4.9
105.5
57
LAMOURE4
-116.8
-42.2
106.0
-10.5
-105.9
9.3
63
LAMOURE7
48.6
29.4
-42.3
6.5
-15.7
13.7
51.0
15.0
0.99053
0.99053
30.5
31.2
28.6
28.8
1.033
248.0
1.034
142.7
922
ROSS TAP
1.034
142.7
45
ROSS CRK
-32.2
-8.4
1.034
142.7
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LAMONT_LV1
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LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
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248.0
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JOSEPH2
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SHELL TP
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8.5
-11.2
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SHELL A1
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SCOT4_8
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SCOTF ST
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1.035
14.3
4185
SCOTF GT
70.2
37.7R
1.035
14.3
627
AIR LIQC
68.1
35.1R
1.035
14.3
106
DEERLAN7
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24.3
21.7
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-41.5
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19.9
1.032
142.5
1.052
252.6
-3.9
15.2
1.022
141.0
628
ALC SCOT
1.021
140.9
43
SCOT4_7
20.9
26.5
-55.9
-17.9
28.1
42.8
-28.1
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28.1
43.9
-28.1
-43.9
1.023
141.1
1.023
141.2
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SHERRIT7
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1.035
142.8
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74.6
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54
DOW GEN1
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16.8R
1.030
14.8
454
DOW GEN2
51.5
2.3R
1.030
14.8
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-11.6
61
DOW CHEM
952
DIAM TAP
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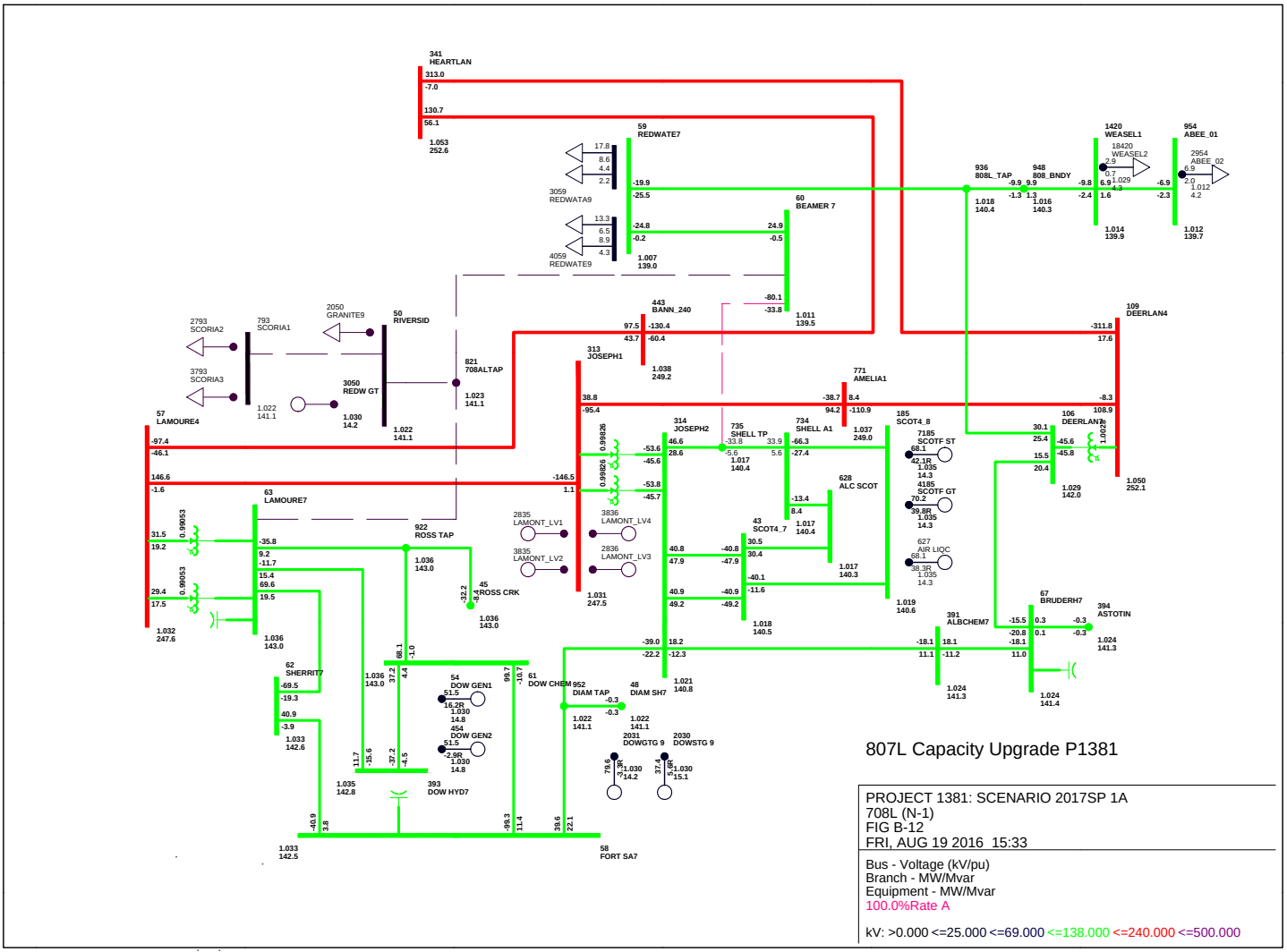
-0.3
48
DIAM SH7
1.024
141.4
1.025
141.5
1.025
141.5
2031
DOWGTG 9
78.6
1.030
14.2
2030
DOWSTG 9
37.4
1.030
15.1
15.7
-15.9
-41.2
-6.2
1.033
142.5
393
DOW HYD7
-22.3
6.1
-88.8
12.1
21.3
13.7
1.032
142.4
58
FORT SA7
391
ALBCHEM7
-16.5
-20.3
-17.0
0.3
0.1
-0.3
-0.3
17.0
-10.7
10.5
-17.0
10.6
1.028
141.8
67
BRUDERH7
1.028
141.9
394
ASTOTIN
1.028
141.9
-20.9
-14.2
17.1
-11.8
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
921L (N-1)
FIG B-11
FRI, AUG 19 2016 15:33
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

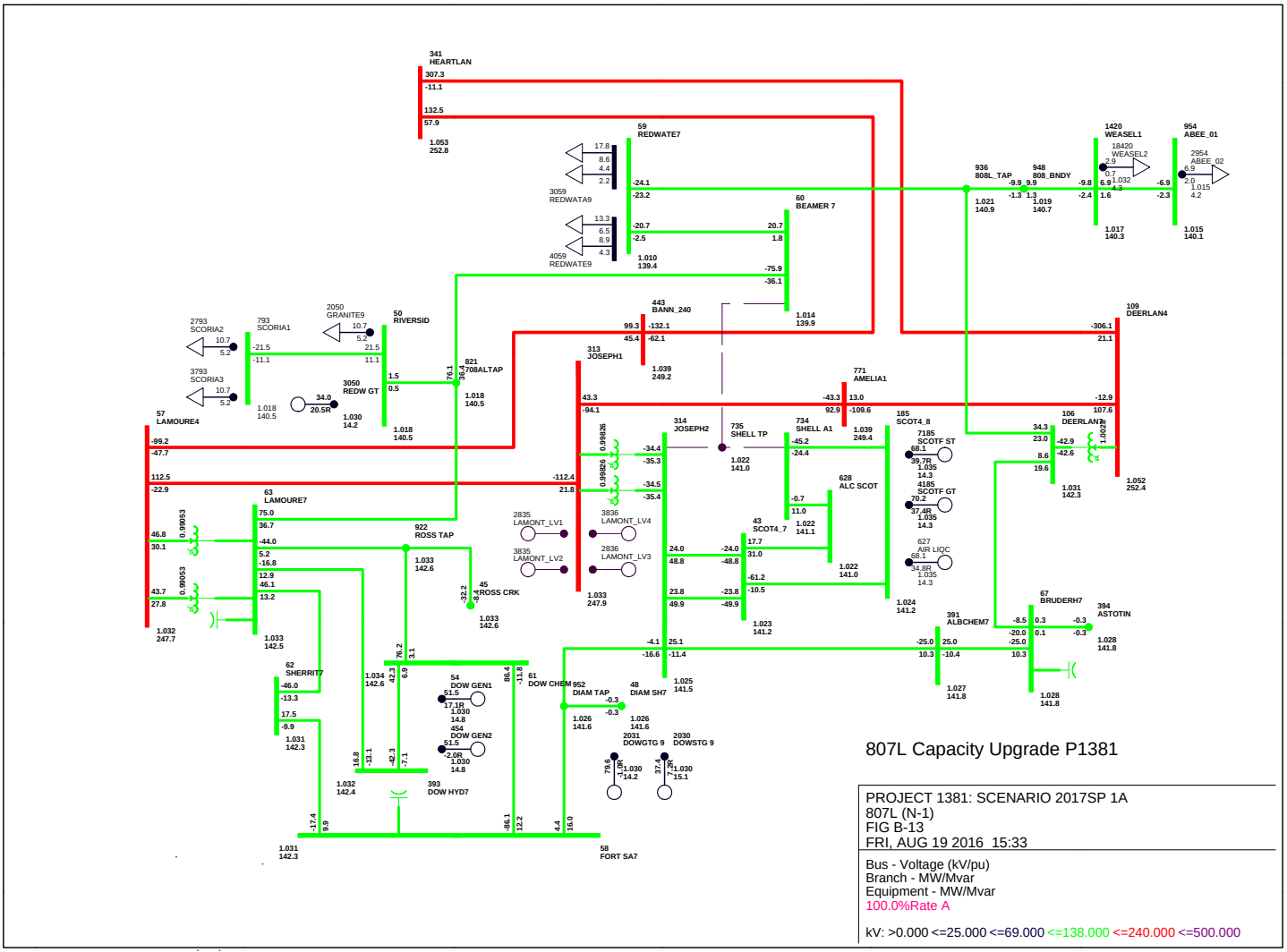


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
708L (N-1)
FIG B-12
FRI, AUG 19 2016 15:33

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

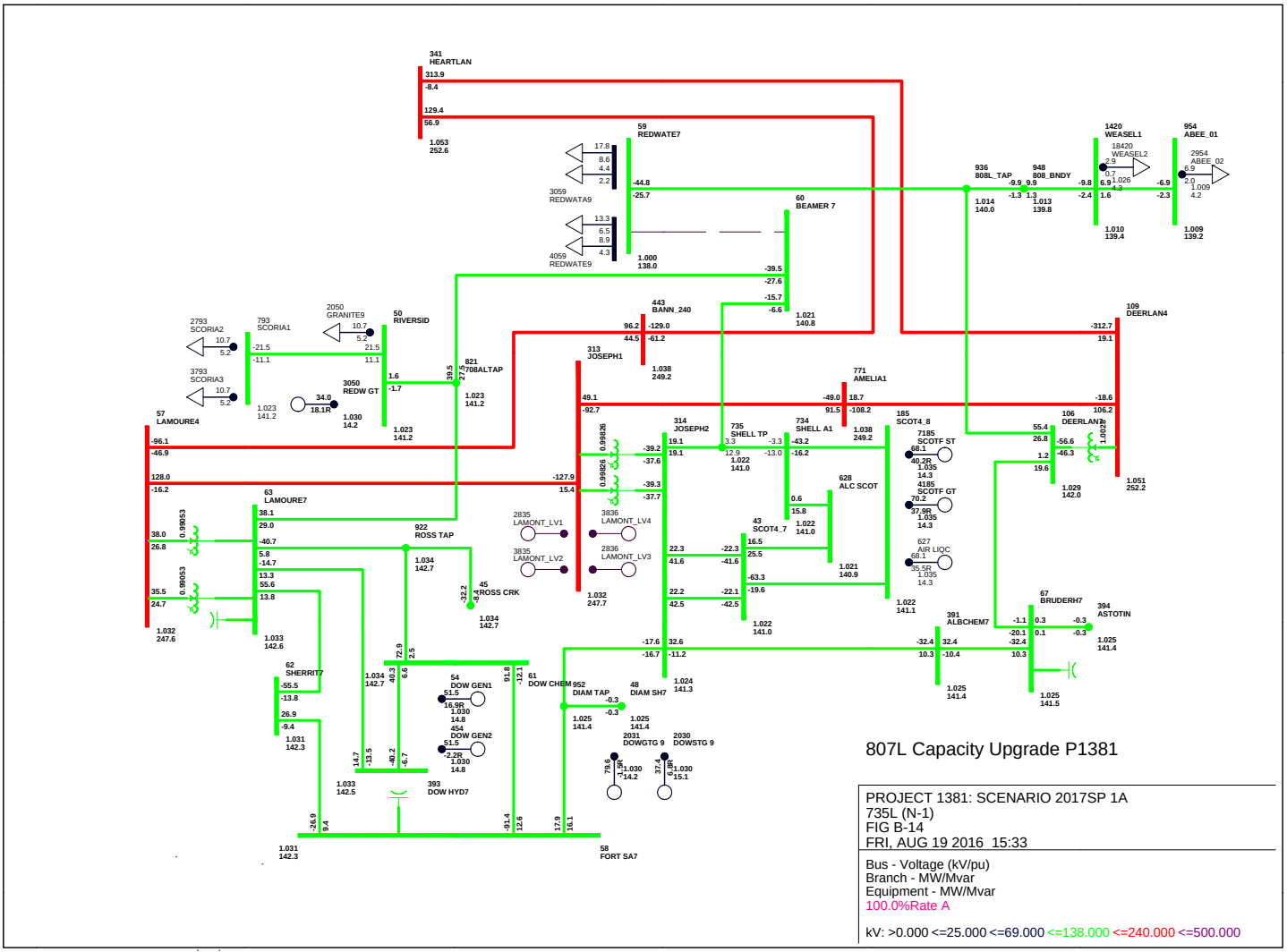


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
807L (N-1)
FIG B-13
FRI, AUG 19 2016 15:33

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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252.6
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REDWATE7
17.8
8.6
4.4
2.2
3059
REDWATA9
-44.8
-25.7
13.3
6.5
8.9
4.3
4059
REDWATE9
1.000
138.0
60
BEAMER 7
-39.5
-27.6
-15.7
-6.6
1.021
140.8
1420
WEASEL1
18420
WEASEL2
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0.7
1.026
4.3
954
ABEE_01
6.9
2954
ABEE_02
2.0
1.009
4.2
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808L_TAP
-9.9
-1.3
948
808_BNDY
9.9
1.3
1.013
139.8
-9.8
-2.4
6.9
1.6
-6.9
-2.3
1.014
140.0
1.010
139.4
1.009
139.2
2793
SCORIA2
10.7
5.2
793
SCORIA1
-21.5
-11.1
21.5
11.1
2050
GRANITE9
10.7
5.2
50
RIVERSID
3793
SCORIA3
10.7
5.2
1.023
141.2
34.0
18.1R
3050
REDW GT
1.030
14.2
1.6
-1.7
39.5
27.5
821
708ALTAP
1.023
141.2
443
BANN_240
96.2
44.5
-129.0
-61.2
1.038
249.2
313
JOSEPH1
49.1
-92.7
771
AMELIA1
-49.0
91.5
18.7
-108.2
1.038
249.2
109
DEERLAN4
-312.7
19.1
-18.6
106.2
57
LAMOURE4
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-46.9
128.0
-16.2
1.032
247.6
63
LAMOURE7
38.1
29.0
-40.7
5.8
-14.7
13.3
55.6
13.8
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0.99053
922
ROSS TAP
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142.7
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ROSS CRK
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1.034
142.7
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LAMONT_LV1
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LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
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1.032
247.7
314
JOSEPH2
19.1
19.1
-39.2
-37.6
-39.3
-37.7
735
SHELL TP
3.3
-3.3
12.9
-13.0
1.022
141.0
734
SHELL A1
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-16.2
0.6
15.8
1.022
141.0
628
ALC SCOT
1.021
140.9
185
SCOT4_8
7185
SCOTF ST
68.1
40.2R
1.035
14.3
4185
SCOTF GT
70.2
37.9R
1.035
14.3
627
AIR LIQC
68.1
35.5R
1.035
14.3
1.022
141.1
43
SCOT4_7
16.5
25.5
-63.3
-19.6
22.3
-22.3
41.6
-41.6
22.2
-22.1
42.5
-42.5
1.022
141.0
106
DEERLAN7
55.4
26.8
-56.6
-46.3
1.2
19.6
1.029
142.0
1.051
252.2
67
BRUDERH7
-1.1
0.3
-0.3
-20.1
0.1
-0.3
-32.4
1.025
141.4
1.025
141.5
391
ALBCHEM7
-32.4
32.4
10.3
-10.4
10.3
1.025
141.4
394
ASTOTIN
62
SHERRIT7
-55.5
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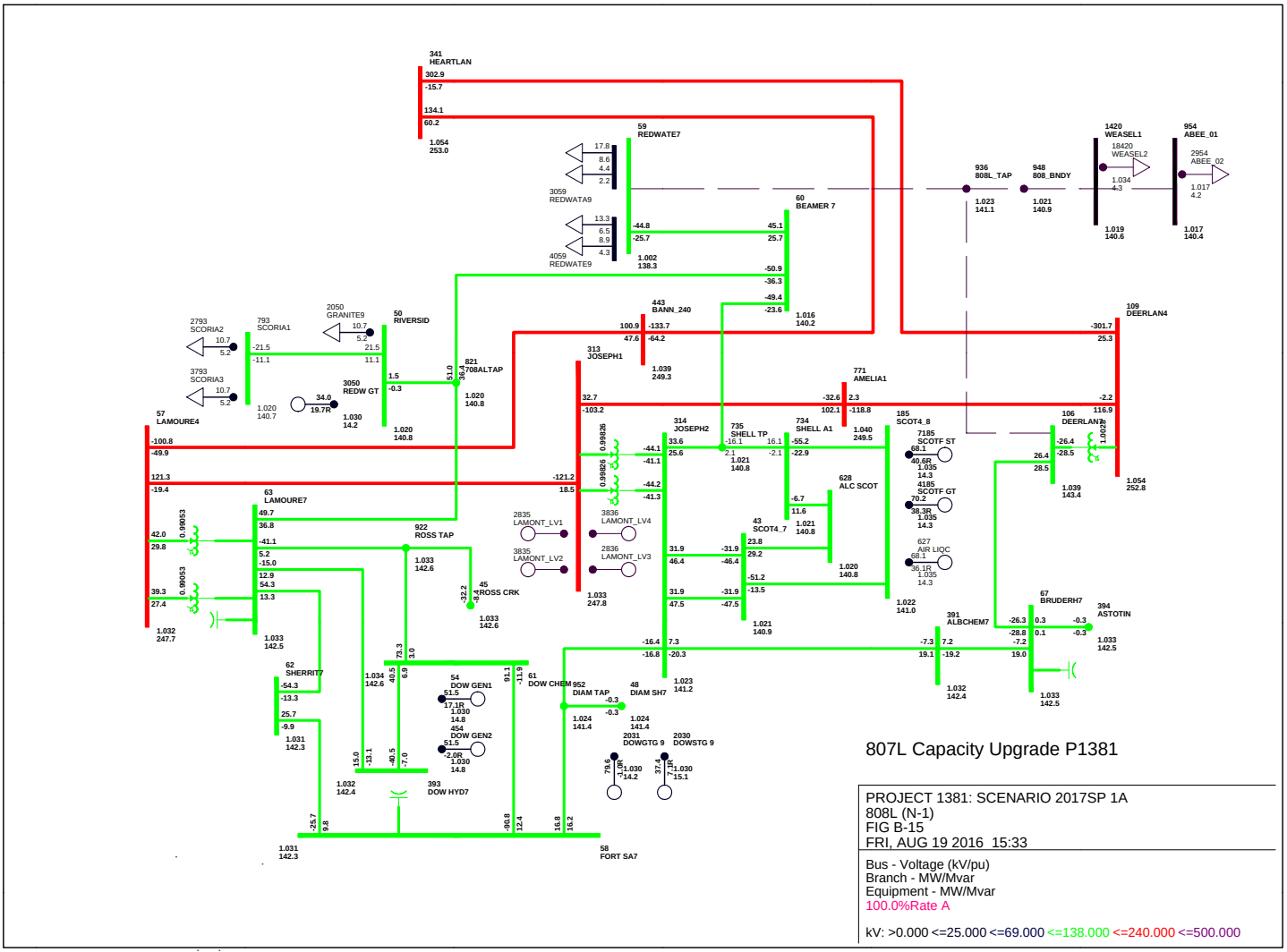
26.9
-9.4
1.031
142.3
1.034
142.7
40.2
6.6
72.9
2.5
54
DOW GEN1
51.5
16.9R
1.030
14.8
454
DOW GEN2
51.5
2.2R
1.030
14.8
91.8
-12.1
61
DOW CHEM
952
DIAM TAP
-0.3
-0.3
48
DIAM SH7
1.024
141.3
1.025
141.4
1.025
141.4
2031
DOWGTG 9
2030
DOWSTG 9
78.6
DR
1.030
14.2
37.4
DR
1.030
15.1
14.7
-13.5
-40.2
-6.7
1.033
142.5
393
DOW HYD7
-26.9
9.4
1.031
142.3
-91.4
12.6
17.9
16.1
58
FORT SA7
-17.6
-16.7
32.6
-11.2
1.025
141.4
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
735L (N-1)
FIG B-14
FRI, AUG 19 2016 15:33
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

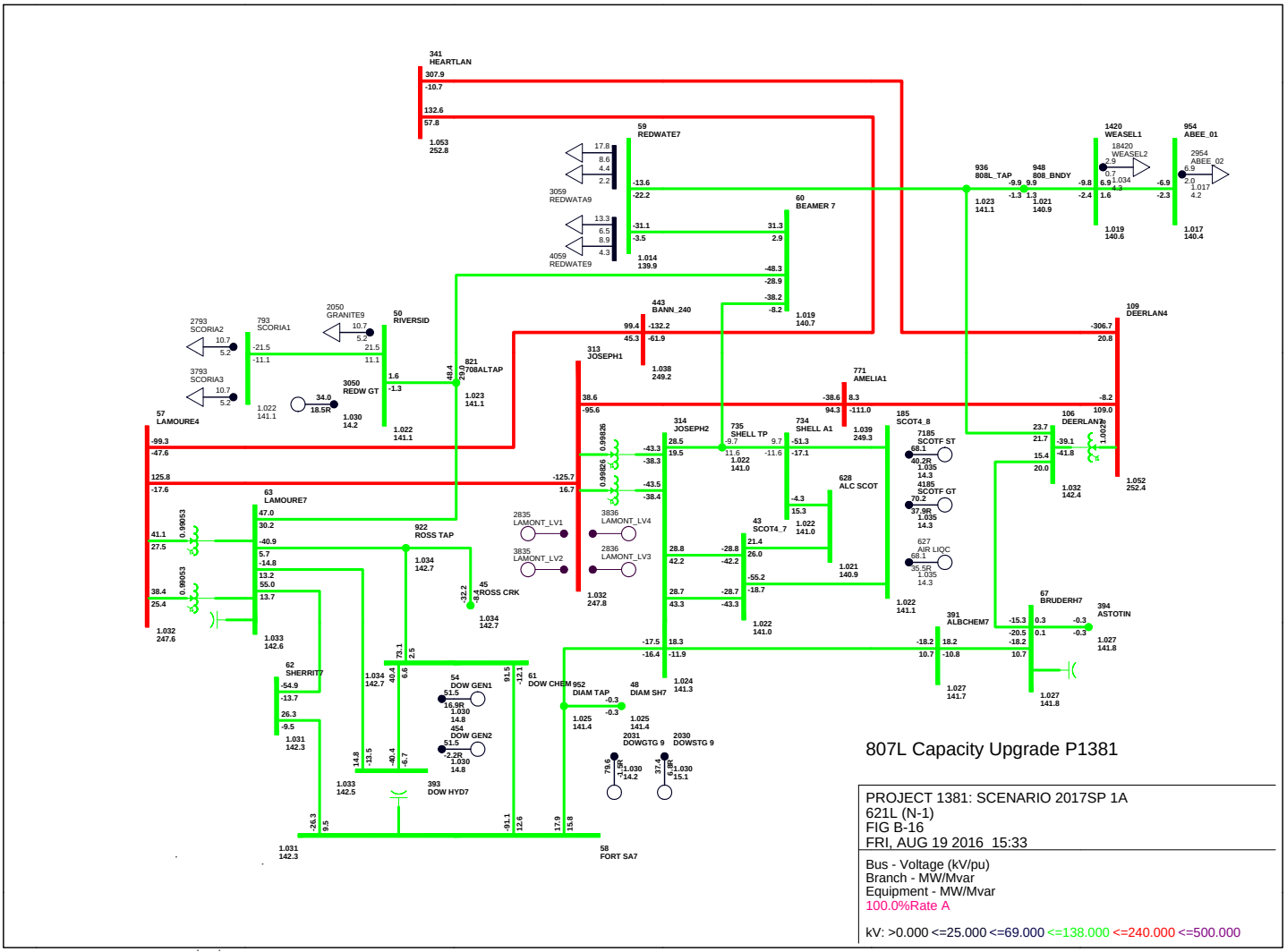


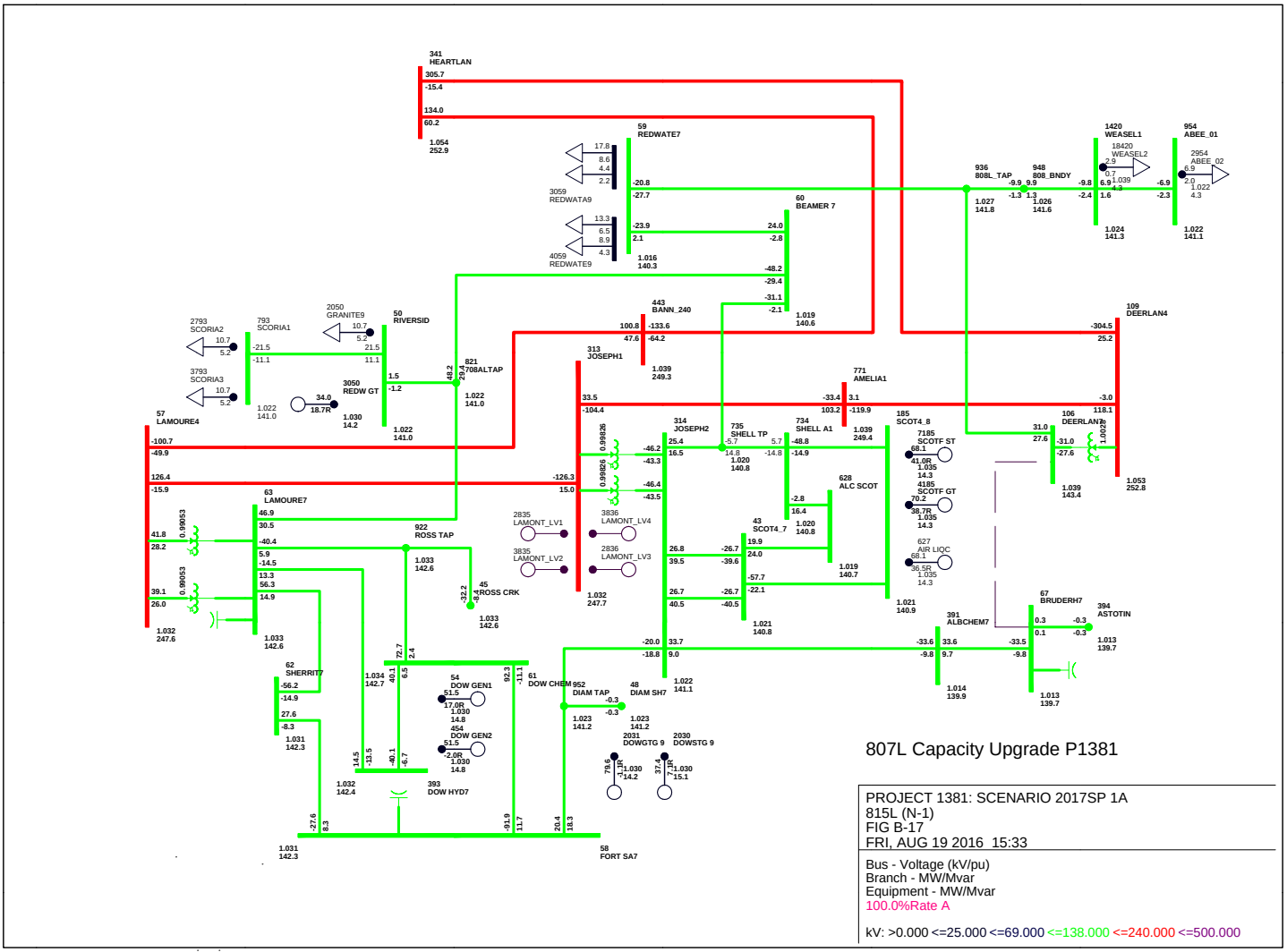
807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
808L (N-1)
FIG B-15
FRI, AUG 19 2016 15:33

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
621L (N-1)
FIG B-16
FRI, AUG 19 2016 15:33
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

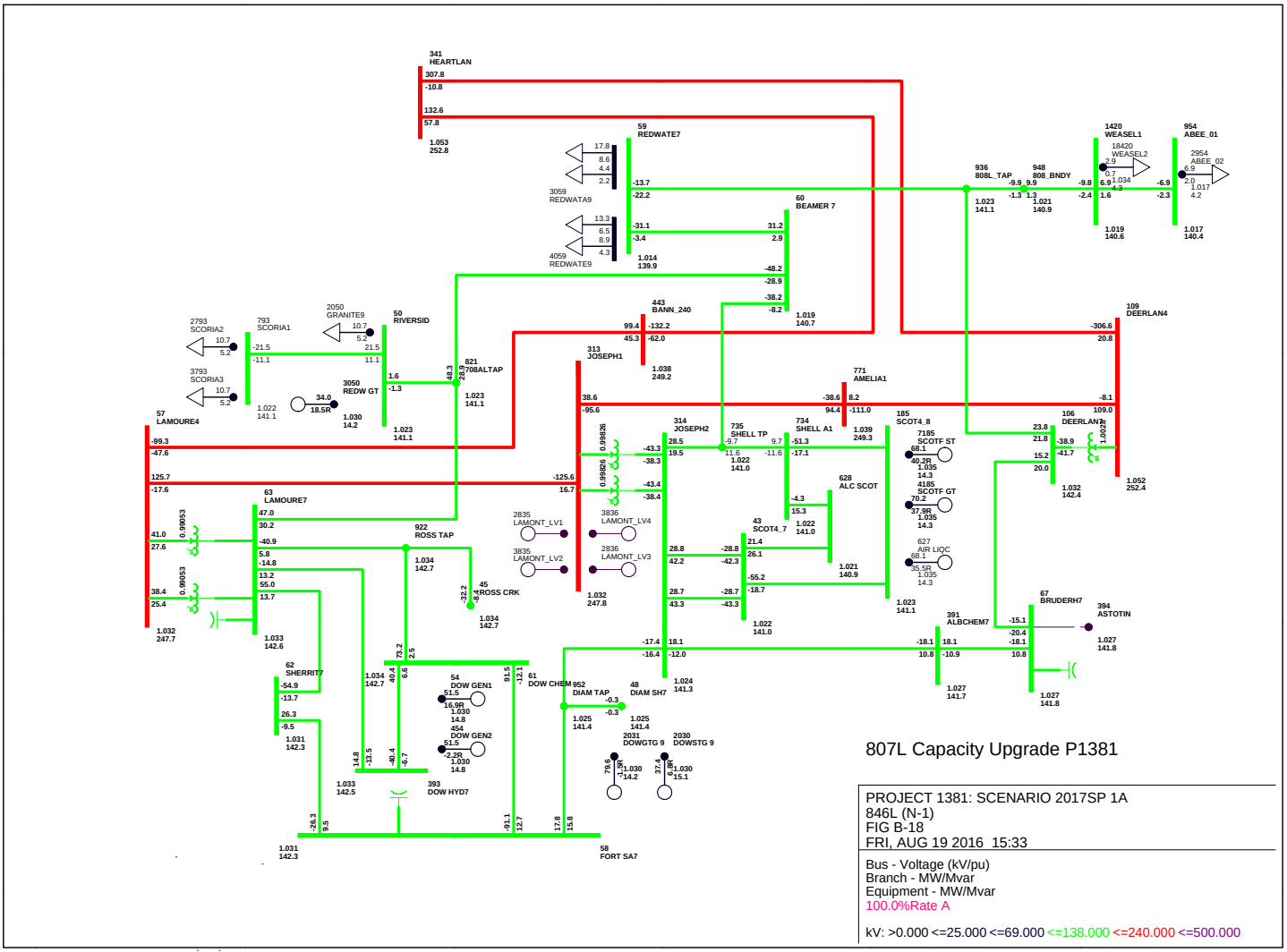


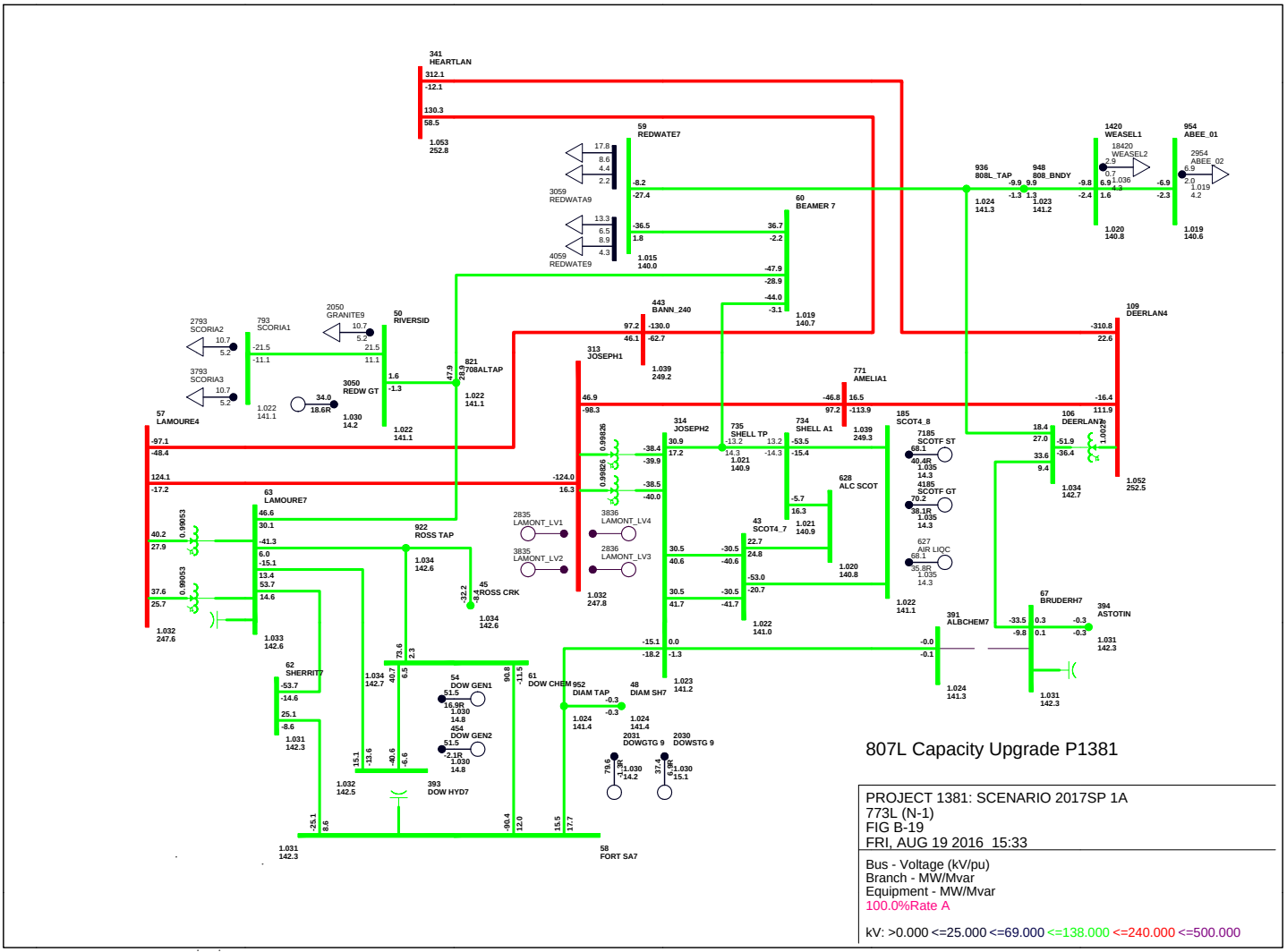
807L Capacity Upgrade P1381

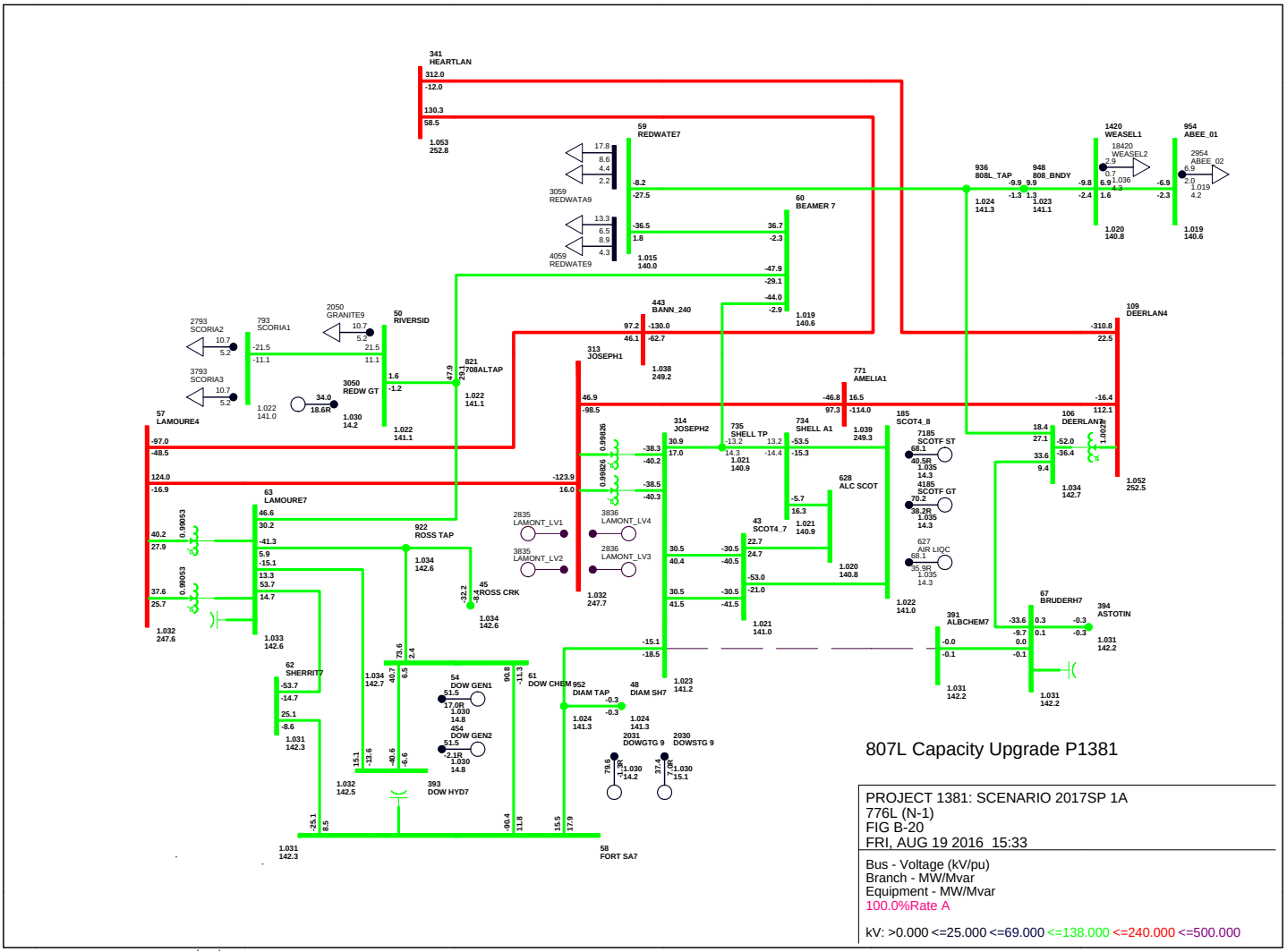
PROJECT 1381: SCENARIO 2017SP 1A
815L (N-1)
FIG B-17
FRI, AUG 19 2016 15:33

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
846L (N-1)
FIG B-18
FRI, AUG 19 2016 15:33
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
773L (N-1)
FIG B-19
FRI, AUG 19 2016 15:33
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

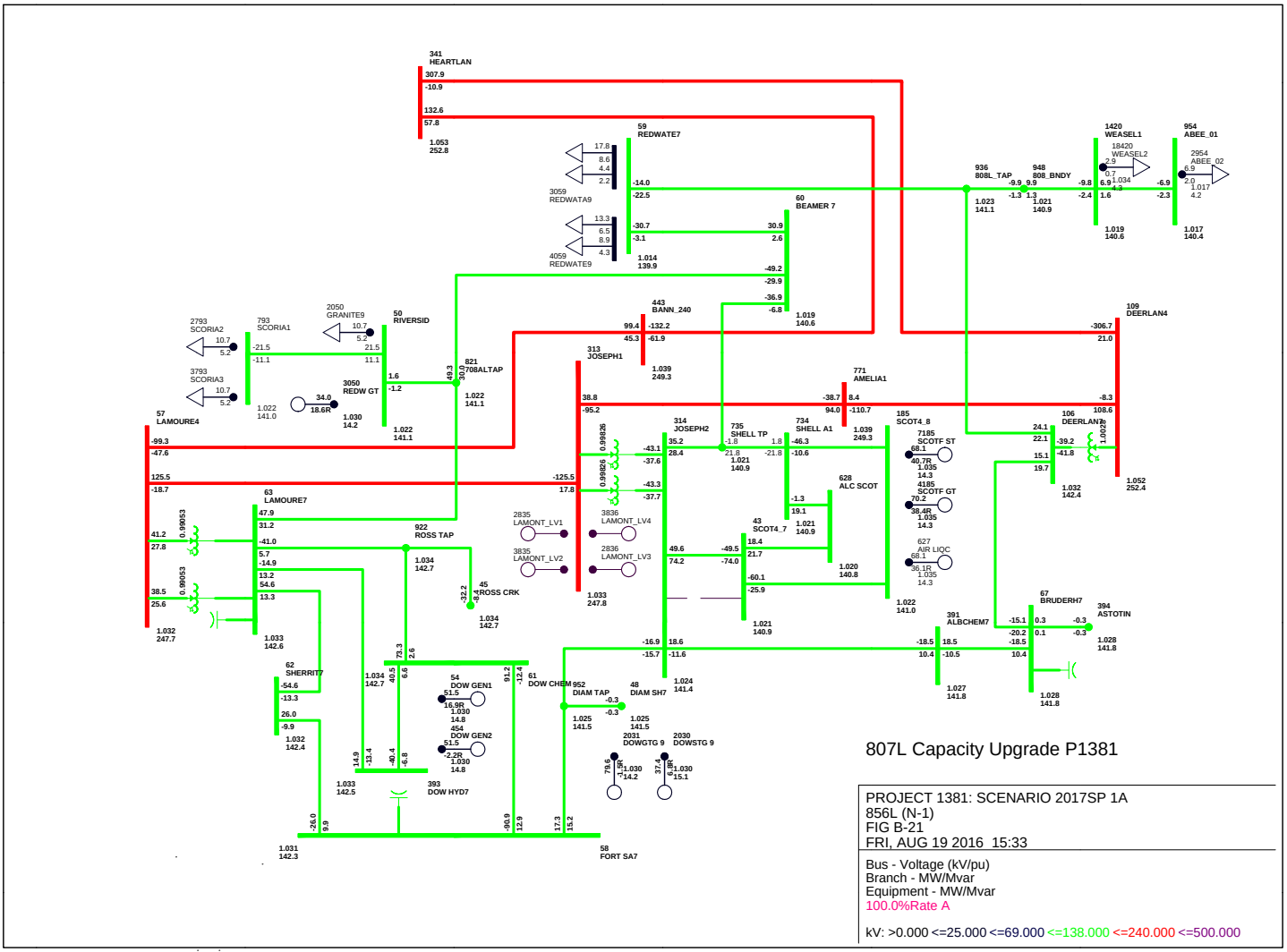


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
776L (N-1)
FIG B-20
FRI, AUG 19 2016 15:33

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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REDWATE7
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4.4
2.2
3059
REDWATA9
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-22.5
13.3
6.5
8.9
4.3
4059
REDWATE9
-30.7
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30.9
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139.9
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BEAMER 7
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-29.9
-36.9
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1.019
140.6
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808L_TAP
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808_BNDY
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WEASEL2
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ABEE_01
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ABEE_02
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1.019
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SCORIA1
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-11.1
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GRANITE9
10.7
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RIVERSID
3793
SCORIA3
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1.022
141.0
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REDW GT
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18.6R
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708ALTAP
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AMELIA1
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DEERLAN4
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LAMOURE4
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LAMOURE7
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ROSS TAP
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ROSS CRK
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1.034
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LAMONT_LV1
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LAMONT_LV2
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LAMONT_LV4
2836
LAMONT_LV3
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314
JOSEPH2
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28.4
-43.1
-37.6
-43.3
-37.7
-125.5
17.8
735
SHELL TP
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21.8
1.8
-21.8
1.021
140.9
734
SHELL A1
-46.3
-10.6
-1.3
19.1
1.021
140.9
1.039
249.3
628
ALC SCOT
1.020
140.8
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SCOT4_8
7185
SCOTF ST
68.1
40.7R
1.035
14.3
4195
SCOTF GT
70.2
38.4R
1.035
14.3
627
AIR LIQC
68.1
36.1R
1.035
14.3
43
SCOT4_7
18.4
21.7
-49.5
-74.0
49.6
74.2
-60.1
-25.9
1.021
140.9
1.022
141.0
106
DEERLAN7
24.1
22.1
-39.2
-41.8
15.1
19.7
1.032
142.4
1.052
252.4
67
BRUDERH7
-15.1
-20.2
-18.5
0.3
0.1
-0.3
-0.3
10.4
391
ALBCHEM7
-18.5
10.4
18.5
-10.5
1.027
141.8
394
ASTOTIN
1.028
141.8
1.028
141.8
62
SHERRIT7
-54.6
-13.3
26.0
-9.9
1.032
142.4
1.034
142.7
73.3
2.6
-40.5
6.6
54
DOW GEN1
51.5
16.9R
1.030
14.8
454
DOW GEN2
51.5
2.2R
1.030
14.8
61
DOW CHEM
91.2
-12.4
952
DIAM TAP
-0.3
-0.3
48
DIAM SH7
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141.4
1.025
141.5
1.025
141.5
2031
DOWGTG 9
2030
DOWSTG 9
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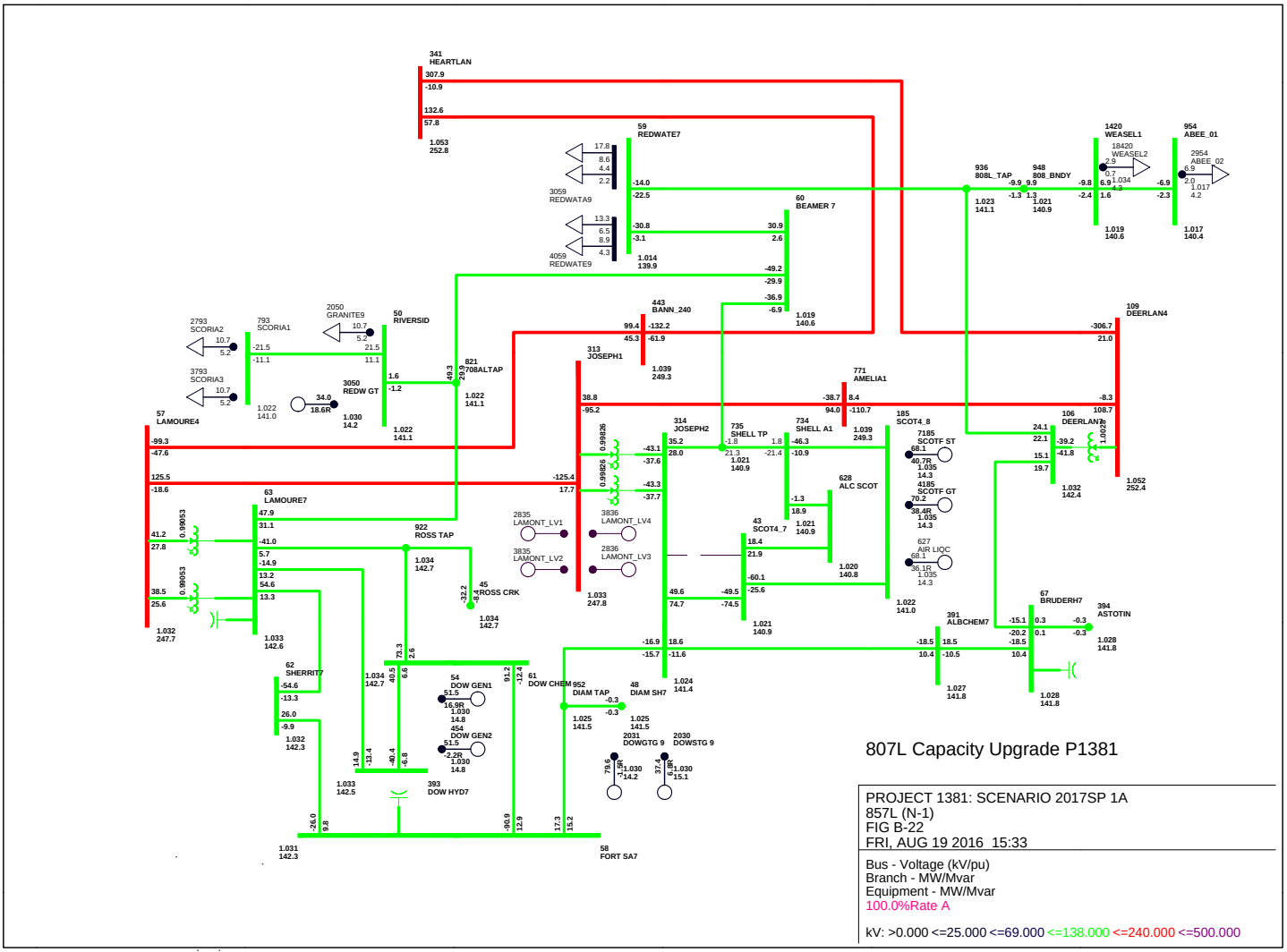
14.2
37.4
1.030
15.1
14.9
-13.4
-40.4
-6.8
1.033
142.5
393
DOW HYD7
-26.0
9.9
-90.9
12.9
17.3
15.2
1.031
142.3
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
856L (N-1)
FIG B-21
FRI, AUG 19 2016 15:33
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

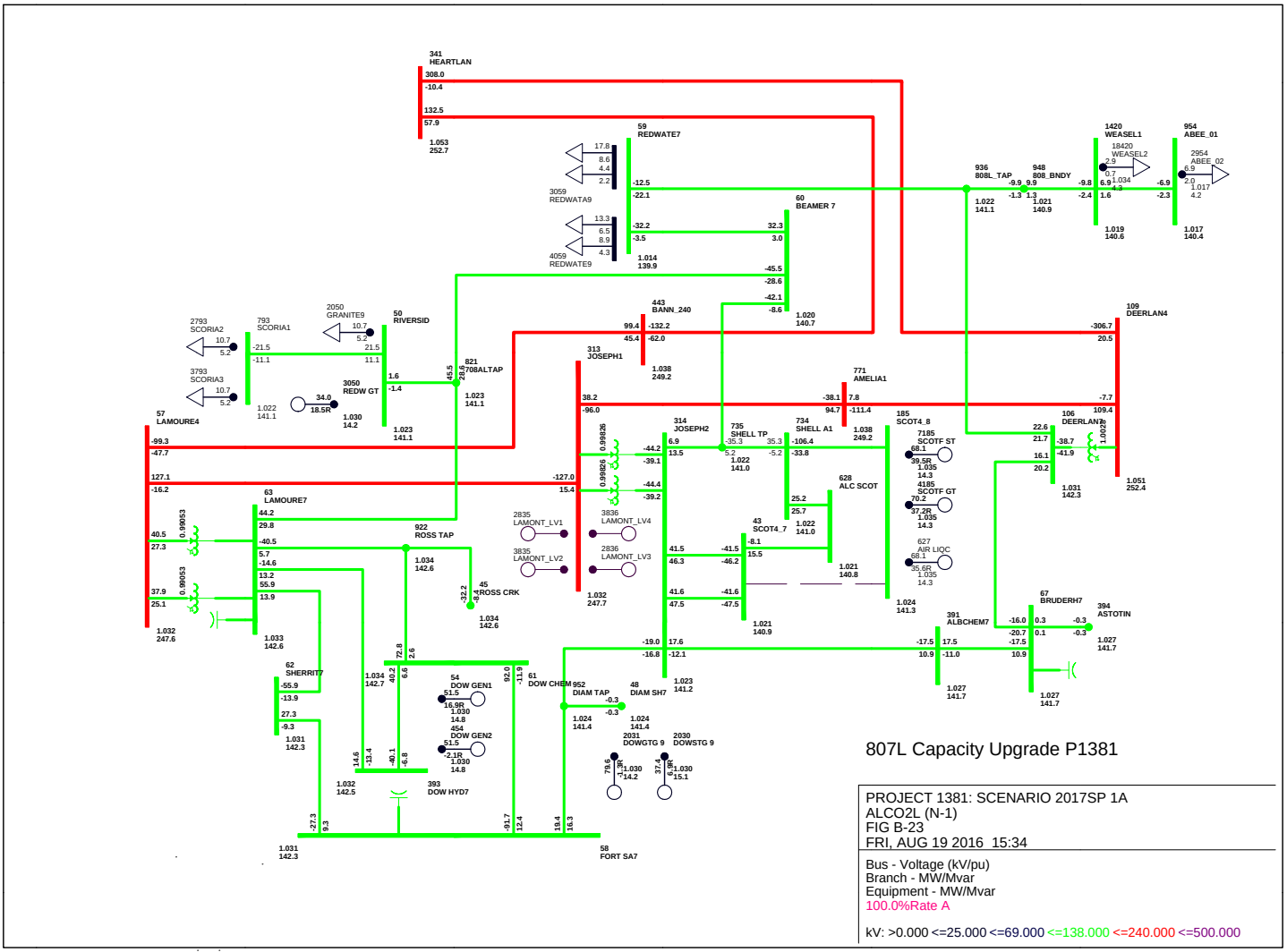


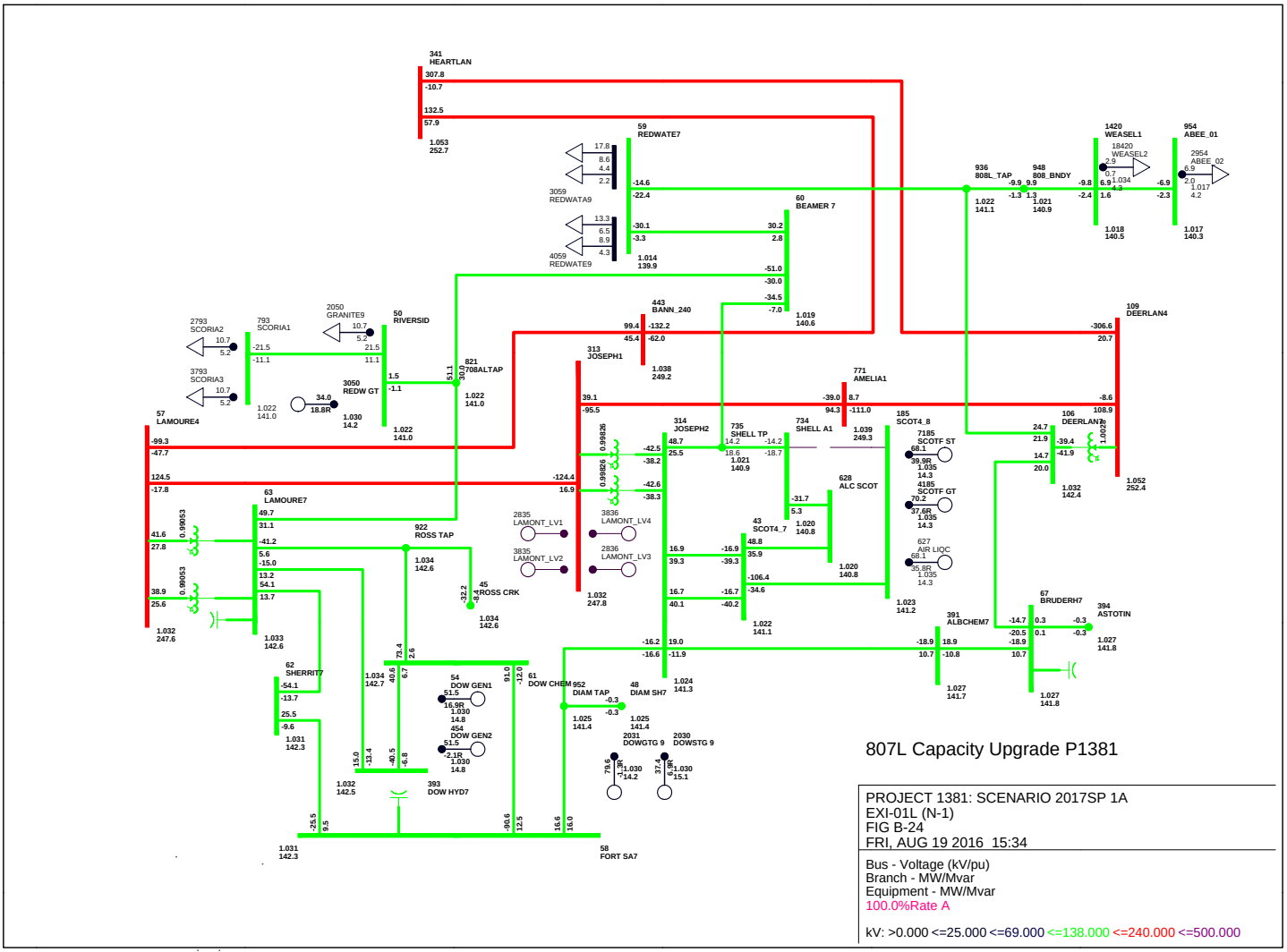
807L Capacity Upgrade P1381

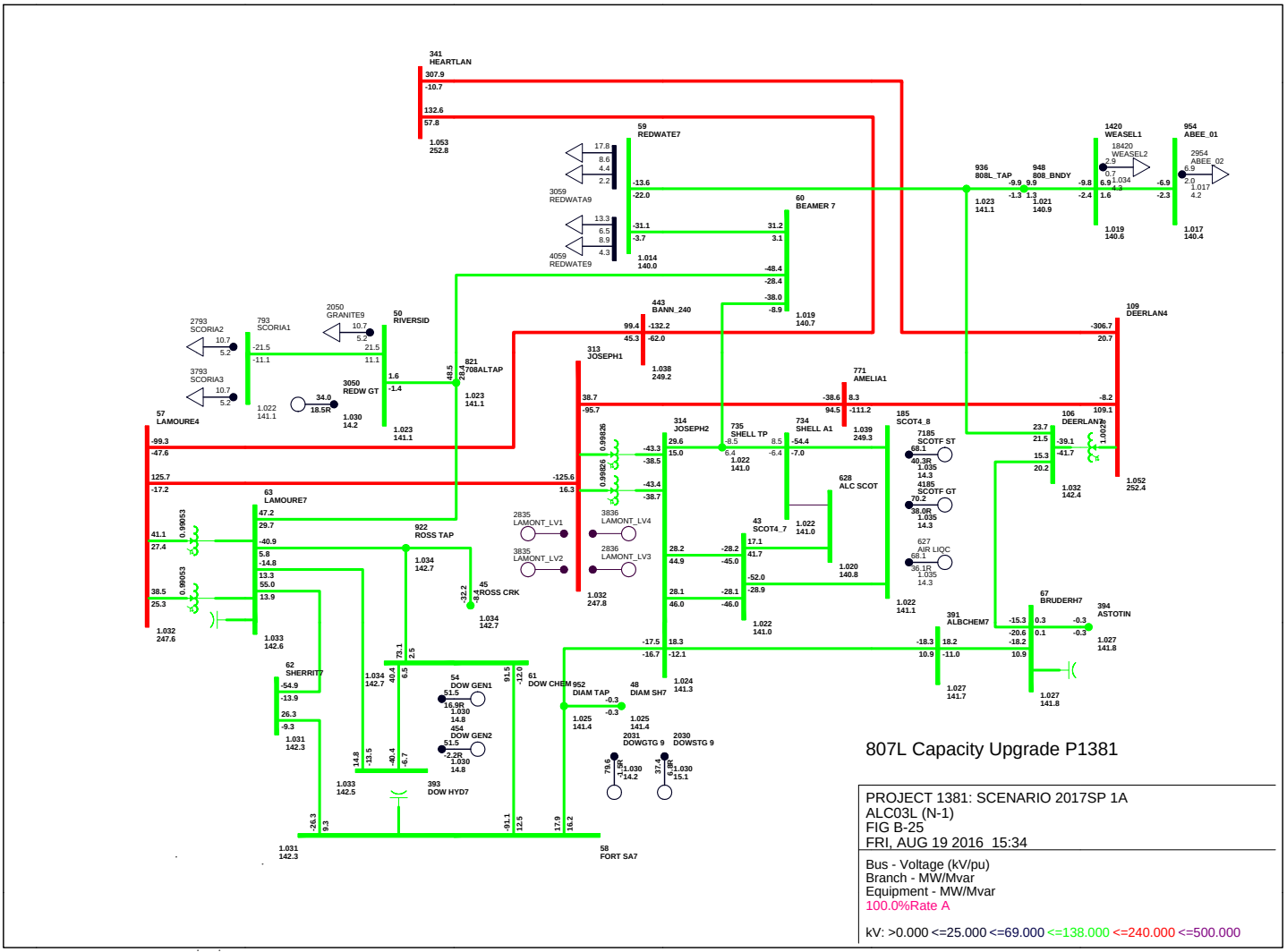
PROJECT 1381: SCENARIO 2017SP 1A
857L (N-1)
FIG B-22
FRI, AUG 19 2016 15:33

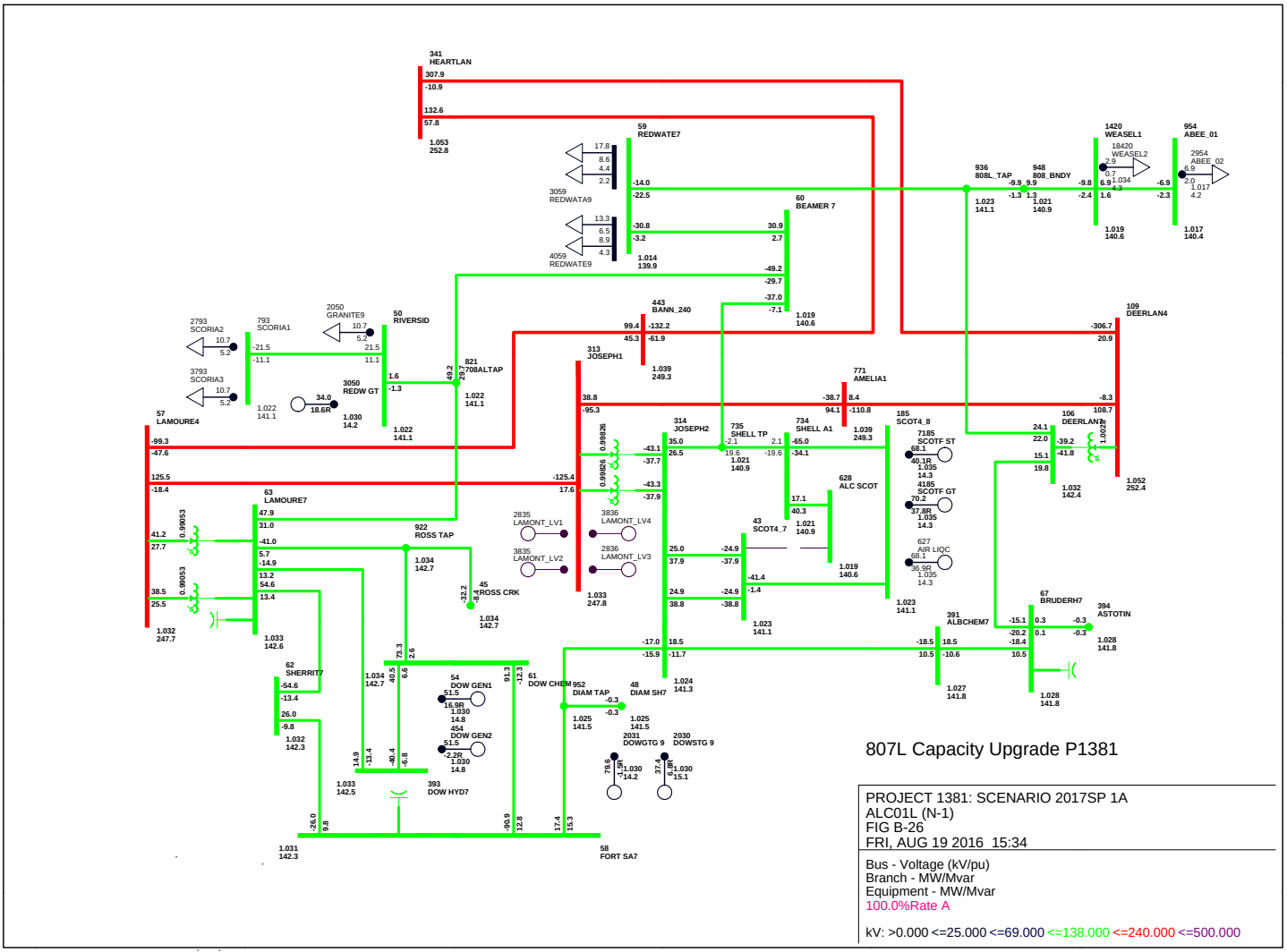
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
ALCO2L (N-1)
FIG B-23
FRI, AUG 19 2016 15:34
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
EXI-01L (N-1)
FIG B-24
FRI, AUG 19 2016 15:34
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
ALC03L (N-1)
FIG B-25
FRI, AUG 19 2016 15:34
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

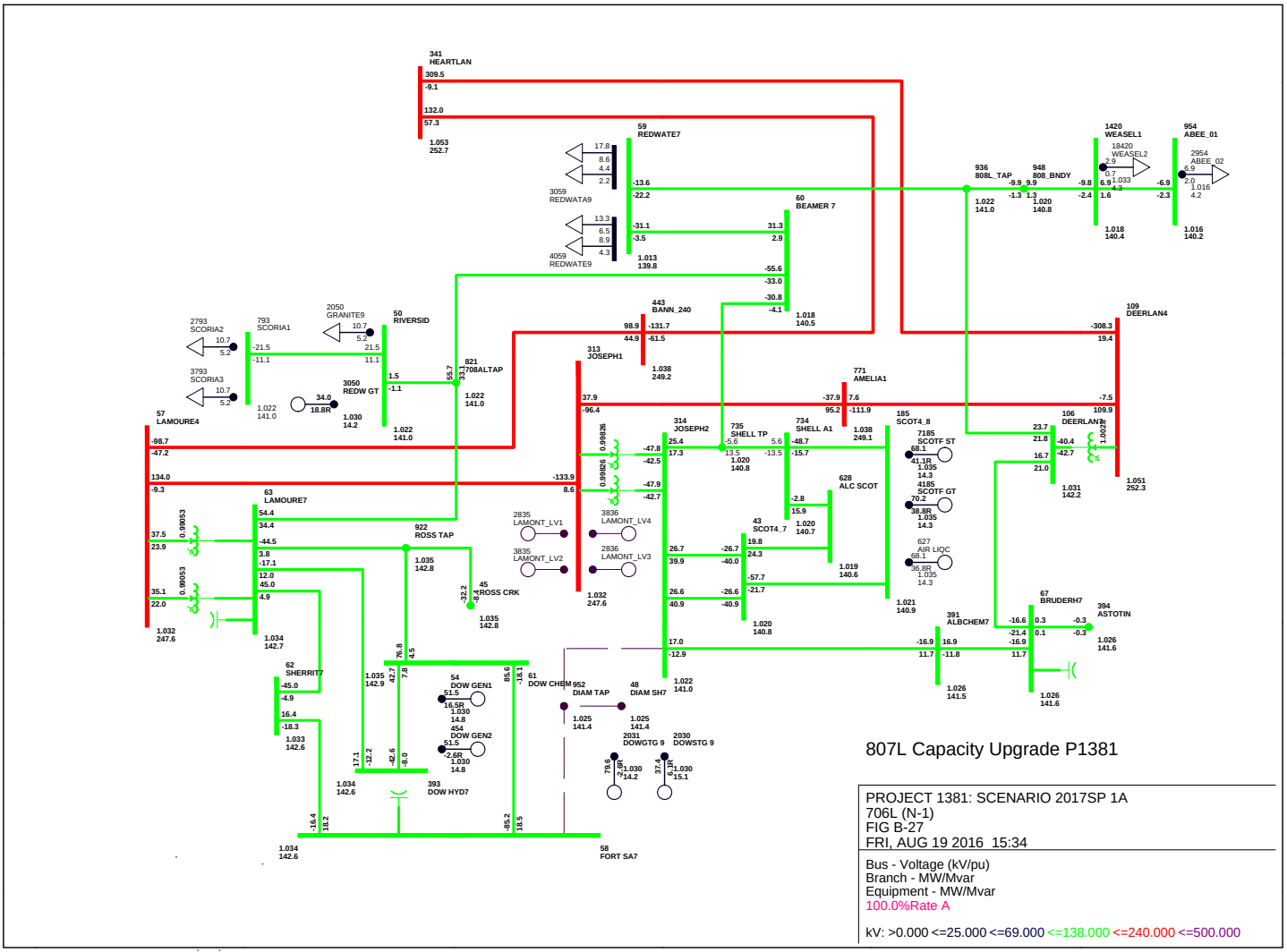


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
ALC01L (N-1)
FIG B-26
FRI, AUG 19 2016 15:34

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

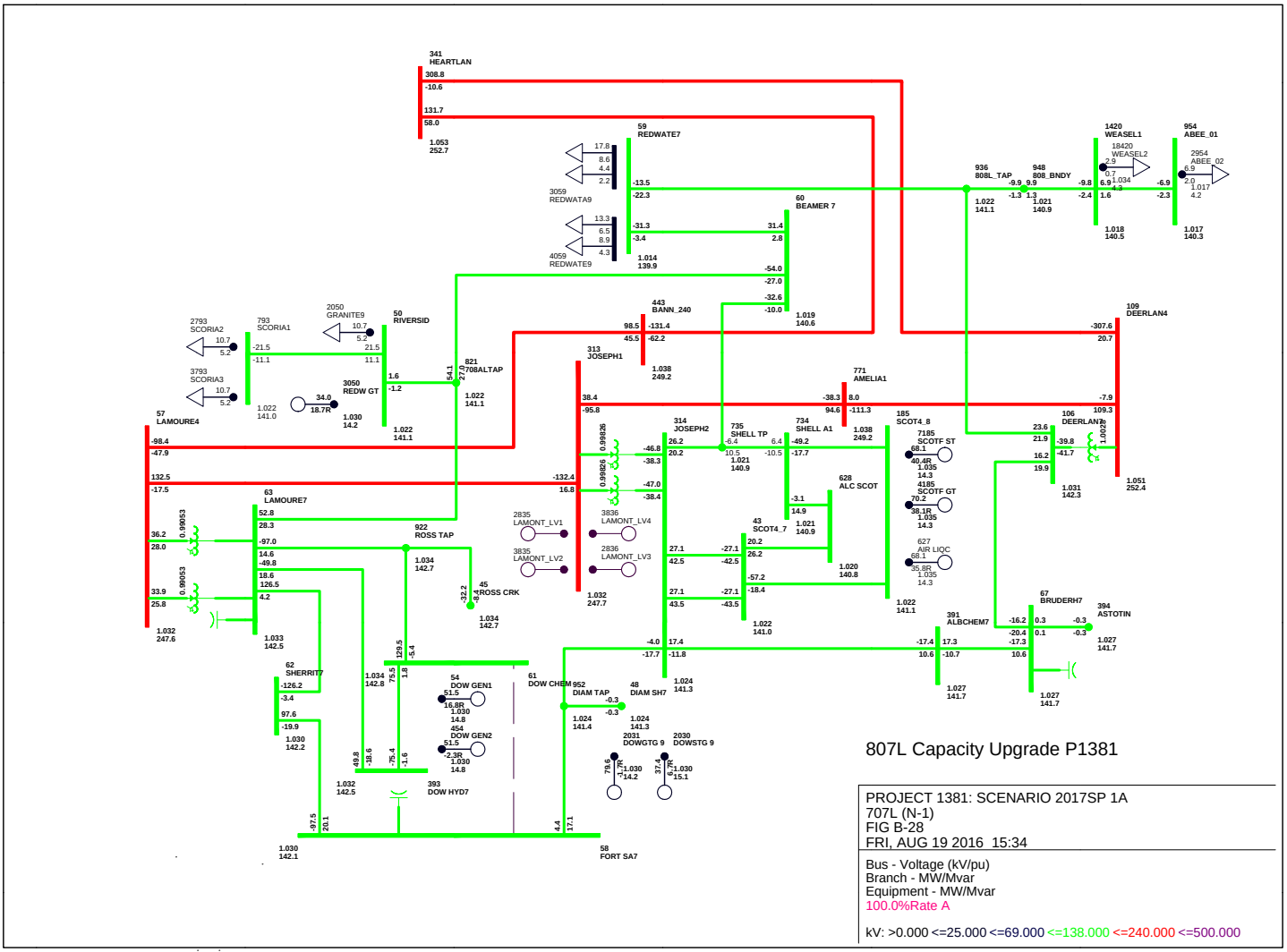


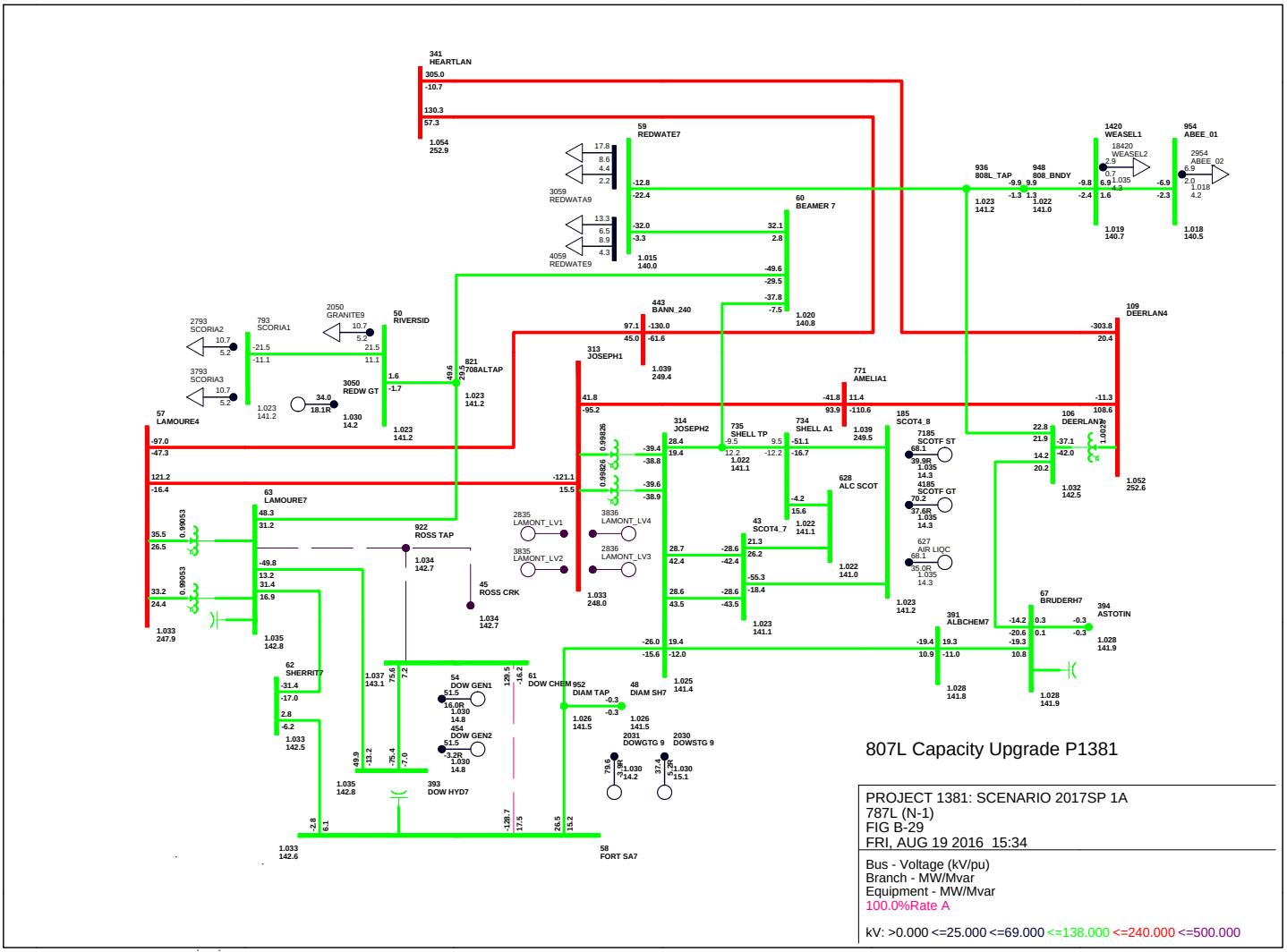
807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
706L (N-1)
FIG B-27
FRI, AUG 19 2016 15:34

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341
HEARTLAN
308.8
-10.6
131.7
58.0
1.053
252.7
59
REDWATE7
17.8
8.6
4.4
2.2
3059
REDWATA9
-13.5
-22.3
13.3
6.5
8.9
4.3
4059
REDWATE9
-31.3
-3.4
1.014
139.9
60
BEAMER 7
31.4
2.8
-54.0
-27.0
-32.6
-10.0
1.019
140.6
1420
WEASEL1
18420
WEASEL2
2.9
0.7
1.034
4.3
954
ABEE_01
2954
ABEE_02
6.9
2.0
1.017
4.2
936
808L_TAP
948
808_BNDY
-9.9
9.9
-1.3
1.3
1.021
140.9
-9.8
-2.4
-6.9
-2.3
1.022
141.1
1.6
1.018
140.5
1.017
140.3
2793
SCORIA2
10.7
5.2
793
SCORIA1
-21.5
-11.1
21.5
11.1
1.022
141.0
3793
SCORIA3
10.7
5.2
2050
GRANITE9
10.7
5.2
50
RIVERSID
3050
REDW GT
34.0
18.7R
1.030
14.2
1.6
-1.2
54.1
27.0
821
708ALTAP
1.022
141.1
443
BANN_240
98.5
45.5
-131.4
-62.2
1.038
249.2
313
JOSEPH1
38.4
-95.8
771
AMELIA1
-38.3
94.6
8.0
-111.3
109
DEERLAN4
-307.6
20.7
-7.9
109.3
106
DEERLAN7
23.6
21.9
16.2
19.9
-39.8
-41.7
1.030
1.031
142.3
1.051
252.4
57
LAMOURE4
-98.4
-47.9
132.5
-17.5
1.032
247.6
63
LAMOURE7
52.8
28.3
-97.0
14.6
-49.8
18.6
126.5
4.2
1.033
142.5
0.99053
0.99053
36.2
28.0
33.9
25.8
922
ROSS TAP
1.034
142.7
45
ROSS CRK
-32.2
-8.4
1.034
142.7
2835
LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
1.032
247.7
0.99826
0.99826
314
JOSEPH2
26.2
20.2
-46.8
-38.3
-47.0
-38.4
-132.4
16.8
735
SHELL TP
-6.4
6.4
10.5
-10.5
1.021
140.9
734
SHELL A1
-49.2
-17.7
1.038
249.2
-3.1
14.9
1.021
140.9
628
ALC SCOT
1.020
140.8
43
SCOT4_7
20.2
26.2
-57.2
-18.4
27.1
42.5
-27.1
-42.5
27.1
43.5
-27.1
-43.5
1.022
141.0
185
SCOT4_8
7185
SCOTF ST
68.1
40.4R
1.035
14.3
4195
SCOTF GT
70.2
38.1R
1.035
14.3
627
AIR LIQC
68.1
35.8R
1.035
14.3
1.022
141.1
391
ALBCHEM7
-16.2
-20.4
-17.3
0.3
0.1
-0.3
-0.3
-17.4
17.3
10.6
-10.7
10.6
1.027
141.7
1.027
141.7
67
BRUDERH7
394
ASTOTIN
1.027
141.7
62
SHERRIT7
-126.2
-3.4
97.6
-19.9
1.030
142.2
1.034
142.8
75.5
1.8
129.5
-5.4
54
DOW GEN1
51.5
16.8R
1.030
14.8
454
DOW GEN2
51.5
2.3R
1.030
14.8
49.8
-35.6
75.4
-1.6
1.032
142.5
393
DOW HYD7
61
DOW CHEM
952
DIAM TAP
-0.3
-0.3
48
DIAM SH7
1.024
141.3
1.024
141.4
1.024
141.3
2031
DOWGTG 9
78.6
7R
1.030
14.2
2030
DOWSTG 9
37.4
7R
1.030
15.1
-4.0
17.4
-17.7
-11.8
4.4
17.1
-97.5
20.1
1.030
142.1
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
707L (N-1)
FIG B-28
FRI, AUG 19 2016 15:34
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

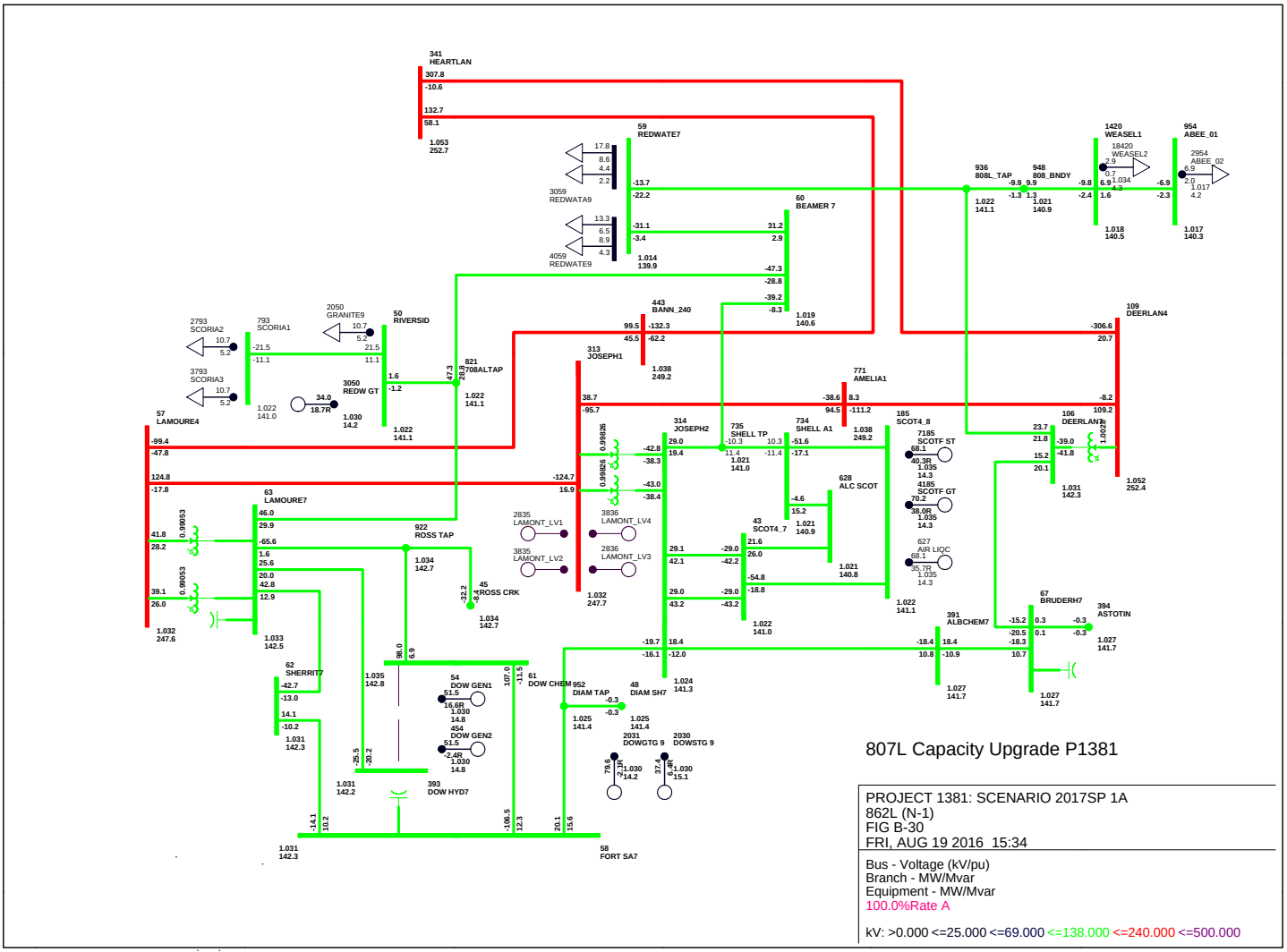


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
787L (N-1)
FIG B-29
FRI, AUG 19 2016 15:34

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

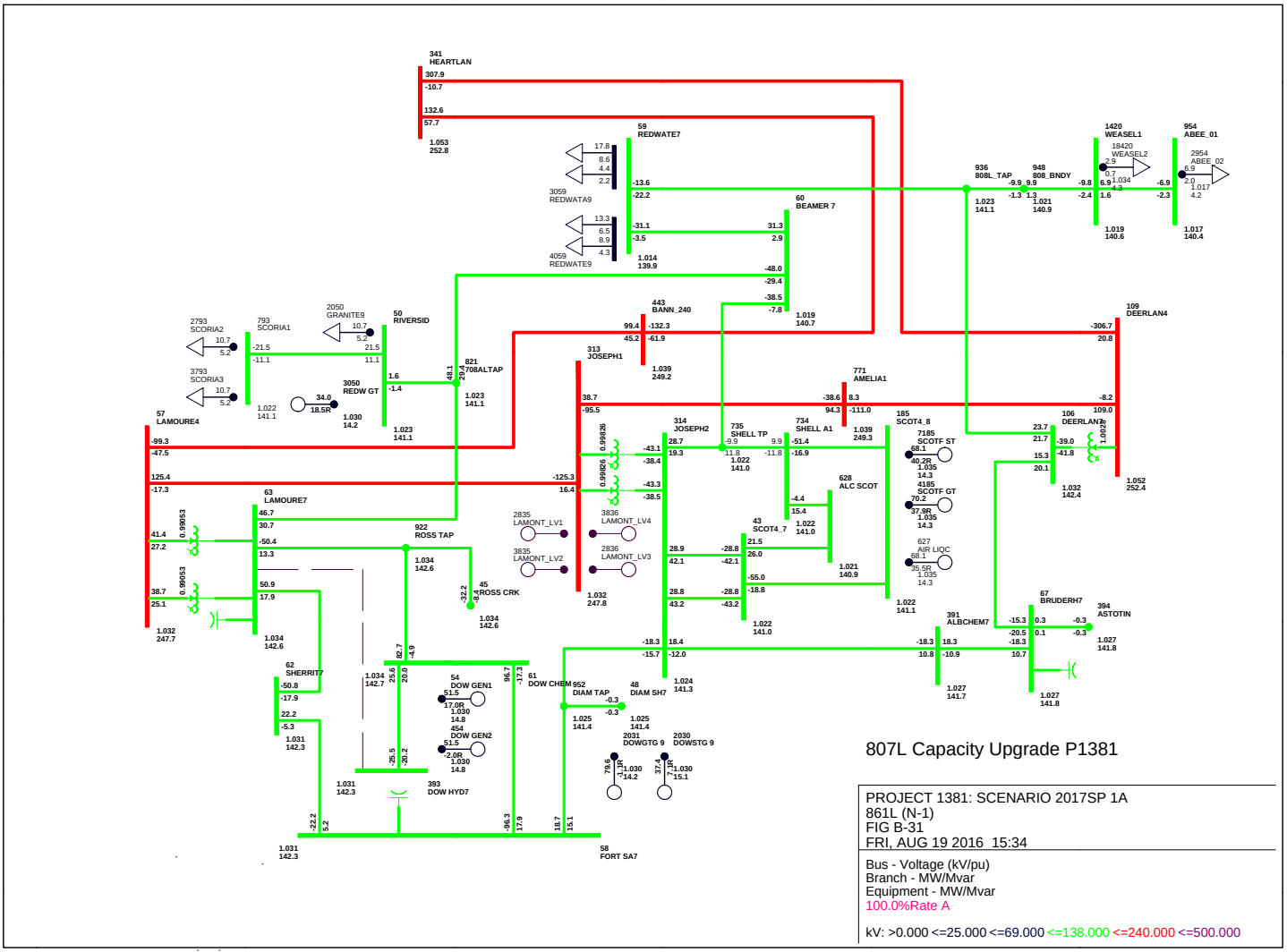


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
862L (N-1)
FIG B-30
FRI, AUG 19 2016 15:34

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

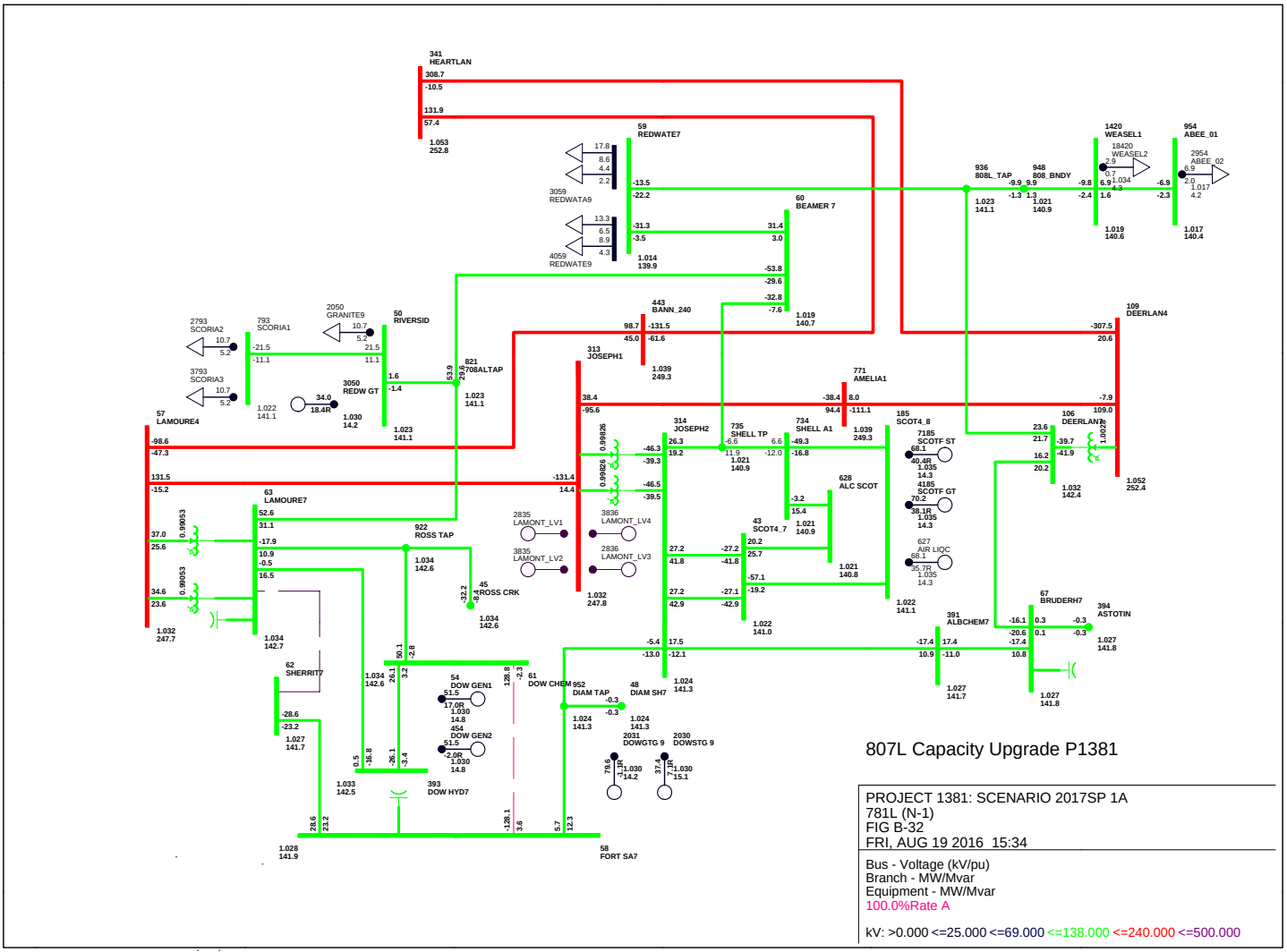


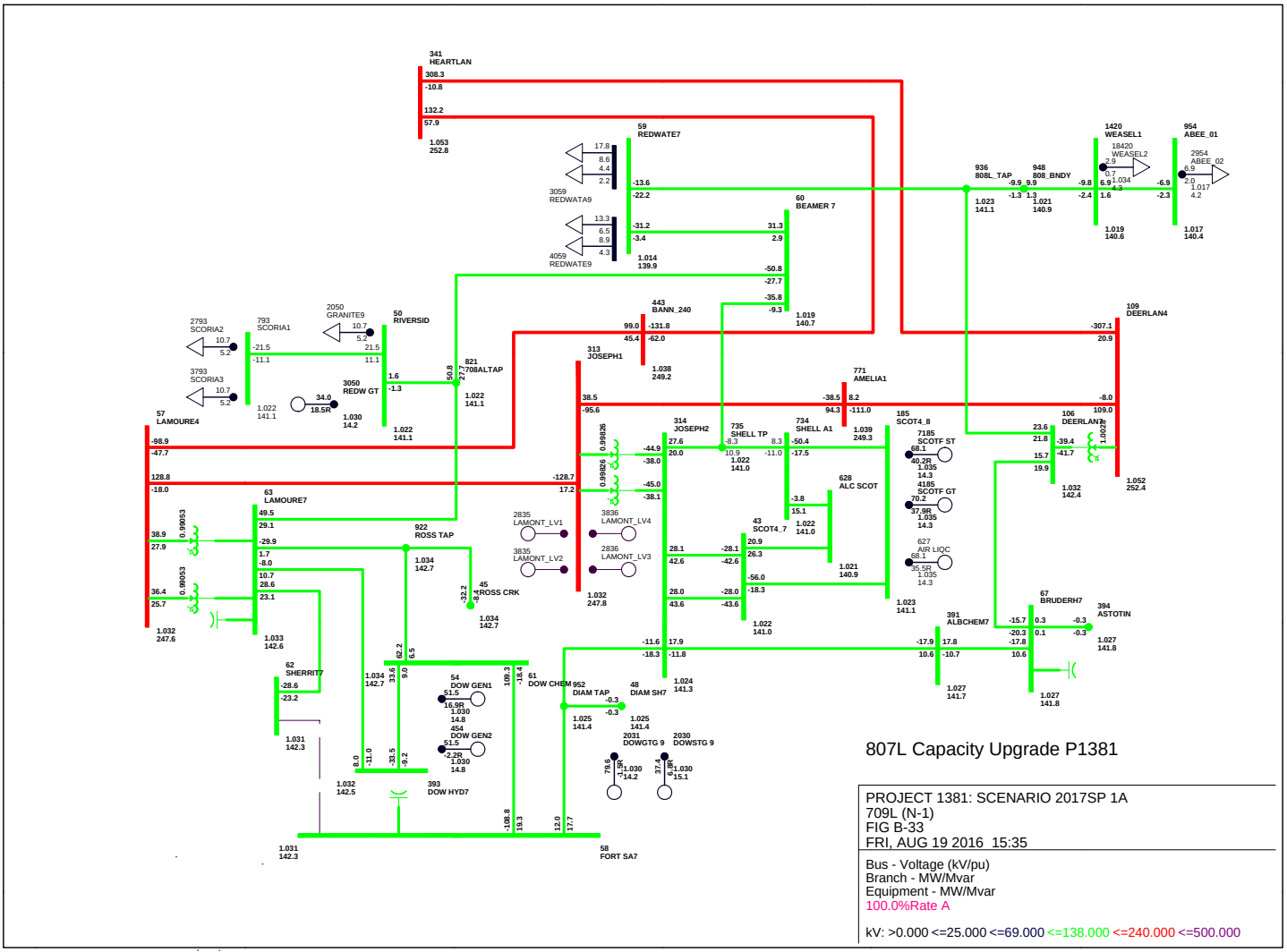
807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
861L (N-1)
FIG B-31
FRI, AUG 19 2016 15:34

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
781L (N-1)
FIG B-32
FRI, AUG 19 2016 15:34
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
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60 BEAMER 7
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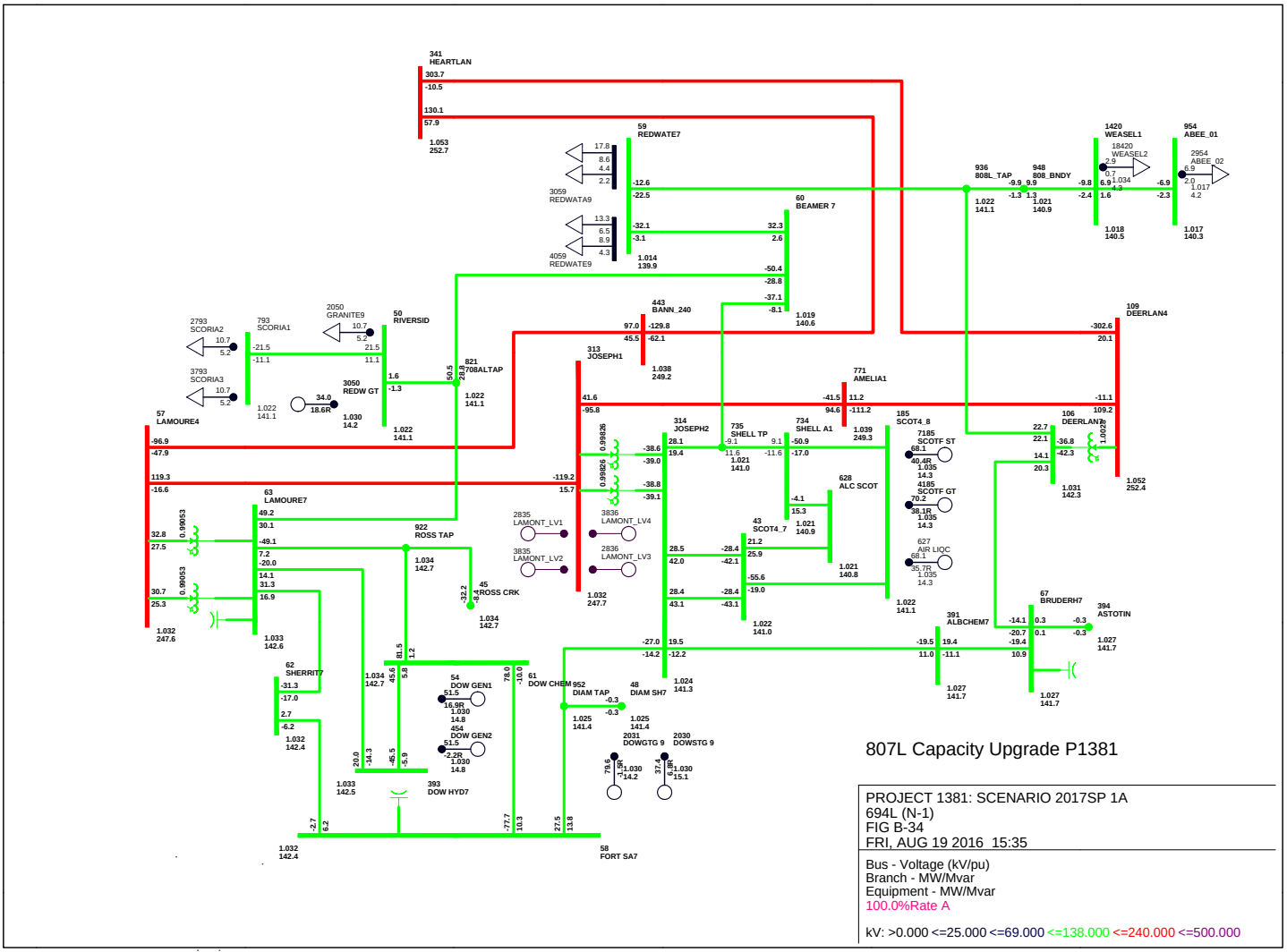
936 808L_TAP
948 808_BNDY
443 BANN_240
109 DEERLAN4
50 RIVERSID
821 708ALTAP
313 JOSEPH1
771 AMELIA1
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
45 ROSS CRK
314 JOSEPH2
735 SHELL TP
734 SHELL A1
185 SCOT4_8
7185 SCOTF ST
4195 SCOTF GT
628 ALC SCOT
43 SCOT4_7
627 AIR LIQC
106 DEERLAN7
391 ALBCHEM7
67 BRUDERH7
394 ASTOTIN
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
393 DOW HYD7
58 FORT SA7
2835 LAMONT_LV1
3836 LAMONT_LV4
3835 LAMONT_LV2
2836 LAMONT_LV3
2793 SCORIA2
793 SCORIA1
3793 SCORIA3
2050 GRANITE9
3050 REDW GT
3059 REDWATA9
4059 REDWATE9
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
709L (N-1)
FIG B-33
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

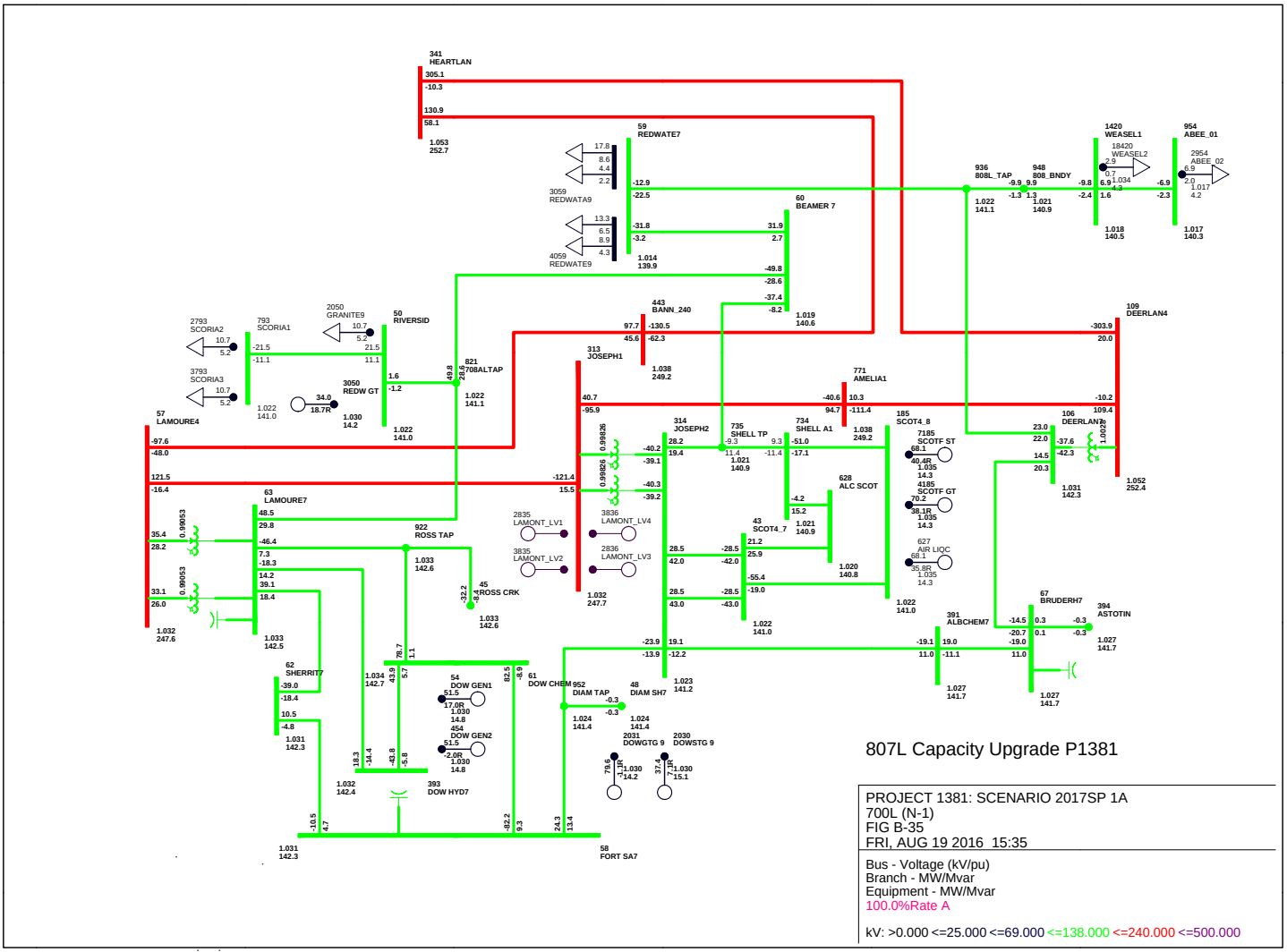


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2017SP 1A
694L (N-1)
FIG B-34
FRI, AUG 19 2016 15:35

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

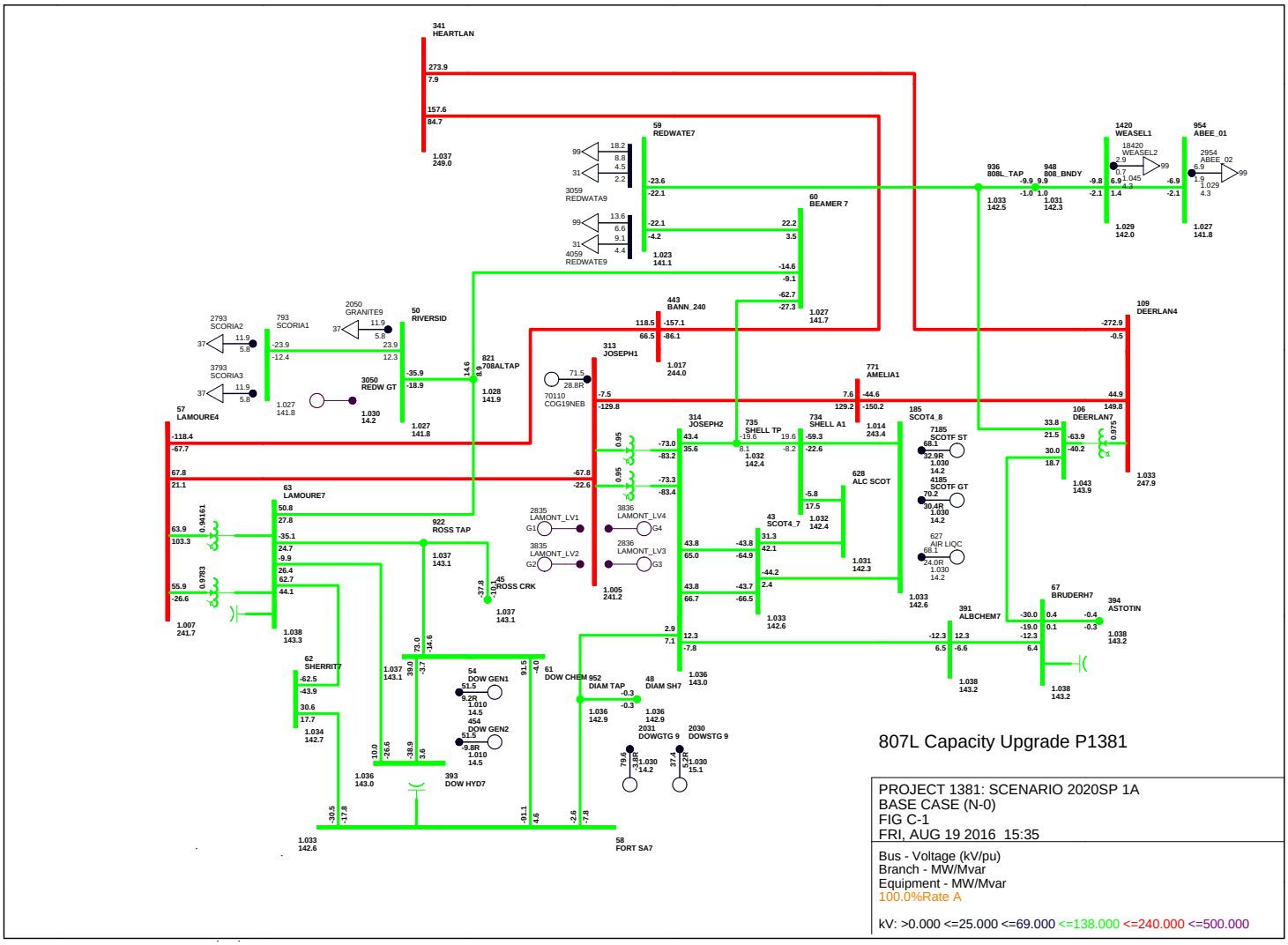

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2017SP 1A
700L (N-1)
FIG B-35
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

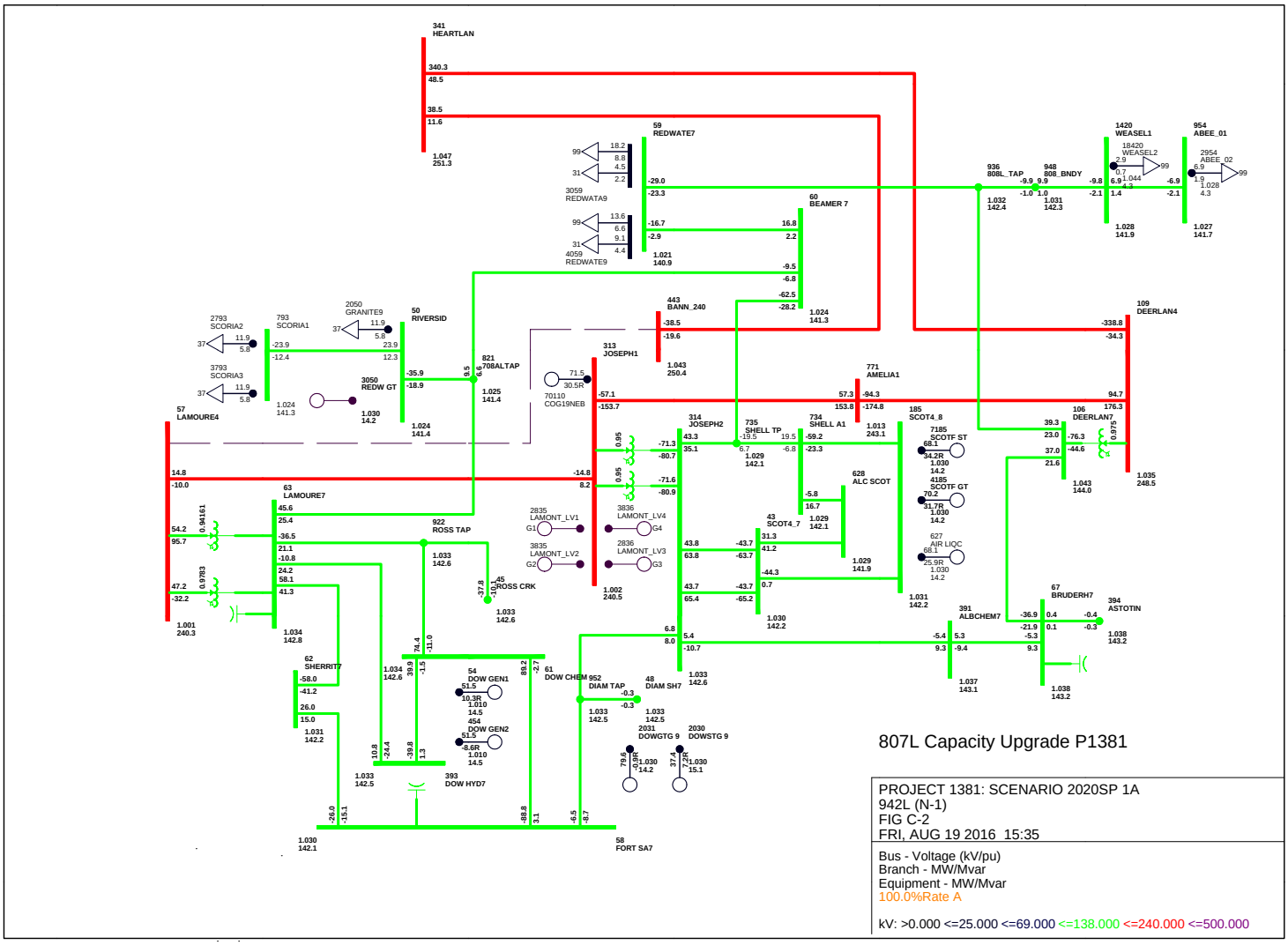
Attachment C

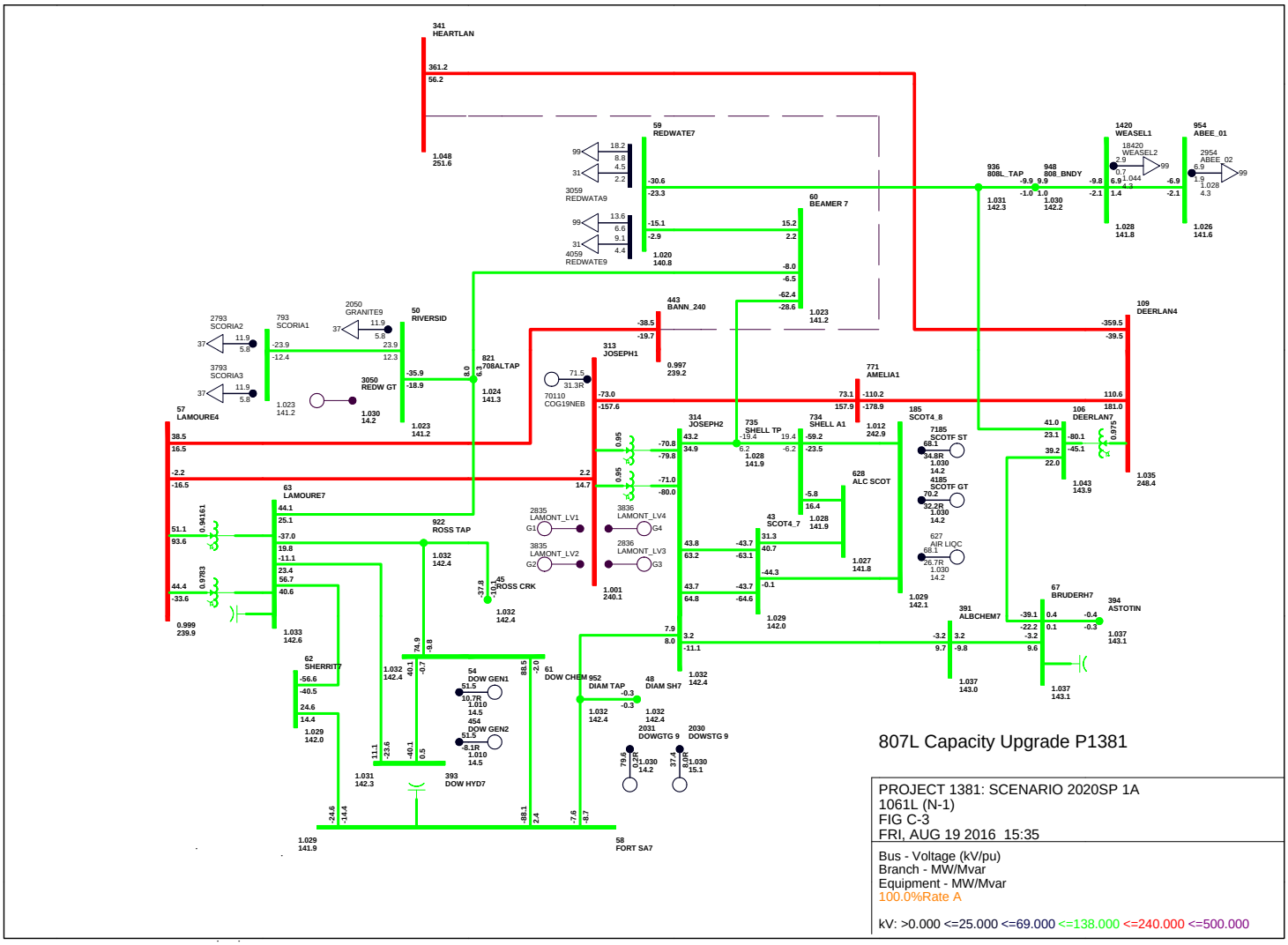
2020SP Power Flow Diagrams

Table C-1: 2020SP Contingency Lists

Figure #	Scenario	Condition
C-1	20_1a	Base Case (N-0)
C-2	20_1a	942L (N-1) 71S Lamoureux to 681S Bannerman
C-3	20_1a	1061L (N-1) 681S Bannerman to 12S Heartland
C-4	20_1a	997L (N-1) 71S Lamoureux to 410S Josephburg
C-5	20_1a	1120L (N-1) 410S Josephburg to 108S Amelia
C-6	20_1a	943L (N-1) 13S Deerland to 108S Amelia
C-7	20_1a	1054L (N-1) 12S Heartland to 13S Deerland
C-8	20_1a	9L960 (N-1) 13S Deerland to 825S Whitefish Lake
C-9	20_1a	9L961 (N-1) 13S Deerland to 825S Whitefish Lake
C-10	20_1a	920L (N-1) 71S Lamoureux to 557S Castle Downs
C-11	20_1a	921L (N-1) 71S Lamoureux to 987S Clover Bar
C-12	20_1a	708L (N-1) 233S Beamer to 71S Lamoureux
C-13	20_1a	807L (N-1) 410S Josephburg to 233S Beamer
C-14	20_1a	735L (N-1) 233S Beamer to 171S Redwater
C-15	20_1a	808L (N-1) 171S Redwater to 13S Deerland
C-16	20_1a	621L (N-1) 13S Deerland to 109S Skaro
C-17	20_1a	815L (N-1) 13S Deerland to 127S Bruderheim
C-18	20_1a	846L (N-1) 127S Bruderheim
C-19	20_1a	773L (N-1) 127S Bruderheim to 308S Albchem Beaverhill Creek
C-20	20_1a	776L (N-1) 410S Josephburg to 308S Albchem Beaverhill Creek
C-21	20_1a	856L (N-1) 410S Josephburg to 409S Shell Scotford
C-22	20_1a	857L (N-1) 410S Josephburg to 409S Shell Scotford
C-23	20_1a	ALCO2L (N-1) 879S Scotford Upgrader to 409S Shell Scotford
C-24	20_1a	EXI-01L (N-1) 879S Scotford Upgrader to 402S Scotford Expansion 1
C-25	20_1a	ALC03L (N-1) 402S Scotford Expansion 1 to Air Liquide
C-26	20_1a	ALC01L (N-1) Air Liquide to 409S Shell Scotford
C-27	20_1a	706L (N-1) 410S Josephburg to 54S Fort Saskatchewan
C-28	20_1a	707L (N-1) 233S Beamer to 71S Lamoureux
C-29	20_1a	787L (N-1) 71S Lamoureux to 166S Dow Chemical
C-30	20_1a	862L (N-1) 166S Dow Chemical to 258S Dow HydroCarbons
C-31	20_1a	861L (N-1) 71S Lamoureux to 258S Dow HydroCarbons
C-32	20_1a	781L (N-1) 172S Sherritt to 71S Lamoureux
C-33	20_1a	709L (N-1) 233S Beamer to 71S Lamoureux
C-34	20_1a	694L (N-1) 54S Fort Saskatchewan to 422S Westwood
C-35	20_1a	700L (N-1) 422S Westwood to 746S Sherwood Park


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
BASE CASE (N-0)
FIG C-1
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
942L (N-1)
FIG C-2
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

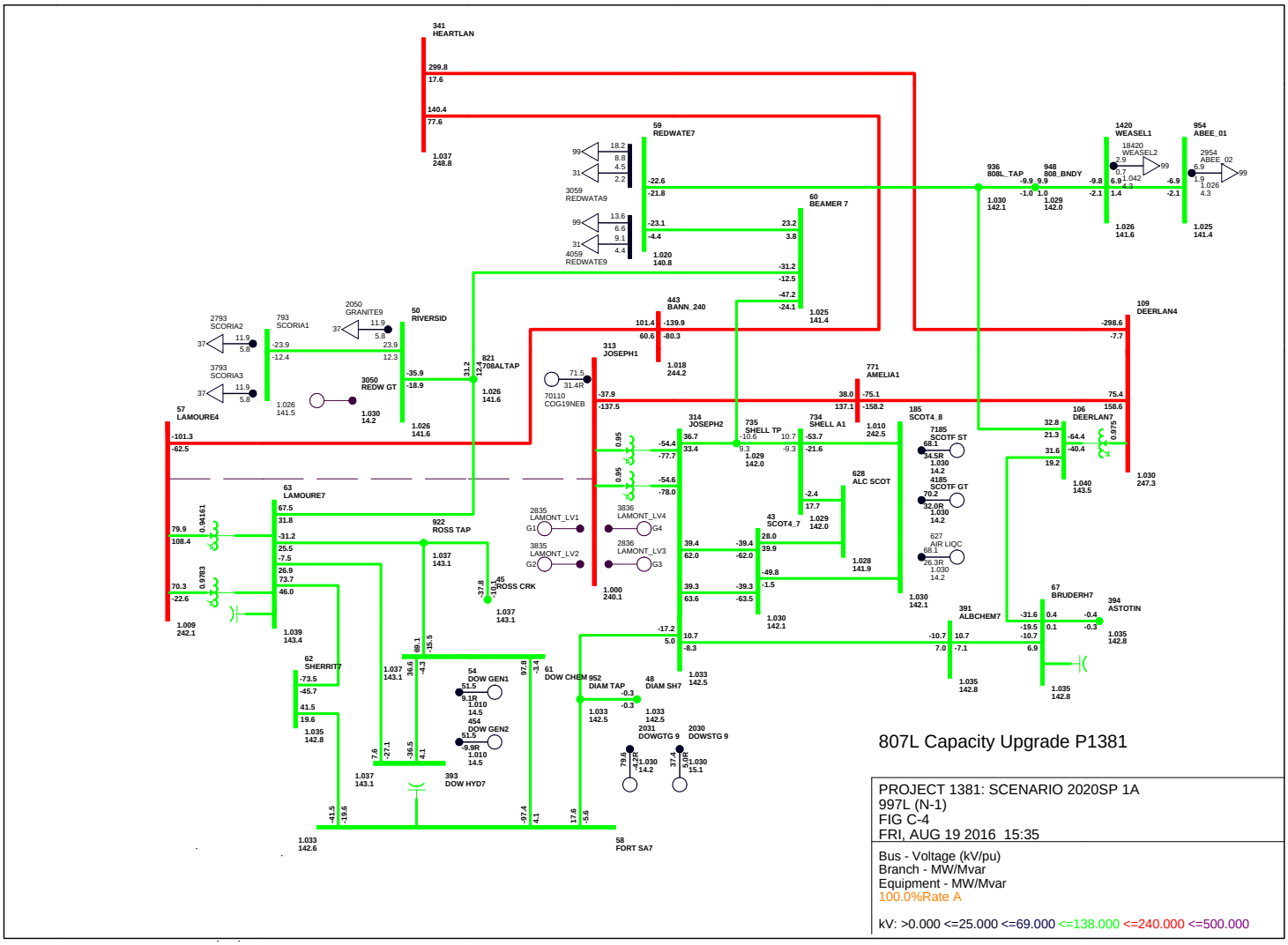


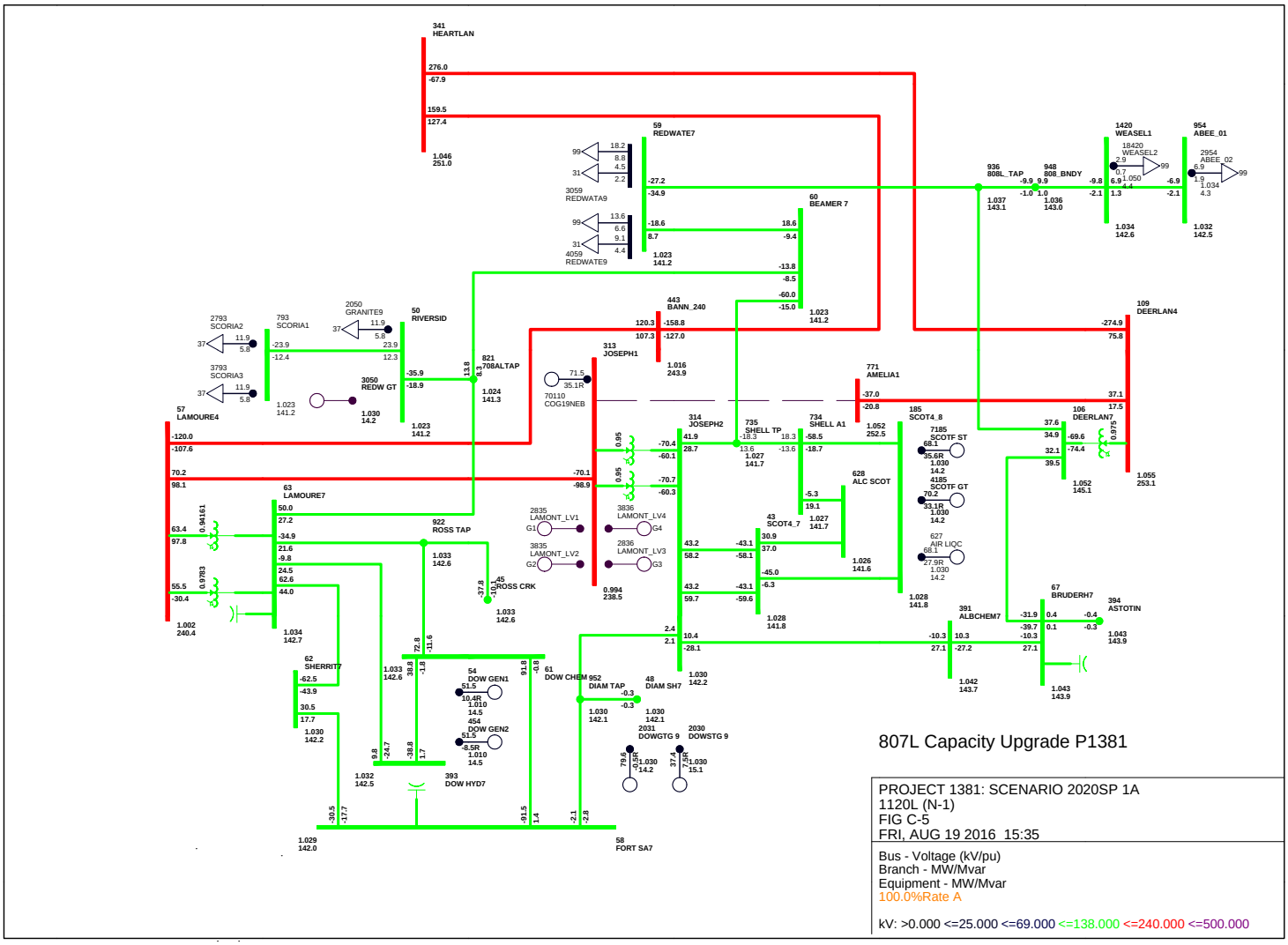
807L Capacity Upgrade P1381

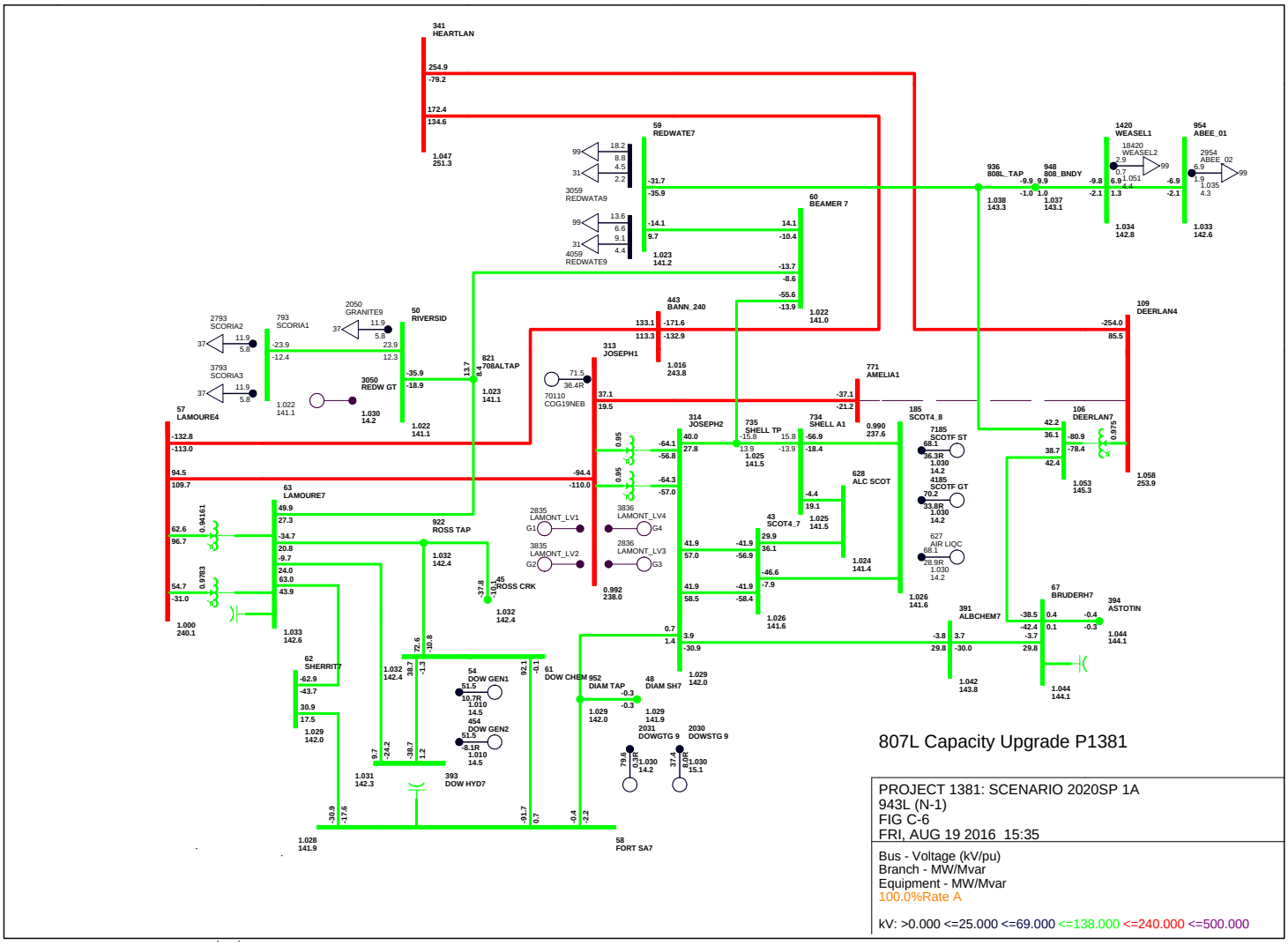
PROJECT 1381: SCENARIO 2020SP 1A
1061L (N-1)
FIG C-3
FRI, AUG 19 2016 15:35

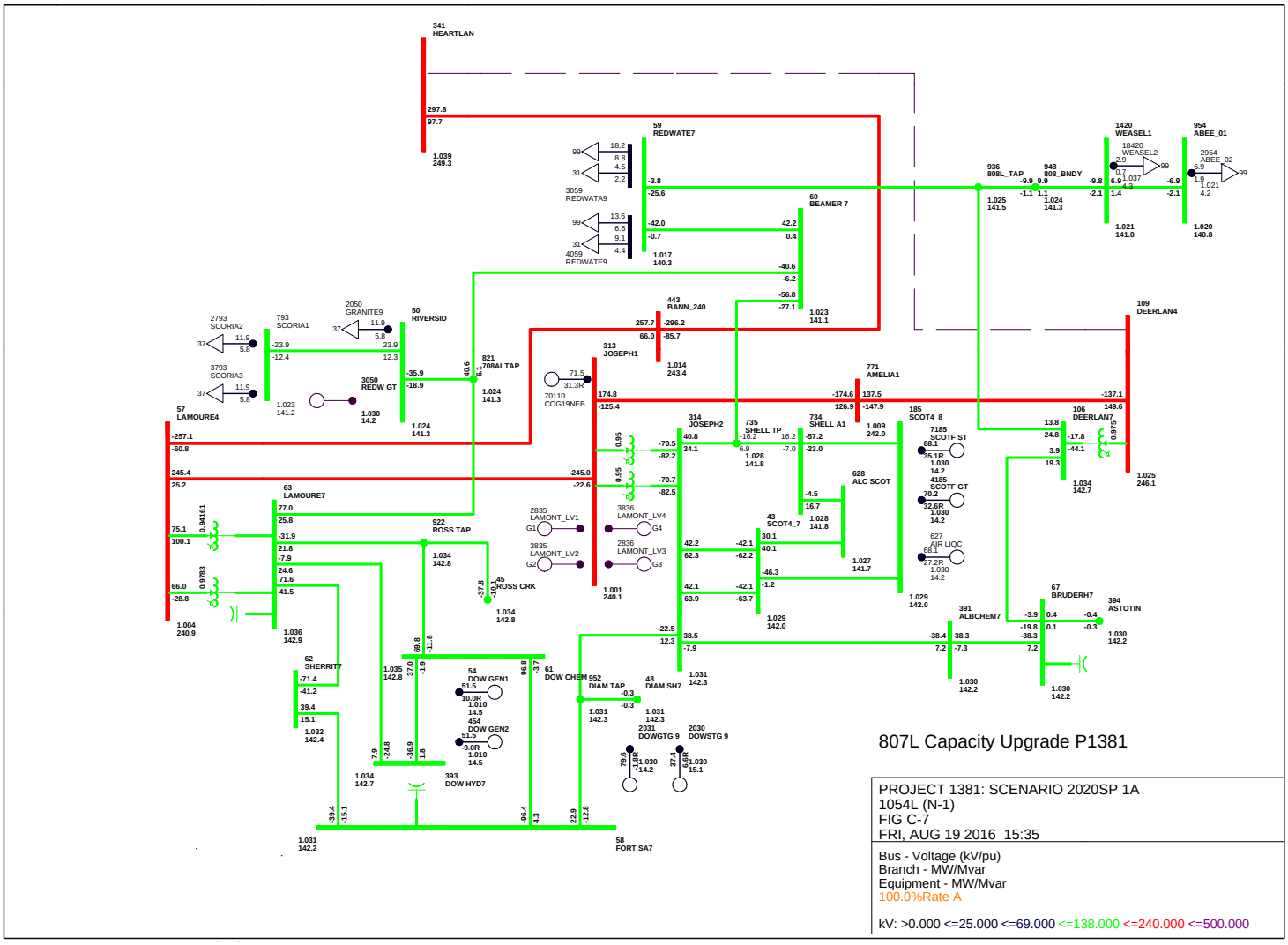
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

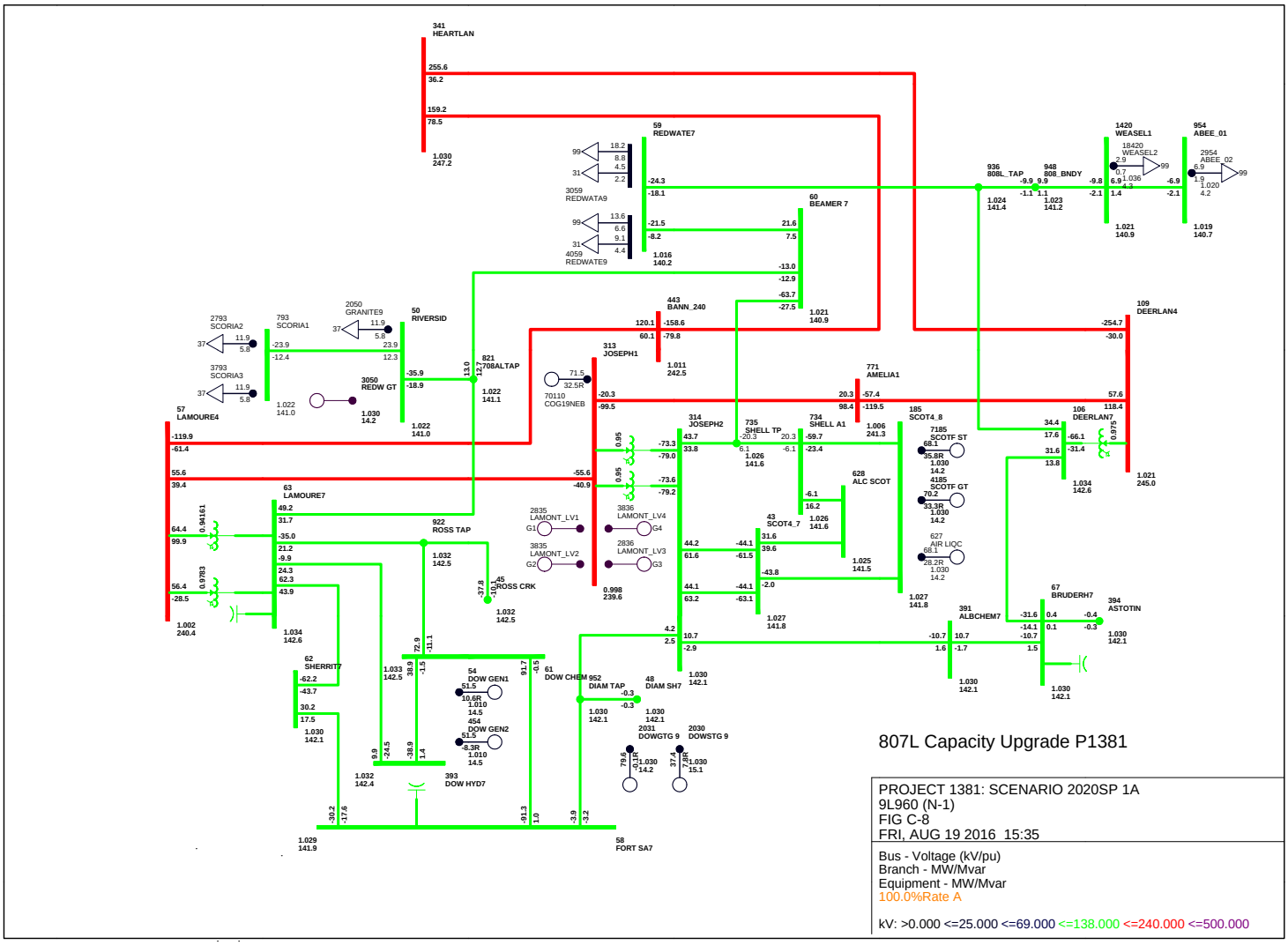
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

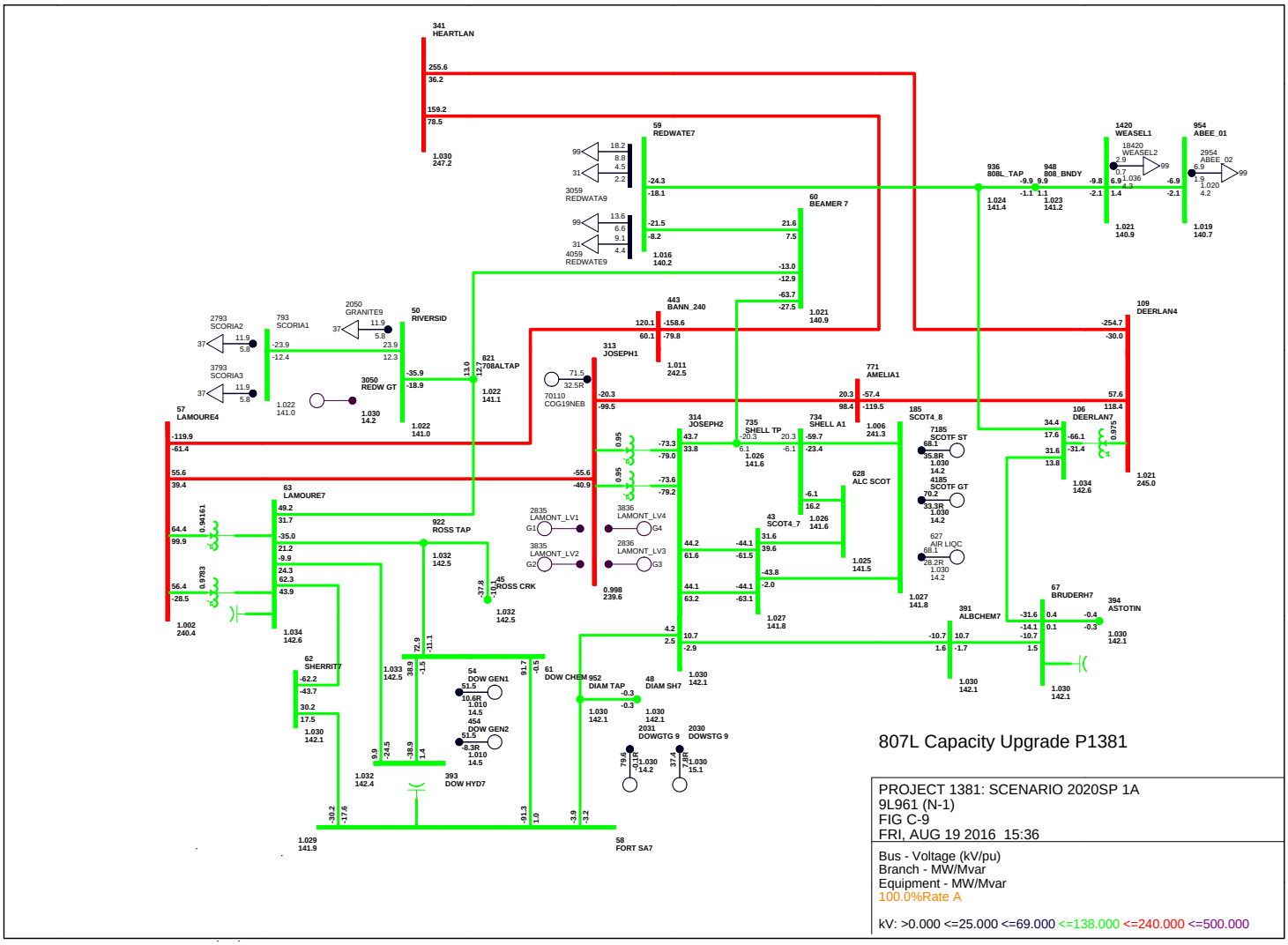

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
997L (N-1)
FIG C-4
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

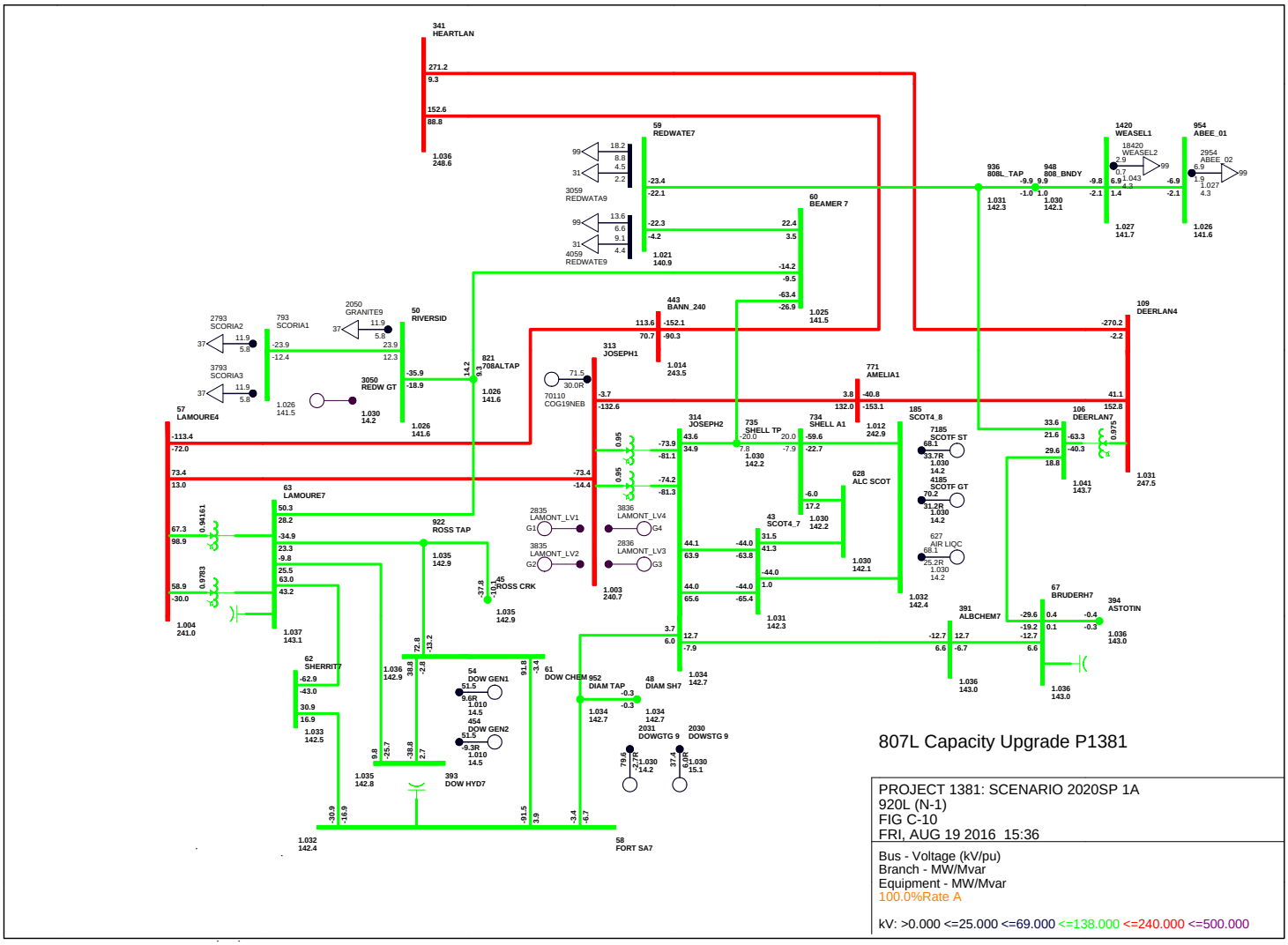

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
1120L (N-1)
FIG C-5
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

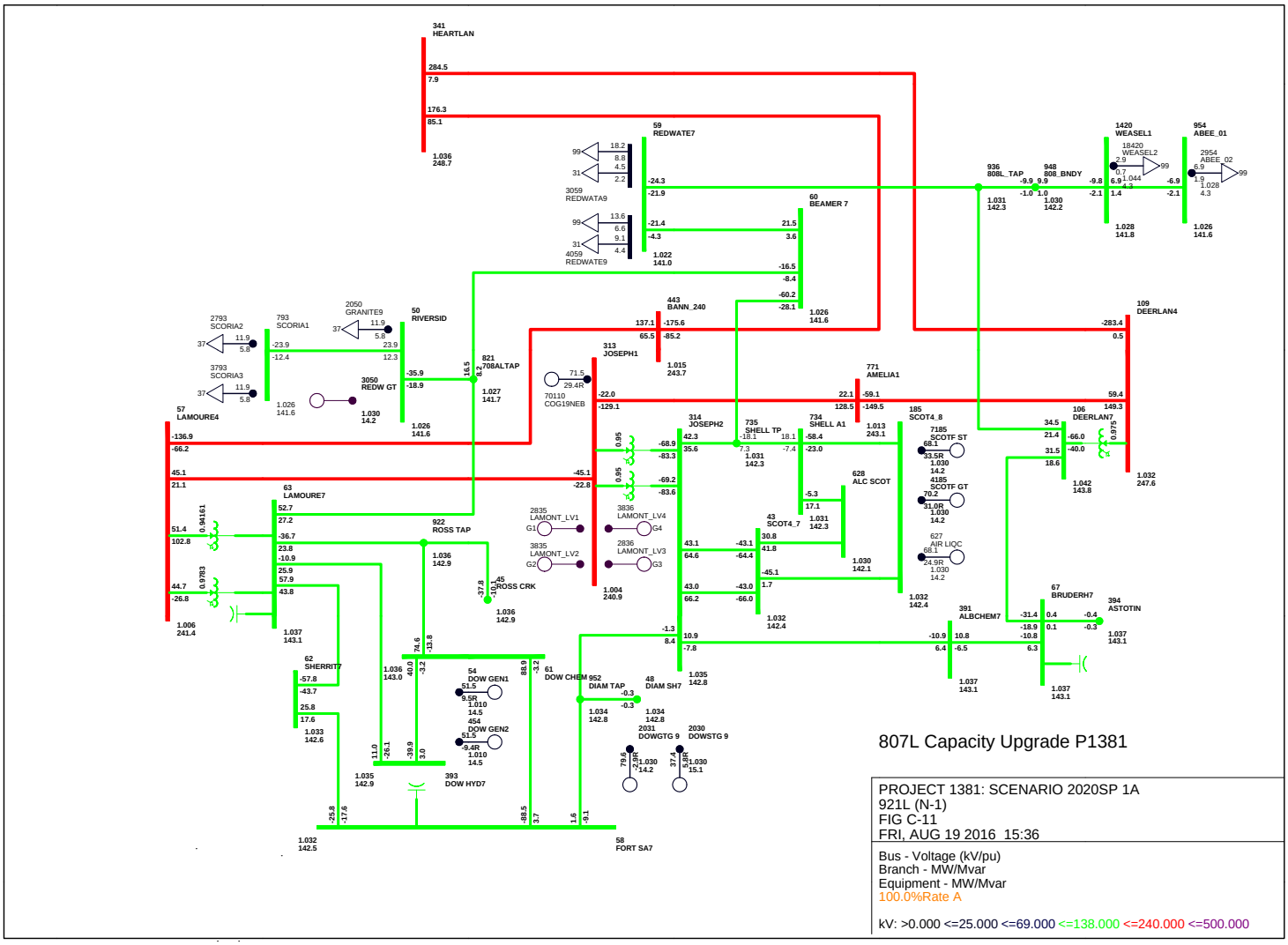

341 HEARTLAN
254.9 -79.2
172.4 134.6
1.047 251.3
59 REDWATE7
3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.023 141.2
1.022 141.0
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.038 143.3
1.037 143.1
1.034 142.8
1.033 142.6
1.035
1.051
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.022 141.1
1.030 14.2
821 708ALTAP
1.023 141.1
1.022 141.1
443 BANN_240
1.016 243.8
313 JOSEPH1
71.5 36.4R
70110 COG19NEB
37.1 19.5
771 AMELIA1
109 DEERLAN4
-254.0 85.5
1.058 253.9
57 LAMOURE4
-132.8 -113.0
94.5 109.7
63 LAMOURE7
49.9 27.3
-34.7 20.8
-9.7 24.0
63.0 43.9
1.033 142.6
62.6 96.7
54.7 -31.0
1.000 240.1
0.9461
0.9783
922 ROSS TAP
1.032 142.4
45 ROSS CRK
1.032 142.4
-37.8 -10.1
62 SHERRIT7
-62.9 -43.7
30.9 17.5
1.029 142.0
1.031 142.3
393 DOW HYD7
9.7 -24.2
-38.7 1.2
1.032 142.4
39.7 -13
72.6 30.8
54 DOW GEN1
51.5
10.7R
1.010
14.5
454 DOW GEN2
-8.1R
92.1 -0.1
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.029 142.0
1.029 141.9
2031 DOWGTG 9
2030 DOWSTG 9
79.6 0.1R
37.4 8.0R
1.030 14.2
1.030 15.1
-30.9 -17.6
1.028 141.9
58 FORT SA7
91.7 0.7
-0.4 -2.2
2835 LAMONT_LV1
3836 LAMONT_LV4
3835 LAMONT_LV2
2836 LAMONT_LV3
0.992 238.0
0.95
314 JOSEPH2
40.0 27.8
-64.1 -56.8
-64.3 -57.0
735 SHELL TP
-15.8 13.9
1.025 141.5
734 SHELL A1
-56.9 -18.4
0.990 237.6
185 SCOT4_8
7185 SCOTF ST
68.1 36.3R
1.030 14.2
4185 SCOTF GT
70.2 33.8R
1.030 14.2
627 AIR LIQC
68.1 28.9R
1.030 14.2
628 ALC SCOT
19.1 -4.4
1.025 141.5
43 SCOT4_7
29.9 36.1
-41.9 -56.9
-46.6 -7.9
-41.9 -58.4
1.024 141.4
1.026 141.6
1.026 141.6
106 DEERLAN7
42.2 36.1
-80.9 -78.4
38.7 42.4
0.975
1.053 145.3
67 BRUDERH7
-38.5 0.4
-42.4 -3.7
0.1 -0.3
1.044 144.1
394 ASTOTIN
391 ALBCHEM7
-3.8 29.8
3.7 -30.0
1.042 143.8
41.9 57.0
41.9 58.5
0.7 1.4
3.9 -30.9
1.029 142.0
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
943L (N-1)
FIG C-6
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

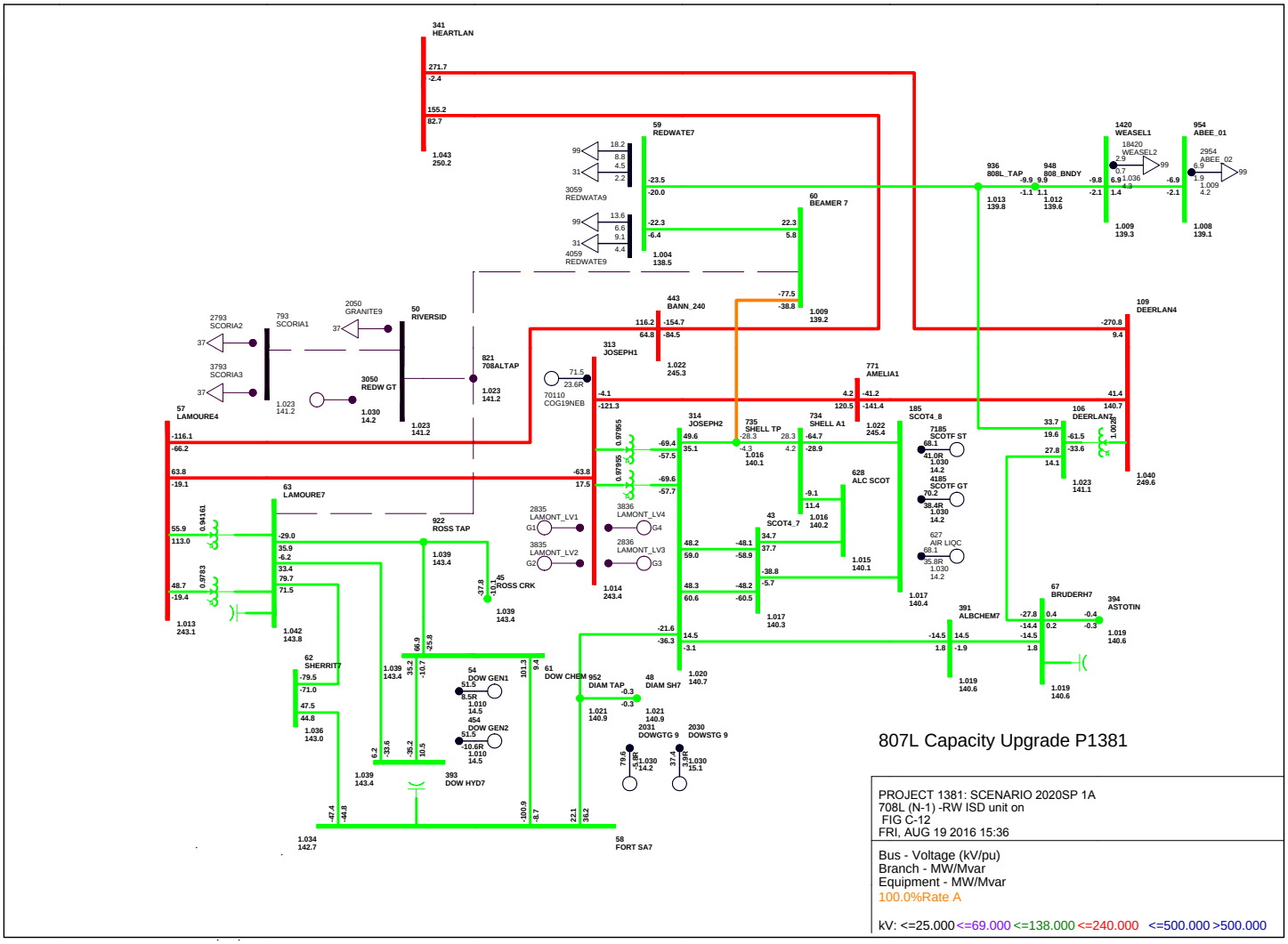

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
1054L (N-1)
FIG C-7
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

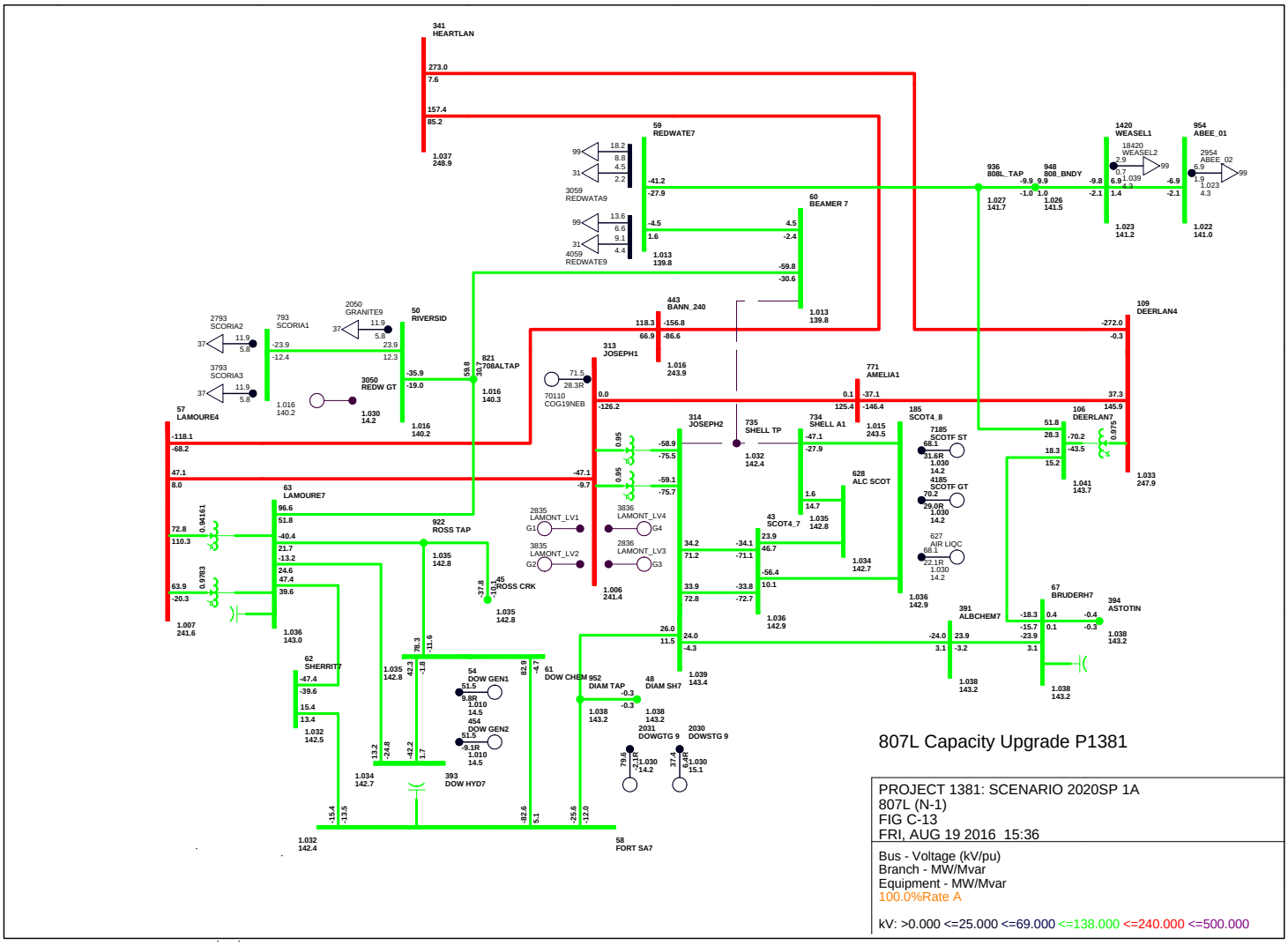

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
9L960 (N-1)
FIG C-8
FRI, AUG 19 2016 15:35
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

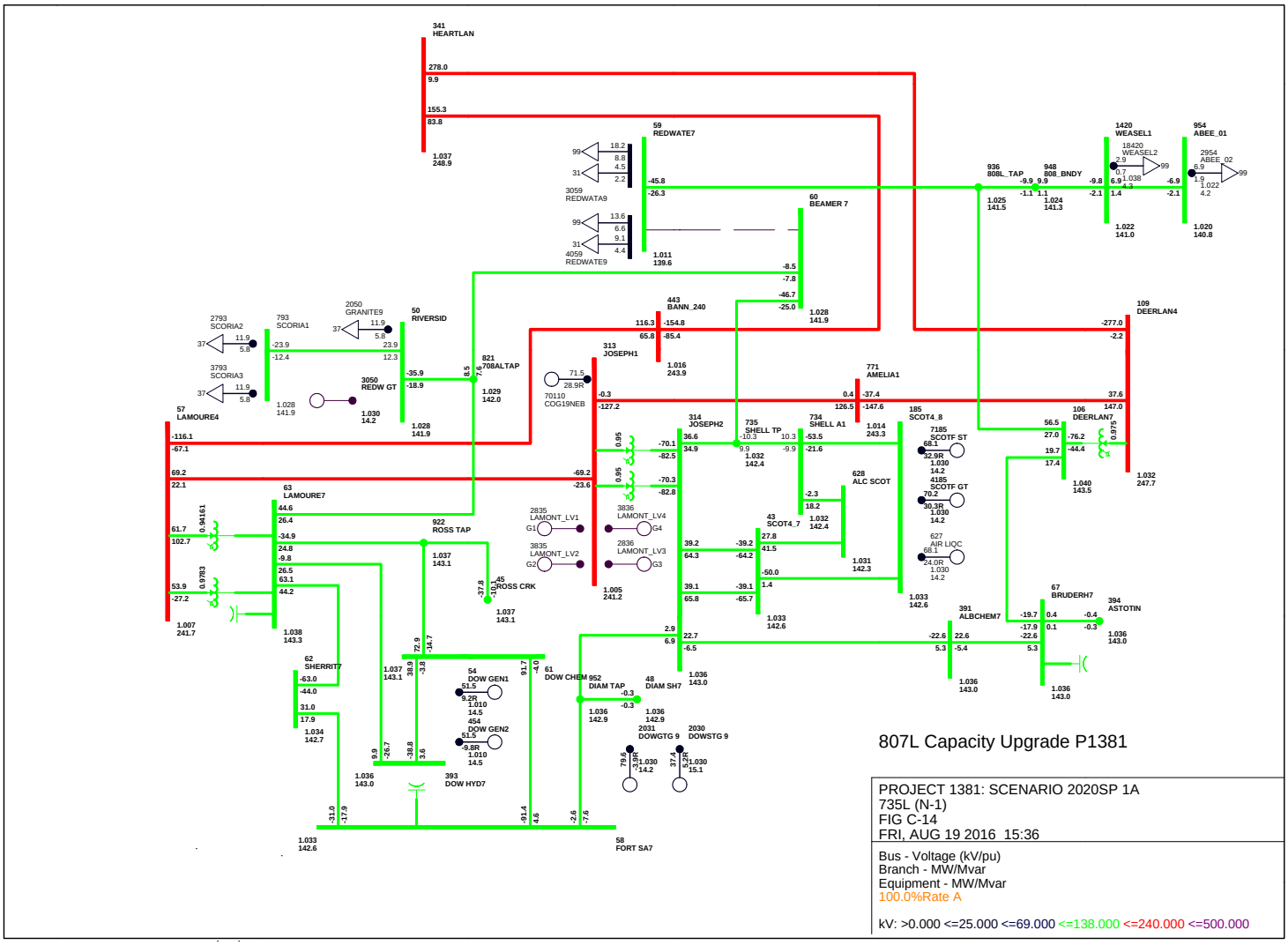

341 HEARTLAN
255.6
36.2
159.2
78.5
1.030
247.2
59 REDWATE7
18.2
8.8
4.5
2.2
99
31
3059 REDWATA9
-24.3
-18.1
13.6
6.6
9.1
4.4
4059 REDWATE9
1.016
140.2
60 BEAMER 7
21.6
7.5
-21.5
-8.2
-13.0
-12.9
-63.7
-27.5
1.021
140.9
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.024
141.4
1.023
141.2
1.021
140.9
1.019
140.7
1.036
1.020
443 BANN_240
120.1
-158.6
60.1
-79.8
1.011
242.5
313 JOSEPH1
71.5
32.5R
70110 COG19NEB
-20.3
-99.5
771 AMELIA1
20.3
98.4
-57.4
-119.5
57.6
109 DEERLAN4
-254.7
-30.0
1.021
245.0
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
2050 GRANITE9
50 RIVERSID
3050 REDW GT
821 708ALTAP
1.022
141.1
1.022
141.0
1.030
14.2
57 LAMOURE4
-119.9
-61.4
55.6
39.4
1.002
240.4
63 LAMOURE7
49.2
31.7
-35.0
21.2
-9.9
24.3
62.3
43.9
1.034
142.6
922 ROSS TAP
1.032
142.5
45 ROSS CRK
-37.8
-10.1
1.032
142.5
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
0.998
239.6
314 JOSEPH2
43.7
33.8
-73.3
-79.0
-73.6
-79.2
735 SHELL TP
-20.3
6.1
1.026
141.6
734 SHELL A1
-59.7
-23.4
1.006
241.3
185 SCOT4_8
7185 SCOTF ST
35.8R
1.030
14.2
4185 SCOTF GT
70.2
33.3R
1.030
14.2
627 AIR LIQC
68.1
28.2R
1.030
14.2
628 ALC SCOT
-6.1
16.2
1.026
141.6
1.025
141.5
43 SCOT4_7
31.6
39.6
-44.1
-61.5
-43.8
-2.0
44.2
61.6
44.1
63.2
-44.1
-63.1
1.027
141.8
1.027
141.8
106 DEERLAN7
34.4
17.6
31.6
13.8
-66.1
-31.4
1.034
142.6
67 BRUDERH7
-31.6
-14.1
-10.7
0.4
0.1
1.5
-0.4
-0.3
1.030
142.1
394 ASTOTIN
391 ALBCHEM7
-10.7
1.6
10.7
-1.7
1.030
142.1
62 SHERRIT7
-62.2
-43.7
30.2
17.5
1.030
142.1
1.033
142.5
54 DOW GEN1
51.5
10.6R
1.010
14.5
454 DOW GEN2
51.5
8.3R
1.010
14.5
393 DOW HYD7
1.032
142.4
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
-0.3
-0.3
1.030
142.1
1.030
142.1
1.030
142.1
2031 DOWGTG 9
2030 DOWSTG 9
79.6
-0.1R
1.030
14.2
37.4
7.8R
1.030
15.1
1.029
141.9
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
9L961 (N-1)
FIG C-9
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

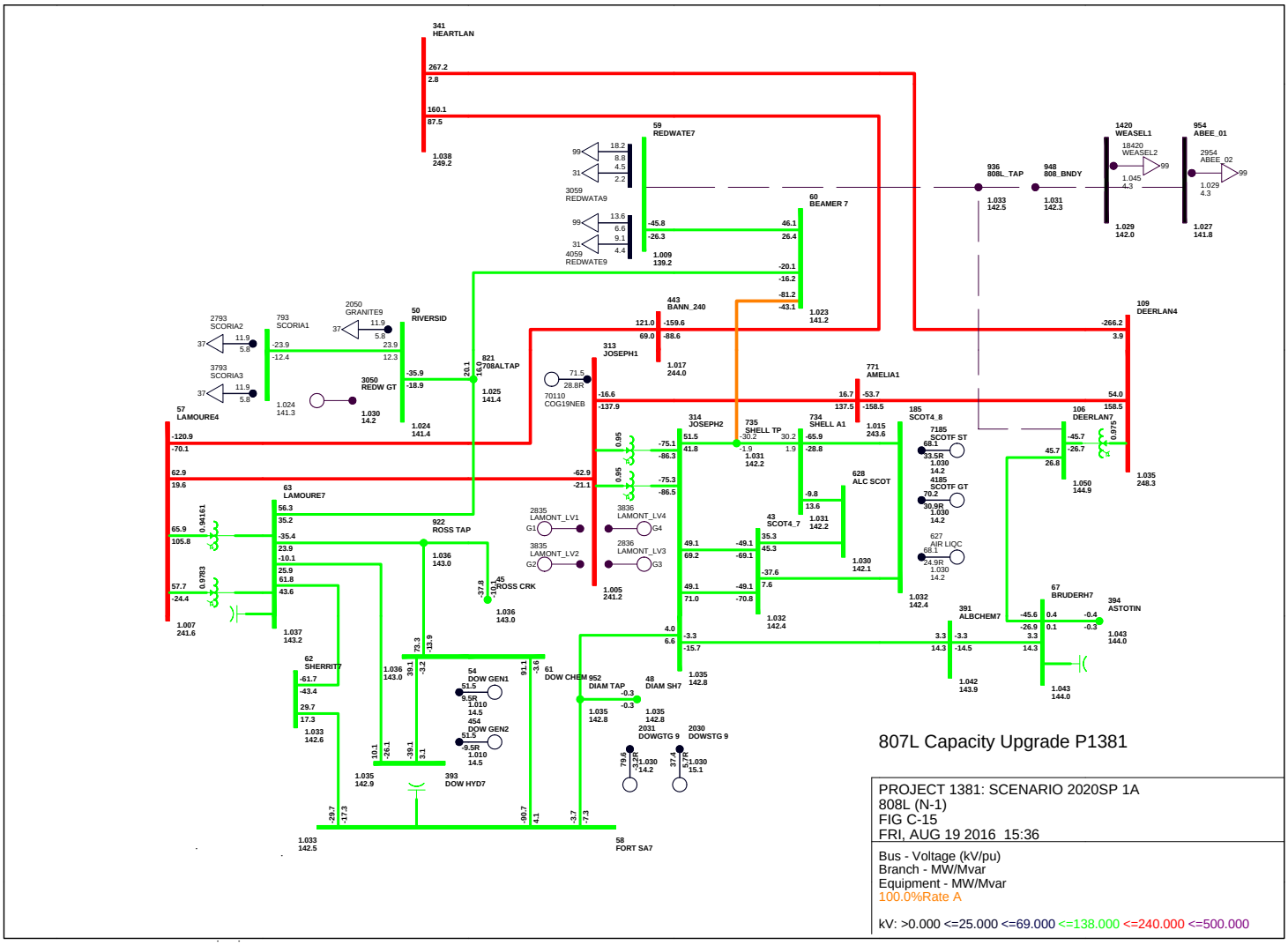

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
920L (N-1)
FIG C-10
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
921L (N-1)
FIG C-11
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
708L (N-1) -RW ISD unit on
FIG C-12
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


341 HEARTLAN
59 REDWATE7
60 BEAMER 7
3059 REDWATA9
4059 REDWATE9
936 808L_TAP
948 808_BNDY
1420 WEASEL1
954 ABEE_01
2793 SCORIA2
793 SCORIA1
2050 GRANITE9
50 RIVERSID
3793 SCORIA3
3050 REDW GT
821 708ALTAP
70110 COG19NEB
443 BANN_240
313 JOSEPH1
109 DEERLAN4
771 AMELIA1
57 LAMOURE4
63 LAMOURE7
314 JOSEPH2
735 SHELL TP
734 SHELL A1
185 SCOT4_8
106 DEERLAN7
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
628 ALC SCOT
43 SCOT4_7
2835 LAMONT_LV1
3836 LAMONT_LV4
3835 LAMONT_LV2
2836 LAMONT_LV3
922 ROSS TAP
45 ROSS CRK
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
393 DOW HYD7
58 FORT SA7
391 ALBCHEM7
67 BRUDERH7
394 ASTOTIN
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
807L (N-1)
FIG C-13
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
735L (N-1)
FIG C-14
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

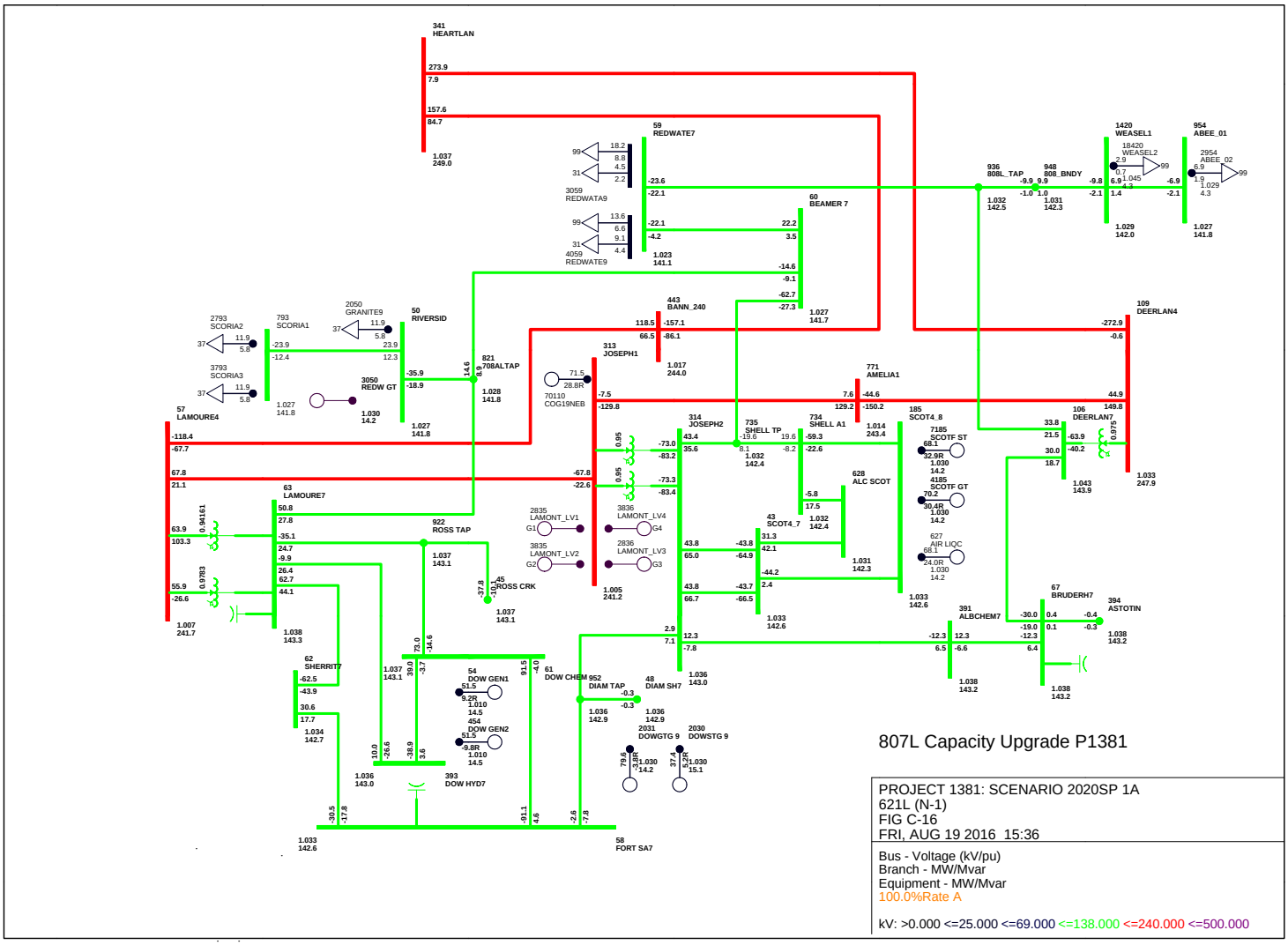


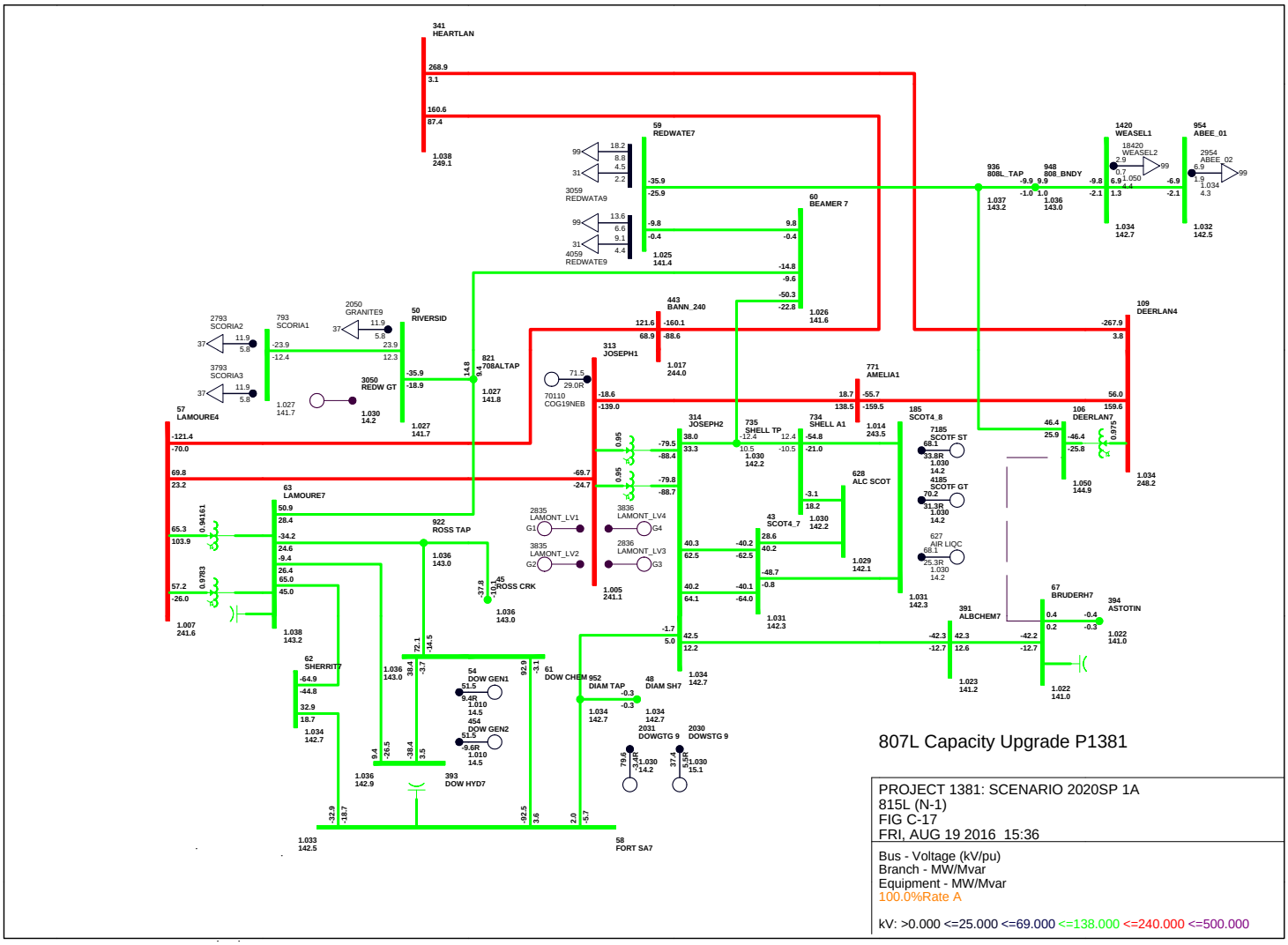
807L Capacity Upgrade P1381

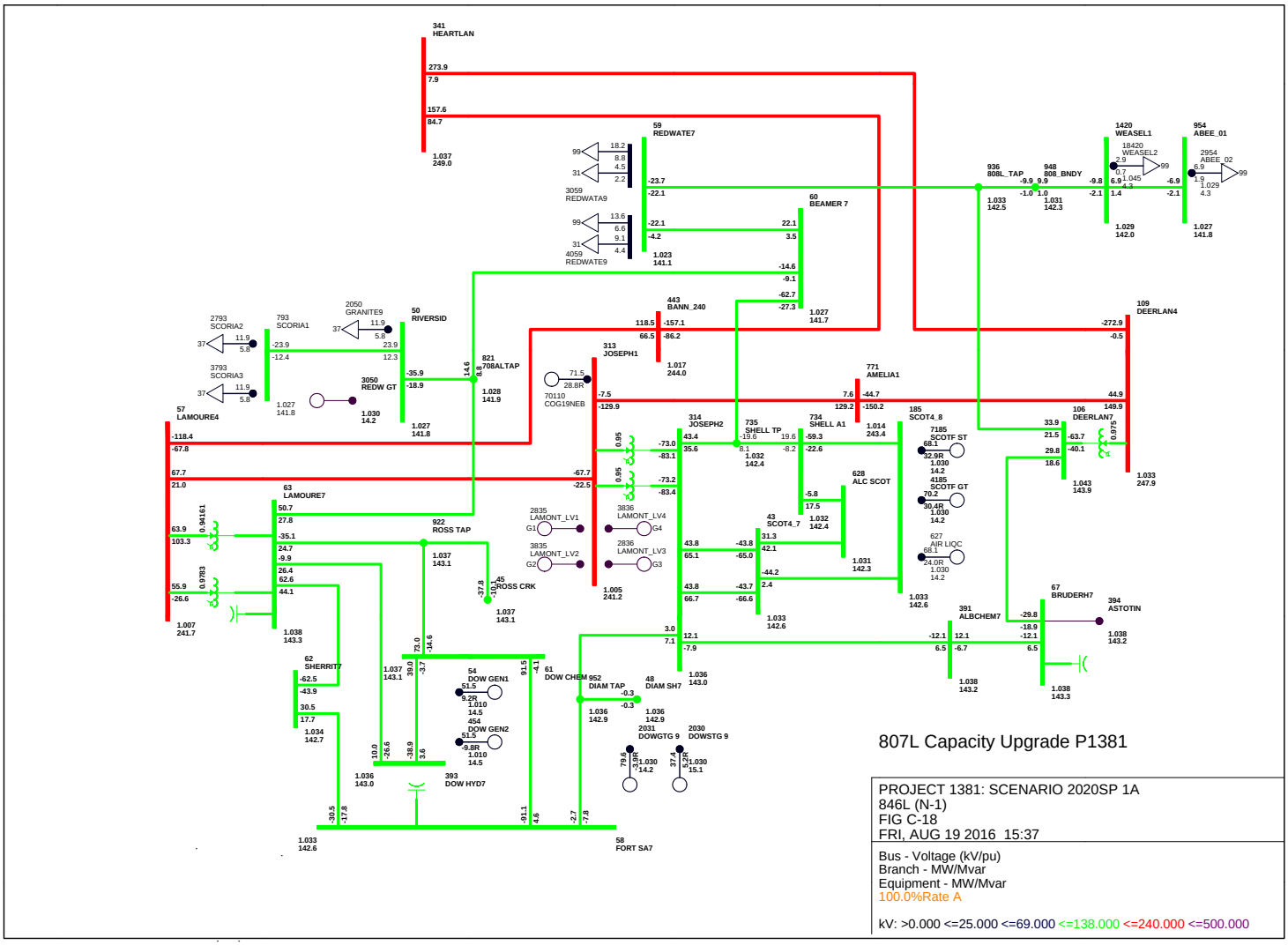
PROJECT 1381: SCENARIO 2020SP 1A
808L (N-1)
FIG C-15
FRI, AUG 19 2016 15:36

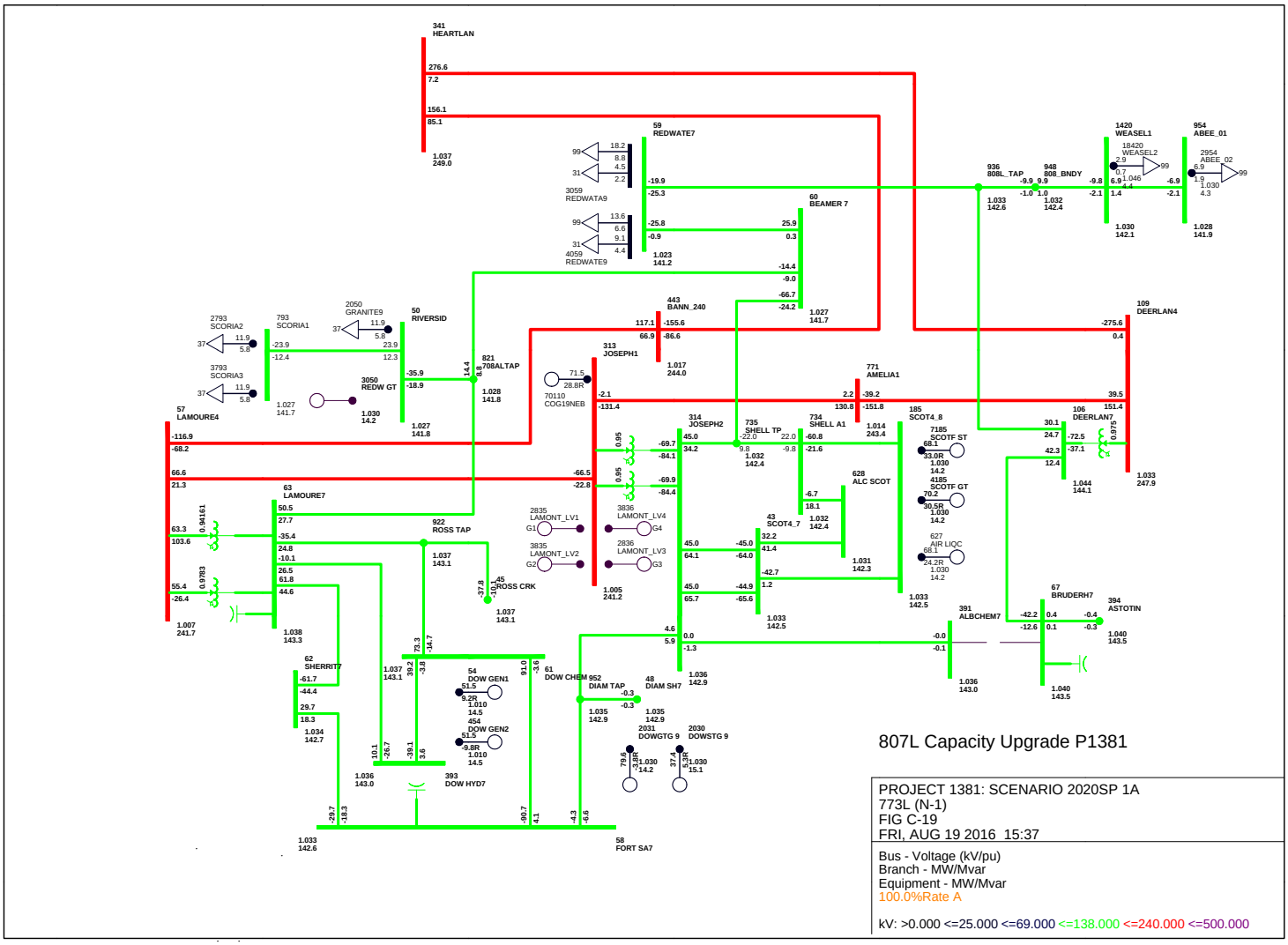
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

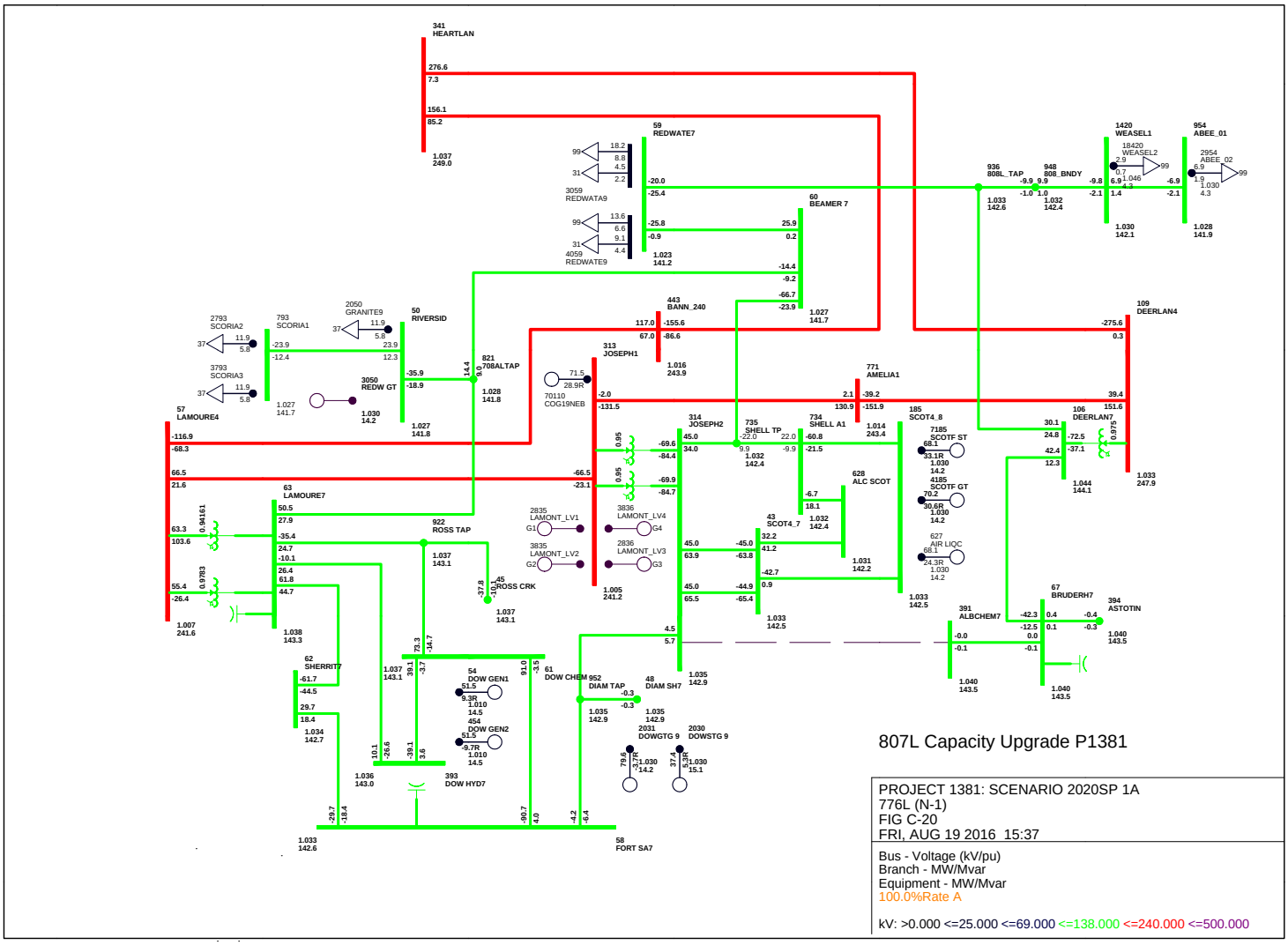
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

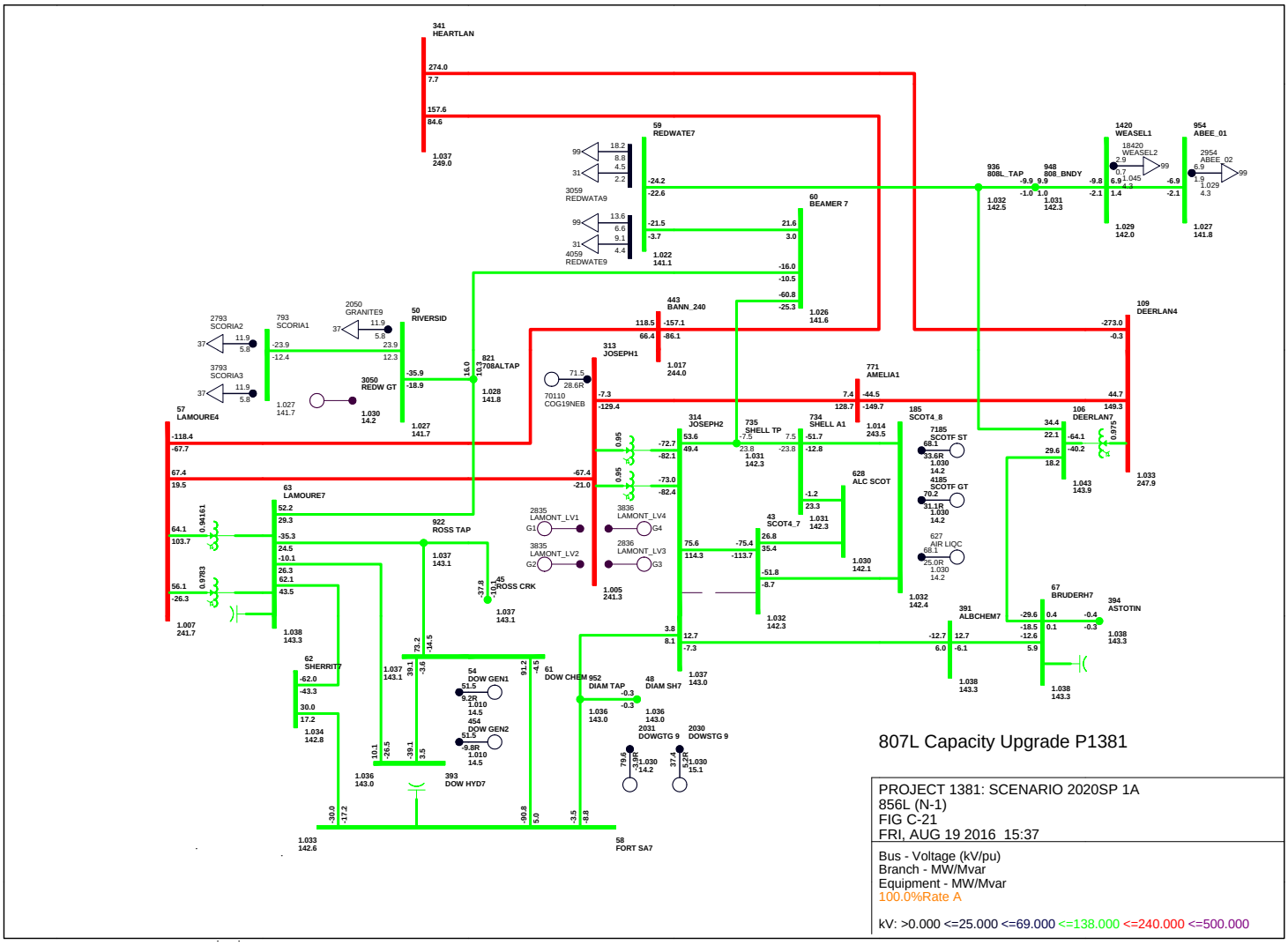

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
621L (N-1)
FIG C-16
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

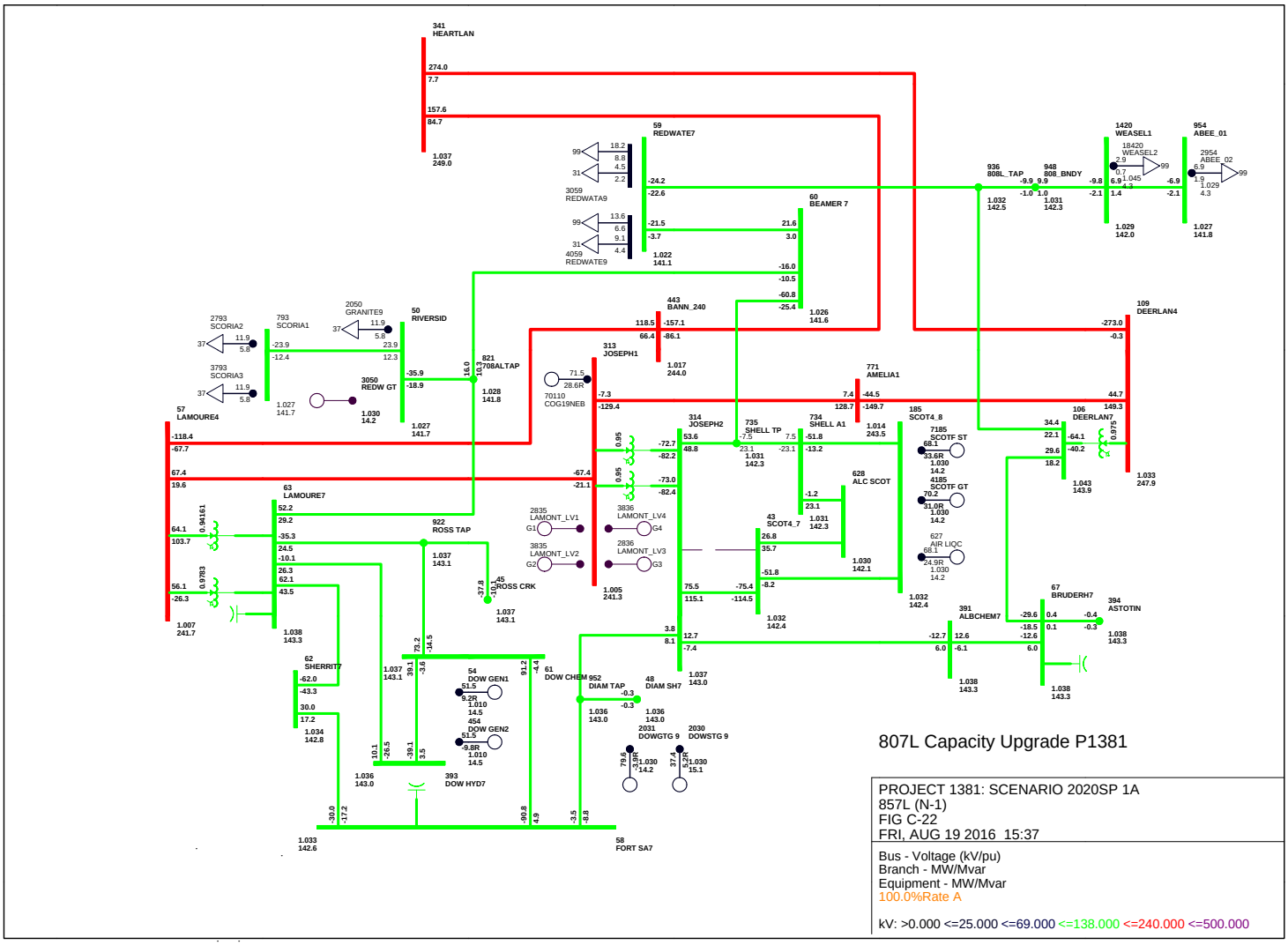

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
815L (N-1)
FIG C-17
FRI, AUG 19 2016 15:36
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

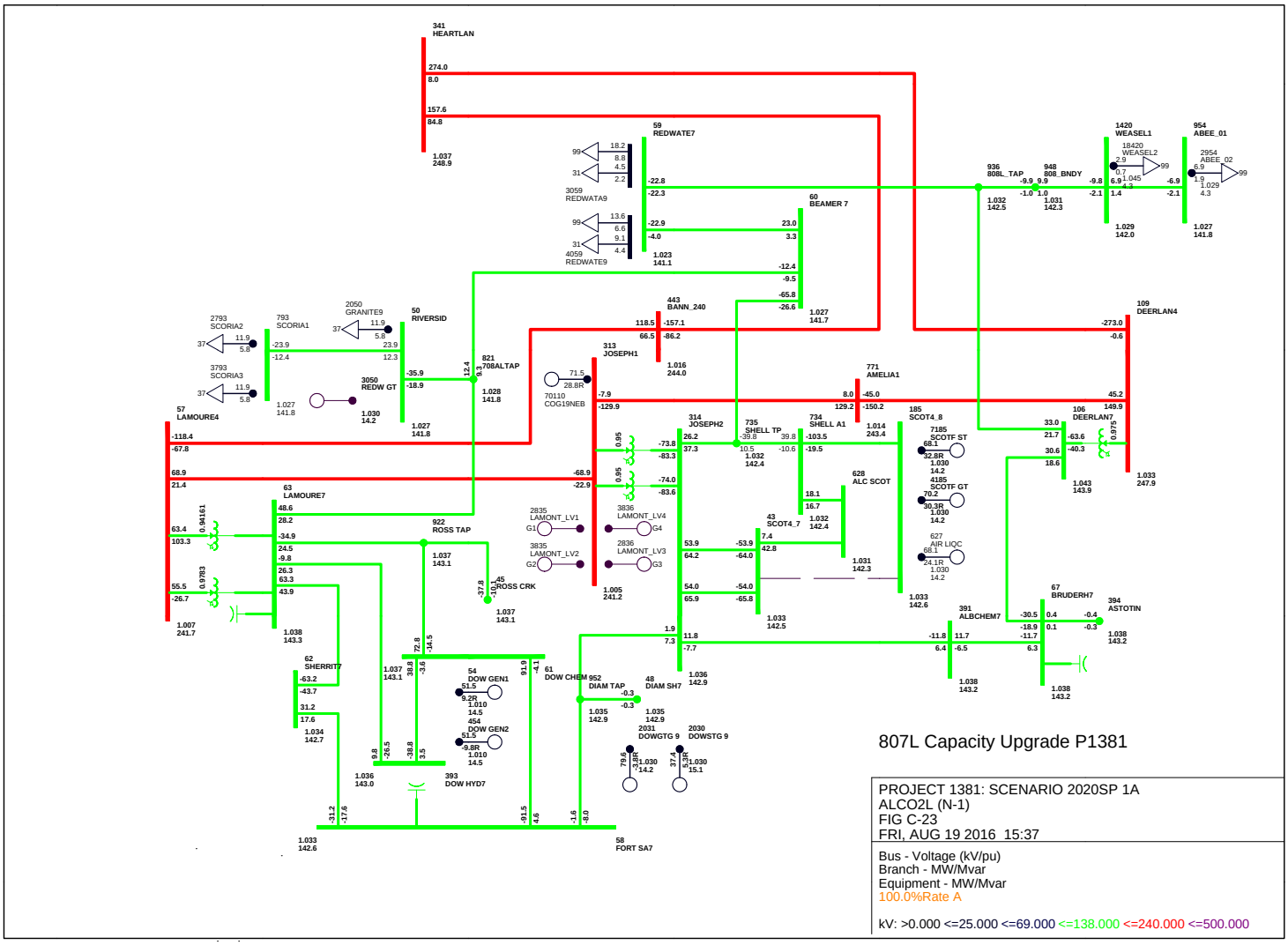

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
846L (N-1)
FIG C-18
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
773L (N-1)
FIG C-19
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
776L (N-1)
FIG C-20
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
856L (N-1)
FIG C-21
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
274.0
7.7
157.6
84.7
1.037
249.0
59 REDWATE7
3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.022
141.1
443 BANN_240
1.017
244.0
1.026
141.6
313 JOSEPH1
821 708ALTAP
1.028
141.8
1.027
141.7
50 RIVERSID
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
2050 GRANITE9
3050 REDW GT
1.030
14.2
1.027
141.7
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
1.037
143.1
45 ROSS CRK
1.037
143.1
1.005
241.3
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
70110 COG19NEB
71.5
28.6R
314 JOSEPH2
735 SHELL TP
734 SHELL A1
1.031
142.3
771 AMELIA1
1.014
243.5
628 ALC SCOT
43 SCOT4_7
1.030
142.1
1.032
142.4
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
24.9R
1.030
14.2
391 ALBCHEM7
67 BRUDERH7
394 ASTOTIN
1.038
143.3
1.038
143.3
109 DEERLAN4
106 DEERLAN7
1.043
143.9
1.033
247.9
936 808L_TAP
948 808_BNDY
1.032
142.5
1.031
142.3
1420 WEASEL1
18420 WEASEL2
1.045
954 ABEE_01
2954 ABEE_02
1.029
1.029
142.0
1.027
141.8
62 SHERRIT7
1.034
142.8
54 DOW GEN1
454 DOW GEN2
1.010
14.5
393 DOW HYD7
1.036
143.0
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.036
143.0
1.037
143.0
2031 DOWGTG 9
2030 DOWSTG 9
1.030
14.2
1.030
15.1
58 FORT SA7
1.033
142.6
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
857L (N-1)
FIG C-22
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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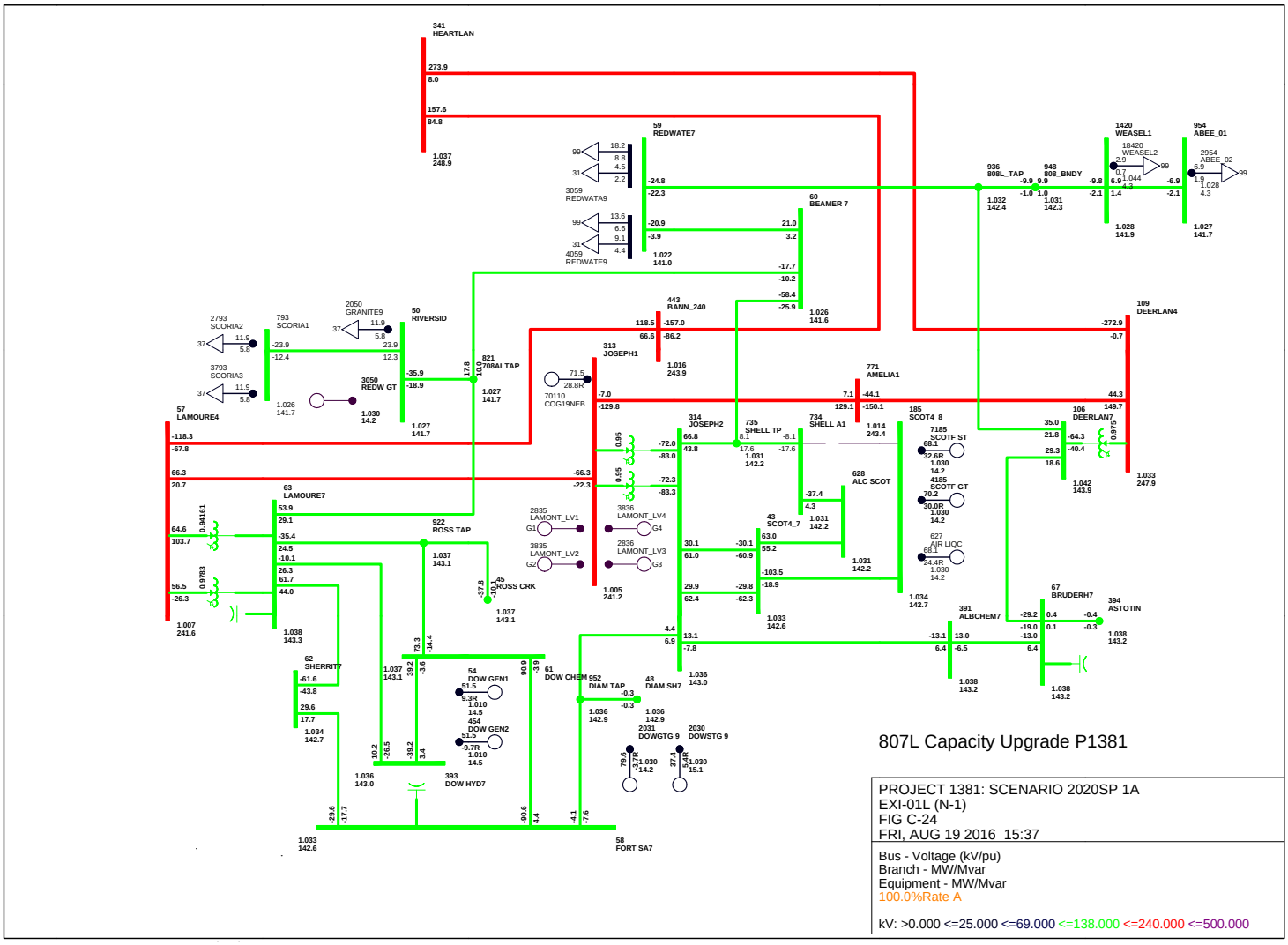
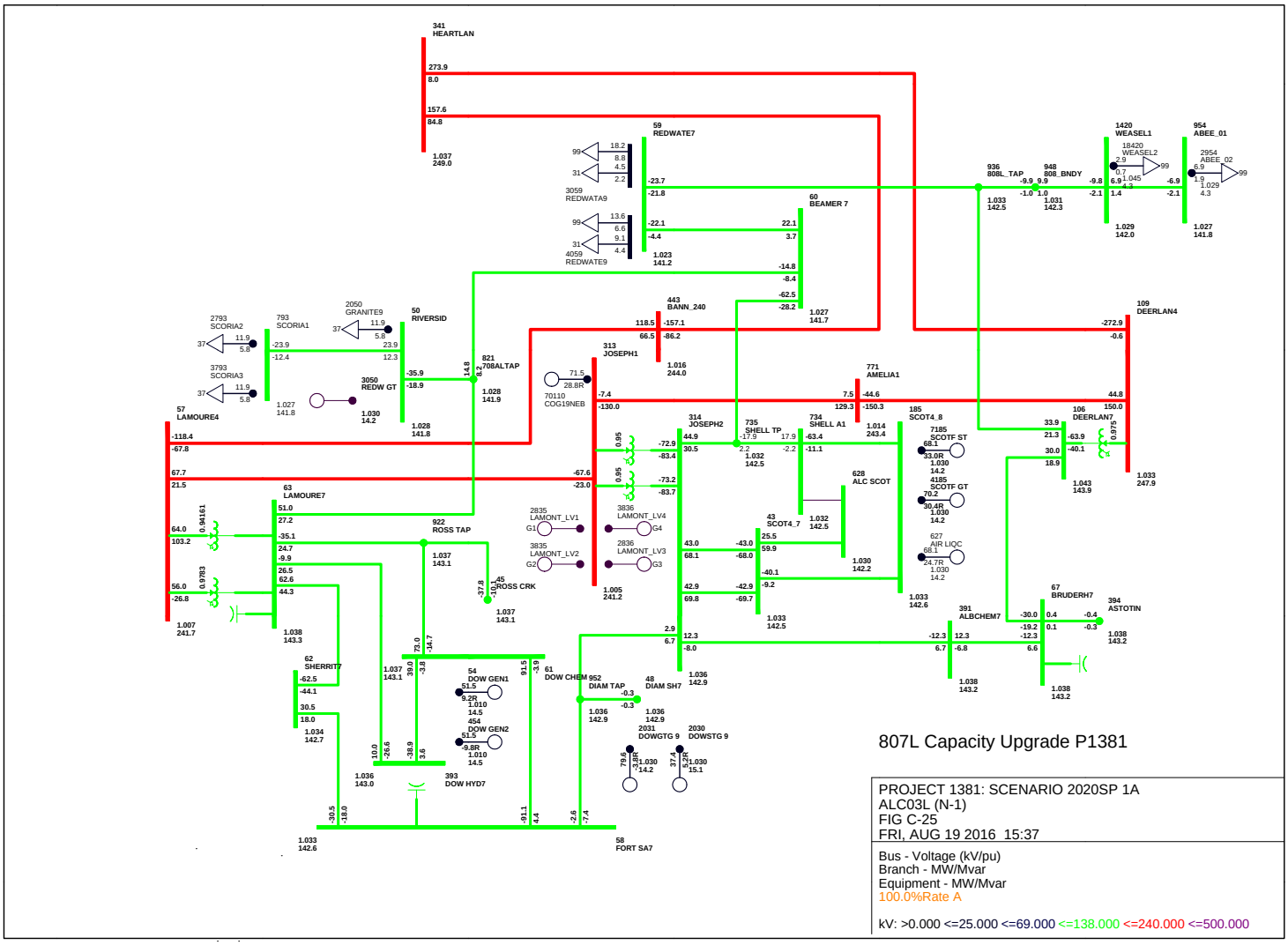
59 REDWATE7
60 BEAMER 7
3059 REDWATA9
4059 REDWATE9
1420 WEASEL1
954 ABEE_01
936 808L_TAP
948 808_BNDY
2050 GRANITE9
2793 SCORIA2
793 SCORIA1
3793 SCORIA3
50 RIVERSID
3050 REDW GT
821 708ALTAP
443 BANN_240
109 DEERLAN4
313 JOSEPH1
71.5 28.8R
70110 COG19NEB
771 AMELIA1
57 LAMOURE4
63 LAMOURE7
314 JOSEPH2
735 SHELL TP
734 SHELL A1
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
106 DEERLAN7
628 ALC SCOT
43 SCOT4_7
922 ROSS TAP
45 ROSS CRK
2835 LAMONT_LV1
3836 LAMONT_LV4
3835 LAMONT_LV2
2836 LAMONT_LV3
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
ALCO2L (N-1)
FIG C-23
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
EXI-01L (N-1)
FIG C-24
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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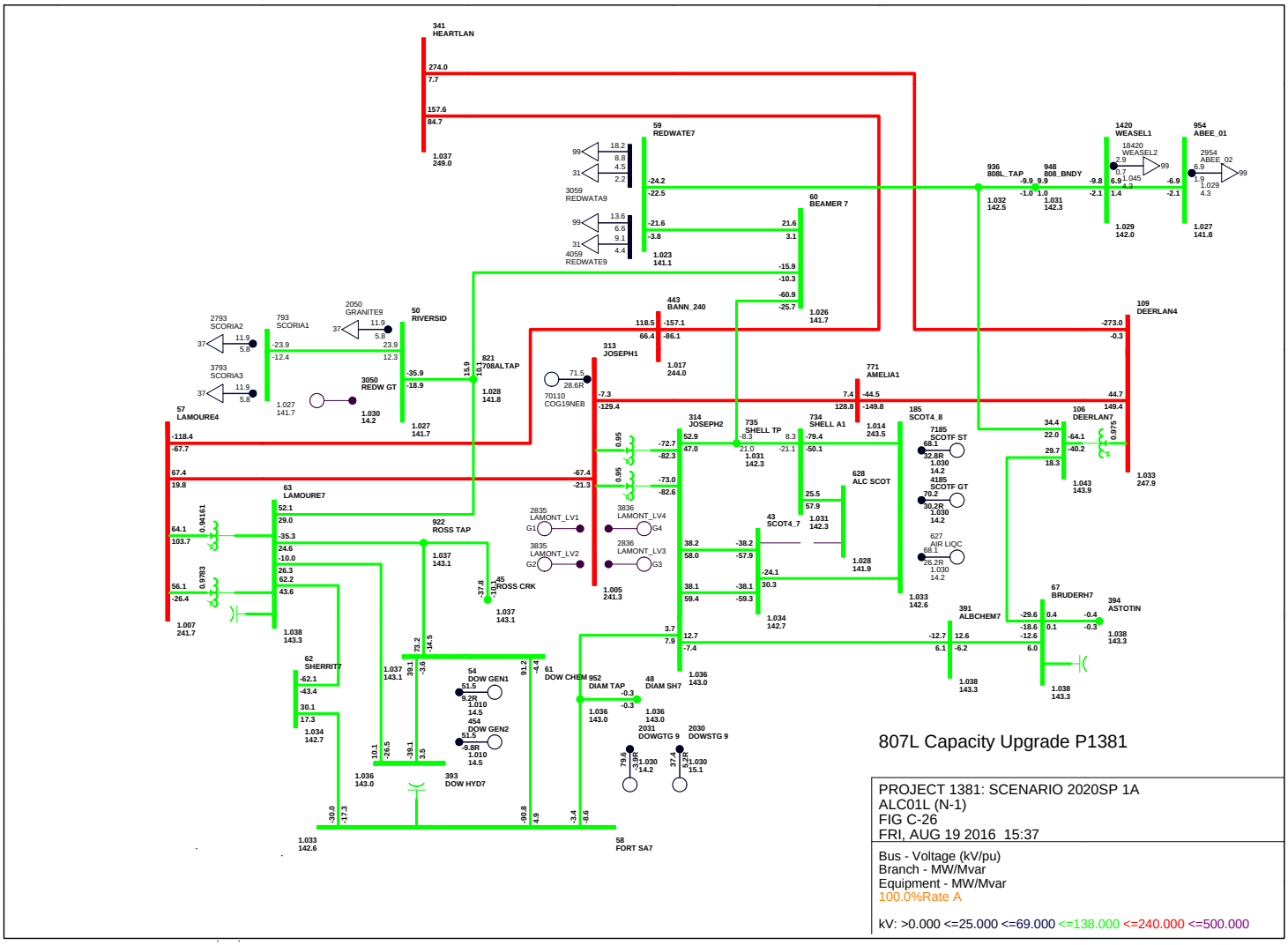
273.9
8.0
157.6
84.8
1.037
249.0
59 REDWATE7
3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.023
141.2
1.027
141.7
443 BANN_240
1.016
244.0
313 JOSEPH1
821 708ALTAP
1.028
141.9
1.028
141.8
50 RIVERSID
2050 GRANITE9
793 SCORIA1
2793 SCORIA2
3793 SCORIA3
3050 REDW GT
1.027
141.8
1.030
14.2
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
1.037
143.1
45 ROSS CRK
1.037
143.1
1.005
241.2
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
71.5
28.8R
70110 COG19NEB
314 JOSEPH2
735 SHELL TP
734 SHELL A1
1.032
142.5
1.014
243.4
771 AMELIA1
628 ALC SCOT
43 SCOT4_7
1.032
142.5
1.030
142.2
1.033
142.5
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
1.030
14.2
1.033
142.6
109 DEERLAN4
106 DEERLAN7
1.043
143.9
1.033
247.9
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
1.038
143.2
1.038
143.2
62 SHERRIT7
1.034
142.7
54 DOW GEN1
454 DOW GEN2
1.010
14.5
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.036
142.9
1.036
142.9
2031 DOWGTG 9
2030 DOWSTG 9
1.030
14.2
1.030
15.1
393 DOW HYD7
1.036
143.0
58 FORT SA7
1.033
142.6
936 808L_TAP
948 808_BNDY
1.033
142.5
1.031
142.3
1420 WEASEL1
18420 WEASEL2
1.045
4.3
954 ABEE_01
2954 ABEE_02
1.029
4.3
1.029
142.0
1.027
141.8
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
ALC03L (N-1)
FIG C-25
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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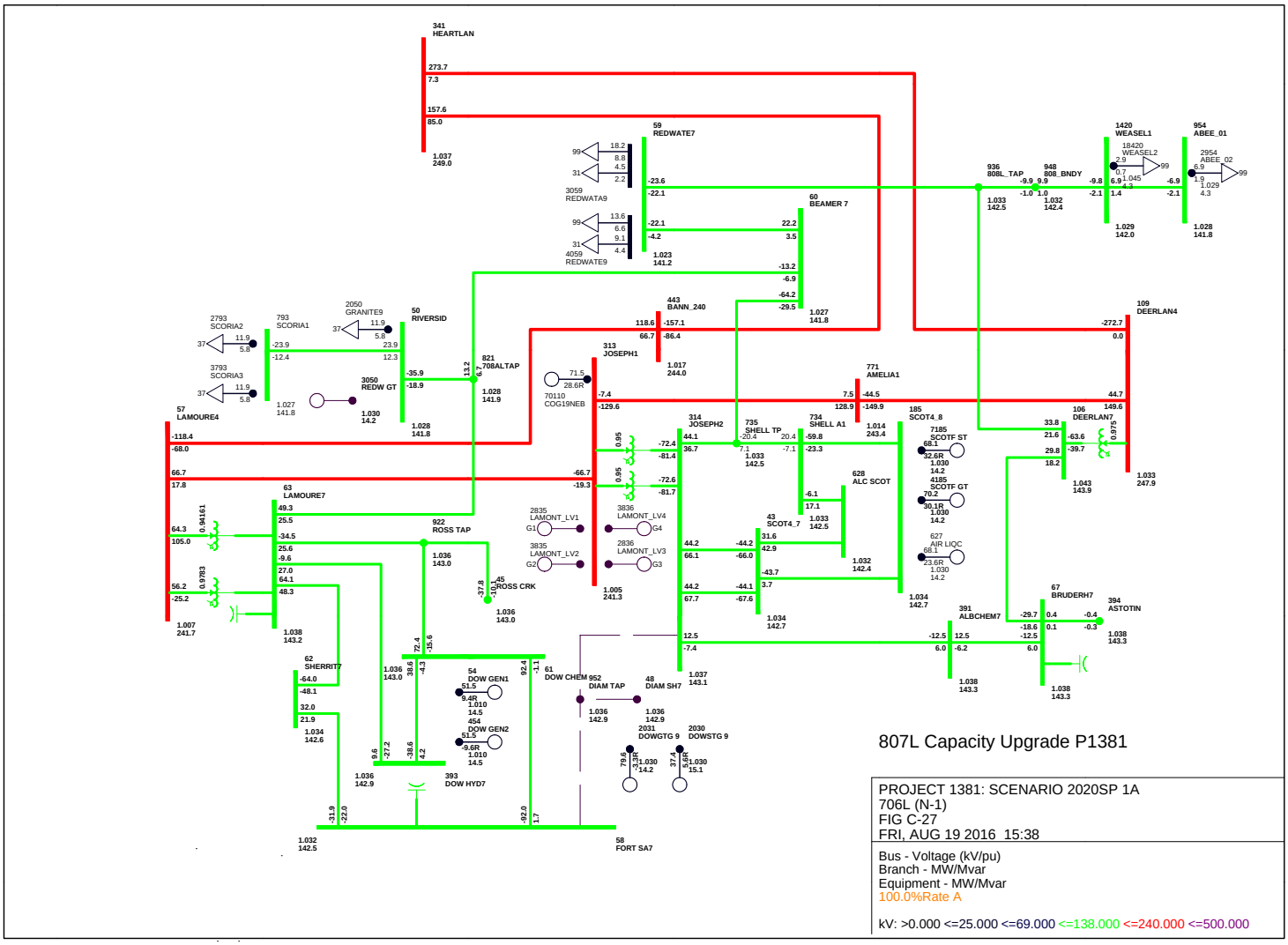
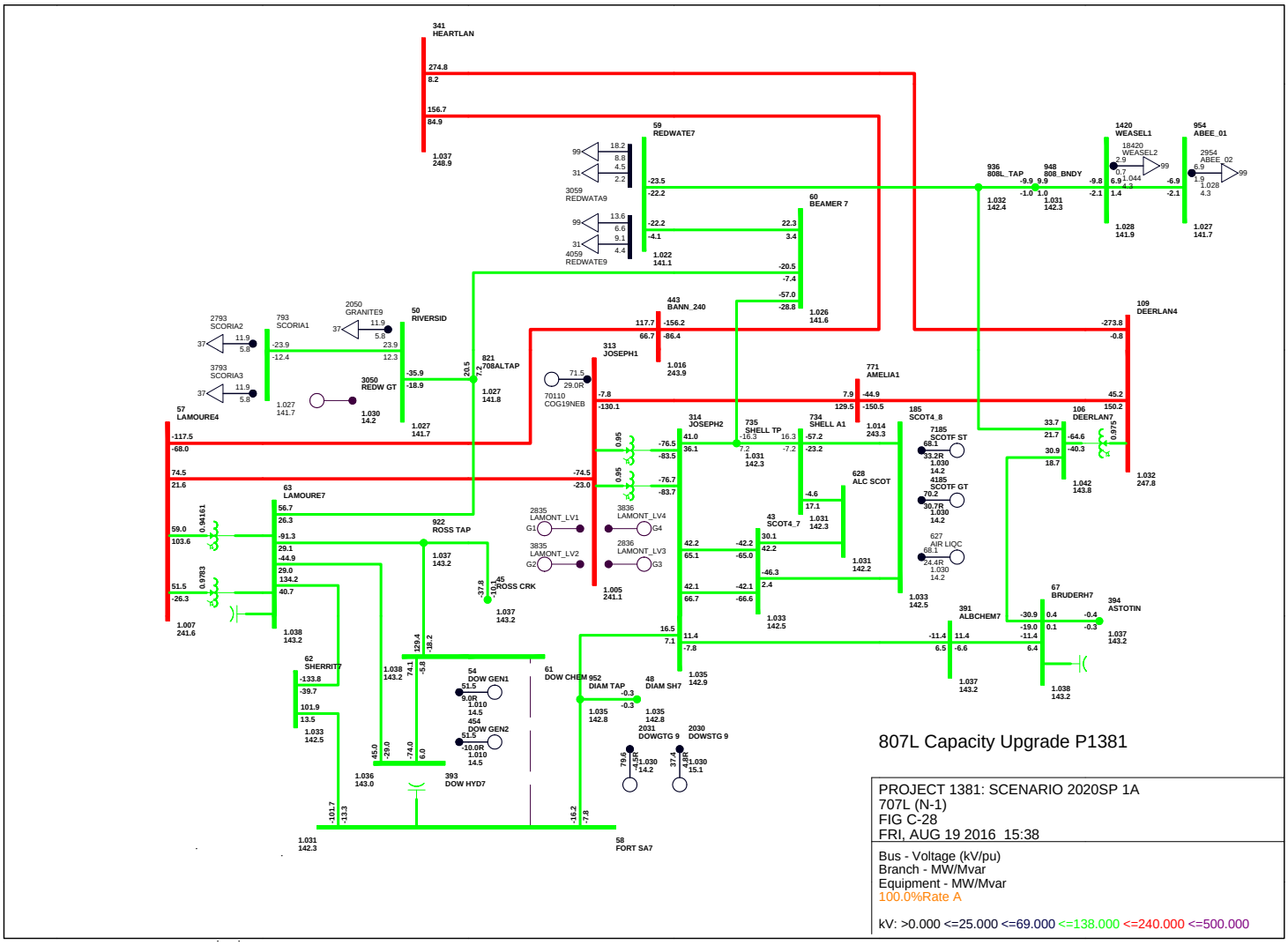
59 REDWATE7
60 BEAMER 7
3059 REDWATA9
4059 REDWATE9
443 BANN_240
313 JOSEPH1
821 708ALTAP
50 RIVERSID
2050 GRANITE9
793 SCORIA1
2793 SCORIA2
3793 SCORIA3
3050 REDW GT
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
45 ROSS CRK
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
58 FORT SA7
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
70110 COG19NEB
771 AMELIA1
314 JOSEPH2
735 SHELL TP
734 SHELL A1
628 ALC SCOT
43 SCOT4_7
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
109 DEERLAN4
106 DEERLAN7
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
ALC01L (N-1)
FIG C-26
FRI, AUG 19 2016 15:37
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
273.7
7.3
157.6
85.0
1.037
249.0
59 REDWATE7
18.2
8.8
4.5
2.2
-23.6
-22.1
3059 REDWATA9
13.6
6.6
9.1
4.4
-22.1
-4.2
4059 REDWATE9
1.023
141.2
60 BEAMER 7
22.2
3.5
-13.2
-6.9
-64.2
-29.5
1.027
141.8
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.033 142.5
1.032 142.4
1.029 142.0
1.028 141.8
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
2050 GRANITE9
50 RIVERSID
3050 REDW GT
1.027 141.8
1.030 14.2
821 708ALTAP
1.028 141.9
1.028 141.8
57 LAMOURE4
-118.4
-68.0
66.7
17.8
1.007 241.7
63 LAMOURE7
49.3
25.5
-34.5
25.6
-9.6
27.0
64.1
48.3
1.038 143.2
922 ROSS TAP
1.036 143.0
45 ROSS CRK
1.036 143.0
64.3
105.0
56.2
-25.2
0.9416
0.9783
62 SHERRIT7
-64.0
-48.1
32.0
21.9
1.034 142.6
1.036 142.9
393 DOW HYD7
54 DOW GEN1
51.5
9.4R
1.010
14.5
454 DOW GEN2
51.5
9.6R
1.010
14.5
61 DOW CHEM
952 DIAM TAP
1.036 142.9
48 DIAM SH7
1.036 142.9
1.037 143.1
2031 DOWGTG 9
2030 DOWSTG 9
79.6
-3.1R
1.030
14.2
37.4
5.1R
1.030
15.1
1.032 142.5
58 FORT SA7
-31.9
-22.0
-92.0
1.7
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
G1
G2
G4
G3
1.005 241.3
313 JOSEPH1
71.5
28.6R
70110 COG19NEB
-7.4
-129.6
-66.7
-19.3
0.95
0.95
1.017 244.0
443 BANN_240
118.6
66.7
-157.1
-86.4
314 JOSEPH2
44.1
36.7
-72.4
-81.4
-72.6
-81.7
735 SHELL TP
-20.4
7.1
1.033 142.5
20.4
-7.1
734 SHELL A1
-59.8
-23.3
-6.1
17.1
1.033 142.5
43 SCOT4_7
31.6
42.9
-43.7
3.7
1.034 142.7
44.2
-44.2
66.0
-66.0
44.2
-44.1
67.7
-67.6
628 ALC SCOT
1.032 142.4
771 AMELIA1
7.5
128.9
-44.5
-149.9
1.014 243.4
185 SCOT4_8
7185 SCOTF ST
68.1
32.6R
1.030
14.2
4185 SCOTF GT
70.2
30.1R
1.030
14.2
627 AIR LIQC
68.1
23.6R
1.030
14.2
1.034 142.7
391 ALBCHEM7
-29.7
-18.6
-12.5
-12.5
12.5
-6.2
6.0
1.038 143.3
67 BRUDERH7
0.4
0.1
-0.4
-0.3
1.038 143.3
394 ASTOTIN
1.038 143.3
109 DEERLAN4
-272.7
0.0
44.7
149.6
106 DEERLAN7
33.8
21.6
29.8
18.2
-63.6
-39.7
0.975
1.043 143.9
1.033 247.9
12.5
-7.4
1.037 143.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
706L (N-1)
FIG C-27
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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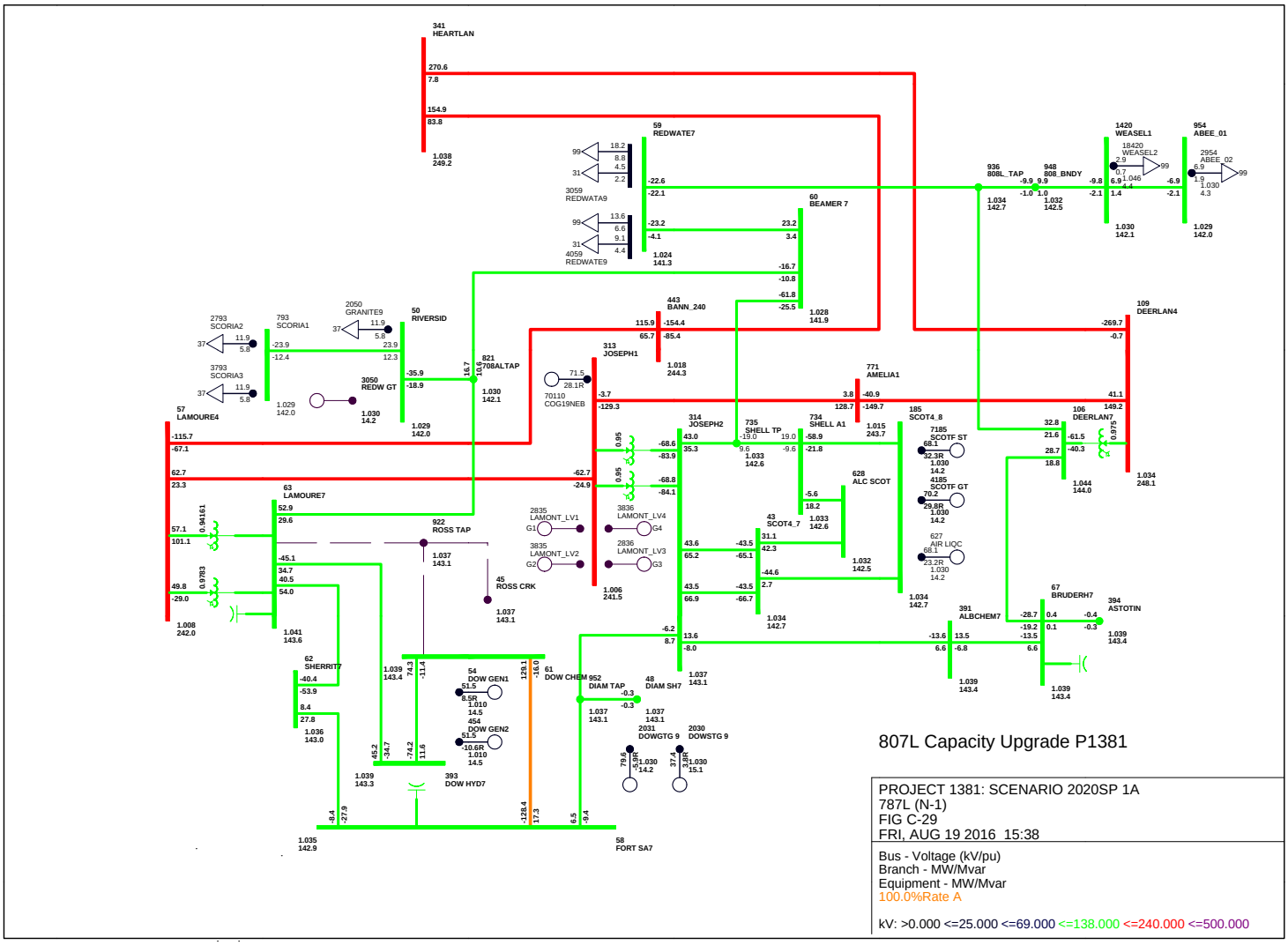
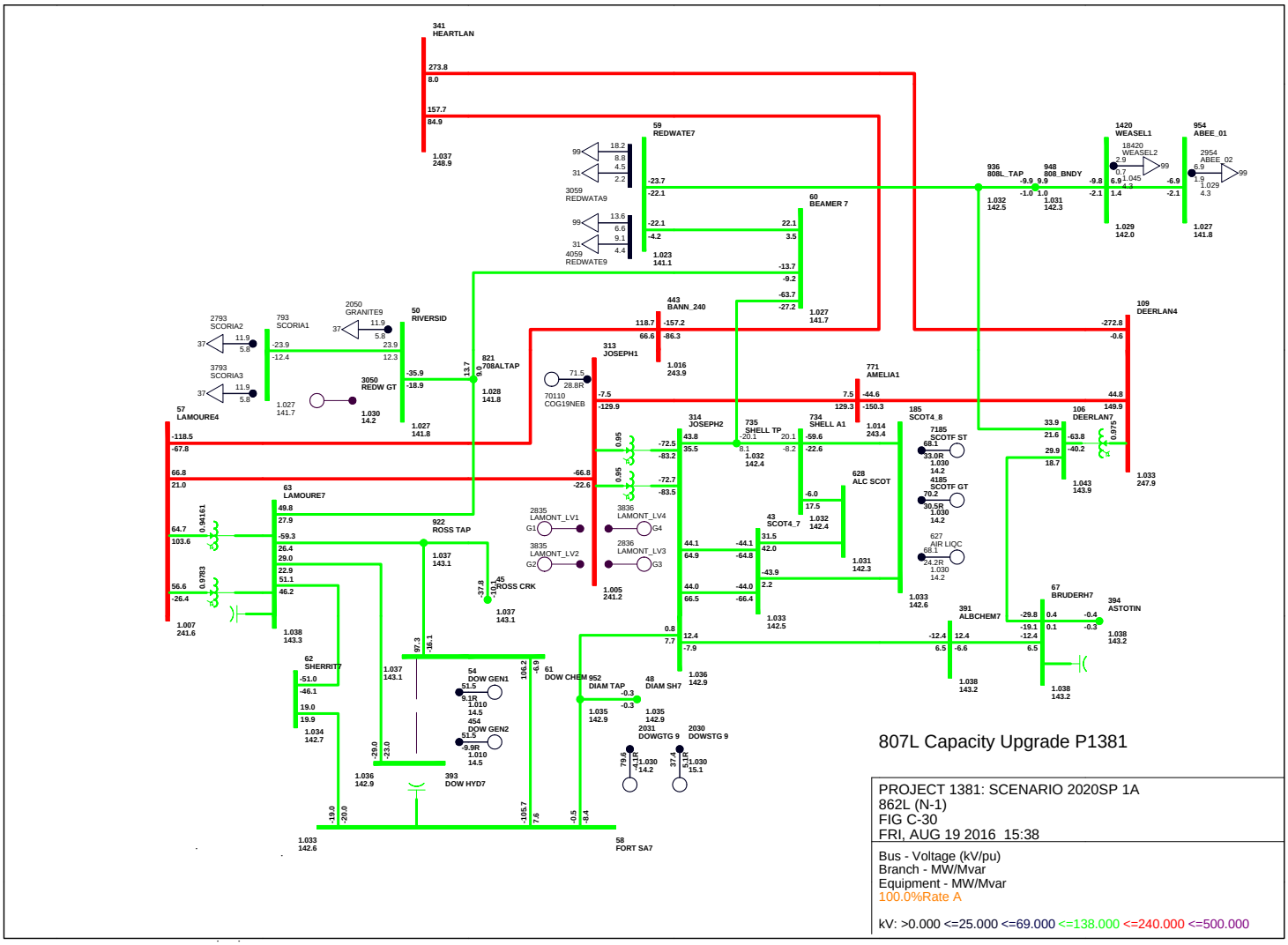
59 REDWATE7
60 BEAMER 7
3059 REDWATA9
4059 REDWATE9
936 808L_TAP
948 808_BNDY
1420 WEASEL1
954 ABEE_01
2793 SCORIA2
793 SCORIA1
2050 GRANITE9
50 RIVERSID
3793 SCORIA3
3050 REDW GT
821 708ALTAP
70110 COG19NEB
443 BANN_240
313 JOSEPH1
771 AMELIA1
109 DEERLAN4
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
45 ROSS CRK
314 JOSEPH2
735 SHELL TP
734 SHELL A1
185 SCOT4_8
106 DEERLAN7
628 ALC SCOT
43 SCOT4_7
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
393 DOW HYD7
58 FORT SA7
391 ALBCHEM7
67 BRUDERH7
394 ASTOTIN
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
707L (N-1)
FIG C-28
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
787L (N-1)
FIG C-29
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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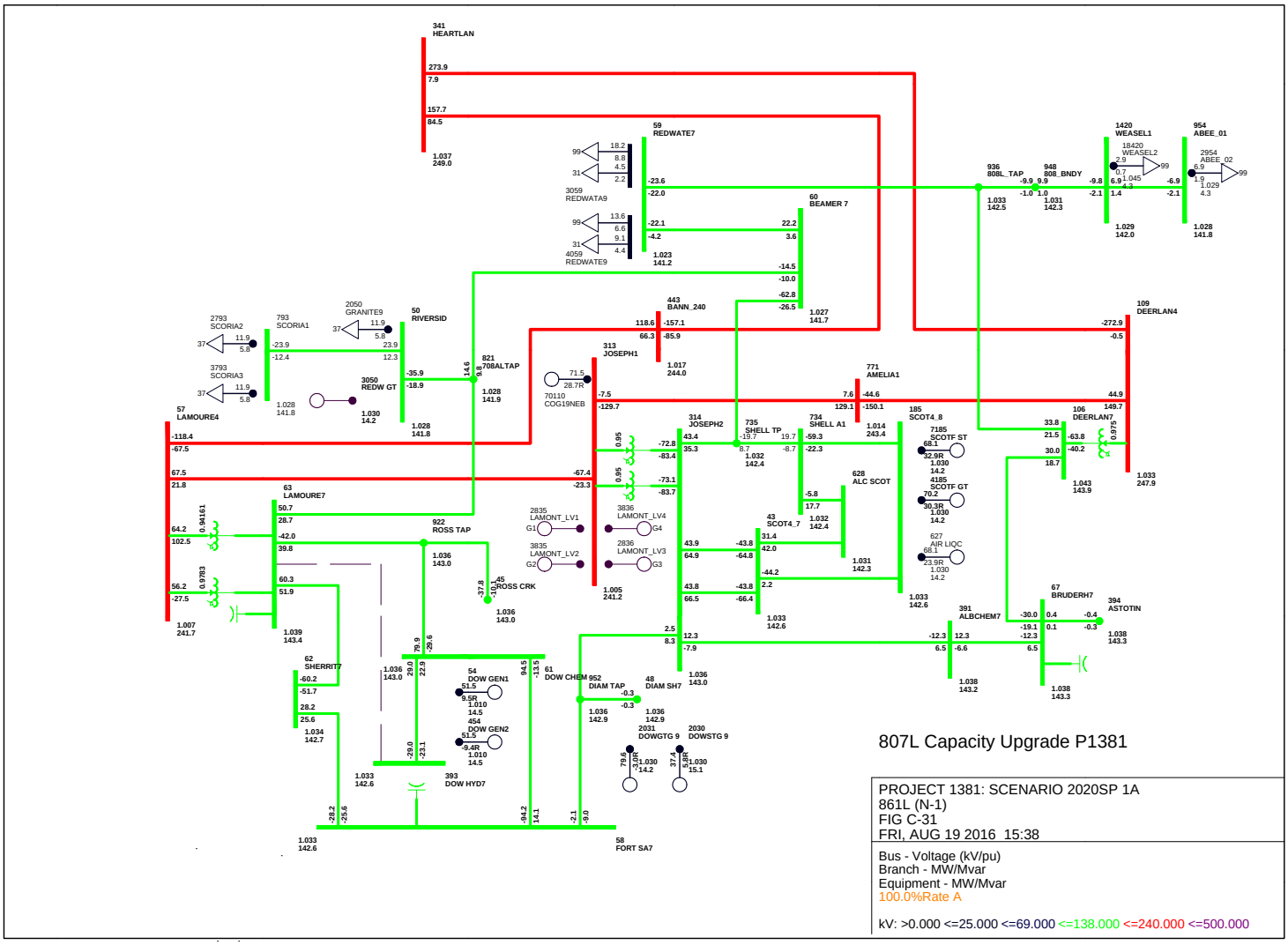
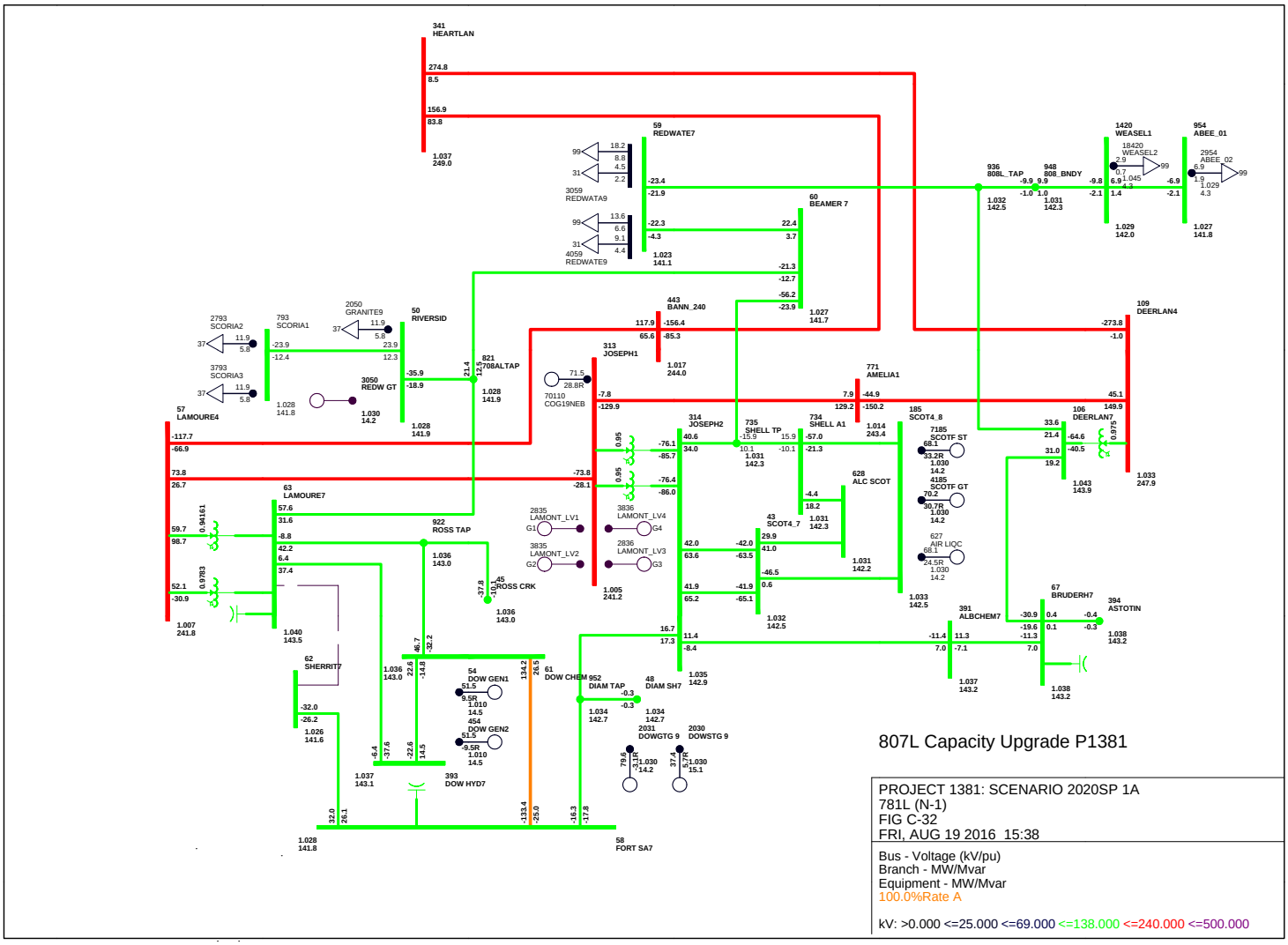
59 REDWATE7
60 BEAMER 7
3059 REDWATA9
4059 REDWATE9
443 BANN_240
313 JOSEPH1
821 708ALTAP
50 RIVERSID
2050 GRANITE9
793 SCORIA1
2793 SCORIA2
3793 SCORIA3
3050 REDW GT
70110 COG19NEB
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
45 ROSS CRK
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
314 JOSEPH2
735 SHELL TP
734 SHELL A1
771 AMELIA1
185 SCOT4_8
628 ALC SCOT
43 SCOT4_7
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
109 DEERLAN4
106 DEERLAN7
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
936 808L_TAP
948 808_BNDY
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
393 DOW HYD7
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
862L (N-1)
FIG C-30
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
861L (N-1)
FIG C-31
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

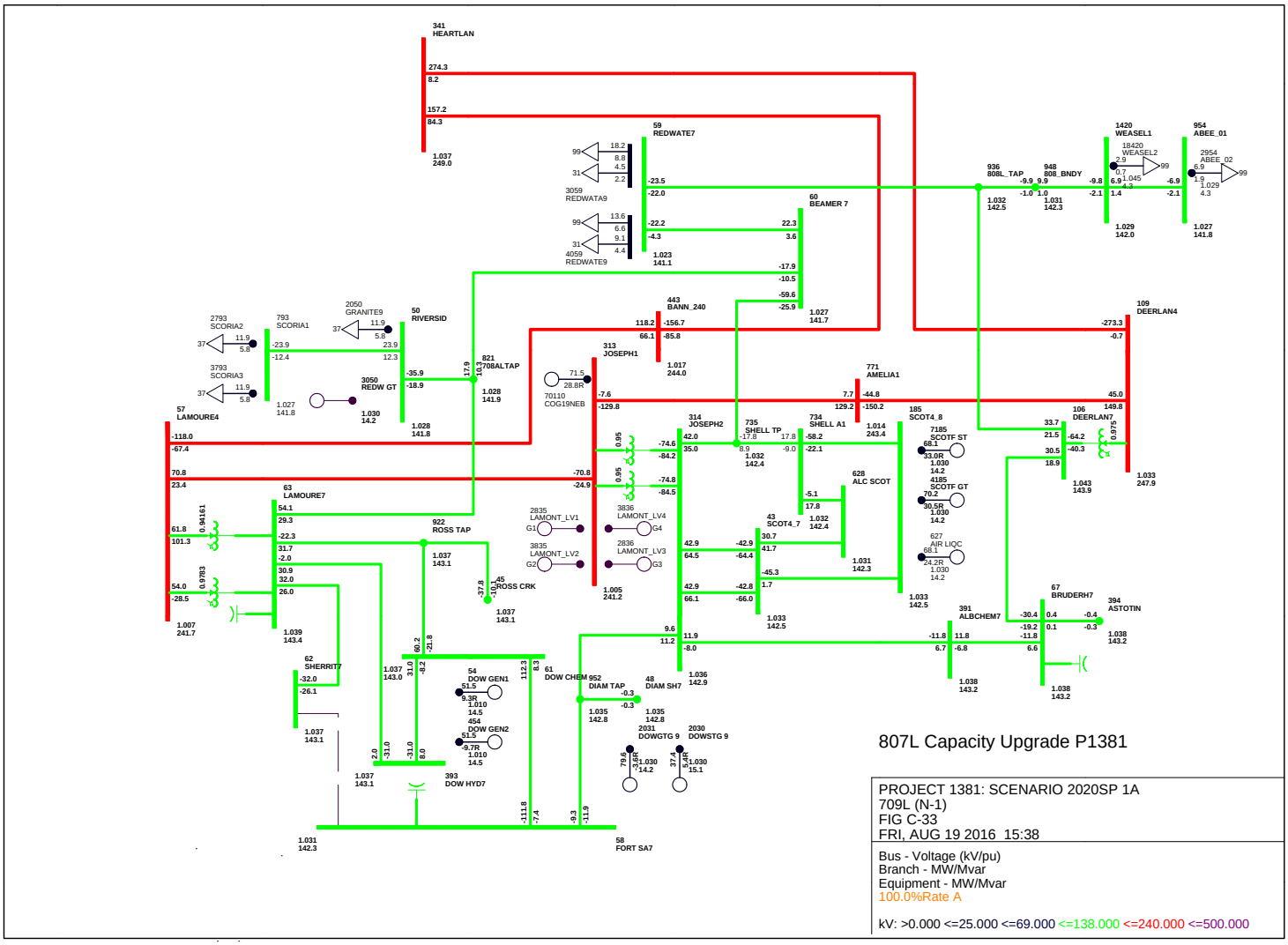


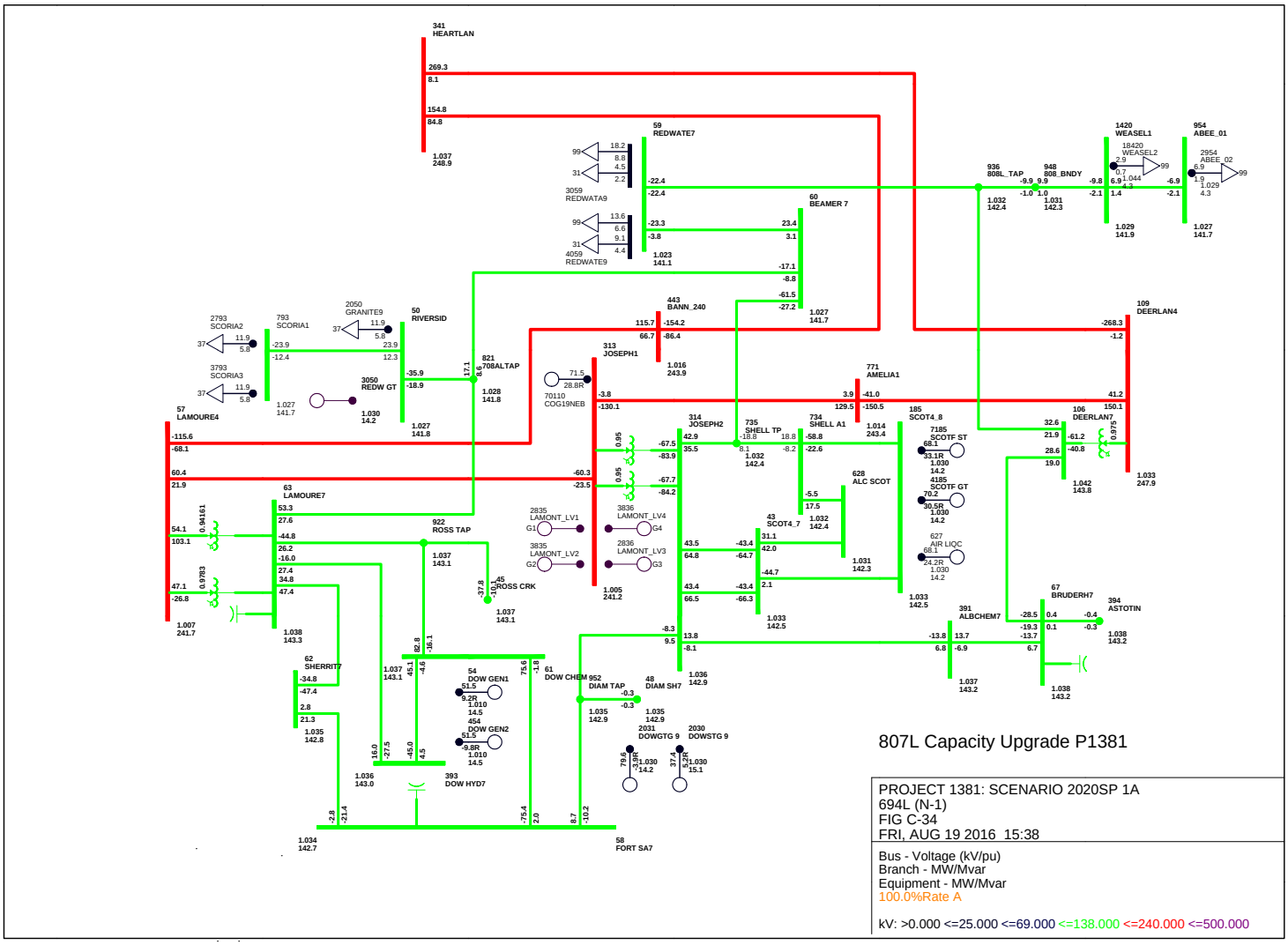
807L Capacity Upgrade P1381

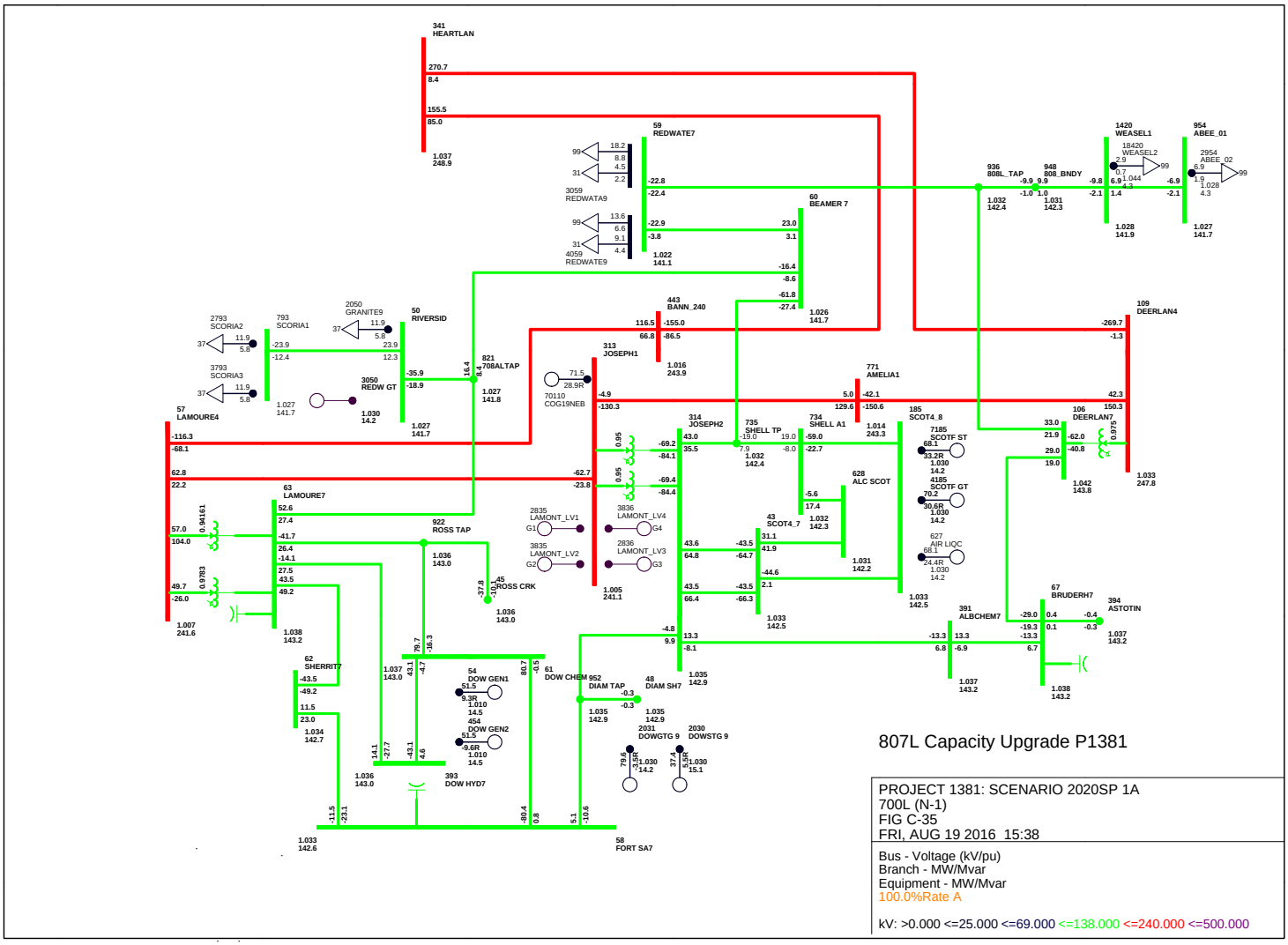
PROJECT 1381: SCENARIO 2020SP 1A
781L (N-1)
FIG C-32
FRI, AUG 19 2016 15:38

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
709L (N-1)
FIG C-33
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
694L (N-1)
FIG C-34
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

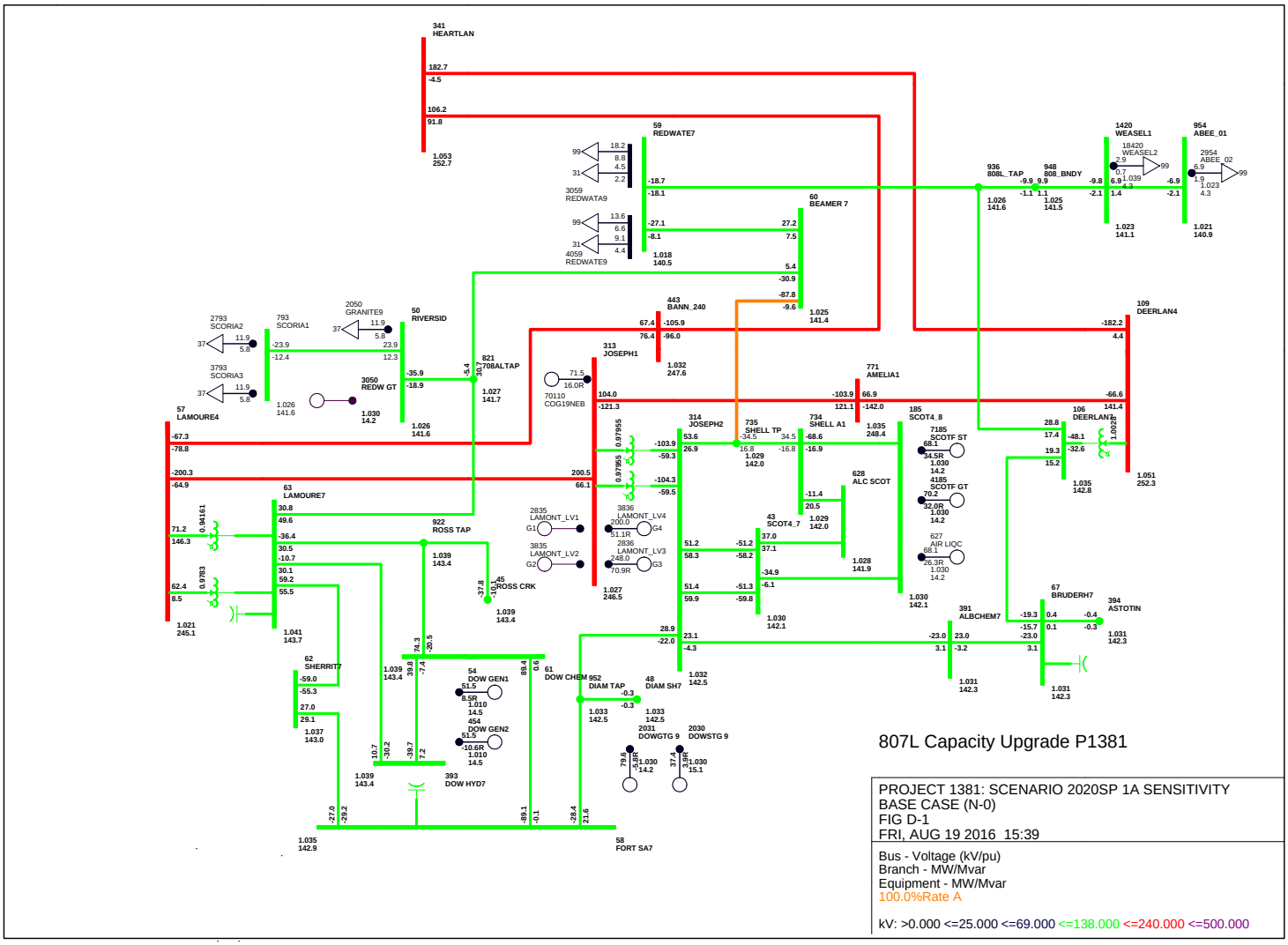

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
700L (N-1)
FIG C-35
FRI, AUG 19 2016 15:38
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

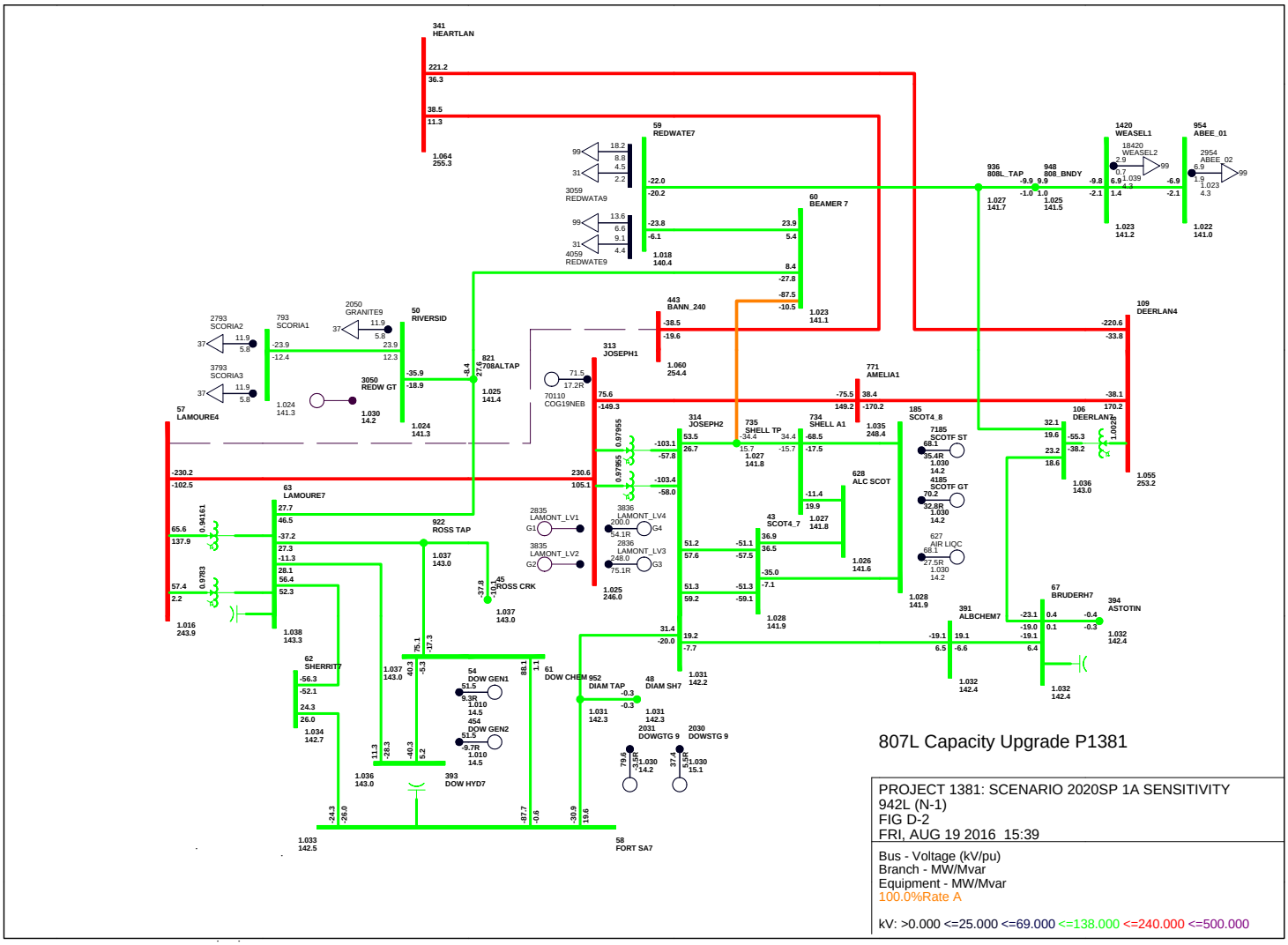
Attachment D

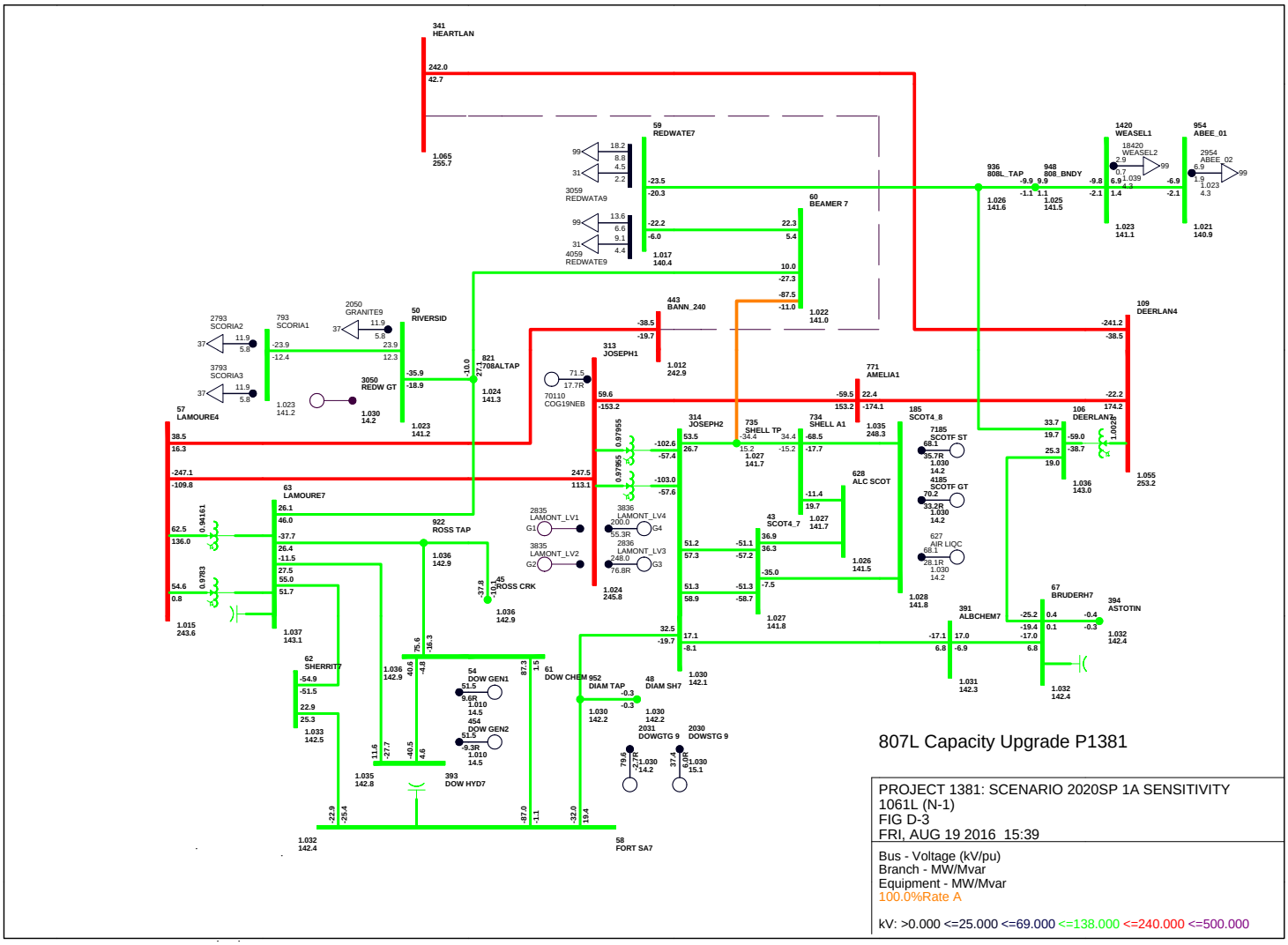
2020SP Sensitivity Power Flow Diagrams

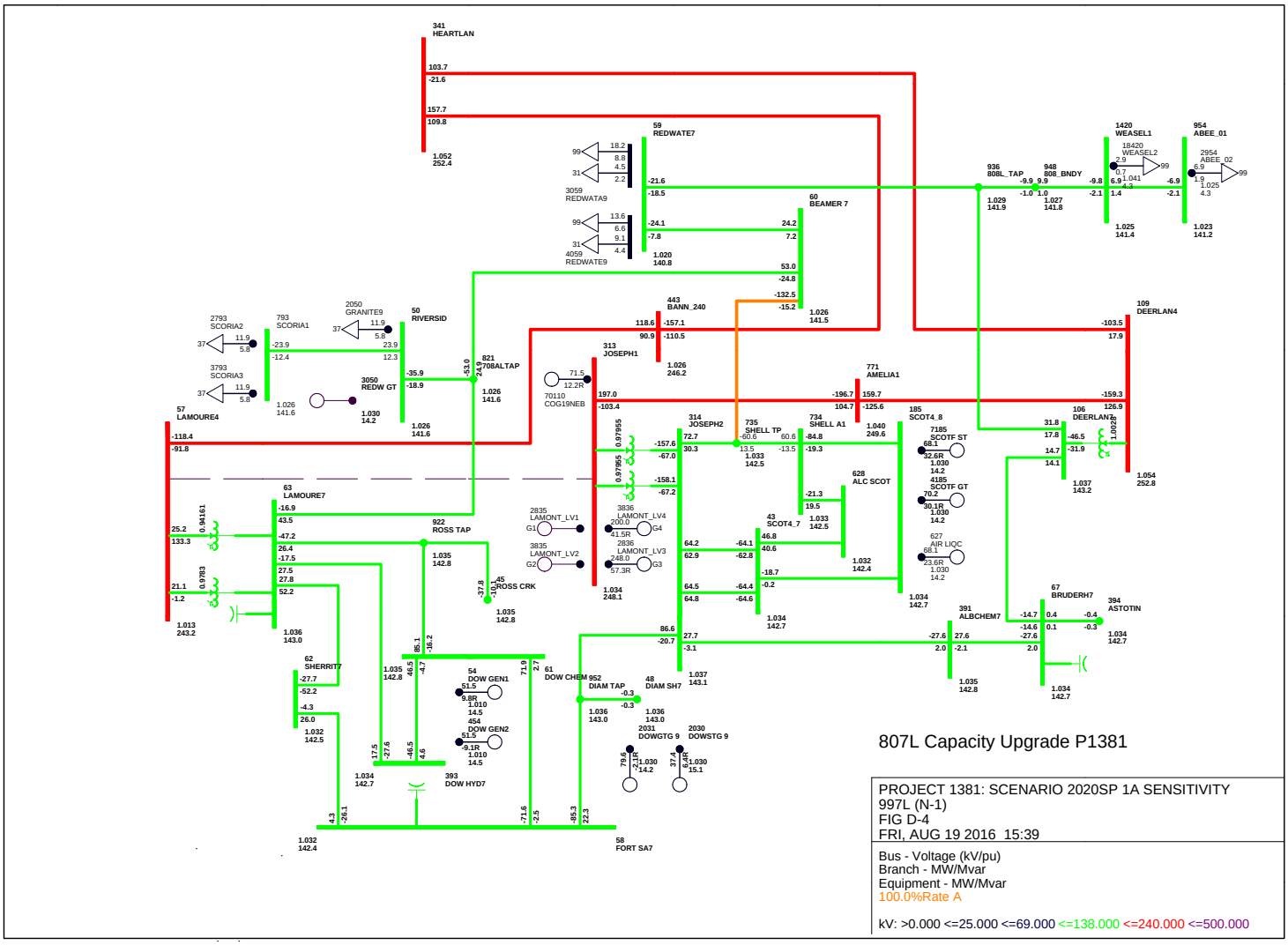
Table D-1: 2020SP Sensitivity Contingency Lists

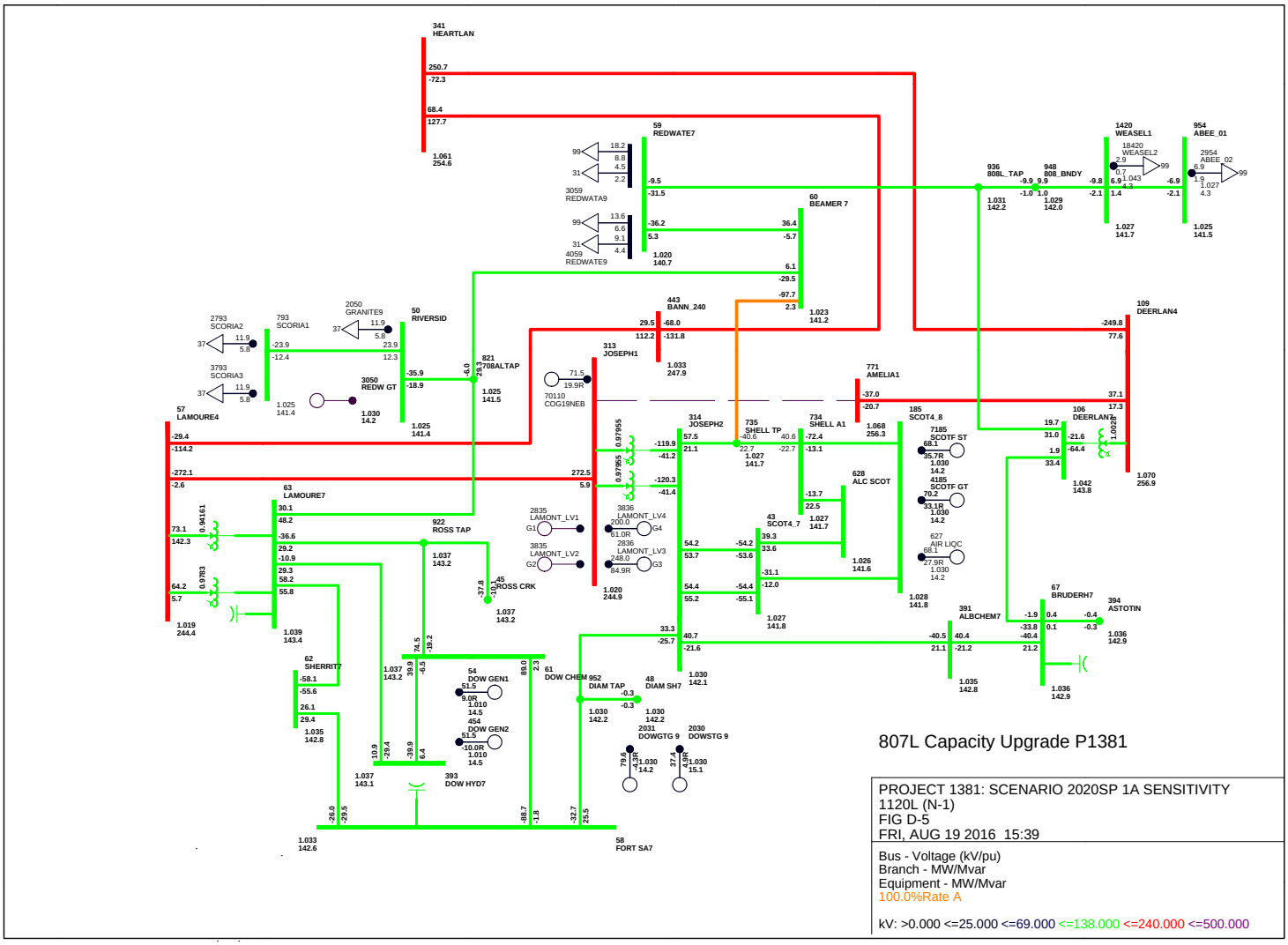
Figure #	Scenario	Condition
D-1	20_1a_Sen	Base Case (N-0)
D-2	20_1a_Sen	942L (N-1) 71S Lamoureux to 681S Bannerman
D-3	20_1a_Sen	1061L (N-1) 681S Bannerman to 12S Heartland
D-4	20_1a_Sen	997L (N-1) 71S Lamoureux to 410S Josephburg
D-5	20_1a_Sen	1120L (N-1) 410S Josephburg to 108S Amelia
D-6	20_1a_Sen	943L (N-1) 13S Deerland to 108S Amelia
D-7	20_1a_Sen	1054L (N-1) 12S Heartland to 13S Deerland
D-8	20_1a_Sen	9L960 (N-1) 13S Deerland to 825S Whitefish Lake
D-9	20_1a_Sen	9L961 (N-1) 13S Deerland to 825S Whitefish Lake
D-10	20_1a_Sen	920L (N-1) 71S Lamoureux to 557S Castle Downs
D-11	20_1a_Sen	921L (N-1) 71S Lamoureux to 987S Clover Bar
D-12	20_1a_Sen	708L (N-1) 233S Beamer to 71S Lamoureux
D-13	20_1a_Sen	807L (N-1) 410S Josephburg to 233S Beamer
D-14	20_1a_Sen	735L (N-1) 233S Beamer to 171S Redwater
D-15	20_1a_Sen	808L (N-1) 171S Redwater to 13S Deerland
D-16	20_1a_Sen	621L (N-1) 13S Deerland to 109S Skaro
D-17	20_1a_Sen	815L (N-1) 13S Deerland to 127S Bruderheim
D-18	20_1a_Sen	846L (N-1) 127S Bruderheim
D-19	20_1a_Sen	773L (N-1) 127S Bruderheim to 308S Albchem Beaverhill Creek
D-20	20_1a_Sen	776L (N-1) 410S Josephburg to 308S Albchem Beaverhill Creek
D-21	20_1a_Sen	856L (N-1) 410S Josephburg to 409S Shell Scotford
D-22	20_1a_Sen	857L (N-1) 410S Josephburg to 409S Shell Scotford
D-23	20_1a_Sen	ALCO2L (N-1) 879S Scotford Upgrader to 409S Shell Scotford
D-24	20_1a_Sen	EXI-01L (N-1) 879S Scotford Upgrader to 402S Scotford Expansion 1
D-25	20_1a_Sen	ALC03L (N-1) 402S Scotford Expansion 1 to Air Liquide
D-26	20_1a_Sen	ALC01L (N-1) Air Liquide to 409S Shell Scotford
D-27	20_1a_Sen	706L (N-1) 410S Josephburg to 54S Fort Saskatchewan
D-28	20_1a_Sen	707L (N-1) 233S Beamer to 71S Lamoureux
D-29	20_1a_Sen	787L (N-1) 71S Lamoureux to 166S Dow Chemical
D-30	20_1a_Sen	862L (N-1) 166S Dow Chemical to 258S Dow HydroCarbons
D-31	20_1a_Sen	861L (N-1) 71S Lamoureux to 258S Dow HydroCarbons
D-32	20_1a_Sen	781L (N-1) 172S Sherritt to 71S Lamoureux
D-33	20_1a_Sen	709L (N-1) 233S Beamer to 71S Lamoureux
D-34	20_1a_Sen	694L (N-1) 54S Fort Saskatchewan to 422S Westwood
D-35	20_1a_Sen	700L (N-1) 422S Westwood to 746S Sherwood Park

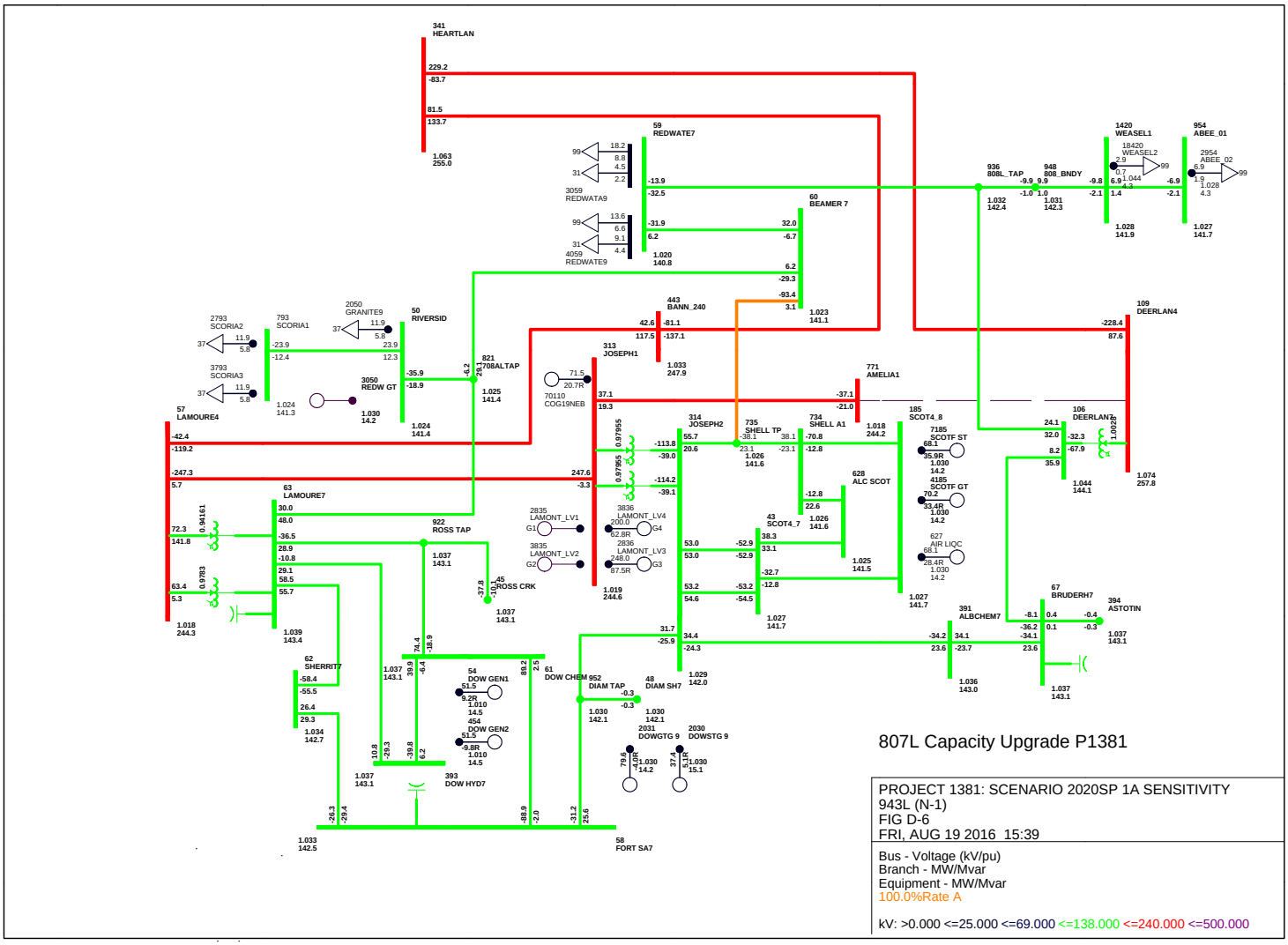

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
BASE CASE (N-0)
FIG D-1
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

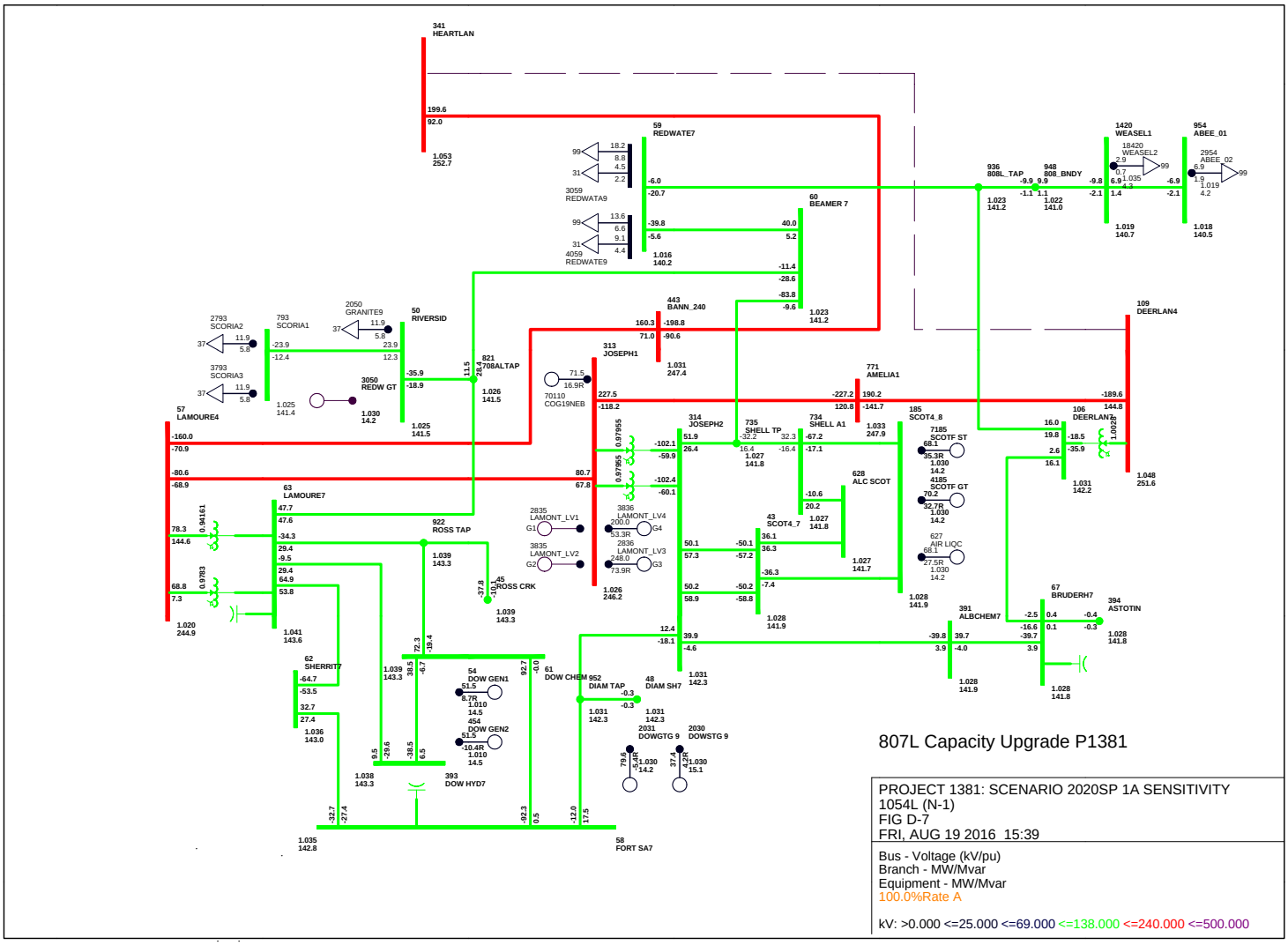

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
942L (N-1)
FIG D-2
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

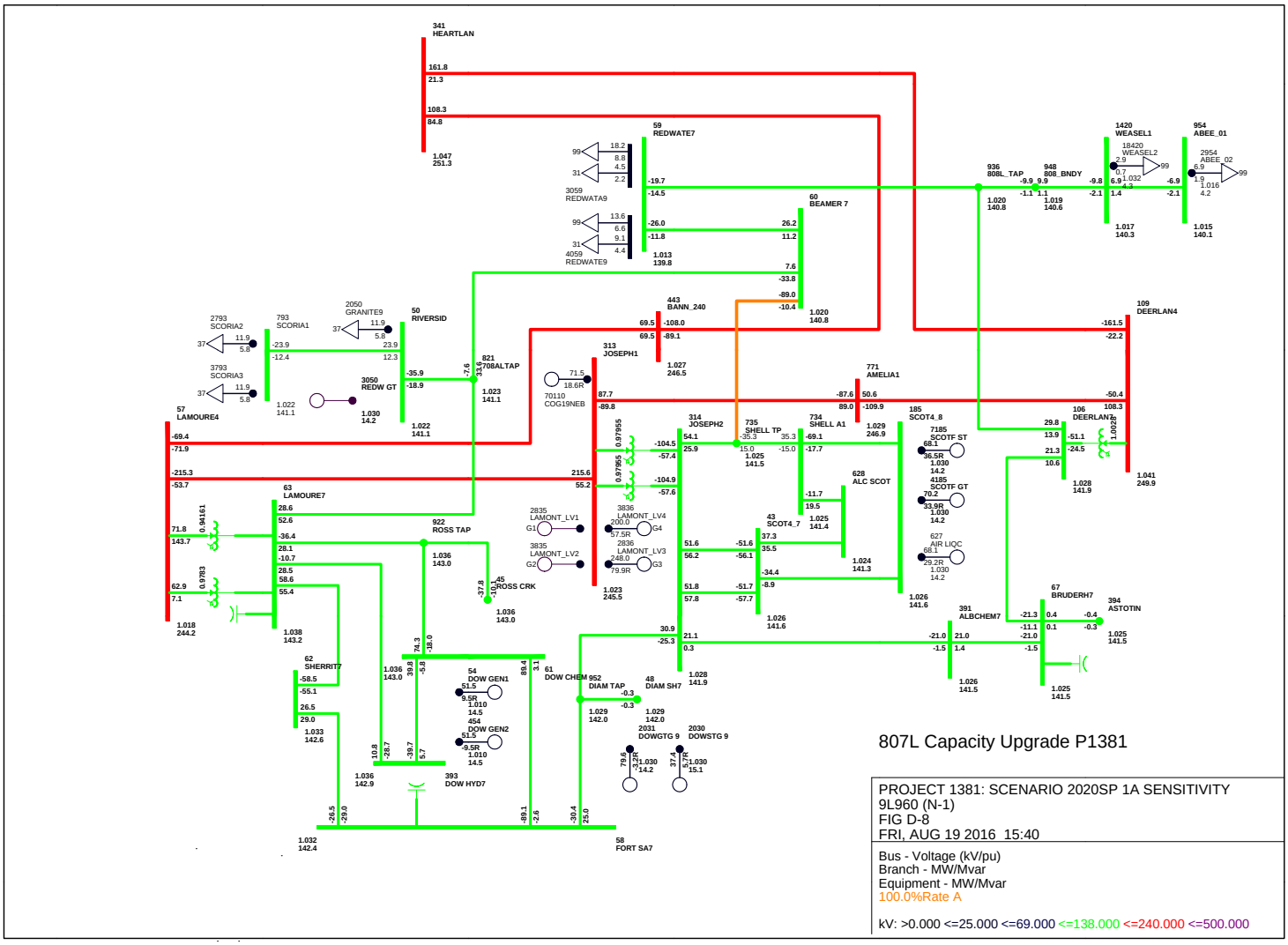

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
1061L (N-1)
FIG D-3
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

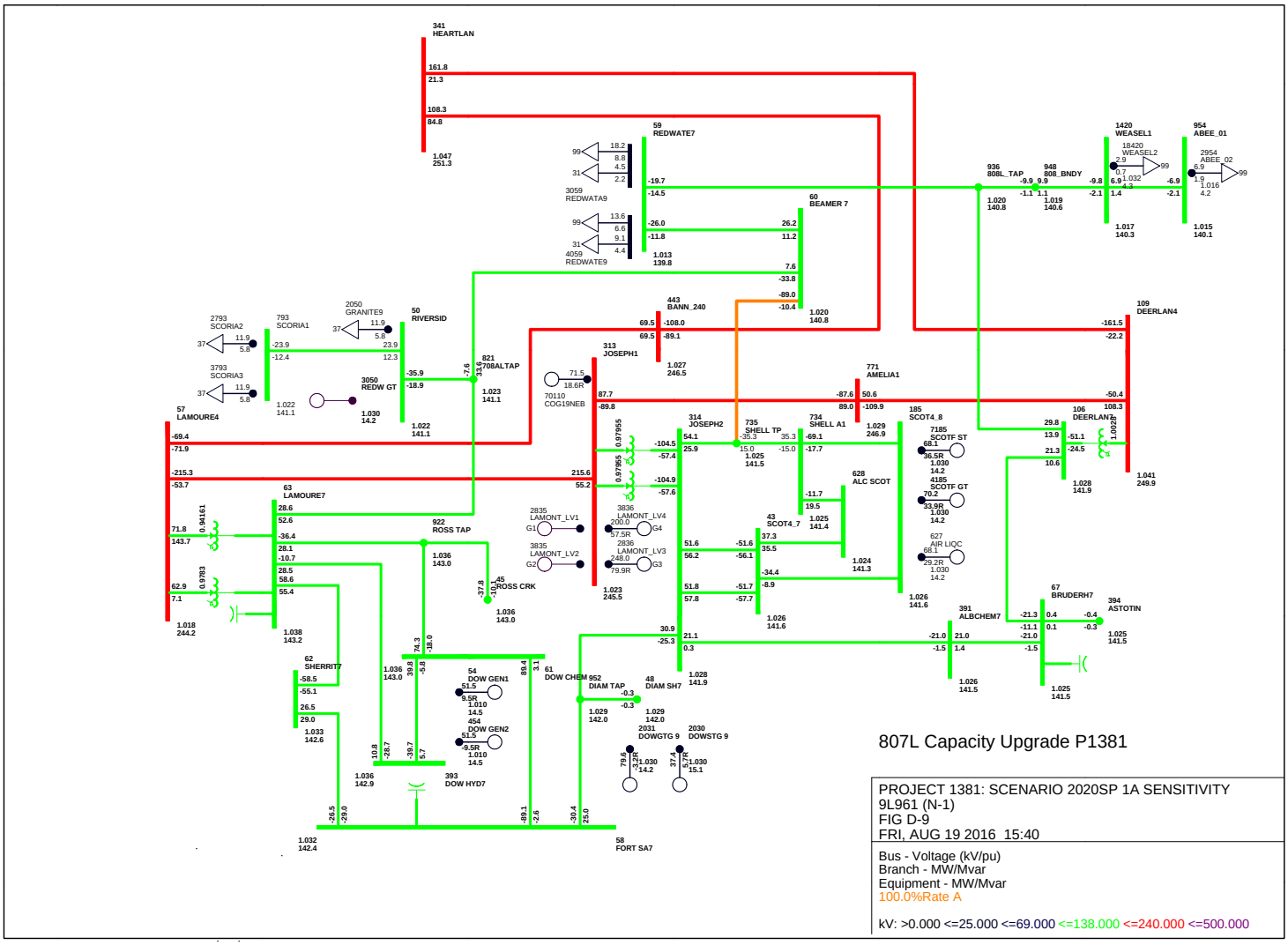

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
997L (N-1)
FIG D-4
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

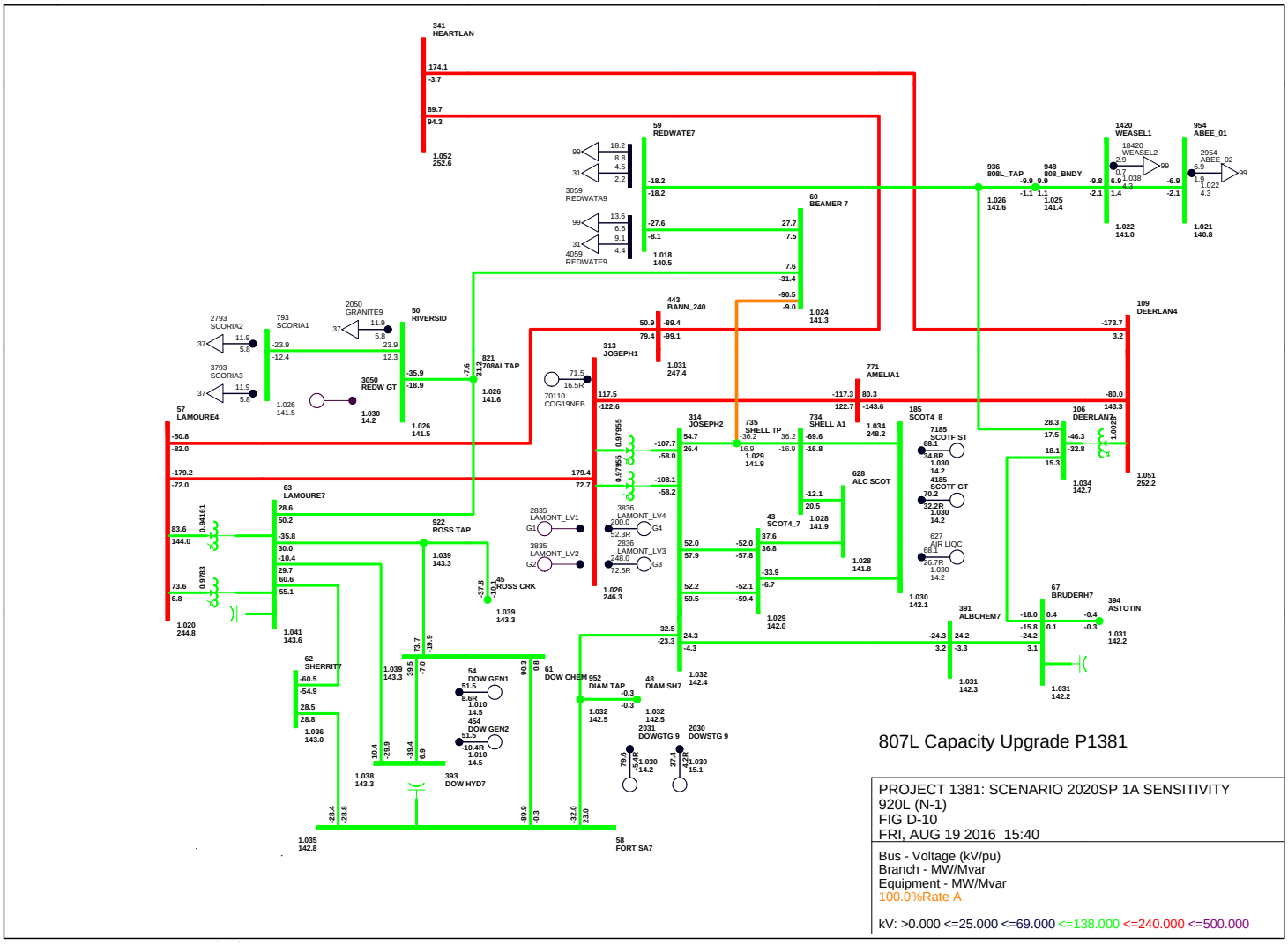

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
1120L (N-1)
FIG D-5
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

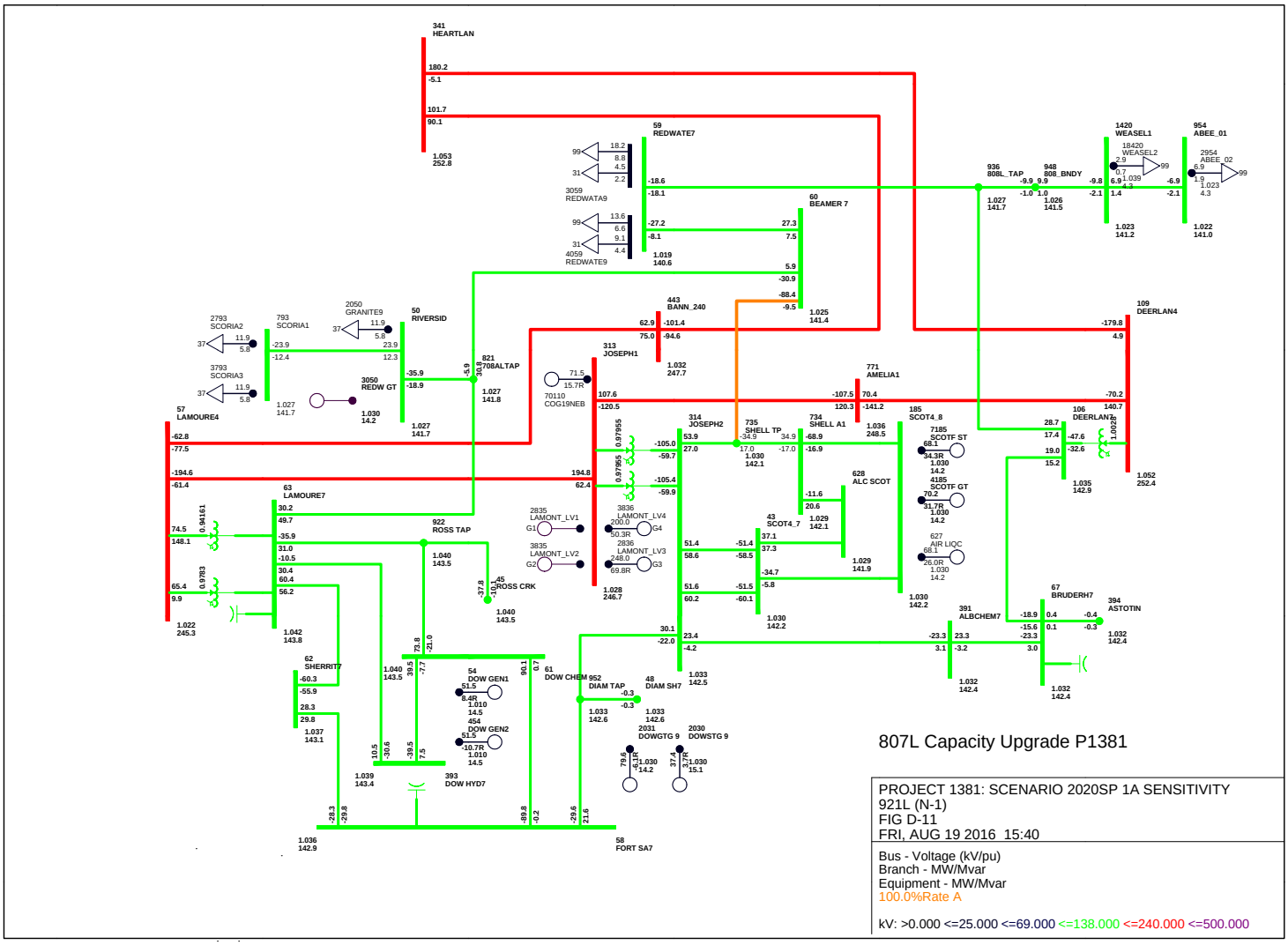

341 HEARTLAN
229.2
-83.7
81.5
133.7
1.063
255.0
59 REDWATE7
18.2
8.8
4.5
2.2
99
31
3059 REDWATA9
-13.9
-32.5
13.6
6.6
9.1
4.4
4059 REDWATE9
-31.9
6.2
32.0
-6.7
1.020
140.8
60 BEAMER 7
6.2
-29.3
-93.4
3.1
1.023
141.1
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
99
1.032 142.4
1.031 142.3
1.028 141.9
1.027 141.7
1.044
1.028
2050 GRANITE9
2793 SCORIA2
793 SCORIA1
3793 SCORIA3
50 RIVERSID
3050 REDW GT
1.024 141.3
1.030 14.2
821 1708ALTAP
1.025 141.4
1.024 141.4
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
1.037 143.1
45 ROSS CRK
1.037 143.1
1.019 244.6
313 JOSEPH1
71.5
20.7R
70110 COG19NEB
443 BANN_240
1.033 247.9
771 AMELIA1
109 DEERLAN4
-228.4
87.6
1.074 257.8
314 JOSEPH2
735 SHELL TP
734 SHELL A1
1.026 141.6
1.018 244.2
628 ALC SCOT
1.025 141.5
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
106 DEERLAN7
1.044 144.1
43 SCOT4_7
1.026 141.6
1.027 141.7
391 ALBCHEM7
67 BRUDERH7
394 ASTOTIN
1.037 143.1
1.036 143.0
62 SHERRIT7
1.039 143.4
1.034 142.7
54 DOW GEN1
454 DOW GEN2
1.010 14.5
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.030 142.1
1.029 142.0
2031 DOWGTG 9
2030 DOWSTG 9
1.030 14.2
1.030 15.1
58 FORT SA7
1.033 142.5
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
943L (N-1)
FIG D-6
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
199.6
92.0
1.053
252.7
59 REDWATE7
18.2
8.8
4.5
2.2
99
31
3059 REDWATA9
-6.0
-20.7
13.6
6.6
9.1
4.4
4059 REDWATE9
-39.8
-5.6
1.016
140.2
60 BEAMER 7
40.0
5.2
-11.4
-28.6
-83.8
-9.6
1.023
141.2
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.035
1.019
1.023 141.2
1.022 141.0
1.019 140.7
1.018 140.5
443 BANN_240
160.3
71.0
-198.8
-90.6
1.031 247.4
109 DEERLAN4
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
2050 GRANITE9
50 RIVERSID
-23.9
-12.4
23.9
12.3
-35.9
-18.9
1.025
141.4
3050 REDW GT
1.030
14.2
1.026
141.5
1.025
141.5
821 6708ALTAP
11.5
28.4
71.5
16.9R
70110 COG19NEB
313 JOSEPH1
227.5
-118.2
771 AMELIA1
-227.2
120.8
190.2
-141.7
-189.6
144.8
57 LAMOURE4
-160.0
-70.9
-80.6
-68.9
80.7
67.8
63 LAMOURE7
47.7
47.6
-34.3
29.4
-9.5
29.4
64.9
53.8
78.3
144.6
68.8
7.3
0.94161
0.9783
1.020
244.9
1.041
143.6
922 ROSS TAP
1.039
143.3
45 ROSS CRK
-37.8
-10.1
1.039
143.3
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
200.0
53.3R
2836 LAMONT_LV3
248.0
73.9R
1.026
246.2
0.97955
0.97955
314 JOSEPH2
51.9
26.4
-102.1
-59.9
-102.4
-60.1
735 SHELL TP
-32.2
32.3
16.4
-16.4
1.027
141.8
734 SHELL A1
-67.2
-17.1
1.033
247.9
185 SCOT4_8
7185 SCOTF ST
68.1
35.3R
1.030
14.2
4185 SCOTF GT
70.2
32.7R
1.030
14.2
106 DEERLAN3
1.0028
16.0
19.8
-18.5
2.6
16.1
-35.9
1.031
142.2
1.048
251.6
628 ALC SCOT
-10.6
20.2
1.027
141.8
43 SCOT4_7
36.1
36.3
-36.3
-7.4
1.028
141.9
50.1
57.3
-50.1
-57.2
50.2
58.9
-50.2
-58.8
1.027
141.7
627 AIR LIQC
68.1
27.5R
1.030
14.2
1.028
141.9
391 ALBCHEM7
-2.5
-16.6
-39.7
67 BRUDERH7
0.4
0.1
-0.4
-0.3
394 ASTOTIN
1.028
141.8
39.7
-4.0
3.9
1.028
141.9
1.028
141.8
12.4
-18.1
39.9
-4.6
-39.8
3.9
1.031
142.3
62 SHERRIT7
-64.7
-53.5
32.7
27.4
1.036
143.0
1.039
143.3
39.5
-6.7
72.3
39.4
54 DOW GEN1
51.5
8.7R
1.010
14.5
454 DOW GEN2
51.5
-10.4R
1.010
14.5
92.7
-0.0
61 DOW CHEM
952 DIAM TAP
-0.3
-0.3
48 DIAM SH7
1.031
142.3
1.031
142.3
2031 DOWGTG 9
2030 DOWSTG 9
79.6
-5.4R
1.030
14.2
37.4
4.2R
1.030
15.1
1.038
143.3
-29.6
-38.5
6.5
9.5
393 DOW HYD7
-32.7
-27.4
1.035
142.8
-92.3
0.5
-12.0
17.5
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
1054L (N-1)
FIG D-7
FRI, AUG 19 2016 15:39
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
9L960 (N-1)
FIG D-8
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
9L961 (N-1)
FIG D-9
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
920L (N-1)
FIG D-10
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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HEARTLAN
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252.8
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REDWATE7
18.2
8.8
4.5
2.2
3059
REDWATA9
-18.6
-18.1
13.6
6.6
9.1
4.4
4059
REDWATE9
-27.2
-8.1
27.3
7.5
1.019
140.6
60
BEAMER 7
5.9
-30.9
-88.4
-9.5
1.025
141.4
936
808L_TAP
948
808_BNDY
1420
WEASEL1
18420
WEASEL2
954
ABEE_01
2954
ABEE_02
1.027
141.7
1.026
141.5
1.023
141.2
1.022
141.0
2050
GRANITE9
2793
SCORIA2
3793
SCORIA3
793
SCORIA1
50
RIVERSID
3050
REDW GT
1.030
14.2
1.027
141.7
821
3708ALTAP
1.027
141.8
57
LAMOURE4
1.027
141.7
443
BANN_240
62.9
75.0
-101.4
-94.6
1.032
247.7
313
JOSEPH1
71.5
15.7R
70110
COG19NEB
107.6
-120.5
771
AMELIA1
-107.5
120.3
-141.2
70.4
109
DEERLAN4
-179.8
4.9
-70.2
140.7
106
DEERLAN3
1.0028
1.035
142.9
1.052
252.4
-62.8
-77.5
-194.6
-61.4
194.8
62.4
63
LAMOURE7
30.2
49.7
922
ROSS TAP
1.040
143.5
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74.5
148.1
0.9783
65.4
9.9
1.022
245.3
-35.9
31.0
-10.5
30.4
60.4
56.2
1.042
143.8
45
ROSS CRK
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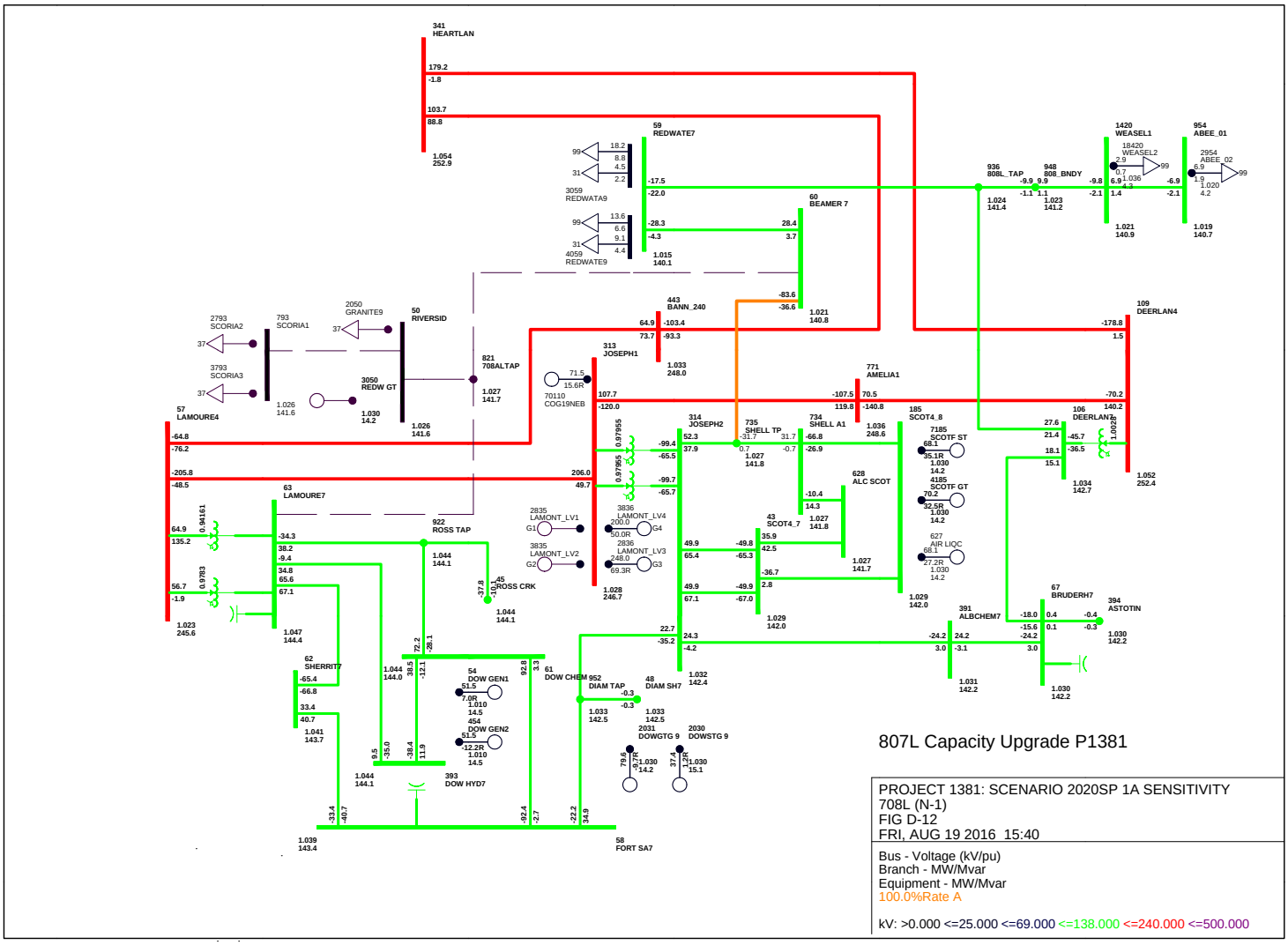
-10.1
1.040
143.5
2835
LAMONT_LV1
G1
2836
LAMONT_LV3
248.0
69.8R
G3
3835
LAMONT_LV2
G2
3836
LAMONT_LV4
200.0
50.3R
G4
1.028
246.7
0.97955
0.97955
314
JOSEPH2
53.9
27.0
-105.0
-59.7
-105.4
-59.9
735
SHELL TP
-34.9
34.9
17.0
-17.0
1.030
142.1
734
SHELL A1
-68.9
-16.9
-11.6
20.6
1.029
142.1
628
ALC SCOT
1.036
248.5
185
SCOT4_8
7185
SCOTF ST
68.1
34.3R
1.030
14.2
4185
SCOTF GT
70.2
31.7R
1.030
14.2
627
AIR LIQC
68.1
26.0R
1.030
14.2
43
SCOT4_7
37.1
37.3
-51.4
-58.5
-34.7
-5.8
51.4
58.6
51.6
60.2
-51.5
-60.1
1.029
141.9
1.030
142.2
1.030
142.2
67
BRUDERH7
-18.9
-15.6
-23.3
0.4
0.1
-0.4
-0.3
1.032
142.4
1.032
142.4
391
ALBCHEM7
394
ASTOTIN
1.032
142.4
-23.3
3.1
23.3
-3.2
3.0
30.1
-22.0
23.4
-4.2
1.033
142.5
62
SHERRIT7
-60.3
-55.9
28.3
29.8
1.037
143.1
1.040
143.5
39.5
-7.7
21.8
21.0
54
DOW GEN1
51.5
8.4R
1.010
14.5
454
DOW GEN2
51.5
-10.7R
1.010
14.5
61
DOW CHEM
90.1
0.7
952
DIAM TAP
-0.3
-0.3
48
DIAM SH7
1.033
142.6
1.033
142.6
2031
DOWGTG 9
2030
DOWSTG 9
79.6
-61R
1.030
14.2
37.4
-31R
1.030
15.1
10.5
-30.6
-39.5
7.5
1.039
143.4
393
DOW HYD7
-28.3
-29.8
-89.8
-0.2
-29.6
21.6
1.036
142.9
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
921L (N-1)
FIG D-11
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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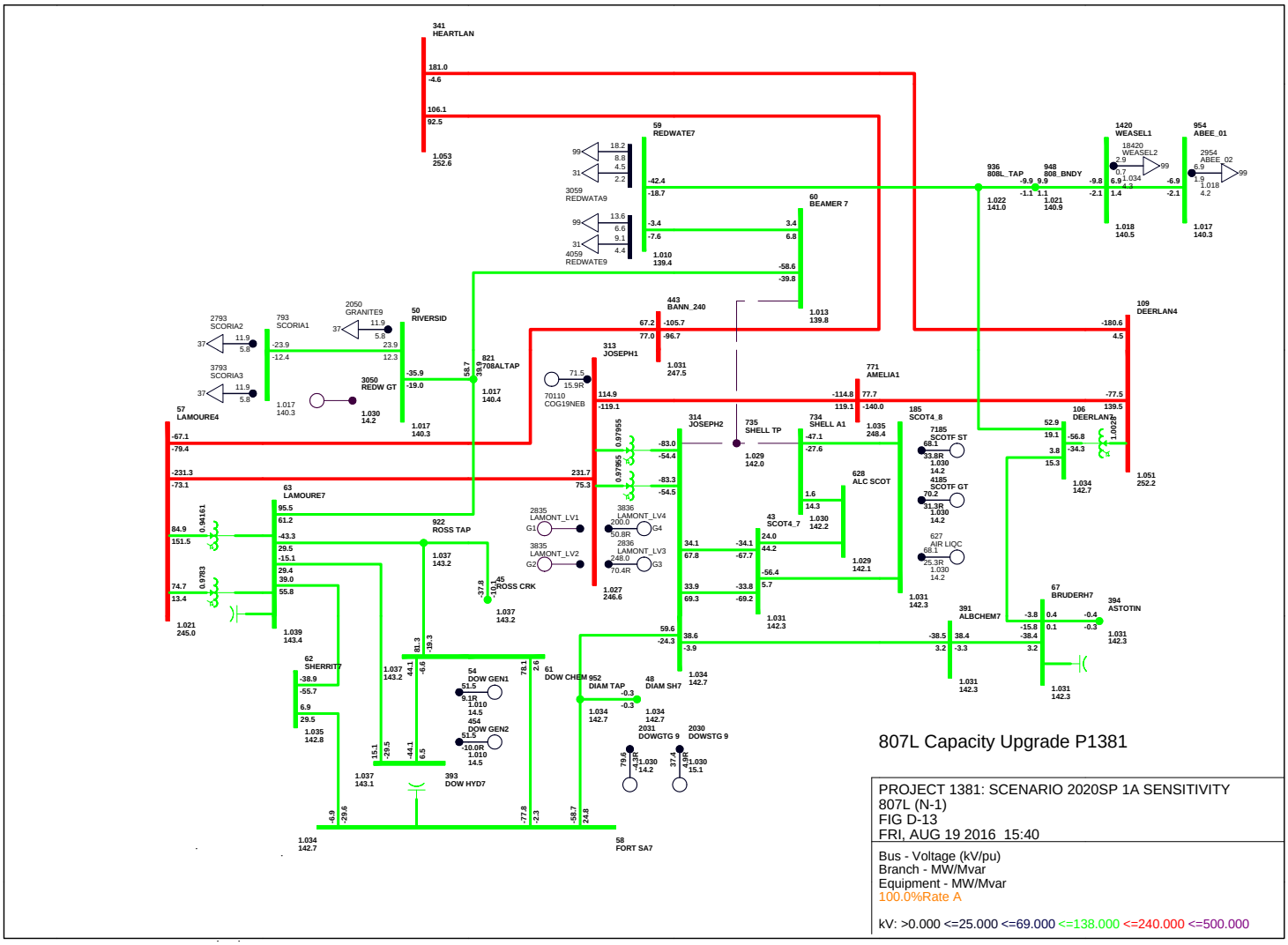
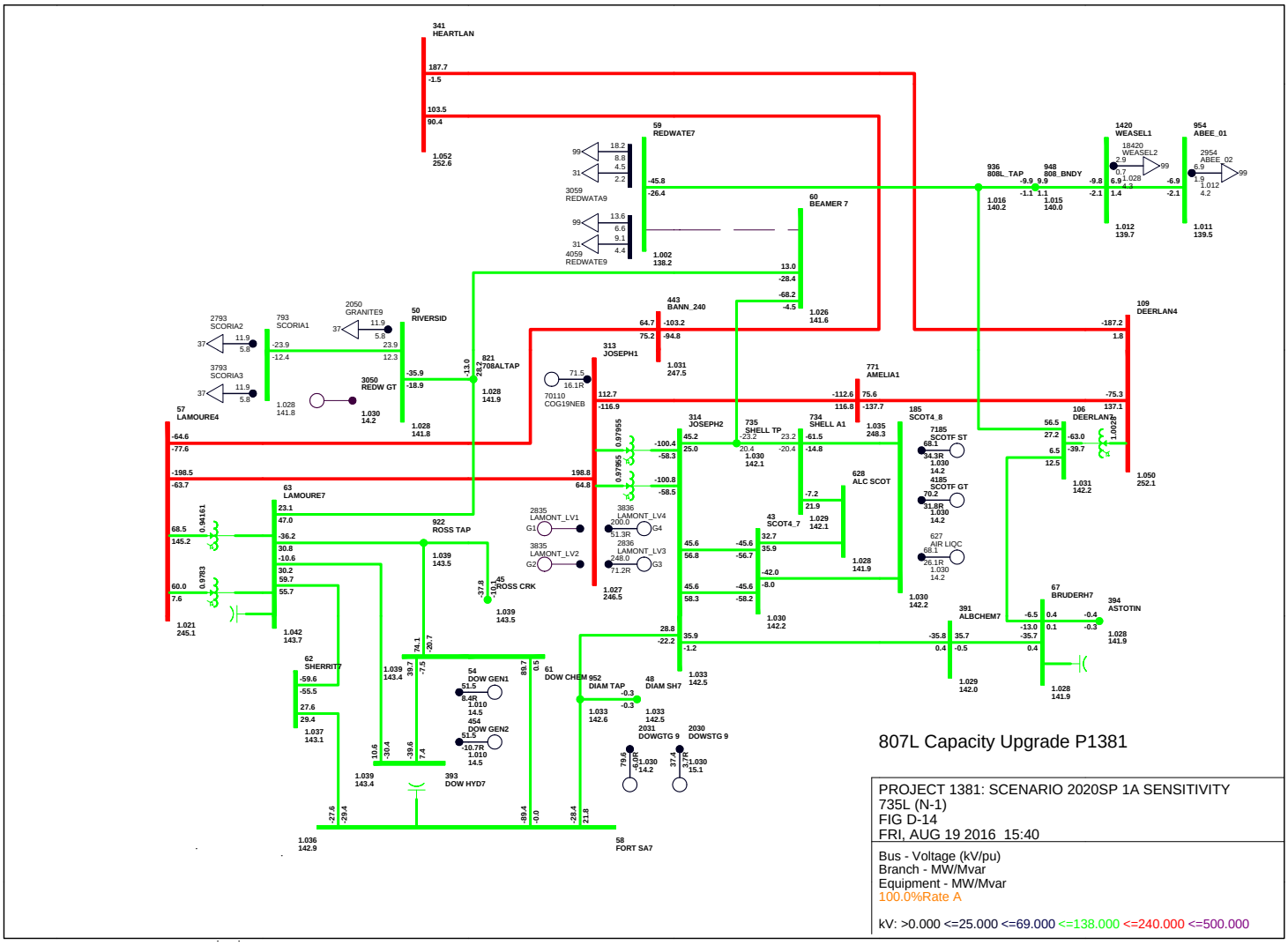
179.2
-1.8
103.7
88.8
1.054
252.9
59 REDWATE7
18.2
8.8
4.5
2.2
99
31
3059 REDWATA9
-17.5
-22.0
13.6
6.6
9.1
4.4
4059 REDWATE9
-28.3
-4.3
28.4
3.7
1.015
140.1
60 BEAMER 7
-83.6
-36.6
1.021
140.8
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.024 141.4
1.023 141.2
1.021 140.9
1.019 140.7
1.036
1.020
2050 GRANITE9
50 RIVERSID
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
3050 REDW GT
1.026 141.6
1.030 14.2
821 708ALTAP
1.027 141.7
443 BANN_240
64.9
73.7
-103.4
-93.3
1.033
248.0
313 JOSEPH1
71.5
15.6R
70110 COG19NEB
107.7
-120.0
771 AMELIA1
-107.5
119.8
70.5
-140.8
109 DEERLAN4
-178.8
1.5
-70.2
140.2
57 LAMOURE4
-64.8
-76.2
-205.8
-48.5
206.0
49.7
63 LAMOURE7
922 ROSS TAP
1.044 144.1
45 ROSS CRK
1.044 144.1
1.028 246.7
0.97955
314 JOSEPH2
52.3
37.9
-99.4
-65.5
-99.7
-65.7
735 SHELL TP
-31.7
31.7
0.7
-0.7
1.027 141.8
734 SHELL A1
-66.8
-26.9
1.036 248.6
628 ALC SCOT
-10.4
14.3
1.027 141.7
185 SCOT4_8
7185 SCOTF ST
35.1R
4185 SCOTF GT
32.5R
627 AIR LIQC
68.1
27.2R
1.030 14.2
106 DEERLAN2
27.6
21.4
-45.7
-36.5
18.1
15.1
1.034 142.7
1.0028
1.052 252.4
2835 LAMONT_LV1
3836 LAMONT_LV4
200.0
50.0R
3835 LAMONT_LV2
2836 LAMONT_LV3
248.0
69.3R
43 SCOT4_7
35.9
42.5
-49.8
-65.3
-36.7
2.8
49.9
65.4
49.9
67.1
-49.9
-67.0
1.029 142.0
1.027 141.7
1.029 142.0
0.94161
0.9783
64.9
135.2
56.7
-1.9
1.023 245.6
-34.3
38.2
-9.4
34.8
65.6
67.1
1.047 144.4
62 SHERRIT7
-65.4
-66.8
33.4
40.7
1.041 143.7
1.044 144.0
39.5
-12.1
72.2
28.1
54 DOW GEN1
51.5
7.0R
1.010
14.5
454 DOW GEN2
51.5
-12.2R
1.010
14.5
92.8
3.3
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
-0.3
-0.3
1.033 142.5
1.032 142.4
1.033 142.5
2031 DOWGTG 9
2030 DOWSTG 9
79.6
-9.7R
1.030
14.2
37.4
-1.2R
1.030
15.1
8.5
-35.0
-38.4
11.9
1.044 144.1
393 DOW HYD7
-33.4
-40.7
-92.4
-2.7
-22.2
34.9
1.039 143.4
58 FORT SA7
22.7
-35.2
24.3
-4.2
391 ALBCHEM7
-24.2
3.0
24.2
-3.1
3.0
1.031 142.2
67 BRUDERH7
-18.0
0.4
-0.4
-15.6
0.1
-0.3
-24.2
1.030 142.2
394 ASTOTIN
1.030 142.2
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
708L (N-1)
FIG D-12
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
807L (N-1)
FIG D-13
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

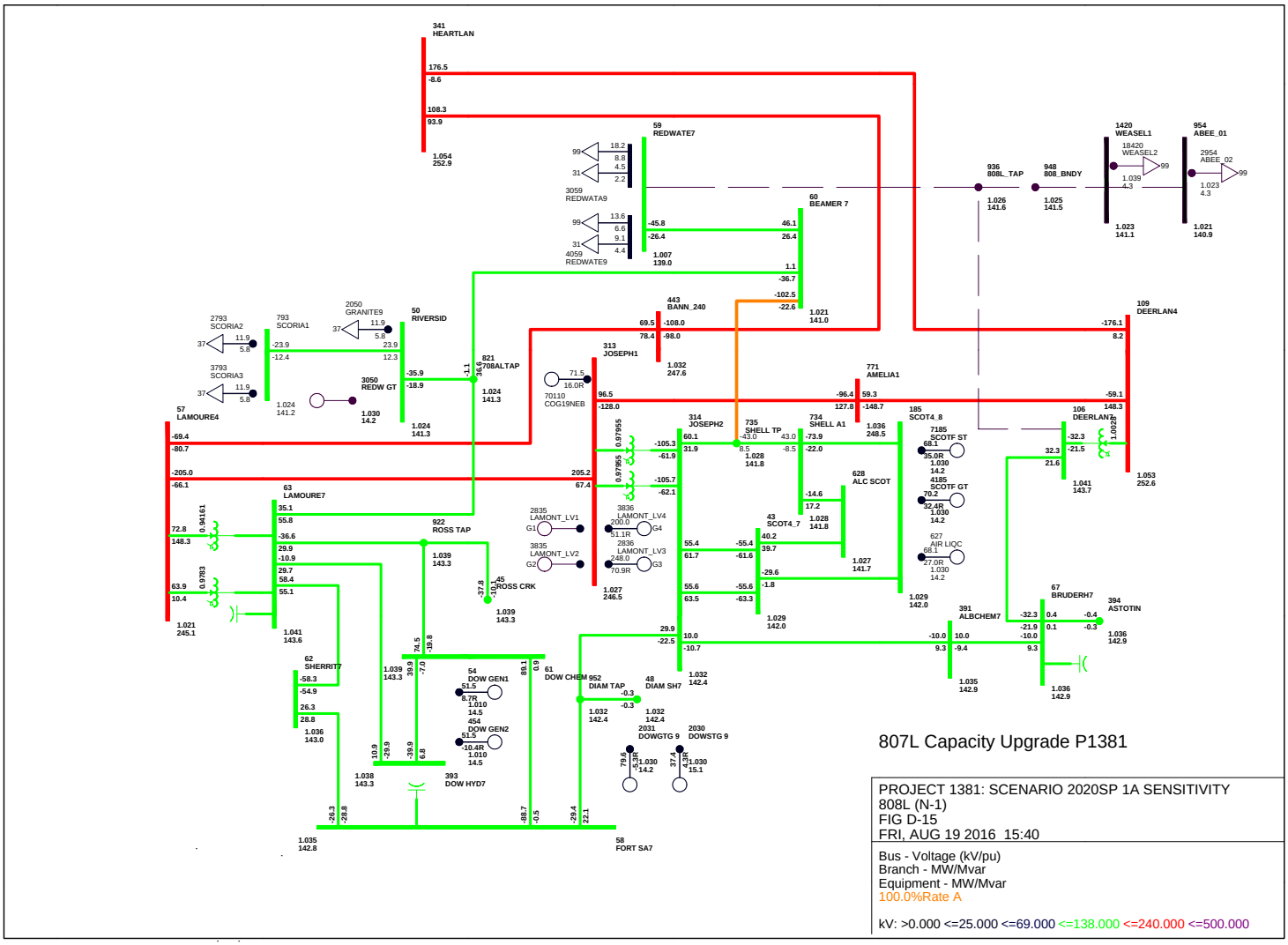


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
735L (N-1)
FIG D-14
FRI, AUG 19 2016 15:40

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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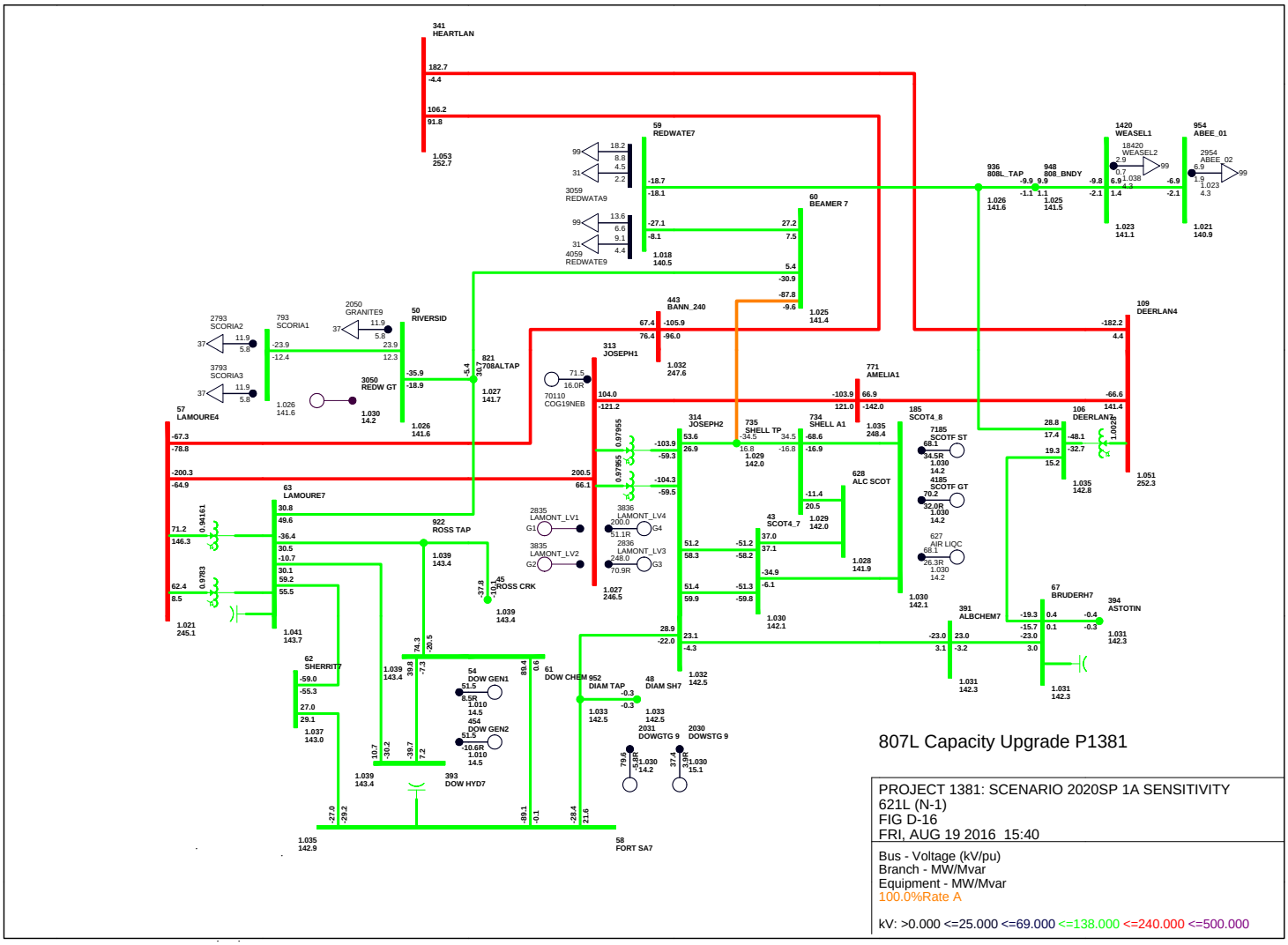
59 REDWATE7
60 BEAMER 7
936 808L_TAP
948 808_BNDY
1420 WEASEL1
954 ABEE_01
443 BANN_240
109 DEERLAN4
50 RIVERSID
821 6708ALTAP
313 JOSEPH1
771 AMELIA1
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
45 ROSS CRK
314 JOSEPH2
735 SHELL TP
734 SHELL A1
628 ALC SCOT
185 SCOT4_8
106 DEERLAN2
43 SCOT4_7
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
58 FORT SA7
391 ALBCHEM7
67 BRUDERH7
394 ASTOTIN
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
808L (N-1)
FIG D-15
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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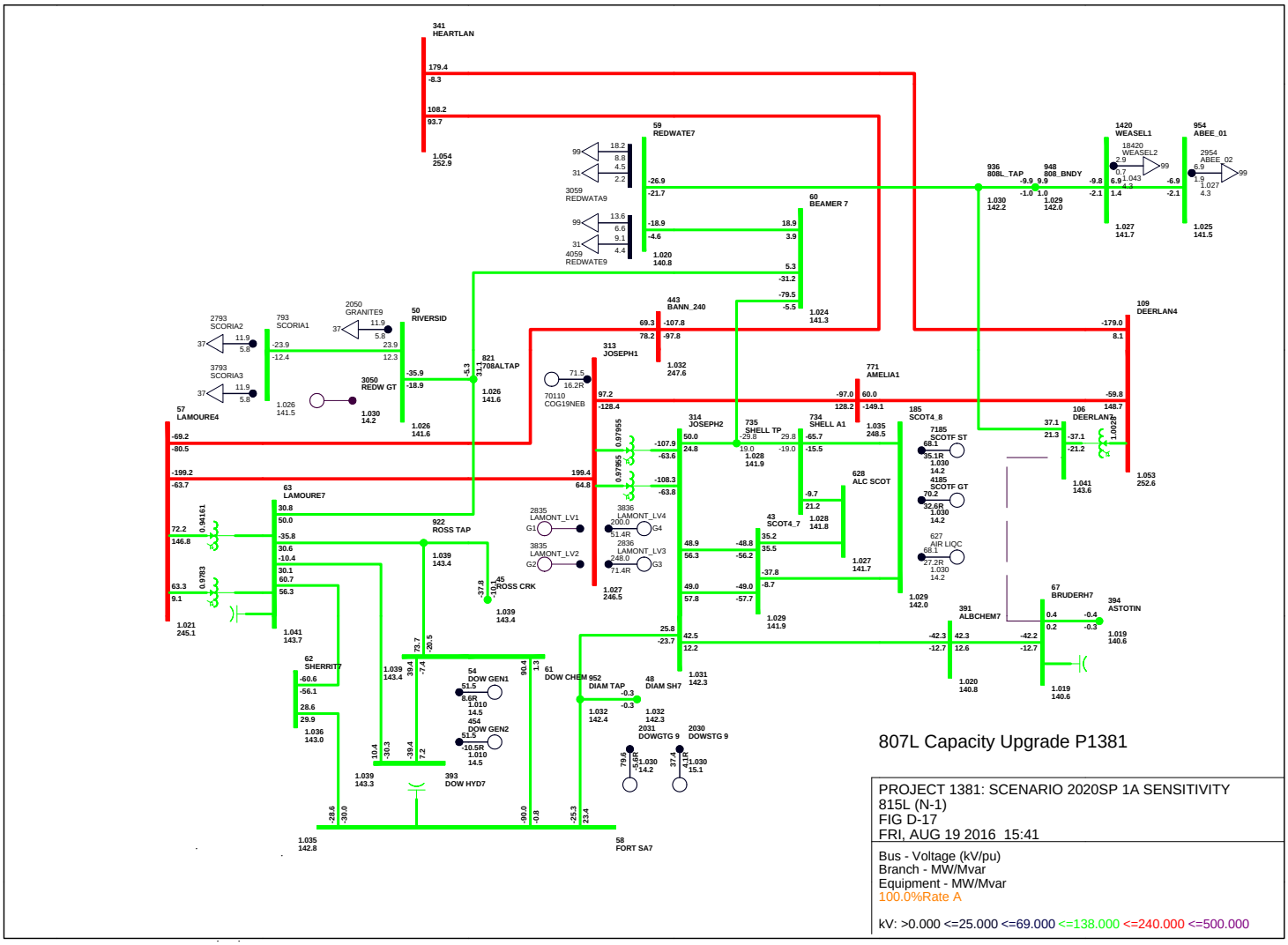
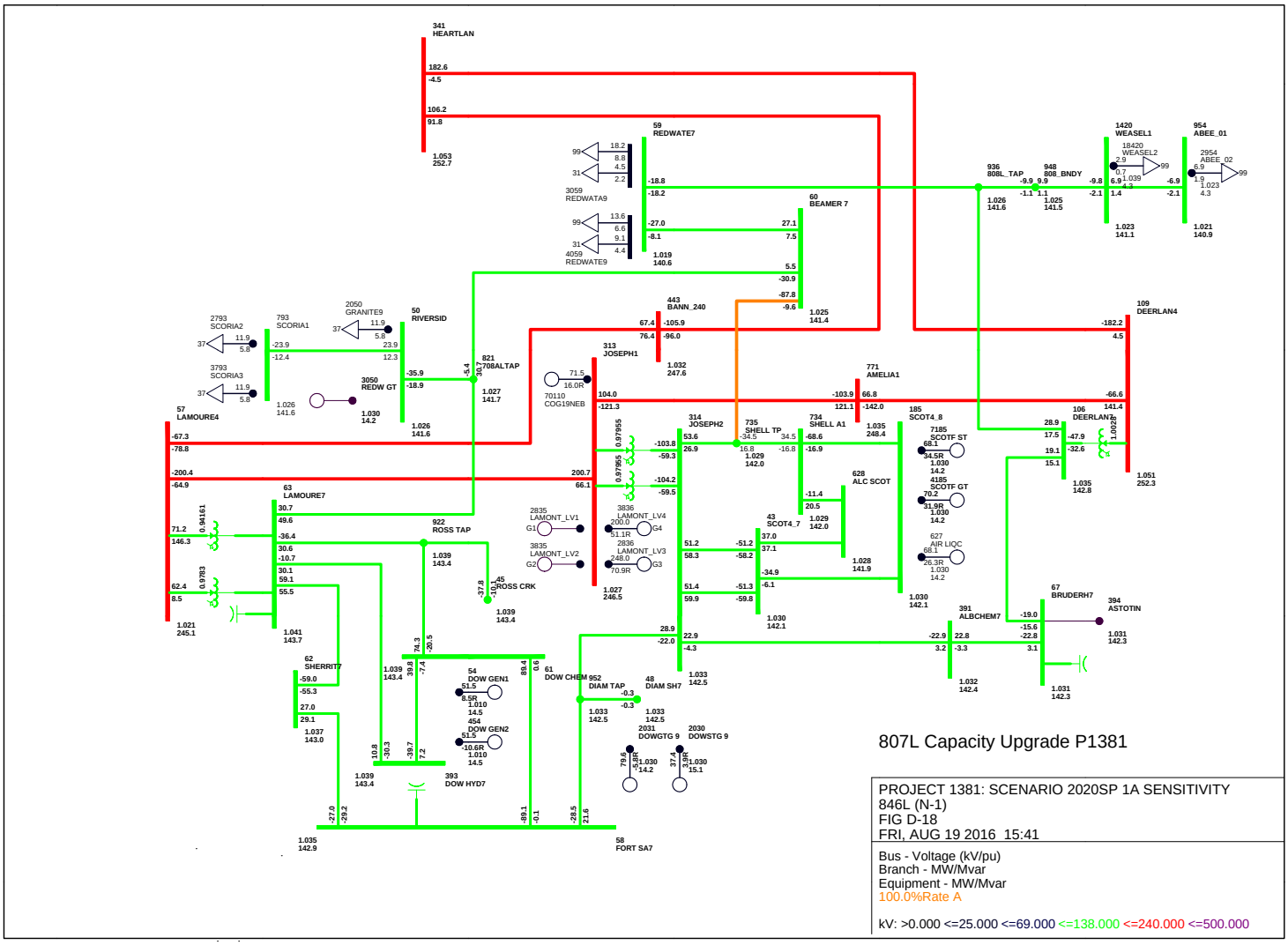
182.7
-4.4
106.2
91.8
1.053
252.7
59 REDWATE7
18.2
8.8
4.5
2.2
3059 REDWATA9
13.6
6.6
9.1
4.4
4059 REDWATE9
-18.7
-18.1
-27.1
-8.1
1.018
140.5
27.2
7.5
60 BEAMER 7
5.4
-30.9
-87.8
-9.6
1.025
141.4
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.026 141.6
1.025 141.5
1.023 141.1
1.021 140.9
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.026 141.6
1.030 14.2
821 6708ALTAP
1.027 141.7
57 LAMOURE4
-67.3
-78.8
-200.3
-64.9
63 LAMOURE7
922 ROSS TAP
1.039 143.4
45 ROSS CRK
1.039 143.4
1.027 246.5
443 BANN_240
67.4
76.4
-105.9
-96.0
1.032 247.6
313 JOSEPH1
71.5
16.0R
70110 COG19NEB
104.0
-121.2
200.5
66.1
314 JOSEPH2
53.6
26.9
-103.9
-59.3
-104.3
-59.5
735 SHELL TP
-34.5
34.5
16.8
1.029
142.0
734 SHELL A1
-68.6
-16.9
-11.4
20.5
1.029
142.0
771 AMELIA1
-103.9
121.0
66.9
-142.0
1.035
248.4
628 ALC SCOT
1.028
141.9
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
1.030
142.1
43 SCOT4_7
37.0
37.1
-51.2
-58.2
-34.9
-6.1
51.2
58.3
51.4
59.9
-51.3
-59.8
1.030
142.1
109 DEERLAN4
-182.2
4.4
-66.6
141.4
106 DEERLAN3
28.8
17.4
19.3
15.2
-48.1
-32.7
1.035
142.8
1.051
252.3
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
-19.3
-15.7
0.4
0.1
-0.4
-0.3
-23.0
-23.0
23.0
-3.2
3.0
1.031
142.3
1.031
142.3
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
200.0
51.1R
248.0
70.9R
0.97955
0.97955
0.94161
0.9783
71.2
146.3
62.4
8.5
1.021
245.1
30.8
49.6
-36.4
30.5
-10.7
30.1
59.2
55.5
1.041
143.7
62 SHERRIT7
-59.0
-55.3
27.0
29.1
1.037
143.0
1.039
143.4
54 DOW GEN1
51.5
8.5R
1.010
14.5
454 DOW GEN2
51.5
10.6R
1.010
14.5
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
-0.3
-0.3
1.033
142.5
1.033
142.5
1.032
142.5
2031 DOWGTG 9
2030 DOWSTG 9
79.6
51.5R
1.030
14.2
37.4
31.9R
1.030
15.1
58 FORT SA7
1.035
142.9
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
621L (N-1)
FIG D-16
FRI, AUG 19 2016 15:40
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
815L (N-1)
FIG D-17
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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HEARTLAN
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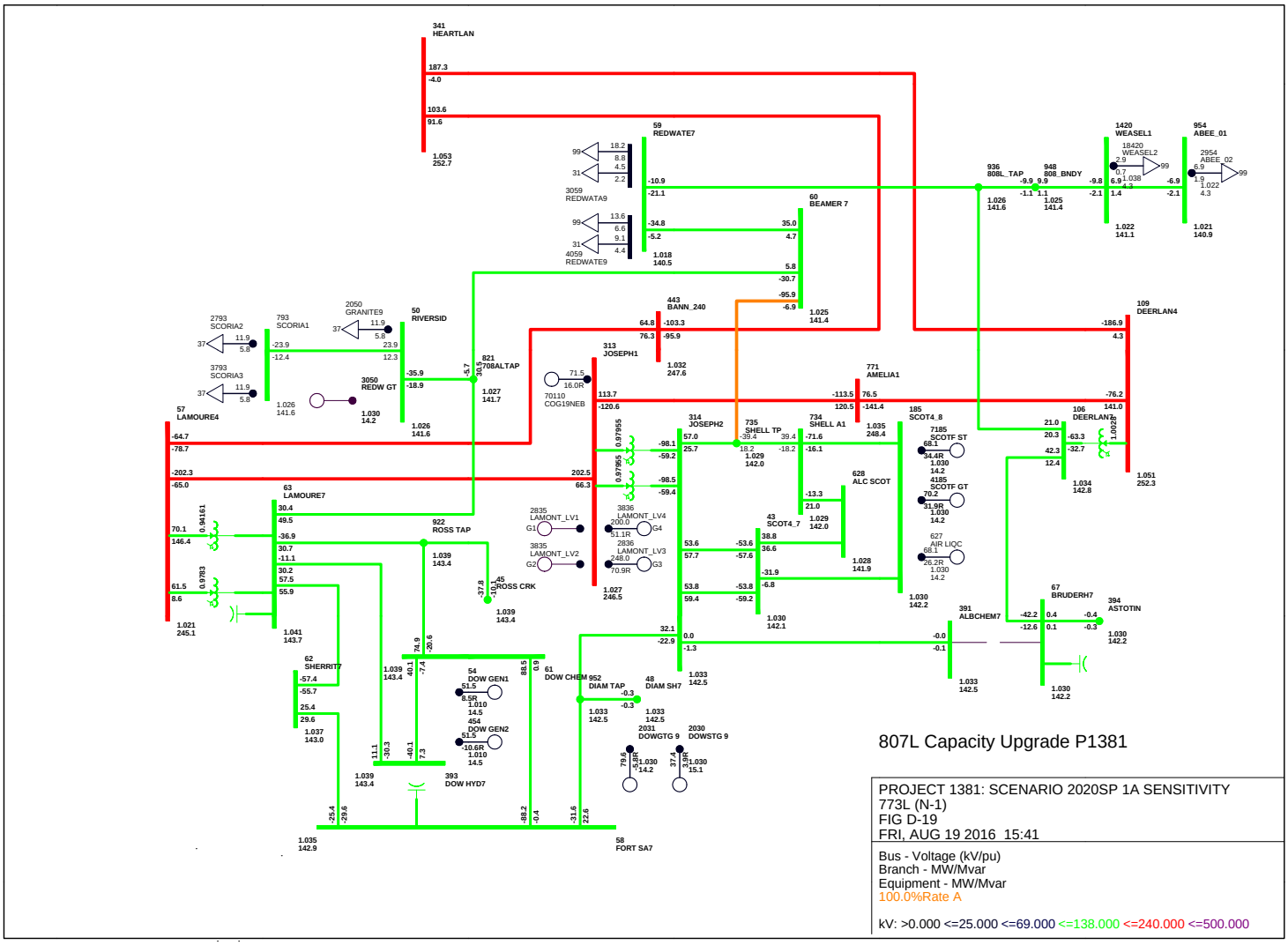
-4.5
106.2
91.8
1.053
252.7
59
REDWATE7
18.2
8.8
4.5
2.2
-18.8
-18.2
3059
REDWATA9
13.6
6.6
9.1
4.4
-27.0
-8.1
1.019
140.6
4059
REDWATE9
60
BEAMER 7
27.1
7.5
5.5
-30.9
-87.8
-9.6
1.025
141.4
443
BANN_240
67.4
76.4
-105.9
-96.0
1.032
247.6
313
JOSEPH1
71.5
16.0R
70110
COG19NEB
104.0
-121.3
821
5708ALTAP
30.7
-5.4
-35.9
-18.9
1.027
141.7
50
RIVERSID
11.9
5.8
23.9
12.3
1.026
141.6
2050
GRANITE9
2793
SCORIA2
793
SCORIA1
3793
SCORIA3
-23.9
-12.4
3050
REDW GT
1.026
141.6
1.030
14.2
57
LAMOURE4
-67.3
-78.8
-200.4
-64.9
63
LAMOURE7
30.7
49.6
-36.4
30.6
-10.7
30.1
59.1
55.5
1.041
143.7
0.94161
0.9783
71.2
146.3
62.4
8.5
1.021
245.1
922
ROSS TAP
1.039
143.4
45
ROSS CRK
-37.8
-10.1
1.039
143.4
62
SHERRIT7
-59.0
-55.3
27.0
29.1
1.037
143.0
54
DOW GEN1
51.5
8.5R
1.010
14.5
454
DOW GEN2
51.5
-10.6R
1.010
14.5
393
DOW HYD7
1.039
143.4
10.8
-30.3
-39.7
7.2
34.3
20.5
39.8
-7.4
89.4
0.6
-27.0
-29.2
-89.1
-0.1
-28.5
21.6
1.035
142.9
58
FORT SA7
61
DOW CHEM
952
DIAM TAP
-0.3
-0.3
1.033
142.5
48
DIAM SH7
1.033
142.5
2031
DOWGTG 9
79.6
-5.1R
1.030
14.2
2030
DOWSTG 9
37.4
3.1R
1.030
15.1
2835
LAMONT_LV1
G1
3835
LAMONT_LV2
G2
3836
LAMONT_LV4
200.0
51.1R
G4
2836
LAMONT_LV3
248.0
70.9R
G3
1.027
246.5
0.97955
0.97955
314
JOSEPH2
53.6
26.9
-103.8
-59.3
-104.2
-59.5
51.2
58.3
-51.2
-58.2
51.4
59.9
-51.3
-59.8
28.9
-22.0
22.9
-4.3
1.033
142.5
735
SHELL TP
-34.5
34.5
16.8
1.029
142.0
-16.8
43
SCOT4_7
37.0
37.1
-34.9
-6.1
1.030
142.1
734
SHELL A1
-68.6
-16.9
-11.4
20.5
1.029
142.0
628
ALC SCOT
1.028
141.9
771
AMELIA1
-103.9
121.1
66.8
-142.0
1.035
248.4
185
SCOT4_8
7185
SCOTF ST
68.1
34.5R
1.030
14.2
4185
SCOTF GT
70.2
31.9R
1.030
14.2
627
AIR LIQC
68.1
26.3R
1.030
14.2
1.030
142.1
391
ALBCHEM7
22.8
-3.3
3.2
-22.9
3.1
-19.0
-15.6
-22.8
1.032
142.4
67
BRUDERH7
1.031
142.3
394
ASTOTIN
1.031
142.3
109
DEERLAN4
-182.2
4.5
66.6
141.4
106
DEERLAN2
28.9
17.5
-47.9
-32.6
19.1
15.1
1.0028
1.035
142.8
1.051
252.3
936
808L_TAP
-9.9
-1.1
1.026
141.6
948
808_BNDY
9.9
1.1
1.025
141.5
-9.8
-2.1
1420
WEASEL1
18420
WEASEL2
2.9
0.7
1.039
4.3
99
6.9
1.4
1.023
141.1
-6.9
-2.1
954
ABEE_01
2954
ABEE_02
6.9
1.9
1.023
4.3
1.021
140.9
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
846L (N-1)
FIG D-18
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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91.6
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252.7
59 REDWATE7
3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.018
140.5
1.025
141.4
443 BANN_240
64.8
76.3
-103.3
-95.9
1.032
247.6
313 JOSEPH1
71.5
16.0R
70110 COG19NEB
113.7
-120.6
771 AMELIA1
-113.5
120.5
76.5
-141.4
1.035
248.4
109 DEERLAN4
-186.9
4.3
-76.2
141.0
1.051
252.3
936 808L_TAP
948 808_BNDY
1.026
141.6
1.025
141.4
1420 WEASEL1
18420 WEASEL2
1.038
1.4
1.022
141.1
954 ABEE_01
2954 ABEE_02
1.022
4.3
1.021
140.9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
2050 GRANITE9
50 RIVERSID
3050 REDW GT
1.026
141.6
1.030
14.2
821 3708ALTAP
1.027
141.7
1.026
141.6
57 LAMOURE4
-64.7
-78.7
-202.3
-65.0
1.021
245.1
63 LAMOURE7
49.5
-36.9
30.7
-11.1
30.2
57.5
55.9
1.041
143.7
922 ROSS TAP
1.039
143.4
45 ROSS CRK
1.039
143.4
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
200.0
51.1R
2836 LAMONT_LV3
248.0
70.9R
1.027
246.5
202.5
66.3
314 JOSEPH2
57.0
25.7
-98.1
-59.2
-98.5
-59.4
735 SHELL TP
-39.4
39.4
18.2
-18.2
1.029
142.0
734 SHELL A1
-71.6
-16.1
-13.3
21.0
1.029
142.0
628 ALC SCOT
1.028
141.9
43 SCOT4_7
38.8
36.6
-53.6
-57.6
-31.9
-6.8
1.030
142.1
185 SCOT4_8
1.030
142.2
7185 SCOTF ST
68.1
34.4R
1.030
14.2
4185 SCOTF GT
70.2
31.9R
1.030
14.2
627 AIR LIQC
68.1
26.2R
1.030
14.2
106 DEERLAN2
21.0
20.3
-63.3
-32.7
42.3
12.4
1.034
142.8
67 BRUDERH7
-42.2
-12.6
0.4
0.1
-0.4
-0.3
394 ASTOTIN
1.030
142.2
391 ALBCHEM7
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-0.1
1.033
142.5
1.030
142.2
32.1
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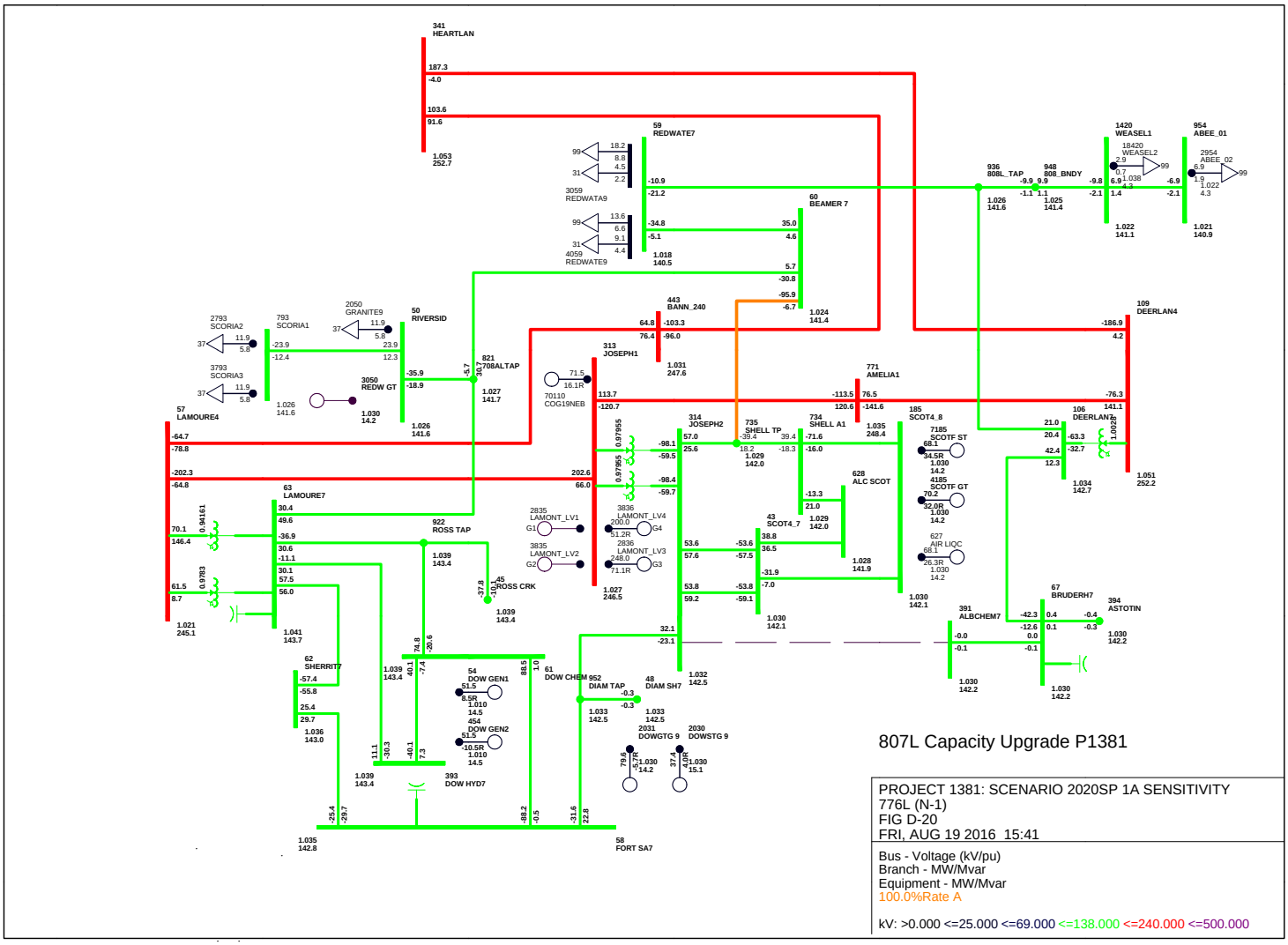
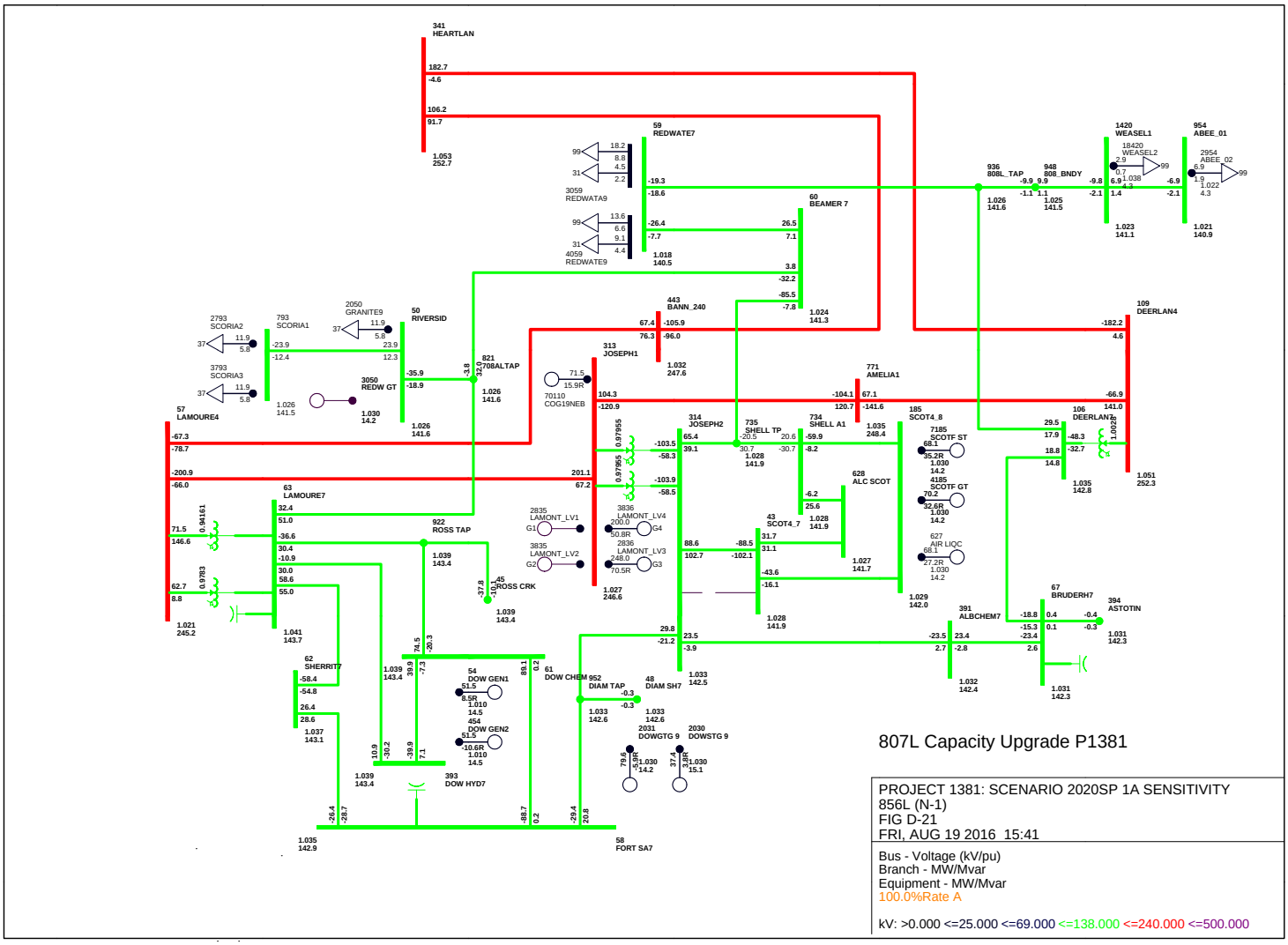
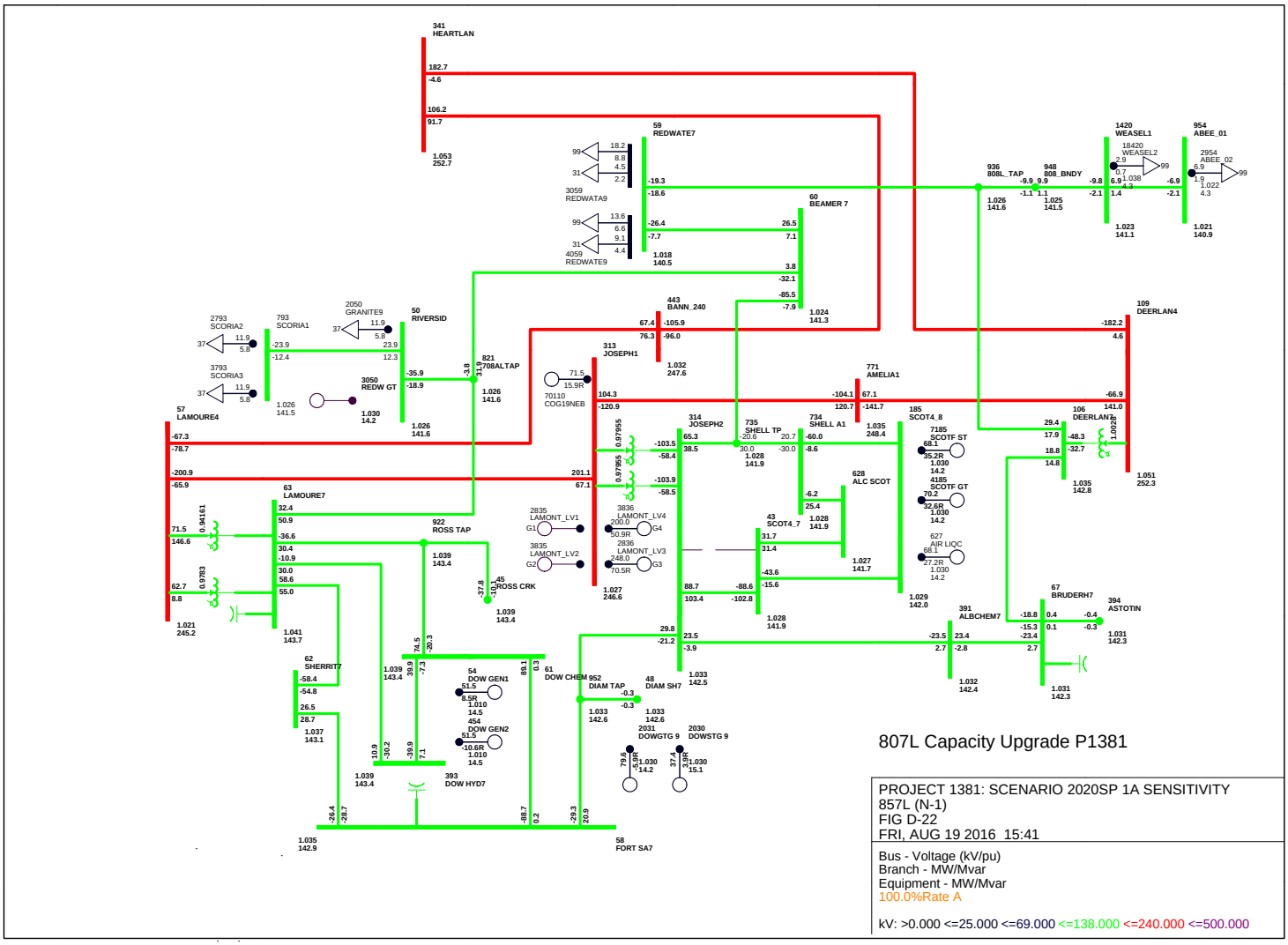
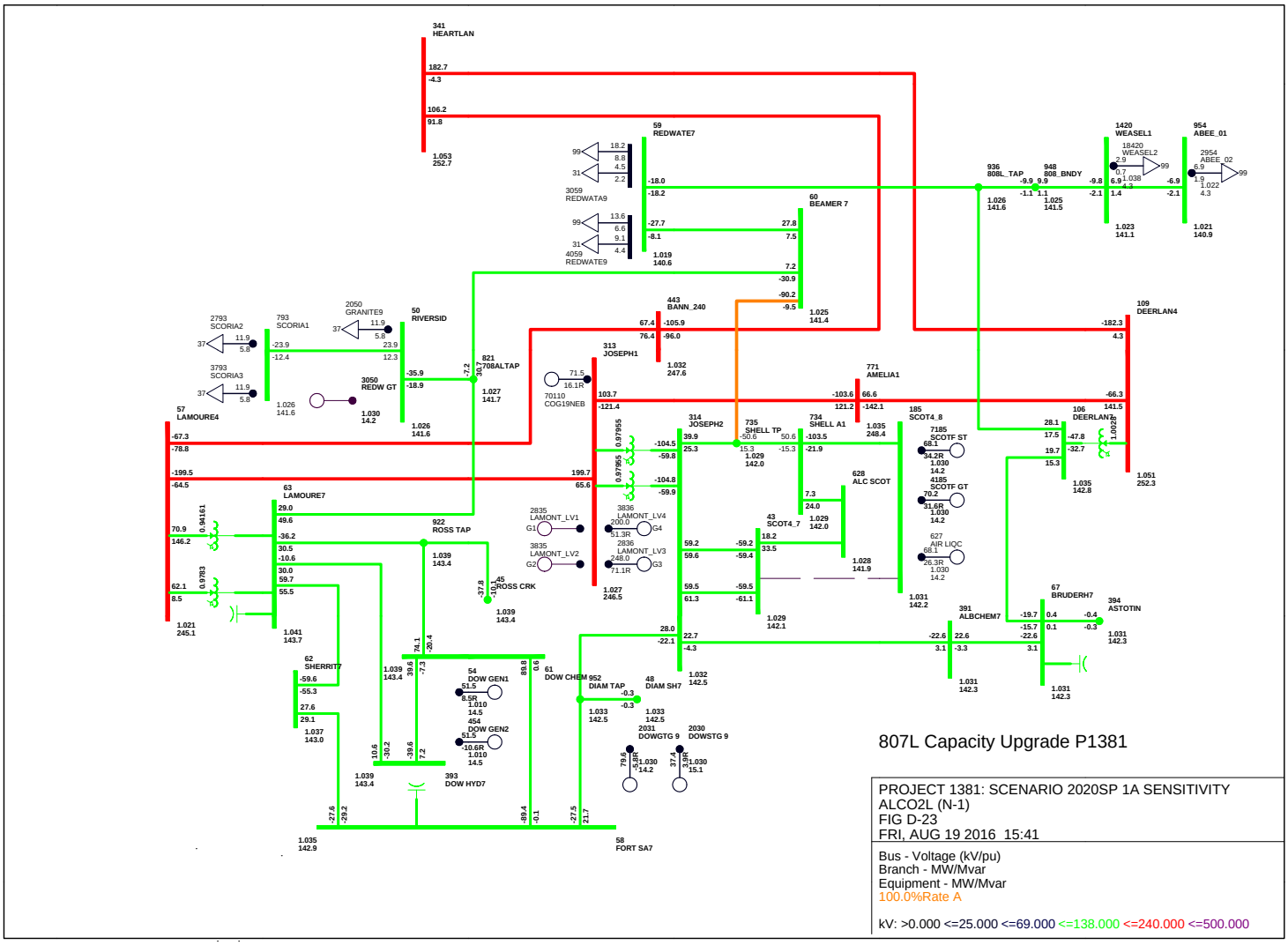
0.0
-1.3
1.033
142.5
952 DIAM TAP
-0.3
-0.3
48 DIAM SH7
1.033
142.5
1.033
142.5
61 DOW CHEM
88.5
0.9
-88.2
-0.4
-31.6
22.6
58 FORT SA7
1.035
142.9
62 SHERRIT7
-57.4
-55.7
25.4
29.6
1.037
143.0
54 DOW GEN1
51.5
8.5R
1.010
14.5
454 DOW GEN2
51.5
-10.6R
1.010
14.5
393 DOW HYD7
1.039
143.4
24.9
20.6
-7.4
-40.1
7.3
-30.3
111.1
-25.4
29.6
2031 DOWGTG 9
79.6
-51.9R
1.030
14.2
2030 DOWSTG 9
37.4
31.9R
1.030
15.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
773L (N-1)
FIG D-19
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
776L (N-1)
FIG D-20
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
182.7
-4.6
106.2
91.7
1.053
252.7
59 REDWATE7
99
18.2
8.8
31
4.5
2.2
3059 REDWATA9
-19.3
-18.6
99
13.6
6.6
31
9.1
4.4
4059 REDWATE9
-26.4
-7.7
26.5
7.1
1.018
140.5
60 BEAMER 7
3.8
-32.2
-85.5
-7.8
1.024
141.3
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
99
1.026
141.6
1.025
141.5
1.023
141.1
1.021
140.9
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
821 2708ALTAP
1.026
141.6
1.030
14.2
57 LAMOURE4
-67.3
-78.7
-200.9
-66.0
1.021
245.2
63 LAMOURE7
922 ROSS TAP
1.039
143.4
45 ROSS CRK
1.027
246.6
1.039
143.4
1.041
143.7
62 SHERRIT7
1.037
143.1
1.035
142.9
54 DOW GEN1
454 DOW GEN2
1.010
14.5
393 DOW HYD7
61 DOW CHEM
58 FORT SA7
443 BANN_240
67.4
-105.9
76.3
-96.0
1.032
247.6
313 JOSEPH1
71.5
15.9R
70110 COG19NEB
104.3
-120.9
201.1
67.2
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
50.8R
70.5R
314 JOSEPH2
65.4
39.1
-103.5
-58.3
-103.9
-58.5
735 SHELL TP
30.7
1.028
141.9
734 SHELL A1
1.035
248.4
771 AMELIA1
-104.1
120.7
67.1
-141.6
628 ALC SCOT
1.027
141.7
43 SCOT4_7
88.6
102.7
-88.5
-102.1
31.7
31.1
-43.6
-16.1
1.028
141.9
1.029
142.0
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
1.030
14.2
109 DEERLAN4
-182.2
4.6
-66.9
141.0
106 DEERLAN3
1.051
252.3
1.035
142.8
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
1.031
142.3
1.032
142.4
952 DIAM TAP
48 DIAM SH7
1.033
142.5
1.033
142.6
2031 DOWGTG 9
2030 DOWSTG 9
1.030
14.2
1.030
15.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
856L (N-1)
FIG D-21
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
857L (N-1)
FIG D-22
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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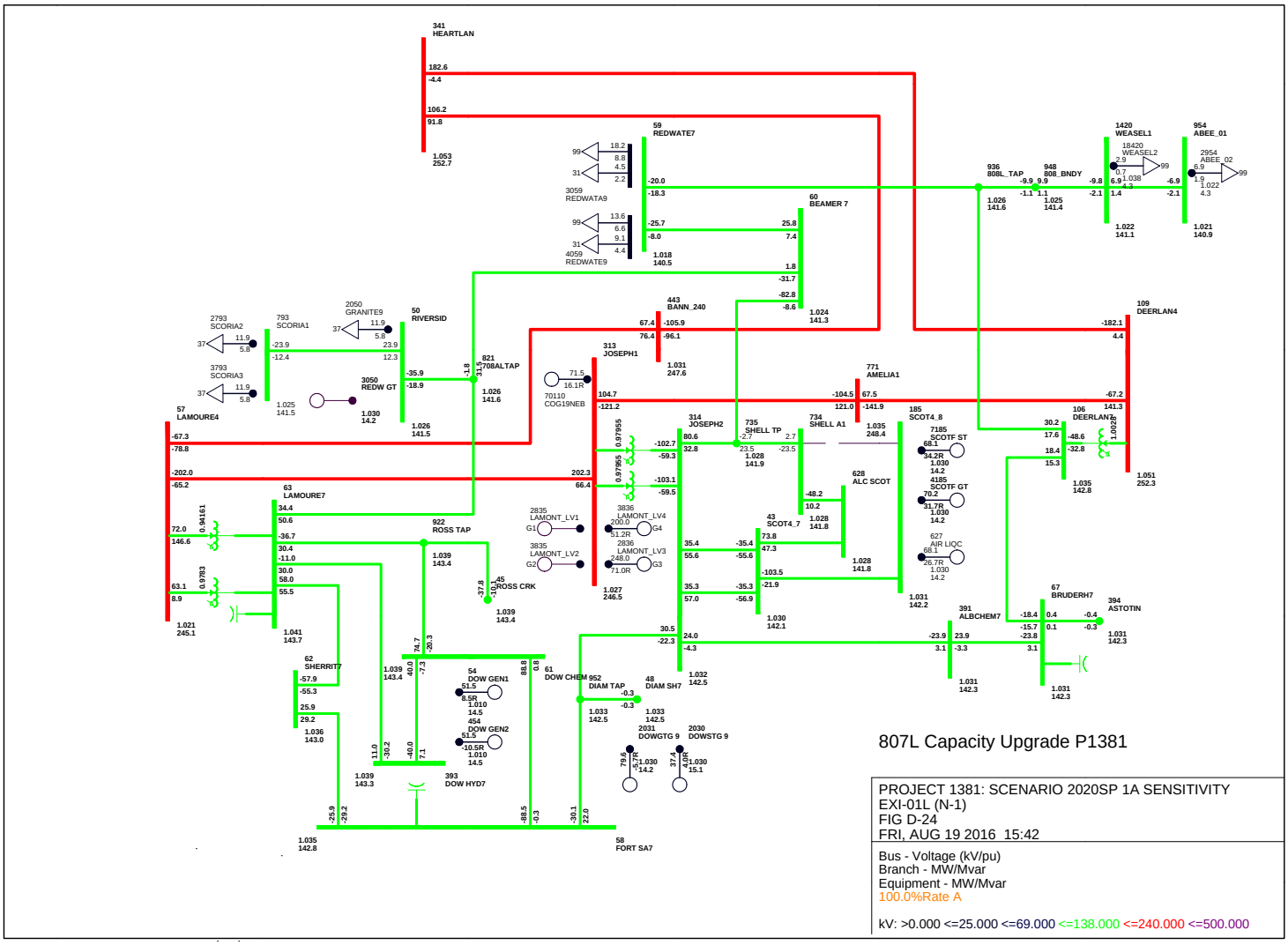
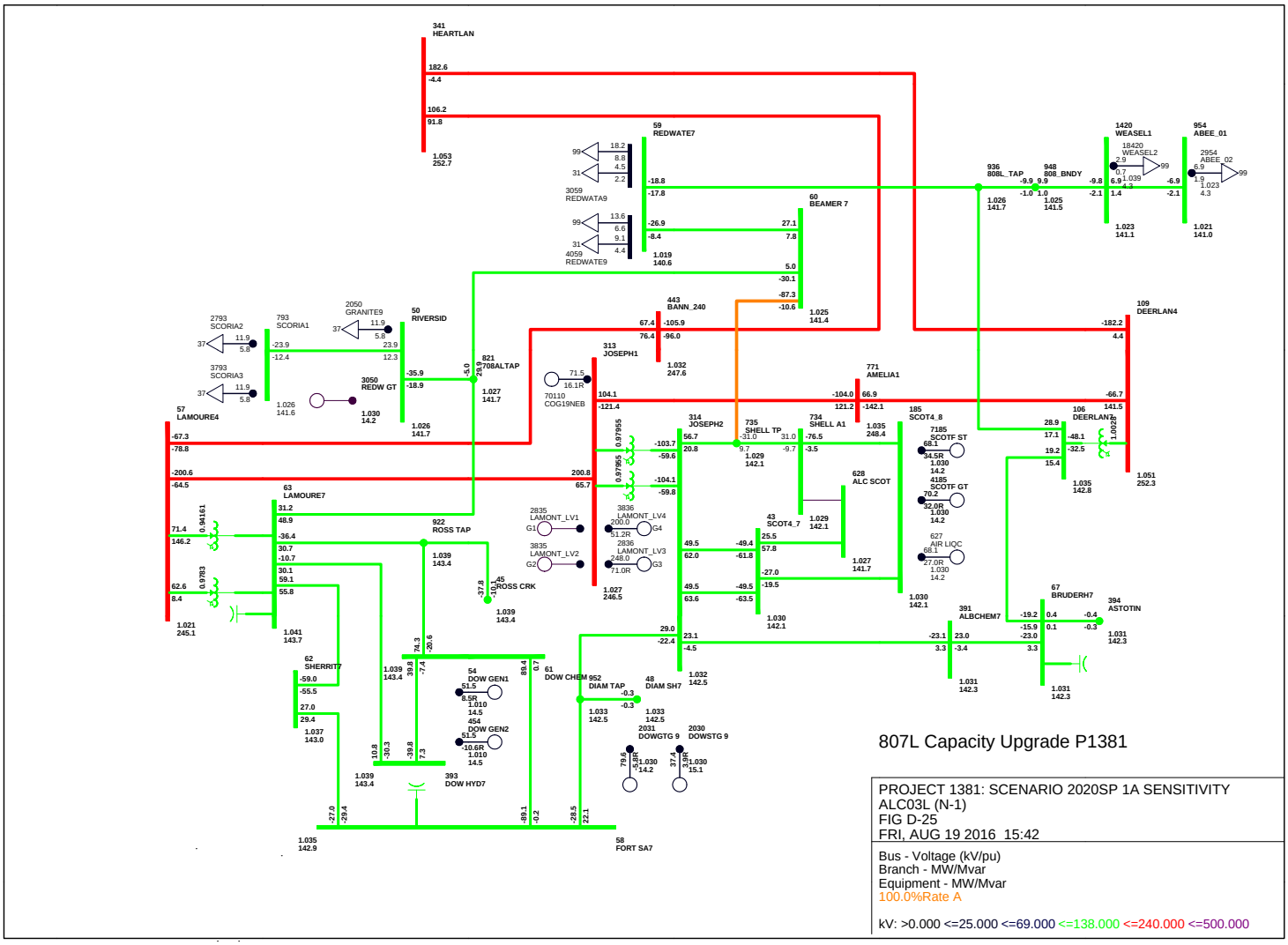
-4.3
106.2
91.8
1.053
252.7
59 REDWATE7
18.2
8.8
4.5
2.2
-18.0
-18.2
3059 REDWATA9
13.6
6.6
9.1
4.4
-27.7
-8.1
4059 REDWATE9
1.019
140.6
60 BEAMER 7
27.8
7.5
7.2
-30.9
-90.2
-9.5
1.025
141.4
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.026
141.6
1.025
141.5
1.023
141.1
1.021
140.9
443 BANN_240
67.4
-105.9
76.4
-96.0
1.032
247.6
109 DEERLAN4
-182.3
4.3
-66.3
141.5
1.051
252.3
2050 GRANITE9
50 RIVERSID
2793 SCORIA2
793 SCORIA1
3793 SCORIA3
3050 REDW GT
1.026
141.6
1.030
14.2
821 6708ALTAP
-35.9
-18.9
30.7
-7.2
1.027
141.7
313 JOSEPH1
71.5
16.1R
70110 COG19NEB
103.7
-121.4
771 AMELIA1
-103.6
121.2
66.6
-142.1
57 LAMOURE4
-67.3
-78.8
-199.5
-64.5
63 LAMOURE7
29.0
49.6
-36.2
30.5
-10.6
30.0
59.7
55.5
1.041
143.7
922 ROSS TAP
1.039
143.4
45 ROSS CRK
-37.8
-10.1
1.039
143.4
199.7
65.6
0.97955
0.97955
-104.8
-59.9
-104.5
-59.8
314 JOSEPH2
39.9
25.3
735 SHELL TP
-50.6
50.6
15.3
-15.3
1.029
142.0
734 SHELL A1
-103.5
-21.9
1.035
248.4
185 SCOT4_8
7185 SCOTF ST
68.1
34.2R
1.030
14.2
4185 SCOTF GT
70.2
31.6R
1.030
14.2
106 DEERLAN3
28.1
17.5
-47.8
-32.7
19.7
15.3
1.035
142.8
1.0028
1.0028
0.94161
0.9783
70.9
146.2
62.1
8.5
1.021
245.1
2835 LAMONT_LV1
G1
3835 LAMONT_LV2
G2
3836 LAMONT_LV4
200.0
51.3R
G4
2836 LAMONT_LV3
248.0
71.1R
G3
1.027
246.5
59.2
59.6
-59.2
-59.4
43 SCOT4_7
18.2
33.5
1.028
141.9
7.3
24.0
1.029
142.0
628 ALC SCOT
627 AIR LIQC
68.1
26.3R
1.030
14.2
59.5
61.3
-59.5
-61.1
1.029
142.1
1.031
142.2
67 BRUDERH7
394 ASTOTIN
391 ALBCHEM7
-19.7
-15.7
-22.6
0.4
0.1
-0.4
-0.3
1.031
142.3
1.031
142.3
28.0
-22.1
22.7
-4.3
-22.6
3.1
22.6
-3.3
3.1
1.031
142.3
62 SHERRIT7
-59.6
-55.3
27.6
29.1
1.037
143.0
74.1
20.4
39.6
-7.3
89.8
0.6
54 DOW GEN1
51.5
8.5R
1.010
14.5
454 DOW GEN2
51.5
-10.6R
1.010
14.5
61 DOW CHEM
952 DIAM TAP
-0.3
-0.3
48 DIAM SH7
1.032
142.5
1.033
142.5
1.033
142.5
2031 DOWGTG 9
79.6
-51.3R
1.030
14.2
2030 DOWSTG 9
37.4
31.3R
1.030
15.1
10.6
-30.2
-39.6
7.2
1.039
143.4
393 DOW HYD7
-27.6
-29.2
-89.4
-0.1
-27.5
21.7
1.035
142.9
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
ALCO2L (N-1)
FIG D-23
FRI, AUG 19 2016 15:41
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
EXI-01L (N-1)
FIG D-24
FRI, AUG 19 2016 15:42
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

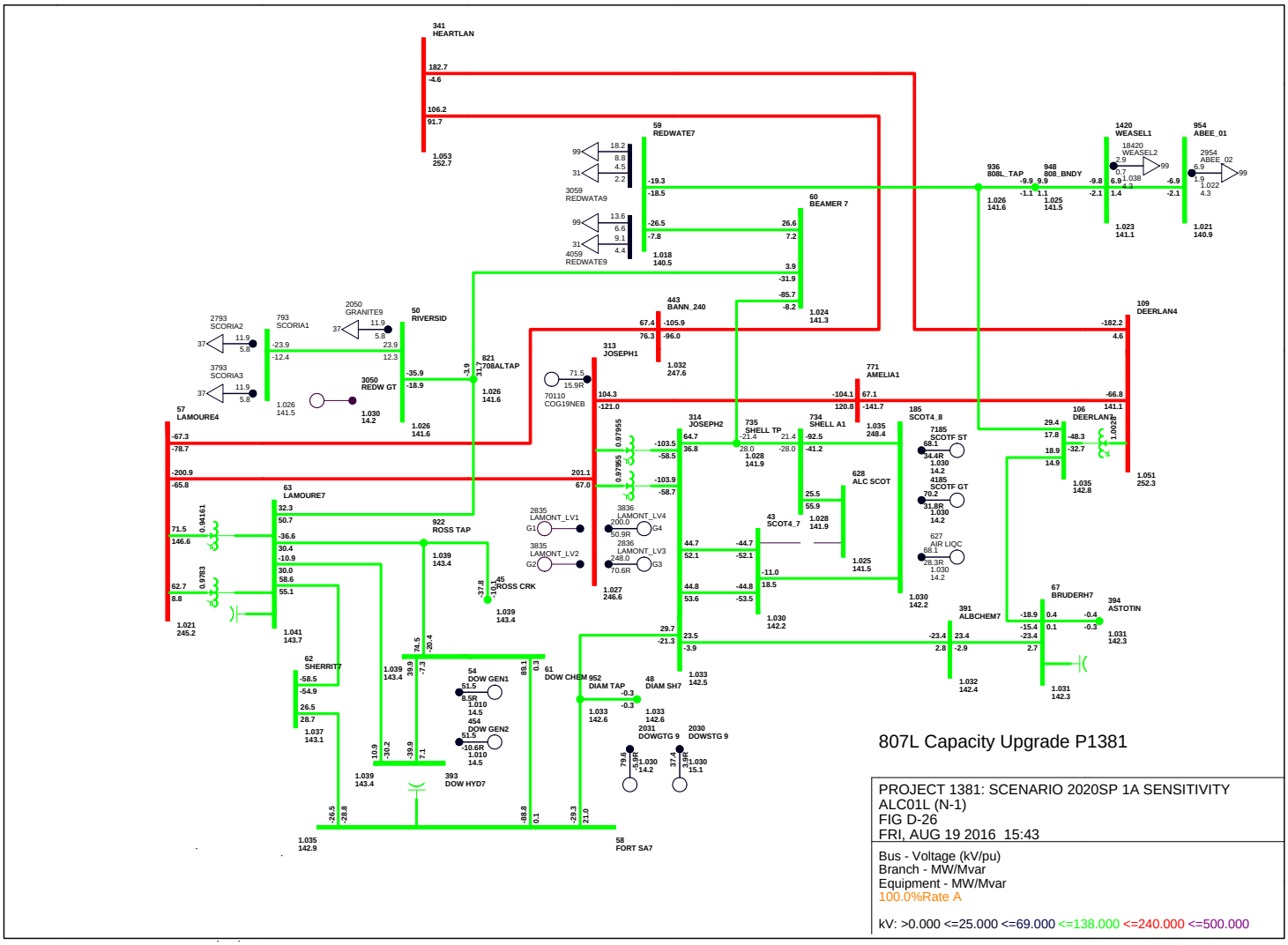


807L Capacity Upgrade P1381

PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
ALC03L (N-1)
FIG D-25
FRI, AUG 19 2016 15:42

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

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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-4.6
106.2
91.7
1.053
252.7
59 REDWATE7
99
18.2
8.8
4.5
31
2.2
3059 REDWATA9
-19.3
-18.5
99
13.6
6.6
9.1
31
4.4
4059 REDWATE9
-26.5
-7.8
1.018
140.5
60 BEAMER 7
26.6
7.2
3.9
-31.9
-85.7
-8.2
1.024
141.3
443 BANN_240
67.4
76.3
-105.9
-96.0
1.032
247.6
313 JOSEPH1
104.3
-121.0
71.5
15.9R
70110 COG19NEB
821 1708ALTAP
-3.9
31.7
-35.9
-18.9
1.026
141.6
50 RIVERSID
2050 GRANITE9
37
11.9
5.8
23.9
12.3
793 SCORIA1
-23.9
-12.4
2793 SCORIA2
3793 SCORIA3
3050 REDW GT
1.026
141.5
1.030
14.2
57 LAMOURE4
-67.3
-78.7
-200.9
-65.8
1.021
245.2
63 LAMOURE7
32.3
50.7
-36.6
30.4
-10.9
30.0
58.6
55.1
1.041
143.7
0.94161
0.9783
71.5
146.6
62.7
8.8
922 ROSS TAP
1.039
143.4
45 ROSS CRK
-37.8
-10.1
1.039
143.4
2835 LAMONT_LV1
G1
3835 LAMONT_LV2
G2
3836 LAMONT_LV4
200.0
50.9R
G4
2836 LAMONT_LV3
248.0
70.6R
G3
1.027
246.6
0.97955
0.97955
201.1
67.0
314 JOSEPH2
64.7
36.8
-103.5
-58.5
-103.9
-58.7
735 SHELL TP
-21.4
28.0
1.028
141.9
21.4
-28.0
734 SHELL A1
-92.5
-41.2
25.5
55.9
1.028
141.9
628 ALC SCOT
1.025
141.5
43 SCOT4_7
44.7
52.1
-44.7
-52.1
44.8
53.6
-44.8
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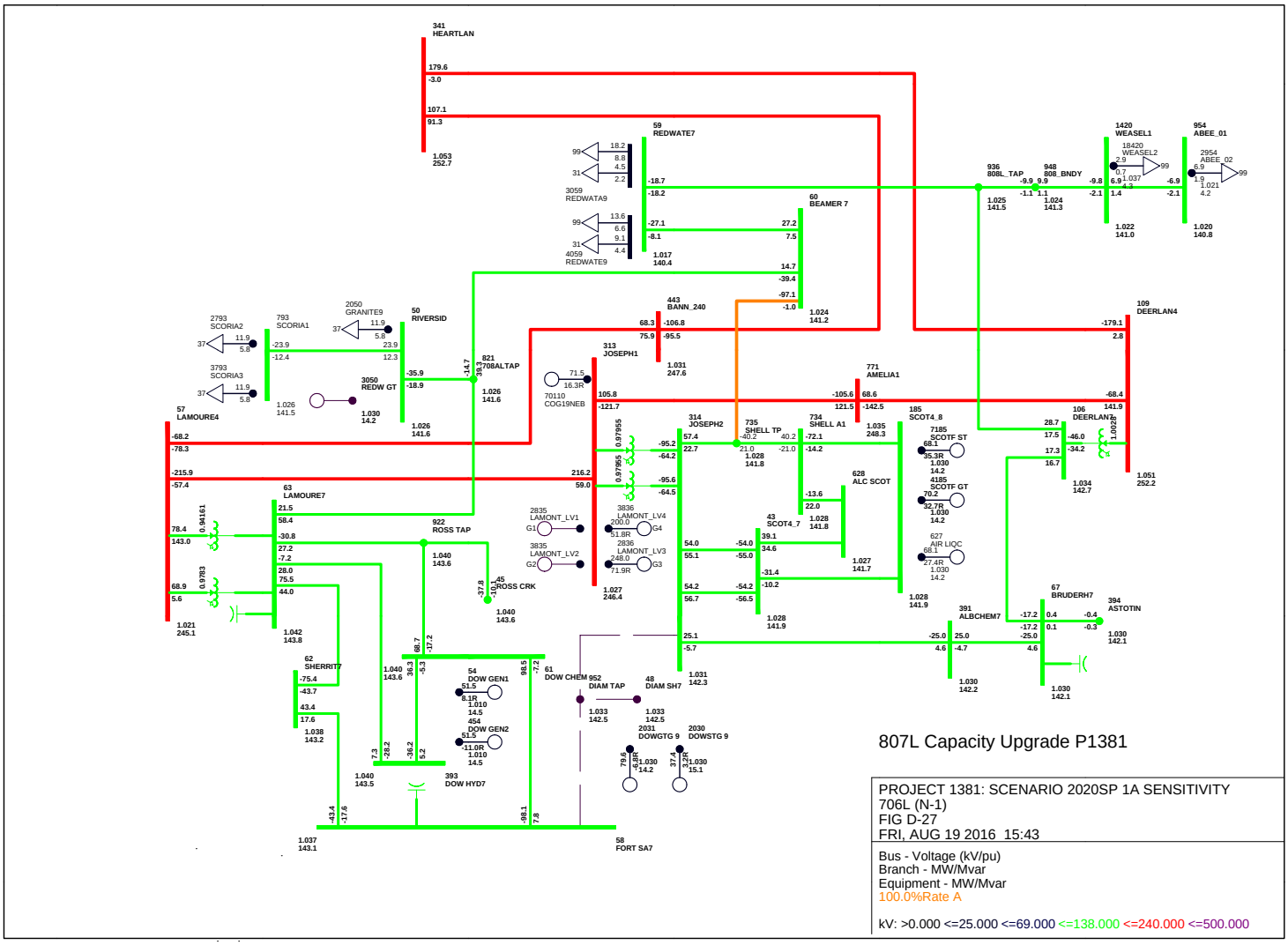
-11.0
18.5
1.030
142.2
771 AMELIA1
-104.1
120.8
67.1
-141.7
1.035
248.4
185 SCOT4_8
7185 SCOTF ST
68.1
34.4R
1.030
14.2
4185 SCOTF GT
70.2
31.8R
1.030
14.2
627 AIR LIQC
68.1
28.3R
1.030
14.2
1.030
142.2
109 DEERLAN4
-182.2
4.6
-66.8
141.1
106 DEERLAN2
1.0028
29.4
17.8
-48.3
-32.7
18.9
14.9
1.035
142.8
1.051
252.3
67 BRUDERH7
-18.9
-15.4
-23.4
0.4
0.1
-0.4
-0.3
1.031
142.3
391 ALBCHEM7
-23.4
2.8
23.4
-2.9
2.7
1.032
142.4
394 ASTOTIN
1.031
142.3
29.7
-21.3
23.5
-3.9
1.033
142.5
61 DOW CHEM
952 DIAM TAP
-0.3
-0.3
48 DIAM SH7
1.033
142.6
1.033
142.6
2031 DOWGTG 9
79.6
-51.9R
1.030
14.2
2030 DOWSTG 9
37.4
-31.9R
1.030
15.1
62 SHERRIT7
-58.5
-54.9
26.5
28.7
1.037
143.1
54 DOW GEN1
51.5
8.5R
1.010
14.5
454 DOW GEN2
51.5
-10.6R
1.010
14.5
393 DOW HYD7
1.039
143.4
24.5
20.4
39.9
-7.3
89.1
0.3
10.9
-30.2
-39.9
7.1
-26.5
29.8
-88.8
0.1
-29.3
21.0
1.035
142.9
58 FORT SA7
936 808L_TAP
-9.9
-1.1
948 808_BNDY
9.9
1.1
1.026
141.6
1.025
141.5
-9.8
-2.1
1420 WEASEL1
18420 WEASEL2
2.9
0.7
99
1.038
4.3
6.9
1.4
954 ABEE_01
2954 ABEE_02
6.9
1.9
99
1.022
4.3
-6.9
-2.1
1.023
141.1
1.021
140.9
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
ALC01L (N-1)
FIG D-26
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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HEARTLAN
179.6
-3.0
107.1
91.3
1.053
252.7
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REDWATE7
18.2
8.8
4.5
2.2
-18.7
-18.2
3059
REDWATA9
13.6
6.6
9.1
4.4
-27.1
-8.1
1.017
140.4
27.2
7.5
14.7
-39.4
-97.1
-1.0
1.024
141.2
60
BEAMER 7
936
808L_TAP
948
808_BNDY
1420
WEASEL1
18420
WEASEL2
954
ABEE_01
2954
ABEE_02
1.037
1.021
1.025
141.5
1.024
141.3
1.022
141.0
1.020
140.8
2050
GRANITE9
2793
SCORIA2
793
SCORIA1
3793
SCORIA3
50
RIVERSID
3050
REDW GT
1.026
141.5
1.030
14.2
1.026
141.6
821
8708ALTAP
443
BANN_240
1.031
247.6
313
JOSEPH1
71.5
16.3R
70110
COG19NEB
105.8
-121.7
68.3
75.9
-106.8
-95.5
109
DEERLAN4
-179.1
2.8
771
AMELIA1
-105.6
121.5
68.6
-142.5
-68.4
141.9
57
LAMOURE4
-68.2
-78.3
-215.9
-57.4
216.2
59.0
63
LAMOURE7
21.5
58.4
-30.8
27.2
-7.2
28.0
75.5
44.0
922
ROSS TAP
1.040
143.6
45
ROSS CRK
-37.8
-10.1
1.040
143.6
1.027
246.4
0.97955
0.97955
314
JOSEPH2
57.4
22.7
-95.2
-64.2
-95.6
-64.5
735
SHELL TP
-40.2
40.2
21.0
-21.0
1.028
141.8
734
SHELL A1
-72.1
-14.2
-13.6
22.0
1.028
141.8
1.035
248.3
628
ALC SCOT
1.027
141.7
185
SCOT4_8
7185
SCOTF ST
35.3R
1.030
14.2
4185
SCOTF GT
70.2
32.7R
1.030
14.2
627
AIR LIQC
68.1
27.4R
1.030
14.2
106
DEERLAN2
1.0028
28.7
17.5
-46.0
-34.2
17.3
16.7
1.034
142.7
1.051
252.2
2835
LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
200.0
51.8R
2836
LAMONT_LV3
248.0
71.9R
43
SCOT4_7
39.1
34.6
-31.4
-10.2
1.028
141.9
54.0
55.1
-54.0
-55.0
54.2
56.7
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-56.5
25.1
-5.7
1.028
141.9
391
ALBCHEM7
-25.0
25.0
-4.7
4.6
1.030
142.2
67
BRUDERH7
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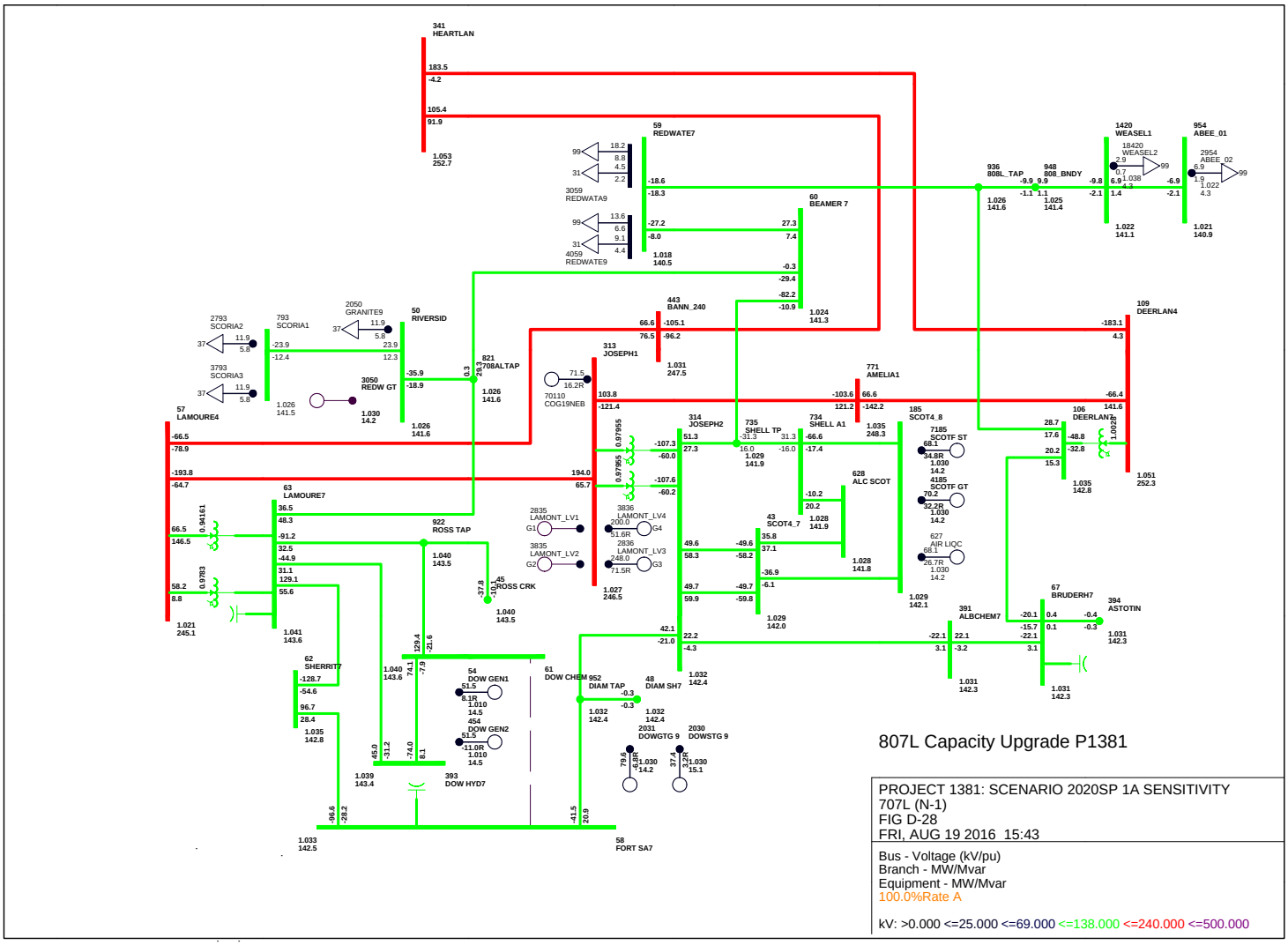
0.4
-0.4
-17.2
0.1
-25.0
4.6
-0.3
1.030
142.1
394
ASTOTIN
1.030
142.1
0.94161
0.9783
78.4
143.0
68.9
5.6
1.021
245.1
1.042
143.8
62
SHERRIT7
-75.4
-43.7
43.4
17.6
1.038
143.2
1.040
143.6
88.7
-17.2
39.3
-5.3
54
DOW GEN1
51.5
8.1R
1.010
14.5
454
DOW GEN2
51.5
-11.0R
1.010
14.5
98.5
-7.2
61
DOW CHEM
952
DIAM TAP
1.033
142.5
48
DIAM SH7
1.031
142.3
1.033
142.5
2031
DOWGTG 9
2030
DOWSTG 9
79.6
45.8R
1.030
14.2
37.4
31.2R
1.030
15.1
7.3
-28.2
-36.2
5.2
1.040
143.5
393
DOW HYD7
-43.4
-17.6
-98.1
7.8
1.037
143.1
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
706L (N-1)
FIG D-27
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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2.2
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6.6
9.1
4.4
4059 REDWATE9
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-18.3
-27.2
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140.5
60 BEAMER 7
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7.4
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-29.4
-82.2
-10.9
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141.3
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.026 141.6
1.025 141.4
1.022 141.1
1.021 140.9
443 BANN_240
66.6
76.5
-105.1
-96.2
1.031
247.5
109 DEERLAN4
-183.1
4.3
-66.4
141.6
1.051
252.3
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.026 141.5
1.030 14.2
821 2708ALTAP
1.026 141.6
313 JOSEPH1
71.5
16.2R
70110 COG19NEB
103.8
-121.4
771 AMELIA1
-103.6
121.2
66.6
-142.2
1.035
248.3
57 LAMOURE4
-66.5
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1.021
245.1
63 LAMOURE7
36.5
48.3
-91.2
32.5
-44.9
31.1
129.1
55.6
1.041
143.6
922 ROSS TAP
1.040
143.5
45 ROSS CRK
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-10.1
1.040
143.5
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3835 LAMONT_LV2
3836 LAMONT_LV4
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2836 LAMONT_LV3
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1.027
246.5
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0.97955
0.97955
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51.3
27.3
-107.3
-60.0
-107.6
-60.2
735 SHELL TP
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1.029
141.9
31.3
-16.0
734 SHELL A1
-66.6
-17.4
-10.2
20.2
1.028
141.9
628 ALC SCOT
1.028
141.8
43 SCOT4_7
35.8
37.1
-36.9
-6.1
1.029
142.0
49.6
58.3
-49.6
-58.2
49.7
59.9
-49.7
-59.8
185 SCOT4_8
7185 SCOTF ST
68.1
34.8R
1.030
14.2
4185 SCOTF GT
70.2
32.2R
1.030
14.2
627 AIR LIQC
68.1
26.7R
1.030
14.2
1.029
142.1
106 DEERLAN3
28.7
17.6
-48.8
-32.8
20.2
15.3
1.035
142.8
1.0028
67 BRUDERH7
-20.1
-15.7
-22.1
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0.1
-0.4
-0.3
1.031
142.3
391 ALBCHEM7
-22.1
3.1
22.1
-3.2
3.1
1.031
142.3
394 ASTOTIN
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62 SHERRIT7
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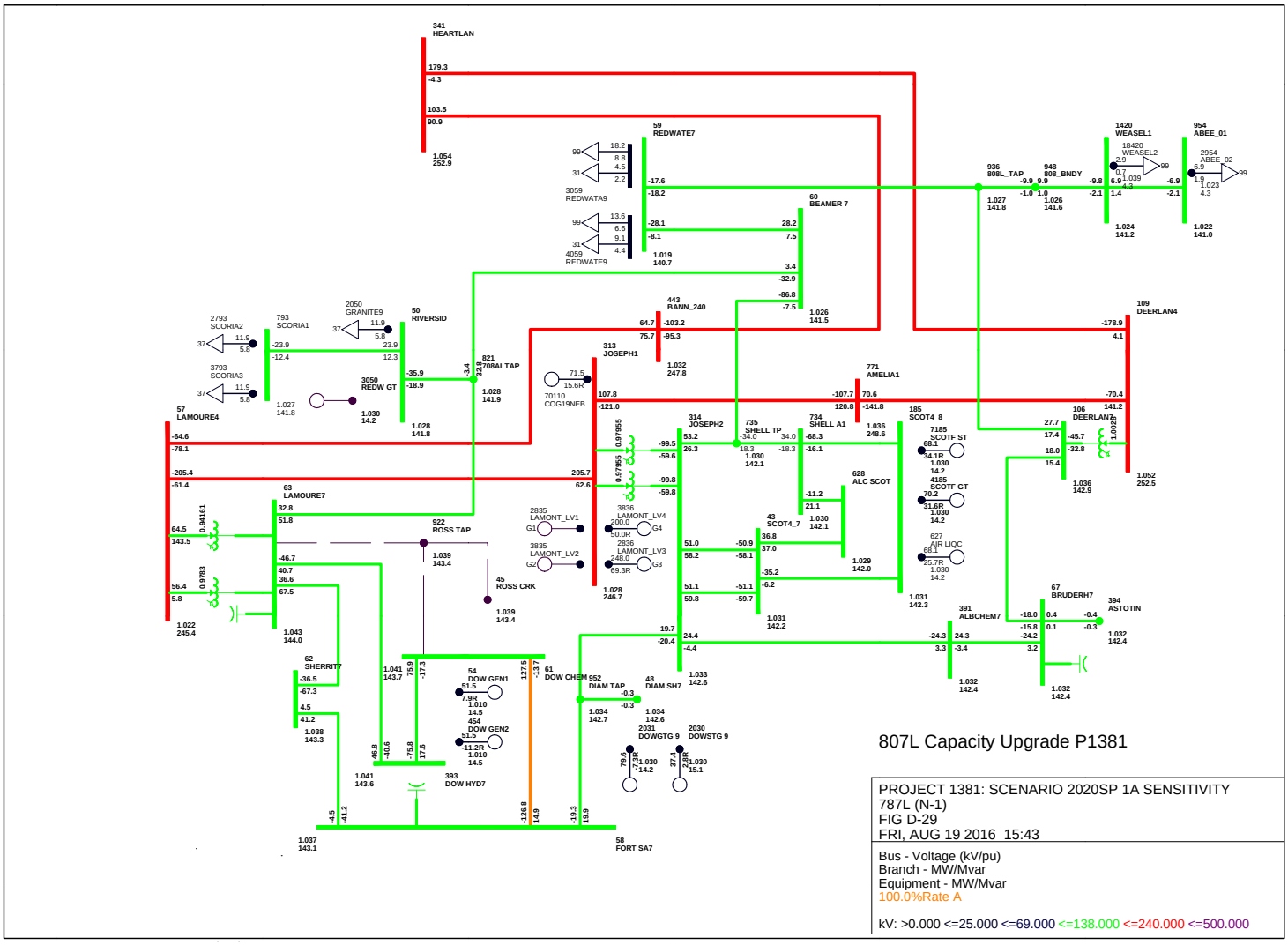
96.7
28.4
1.035
142.8
129.4
21.6
74.1
-7.9
1.040
143.6
54 DOW GEN1
51.5
8.1R
1.010
14.5
454 DOW GEN2
51.5
-11.0R
1.010
14.5
61 DOW CHEM
952 DIAM TAP
-0.3
-0.3
48 DIAM SH7
1.032
142.4
1.032
142.4
2031 DOWGTG 9
79.6
45.0R
1.030
14.2
2030 DOWSTG 9
37.4
31.2R
1.030
15.1
45.0
-31.2
-74.0
8.1
1.039
143.4
393 DOW HYD7
-96.6
-29.2
-41.5
20.9
1.033
142.5
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
707L (N-1)
FIG D-28
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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2.2
-17.6
-18.2
3059 REDWATA9
13.6
6.6
9.1
4.4
-28.1
-8.1
4059 REDWATE9
1.019
140.7
60 BEAMER 7
28.2
7.5
3.4
-32.9
-86.8
-7.5
1.026
141.5
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.027
141.8
1.026
141.6
1.024
141.2
1.022
141.0
1.039
1.023
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.027
141.8
1.030
14.2
1.028
141.8
821 2708ALTAP
1.028
141.9
443 BANN_240
64.7
75.7
-103.2
-95.3
1.032
247.8
313 JOSEPH1
71.5
15.6R
70110 COG19NEB
107.8
-121.0
771 AMELIA1
-107.7
120.8
70.6
-141.8
109 DEERLAN4
-178.9
4.1
-70.4
141.2
57 LAMOURE4
-64.6
-78.1
-205.4
-61.4
63 LAMOURE7
32.8
51.8
205.7
62.6
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0.9783
64.5
143.5
56.4
5.8
1.022
245.4
1.043
144.0
922 ROSS TAP
1.039
143.4
45 ROSS CRK
1.039
143.4
2835 LAMONT_LV1
2836 LAMONT_LV3
3835 LAMONT_LV2
3836 LAMONT_LV4
200.0
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248.0
69.3R
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246.7
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0.97955
314 JOSEPH2
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26.3
-99.5
-59.6
-99.8
-59.8
735 SHELL TP
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34.0
18.3
-18.3
1.030
142.1
734 SHELL A1
-68.3
-16.1
1.036
248.6
185 SCOT4_8
7185 SCOTF ST
68.1
34.1R
1.030
14.2
4185 SCOTF GT
70.2
31.6R
1.030
14.2
106 DEERLAN3
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27.7
17.4
-45.7
-32.8
18.0
15.4
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142.9
1.052
252.5
628 ALC SCOT
-11.2
21.1
1.030
142.1
43 SCOT4_7
36.8
37.0
-50.9
-58.1
-35.2
-6.2
1.029
142.0
51.0
58.2
51.1
59.8
-51.1
-59.7
1.031
142.2
627 AIR LIQC
68.1
25.7R
1.030
14.2
1.031
142.3
67 BRUDERH7
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0.4
-0.4
-15.8
0.1
-0.3
-24.2
1.032
142.4
391 ALBCHEM7
-24.3
24.3
-3.4
3.2
394 ASTOTIN
19.7
-20.4
24.4
-4.4
1.033
142.6
48 DIAM SH7
952 DIAM TAP
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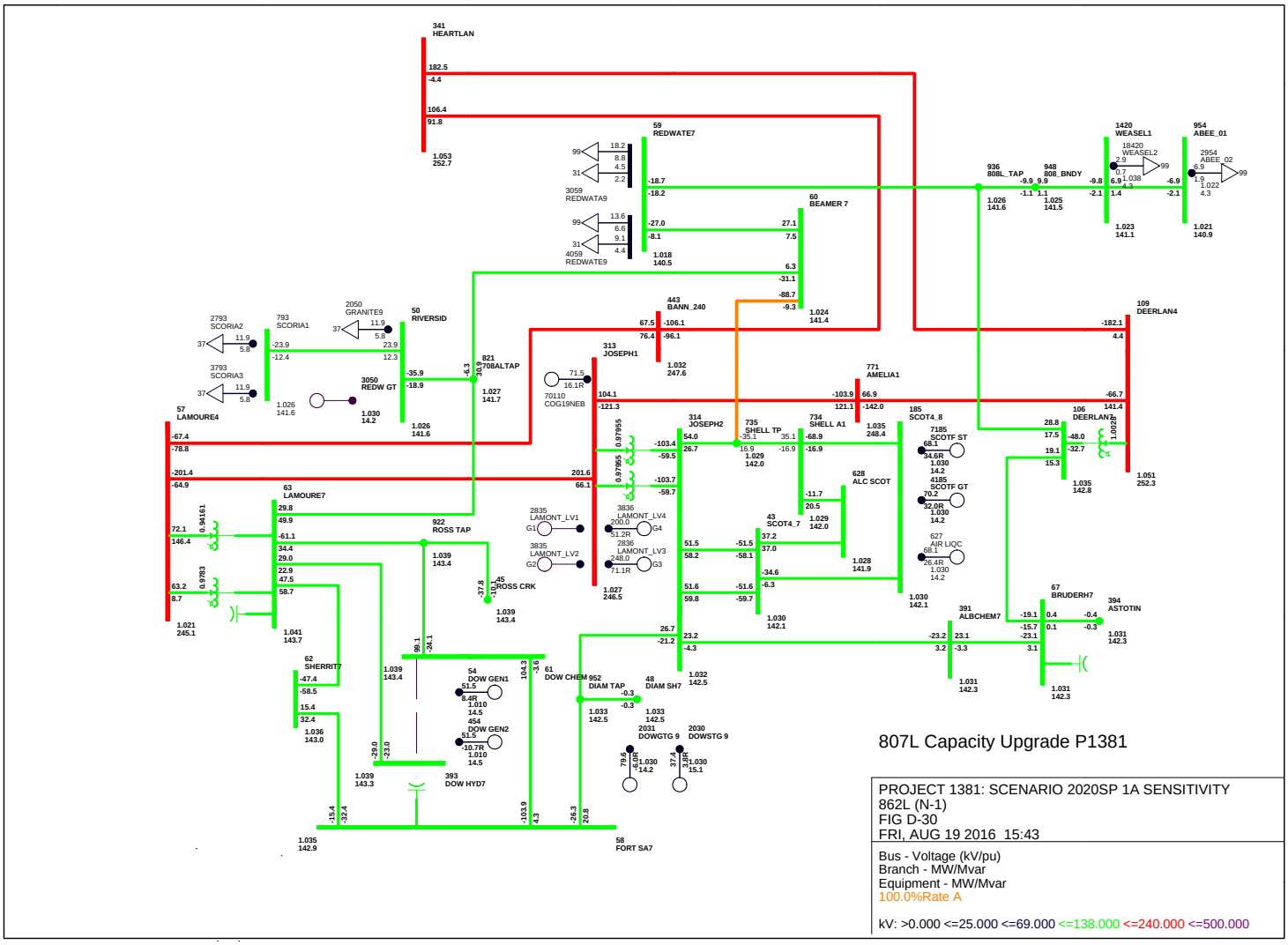
-0.3
1.034
142.7
1.034
142.6
1.032
142.4
62 SHERRIT7
-36.5
-67.3
4.5
41.2
1.038
143.3
1.041
143.7
75.9
-17.3
54 DOW GEN1
51.5
7.3R
1.010
14.5
454 DOW GEN2
51.5
-11.2R
1.010
14.5
61 DOW CHEM
127.5
-13.7
-126.8
14.9
-19.3
19.9
46.8
-40.6
-75.8
17.6
1.041
143.6
393 DOW HYD7
-4.5
-41.2
1.037
143.1
58 FORT SA7
2031 DOWGTG 9
2030 DOWSTG 9
79.6
7.3R
1.030
14.2
37.4
21.8R
1.030
15.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
787L (N-1)
FIG D-29
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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2.2
-18.7
-18.2
3059 REDWATA9
13.6
6.6
9.1
4.4
-27.0
-8.1
4059 REDWATE9
1.018
140.5
60 BEAMER 7
27.1
7.5
6.3
-31.1
-88.7
-9.3
1.024
141.4
443 BANN_240
67.5
76.4
-106.1
-96.1
1.032
247.6
313 JOSEPH1
71.5
16.1R
70110 COG19NEB
104.1
-121.3
201.6
66.1
771 AMELIA1
-103.9
121.1
-142.0
66.9
-66.7
1420 WEASEL1
18420 WEASEL2
2954 ABEE_02
954 ABEE_01
936 808L_TAP
948 808_BNDY
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1.025
141.5
1.023
141.1
1.021
140.9
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4.4
1.051
252.3
106 DEERLAN3
1.035
142.8
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2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.030
14.2
821 8708ALTAP
1.027
141.7
1.026
141.6
57 LAMOURE4
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-201.4
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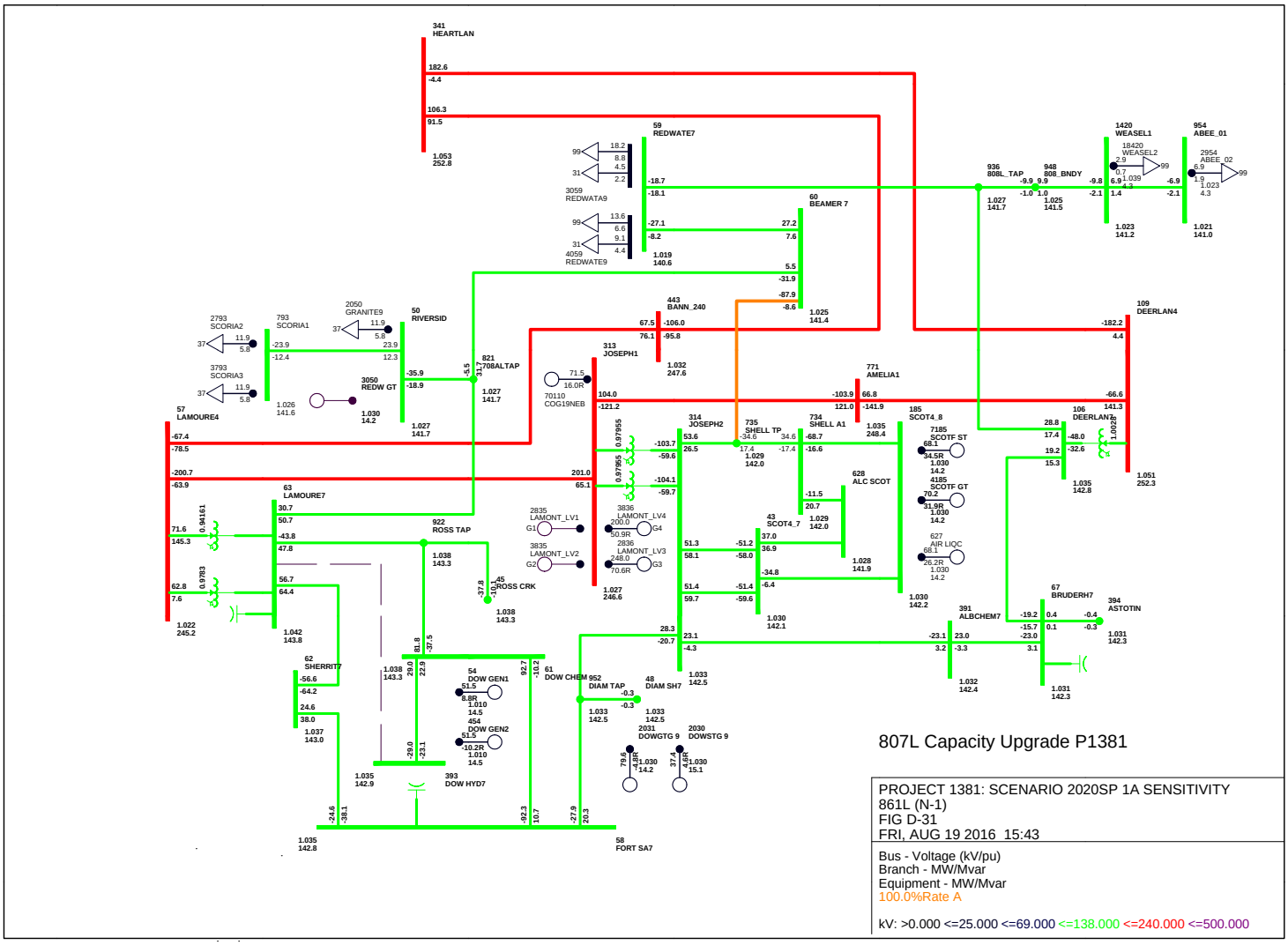
63 LAMOURE7
922 ROSS TAP
1.039
143.4
45 ROSS CRK
1.027
246.5
1.041
143.7
1.021
245.1
62 SHERRIT7
1.036
143.0
1.039
143.3
393 DOW HYD7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.033
142.5
1.032
142.5
2031 DOWGTO 9
2030 DOWSTG 9
1.030
14.2
1.030
15.1
58 FORT SA7
1.035
142.9
314 JOSEPH2
54.0
26.7
-103.4
-59.5
-103.7
-59.7
735 SHELL TP
734 SHELL A1
628 ALC SCOT
1.029
142.0
43 SCOT4_7
1.028
141.9
1.030
142.1
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
1.030
14.2
627 AIR LIQC
67 BRUDERH7
394 ASTOTIN
391 ALBCHEM7
1.031
142.3
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
862L (N-1)
FIG D-30
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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REDWATA9
4059
REDWATE9
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BEAMER 7
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140.6
1.025
141.4
443
BANN_240
1.032
247.6
50
RIVERSID
821
1708ALTAP
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141.7
1.030
14.2
3050
REDW GT
1.026
141.6
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SCORIA2
3793
SCORIA3
793
SCORIA1
2050
GRANITE9
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LAMOURE4
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LAMOURE7
922
ROSS TAP
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ROSS CRK
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143.3
1.027
246.6
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16.0R
70110
COG19NEB
771
AMELIA1
1.035
248.4
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DEERLAN4
1.051
252.3
106
DEERLAN3
1.035
142.8
314
JOSEPH2
735
SHELL TP
1.029
142.0
734
SHELL A1
628
ALC SCOT
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
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SCOT4_7
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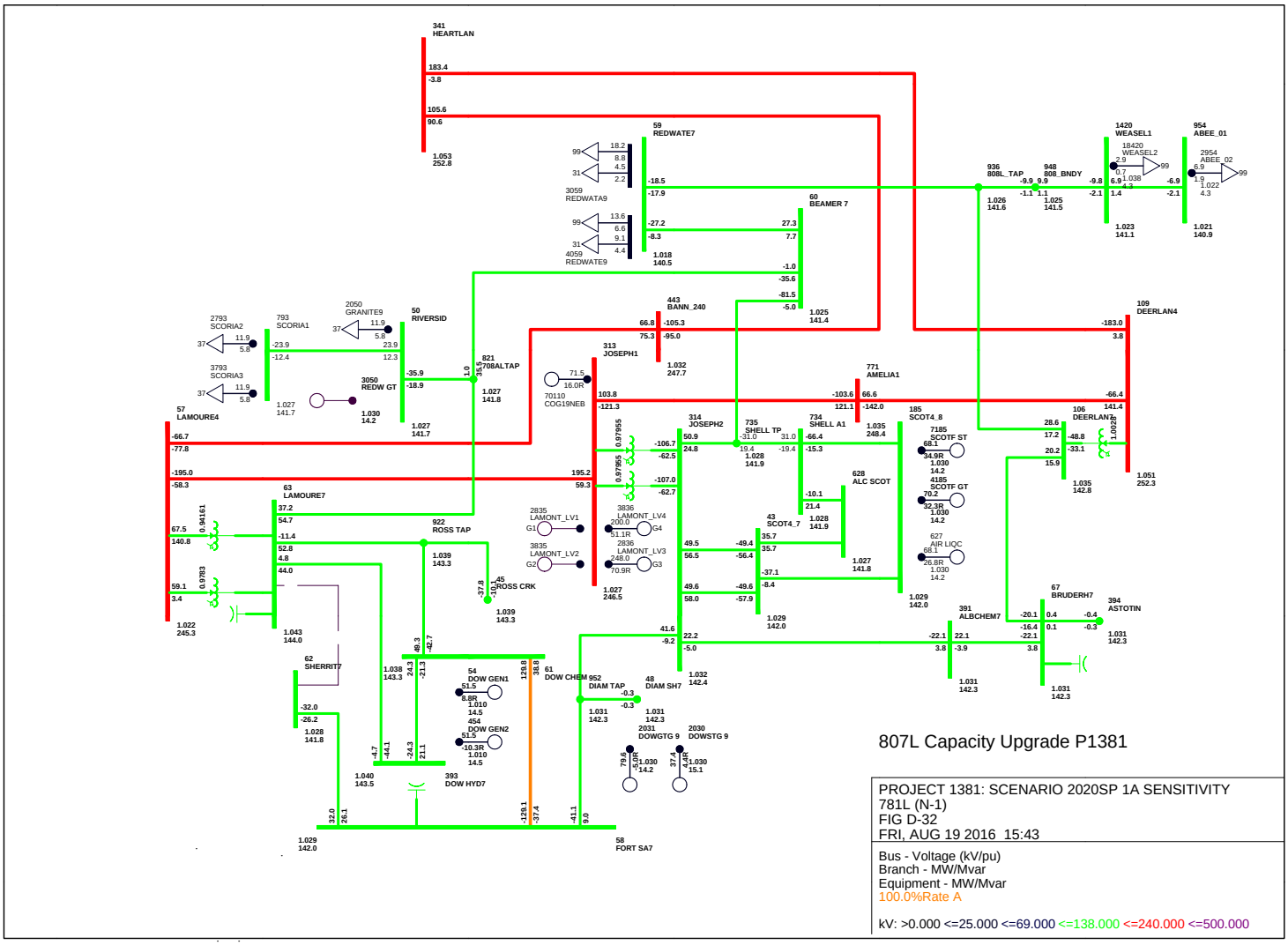
1.030
142.2
391
ALBCHEM7
1.032
142.4
67
BRUDERH7
1.031
142.3
394
ASTOTIN
1.031
142.3
936
808L_TAP
1.027
141.7
948
808_BNDY
1.025
141.5
1420
WEASEL1
18420
WEASEL2
1.039
1.023
141.2
954
ABEE_01
2954
ABEE_02
1.023
141.0
62
SHERRIT7
1.037
143.0
54
DOW GEN1
454
DOW GEN2
1.010
14.5
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
1.033
142.5
2031
DOWGTG 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
393
DOW HYD7
1.035
142.9
58
FORT SA7
1.035
142.8
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
861L (N-1)
FIG D-31
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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90.6
1.053
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3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.018
140.5
1.025
141.4
443 BANN_240
66.8
75.3
-105.3
-95.0
1.032
247.7
313 JOSEPH1
71.5
16.0R
70110 COG19NEB
103.8
-121.3
771 AMELIA1
-103.6
121.1
66.6
-142.0
109 DEERLAN4
-183.0
3.8
-66.4
141.4
1.051
252.3
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
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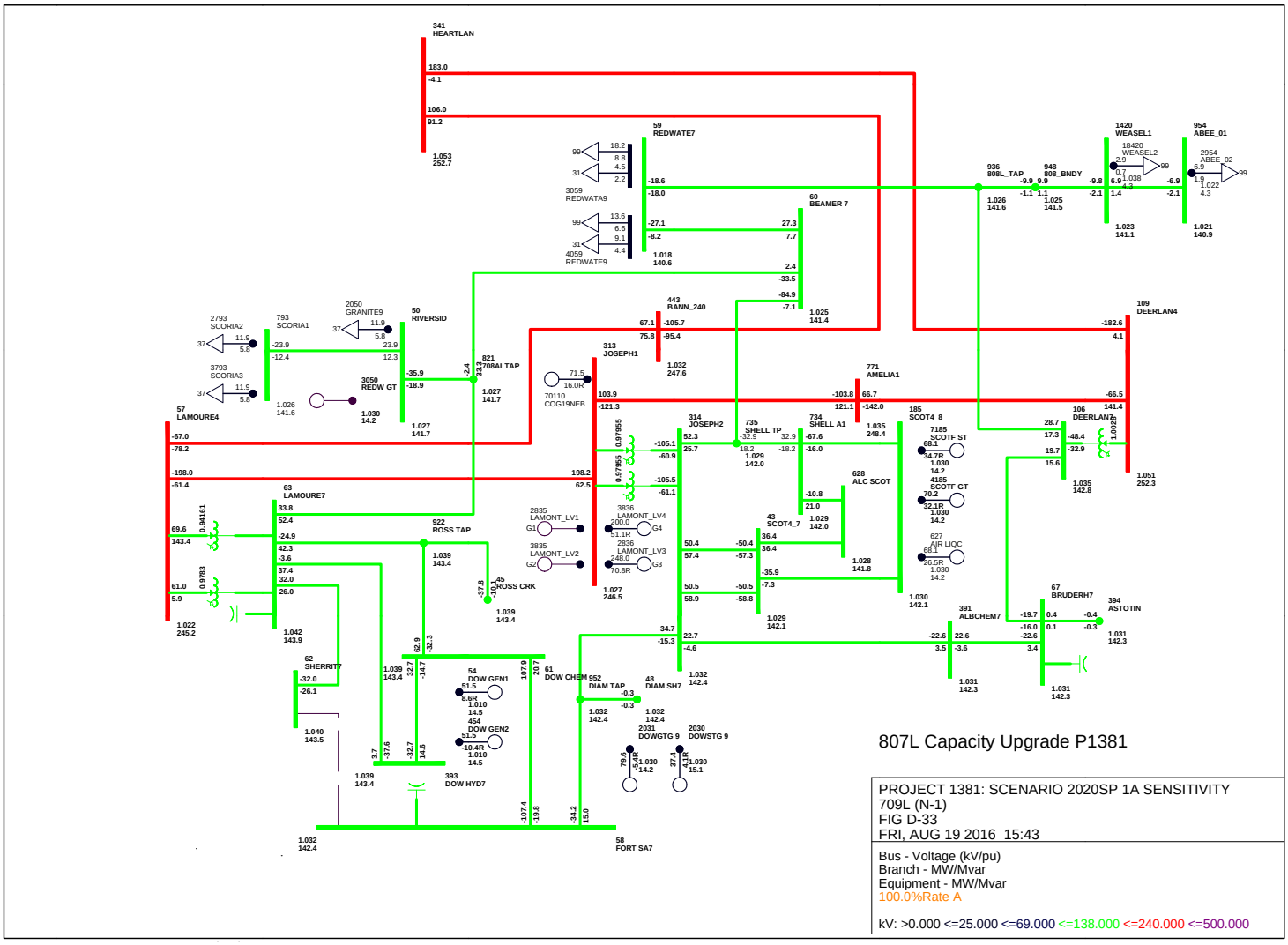
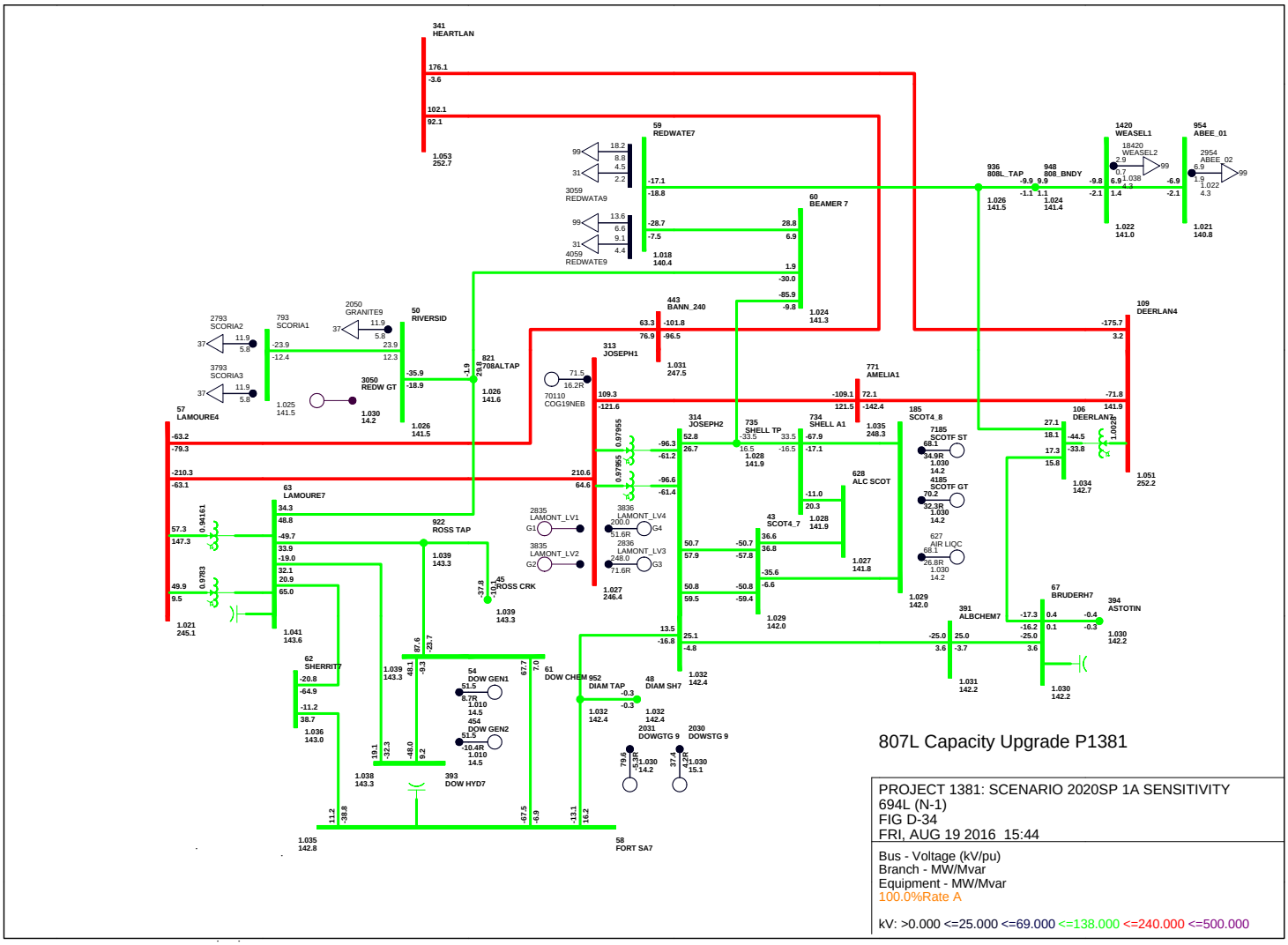
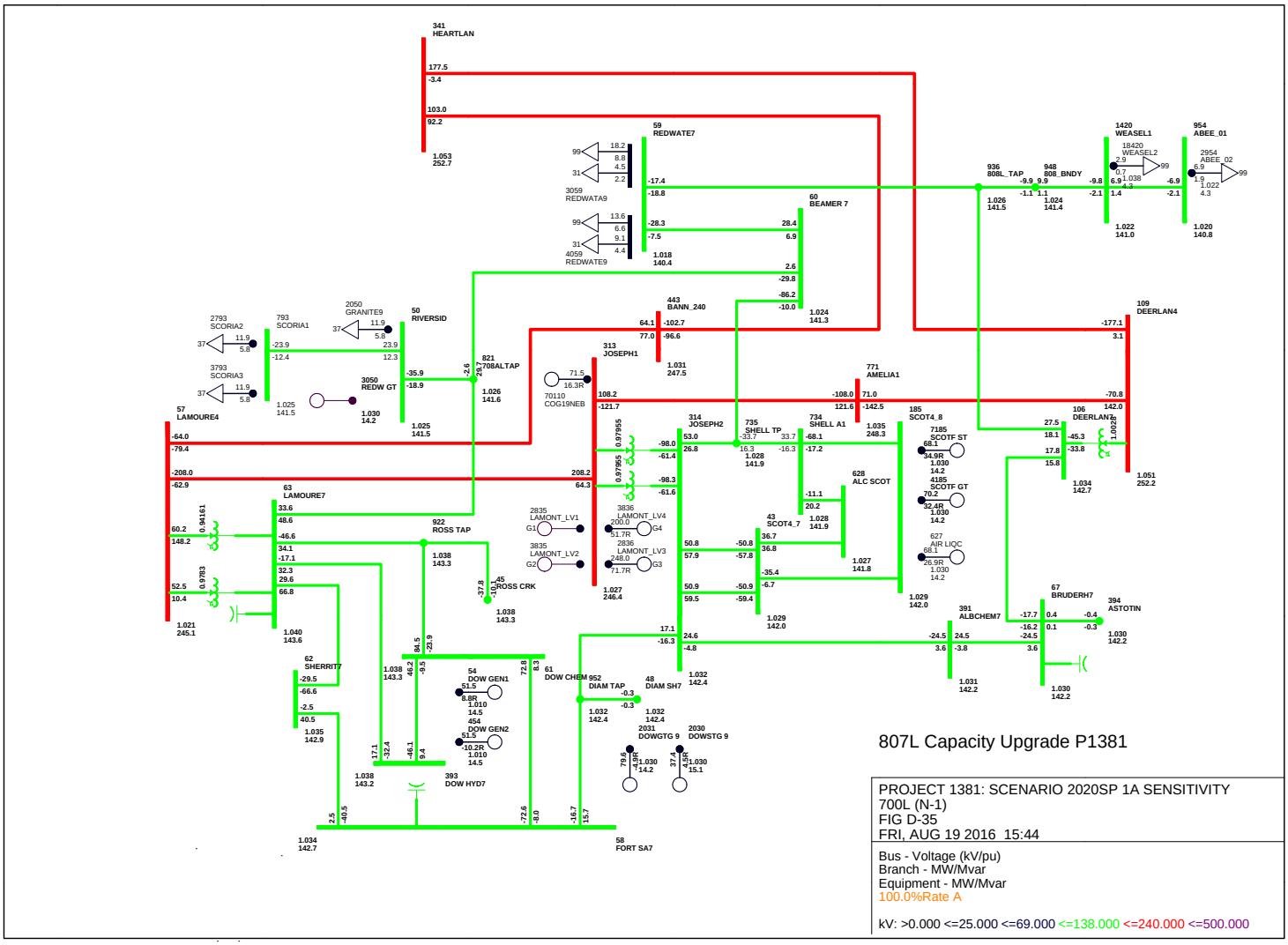
1.025
141.5
1.023
141.1
1.021
140.9
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.027
141.7
1.030
14.2
821 5708ALTAP
1.027
141.8
57 LAMOURE4
-66.7
-77.8
-195.0
-58.3
63 LAMOURE7
37.2
54.7
-11.4
52.8
4.8
44.0
1.043
144.0
922 ROSS TAP
1.039
143.3
45 ROSS CRK
1.039
143.3
1.027
246.5
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
314 JOSEPH2
735 SHELL TP
1.028
141.9
734 SHELL A1
1.035
248.4
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
628 ALC SCOT
43 SCOT4_7
1.027
141.8
1.029
142.0
106 DEERLAN2
1.035
142.8
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
1.031
142.3
62 SHERRIT7
1.028
141.8
1.040
143.5
393 DOW HYD7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.032
142.4
2031 DOWGTG 9
2030 DOWSTG 9
1.029
142.0
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
781L (N-1)
FIG D-32
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
709L (N-1)
FIG D-33
FRI, AUG 19 2016 15:43
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
694L (N-1)
FIG D-34
FRI, AUG 19 2016 15:44
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

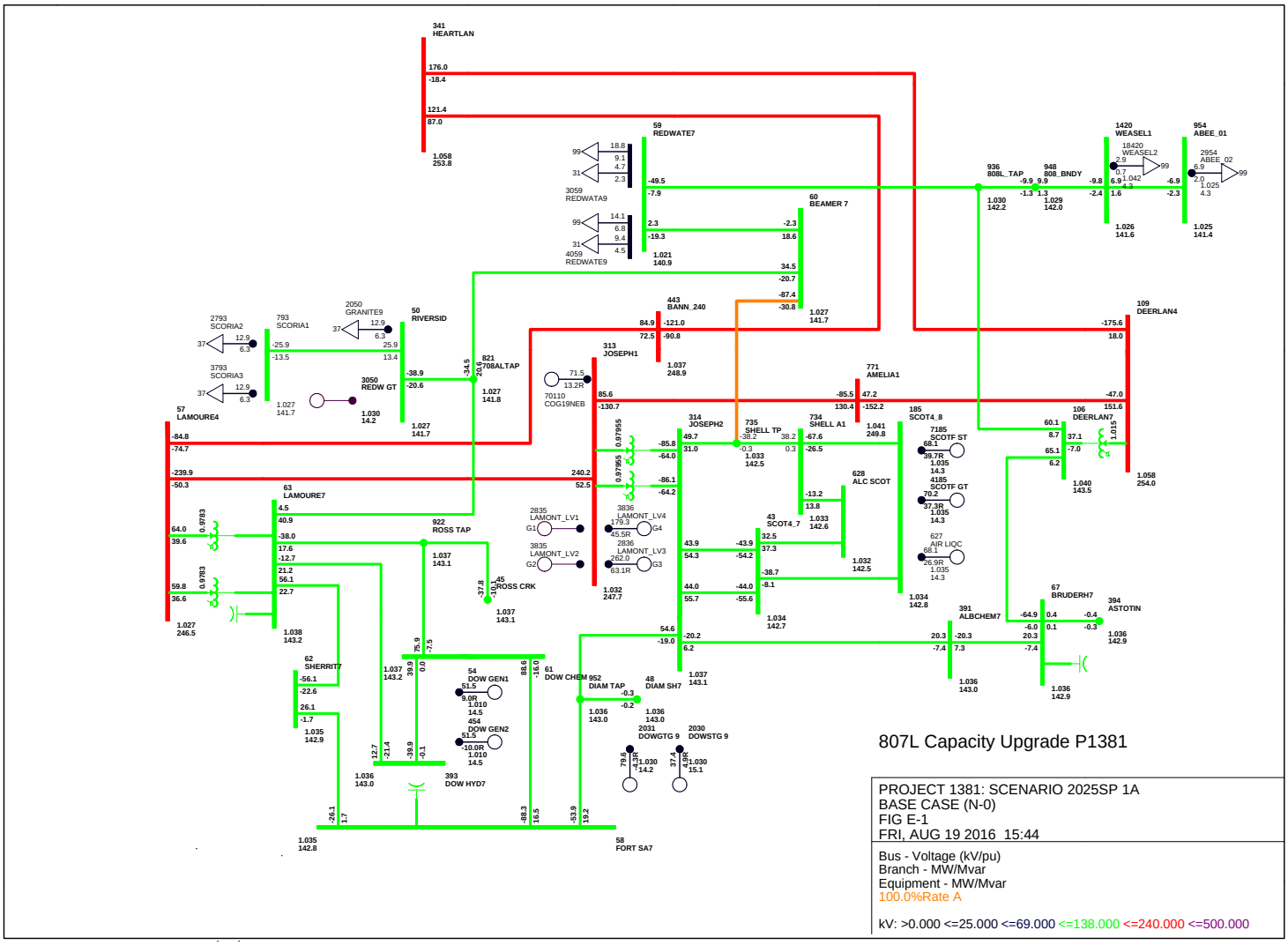

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
700L (N-1)
FIG D-35
FRI, AUG 19 2016 15:44
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

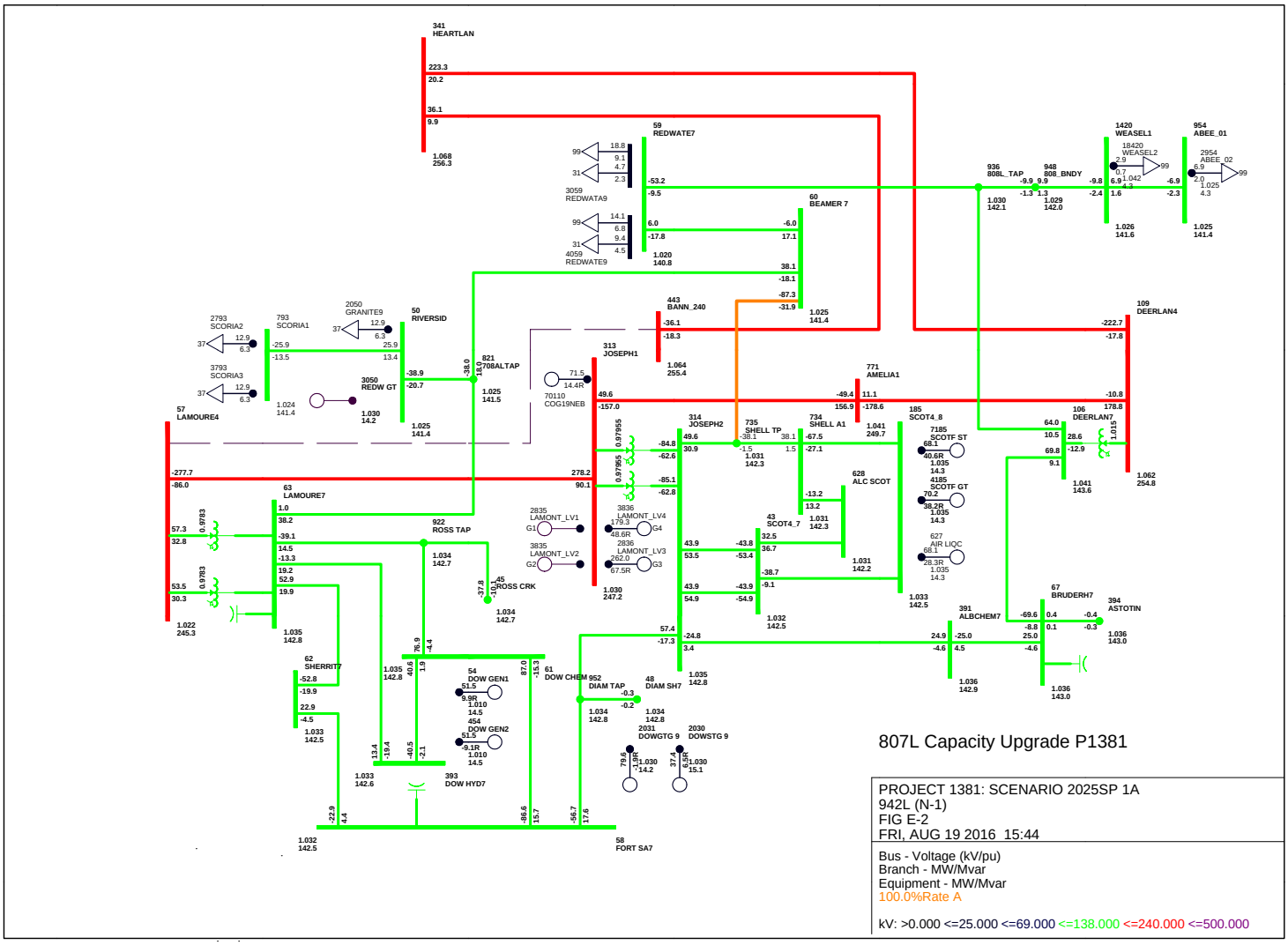
Attachment E

2025SP Power Flow Diagrams

Table E-1: 2025SP Contingency Lists

Figure #	Scenario	Condition
E-1	25_1a	Base Case (N-0)
E-2	25_1a	942L (N-1) 71S Lamoureux to 681S Bannerman
E-3	25_1a	1061L (N-1) 681S Bannerman to 12S Heartland
E-4	25_1a	997L (N-1) 71S Lamoureux to 410S Josephburg
E-5	25_1a	1120L (N-1) 410S Josephburg to 108S Amelia
E-6	25_1a	943L (N-1) 13S Deerland to 108S Amelia
E-7	25_1a	1054L (N-1) 12S Heartland to 13S Deerland
E-8	25_1a	9L960 (N-1) 13S Deerland to 825S Whitefish Lake
E-9	25_1a	9L961 (N-1) 13S Deerland to 825S Whitefish Lake
E-10	25_1a	920L (N-1) 71S Lamoureux to 557S Castle Downs
E-11	25_1a	921L (N-1) 71S Lamoureux to 987S Clover Bar
E-12	25_1a	708L (N-1) 233S Beamer to 71S Lamoureux
E-13	25_1a	807L (N-1) 410S Josephburg to 233S Beamer
E-14	25_1a	735L (N-1) 233S Beamer to 171S Redwater
E-15	25_1a	808L (N-1) 171S Redwater to 13S Deerland
E-16	25_1a	621L (N-1) 13S Deerland to 109S Skaro
E-17	25_1a	815L (N-1) 13S Deerland to 127S Bruderheim
E-18	25_1a	846L (N-1) 127S Bruderheim
E-19	25_1a	773L (N-1) 127S Bruderheim to 308S Albchem Beaverhill Creek
E-20	25_1a	776L (N-1) 410S Josephburg to 308S Albchem Beaverhill Creek
E-21	25_1a	856L (N-1) 410S Josephburg to 409S Shell Scotford
E-22	25_1a	857L (N-1) 410S Josephburg to 409S Shell Scotford
E-23	25_1a	ALCO2L (N-1) 879S Scotford Upgrader to 409S Shell Scotford
E-24	25_1a	EXI-01L (N-1) 879S Scotford Upgrader to 402S Scotford Expansion 1
E-25	25_1a	ALC03L (N-1) 402S Scotford Expansion 1 to Air Liquide
E-26	25_1a	ALC01L (N-1) Air Liquide to 409S Shell Scotford
E-27	25_1a	706L (N-1) 410S Josephburg to 54S Fort Saskatchewan
E-28	25_1a	707L (N-1) 233S Beamer to 71S Lamoureux
E-29	25_1a	787L (N-1) 71S Lamoureux to 166S Dow Chemical
E-30	25_1a	862L (N-1) 166S Dow Chemical to 258S Dow HydroCarbons
E-31	25_1a	861L (N-1) 71S Lamoureux to 258S Dow HydroCarbons
E-32	25_1a	781L (N-1) 172S Sherritt to 71S Lamoureux
E-33	25_1a	709L (N-1) 233S Beamer to 71S Lamoureux
E-34	25_1a	694L (N-1) 54S Fort Saskatchewan to 422S Westwood
E-35	25_1a	700L (N-1) 422S Westwood to 746S Sherwood Park


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
BASE CASE (N-0)
FIG E-1
FRI, AUG 19 2016 15:44
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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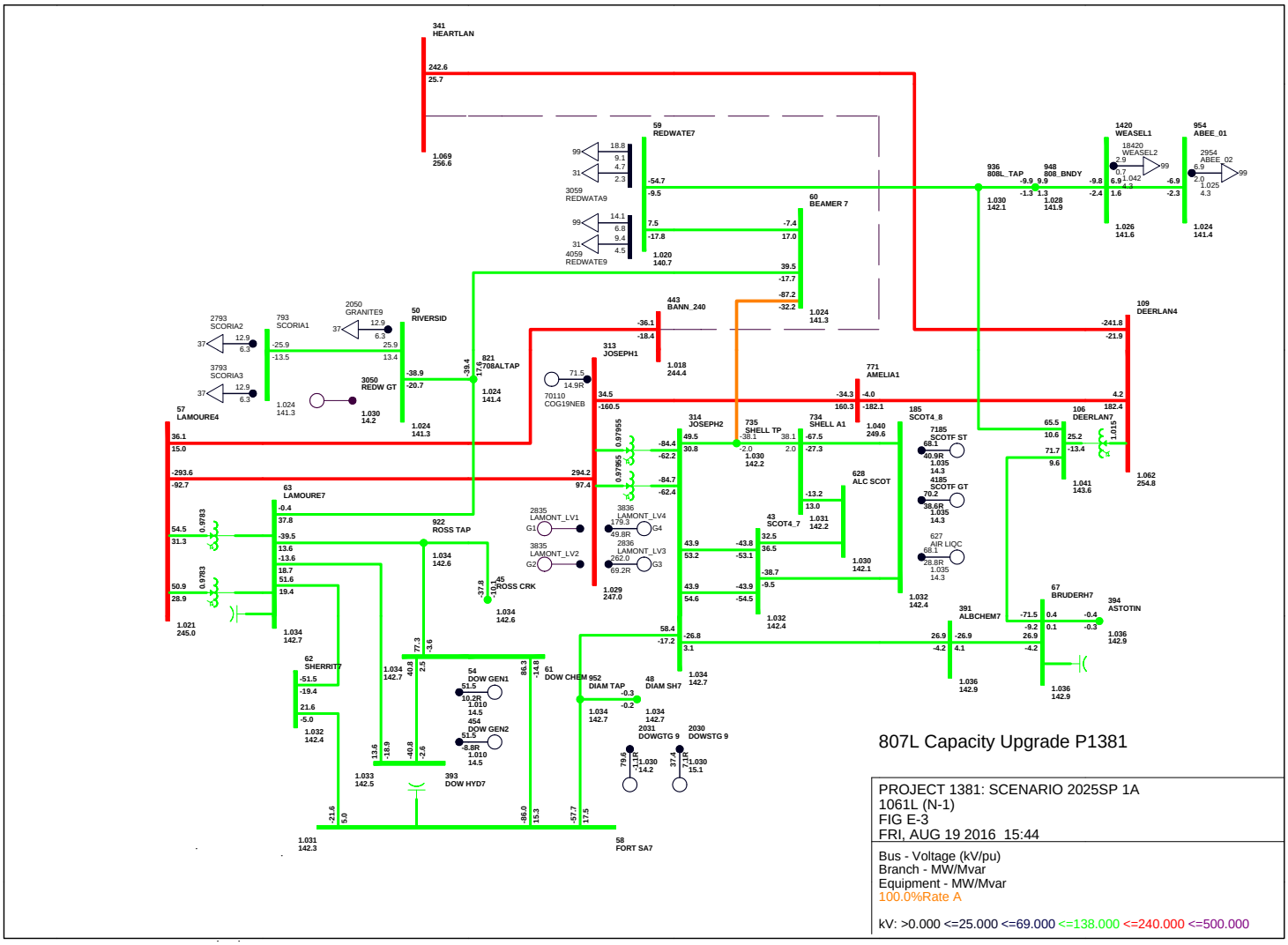
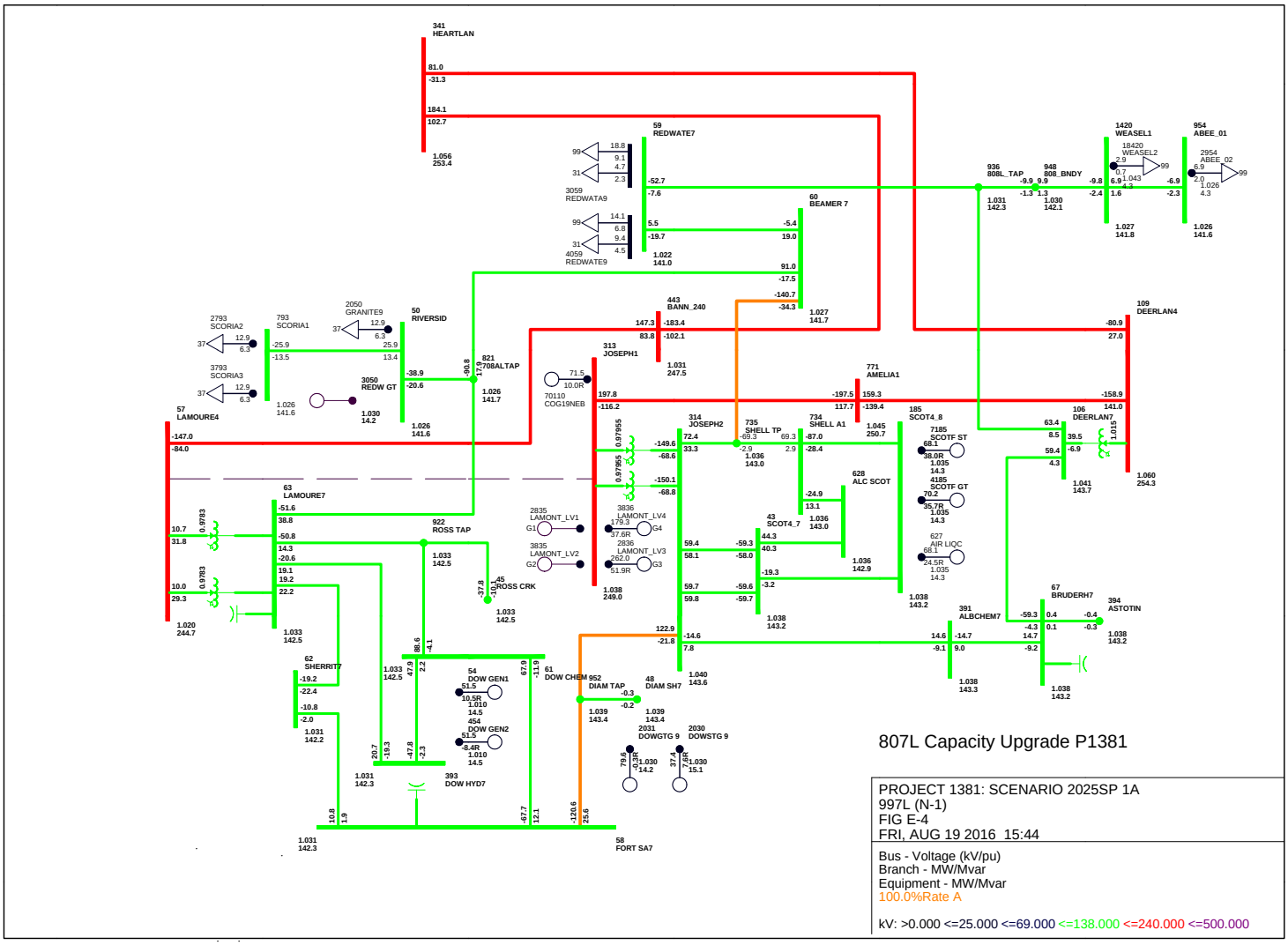
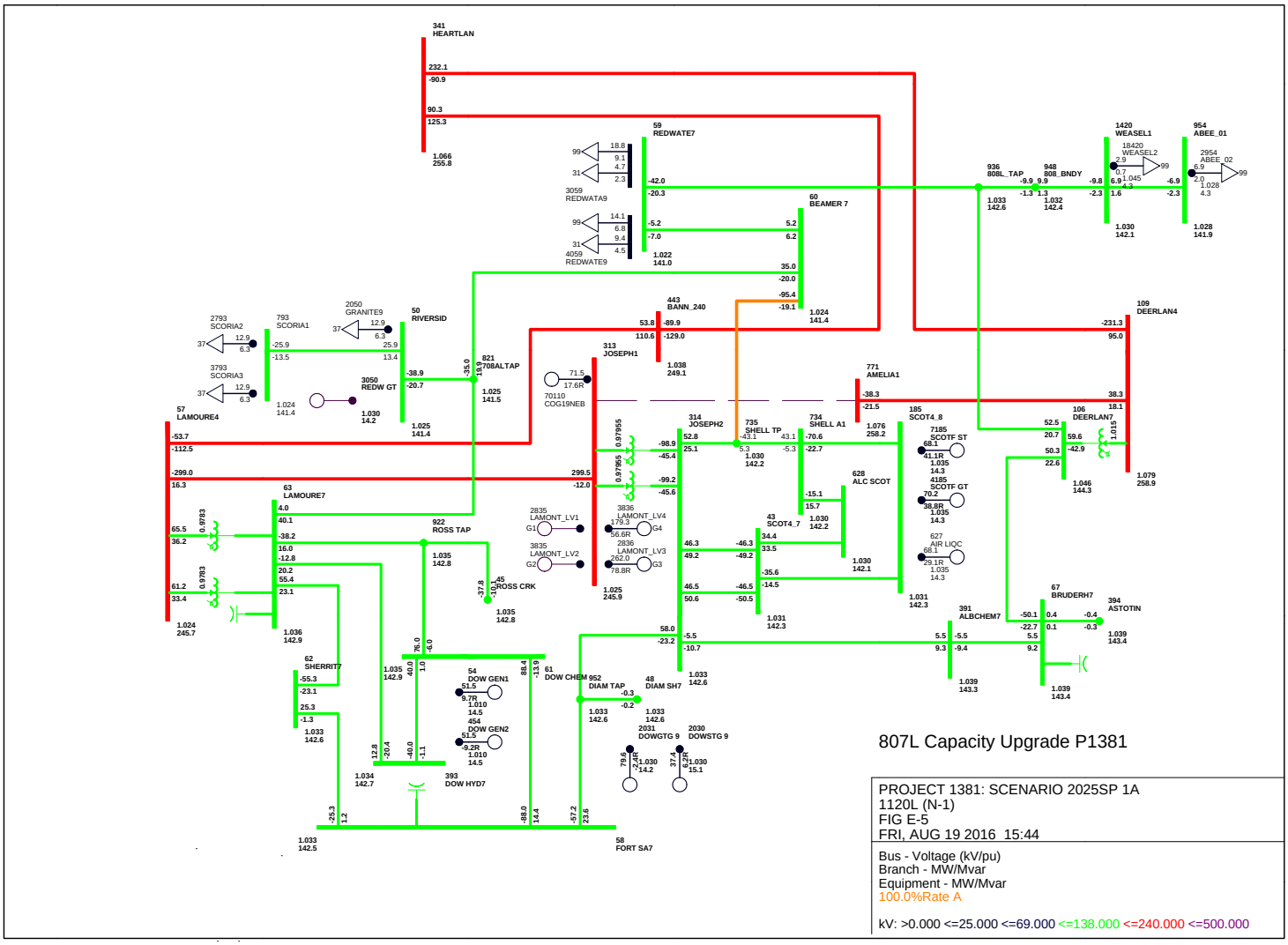
HEARTLAN
223.3
20.2
36.1
9.9
1.068
256.3
59
REDWATE7
3059
REDWATA9
4059
REDWATE9
60
BEAMER 7
1.020
140.8
443
BANN_240
1.064
255.4
1.025
141.4
936
808L_TAP
948
808_BNDY
1420
WEASEL1
954
ABEE_01
1.030
142.1
1.029
142.0
1.026
141.6
1.025
141.4
109
DEERLAN4
1.062
254.8
771
AMELIA1
1.041
249.7
106
DEERLAN7
1.041
143.6
2050
GRANITE9
2793
SCORIA2
793
SCORIA1
3793
SCORIA3
50
RIVERSID
3050
REDW GT
1.024
141.4
1.030
14.2
1.025
141.5
821
1708ALTAP
313
JOSEPH1
71.5
14.4R
70110
COG19NEB
57
LAMOURE4
63
LAMOURE7
1.022
245.3
1.035
142.8
922
ROSS TAP
1.034
142.7
45
ROSS CRK
1.030
247.2
314
JOSEPH2
735
SHELL TP
734
SHELL A1
628
ALC SCOT
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
43
SCOT4_7
1.031
142.3
1.031
142.2
1.033
142.5
391
ALBCHEM7
67
BRUDERH7
394
ASTOTIN
1.036
143.0
1.036
142.9
1.036
143.0
62
SHERRIT7
1.033
142.5
54
DOW GEN1
454
DOW GEN2
1.010
14.5
393
DOW HYD7
1.033
142.6
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
1.034
142.8
1.035
142.8
2031
DOWGTG 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
58
FORT SA7
1.032
142.5
2835
LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
0.9783
0.97955
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
942L (N-1)
FIG E-2
FRI, AUG 19 2016 15:44
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
1061L (N-1)
FIG E-3
FRI, AUG 19 2016 15:44
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
997L (N-1)
FIG E-4
FRI, AUG 19 2016 15:44
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

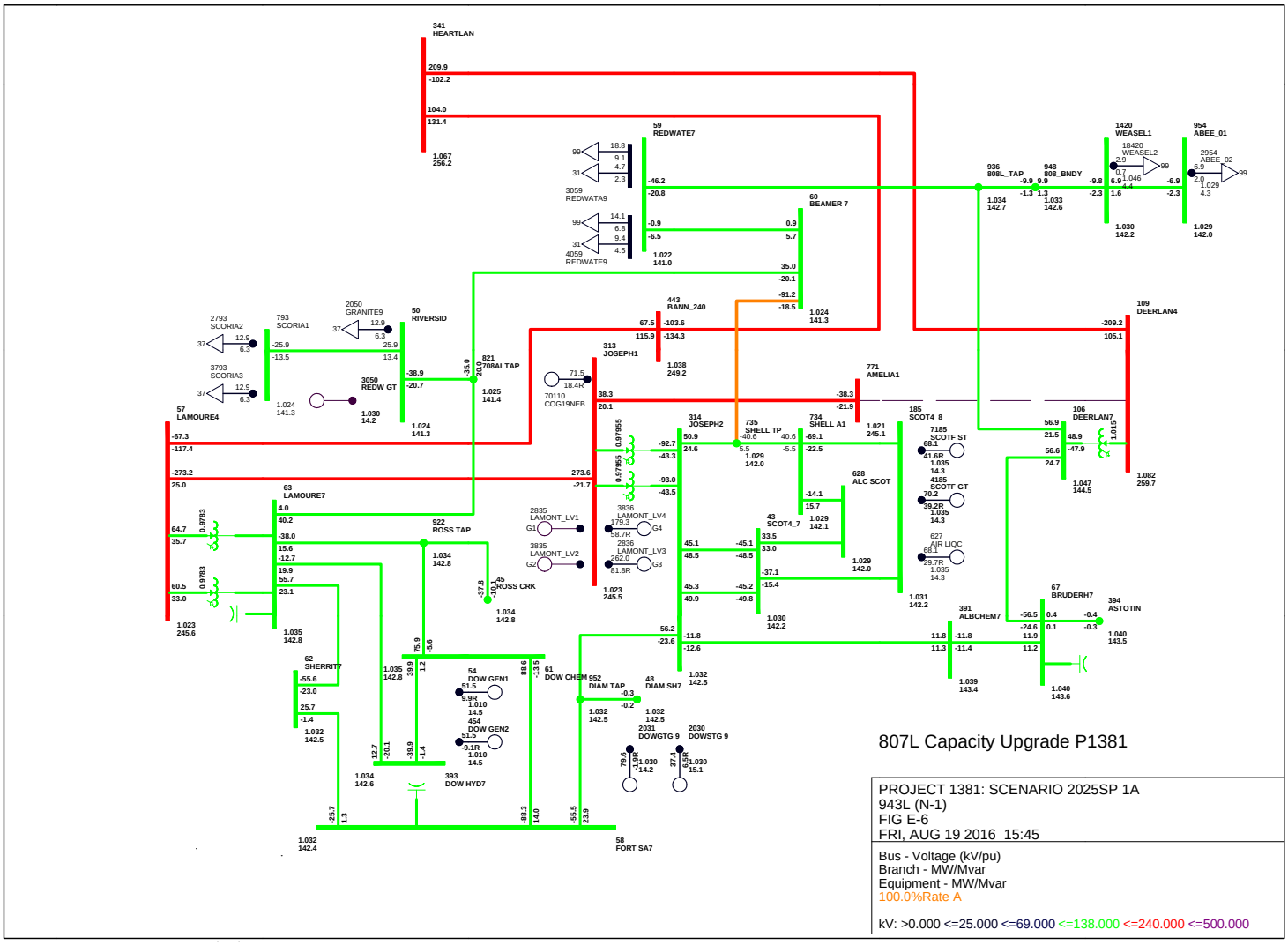


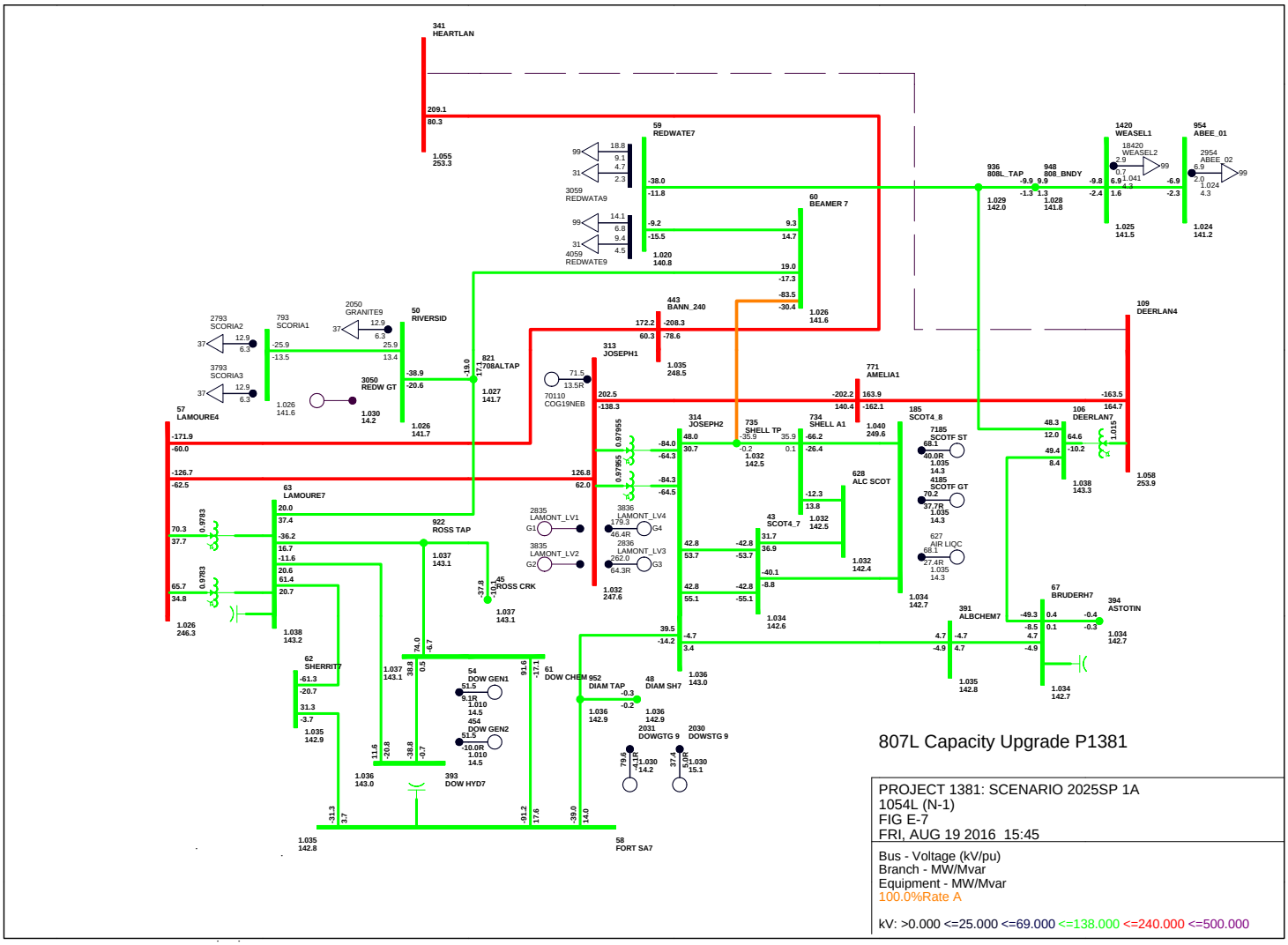
807L Capacity Upgrade P1381

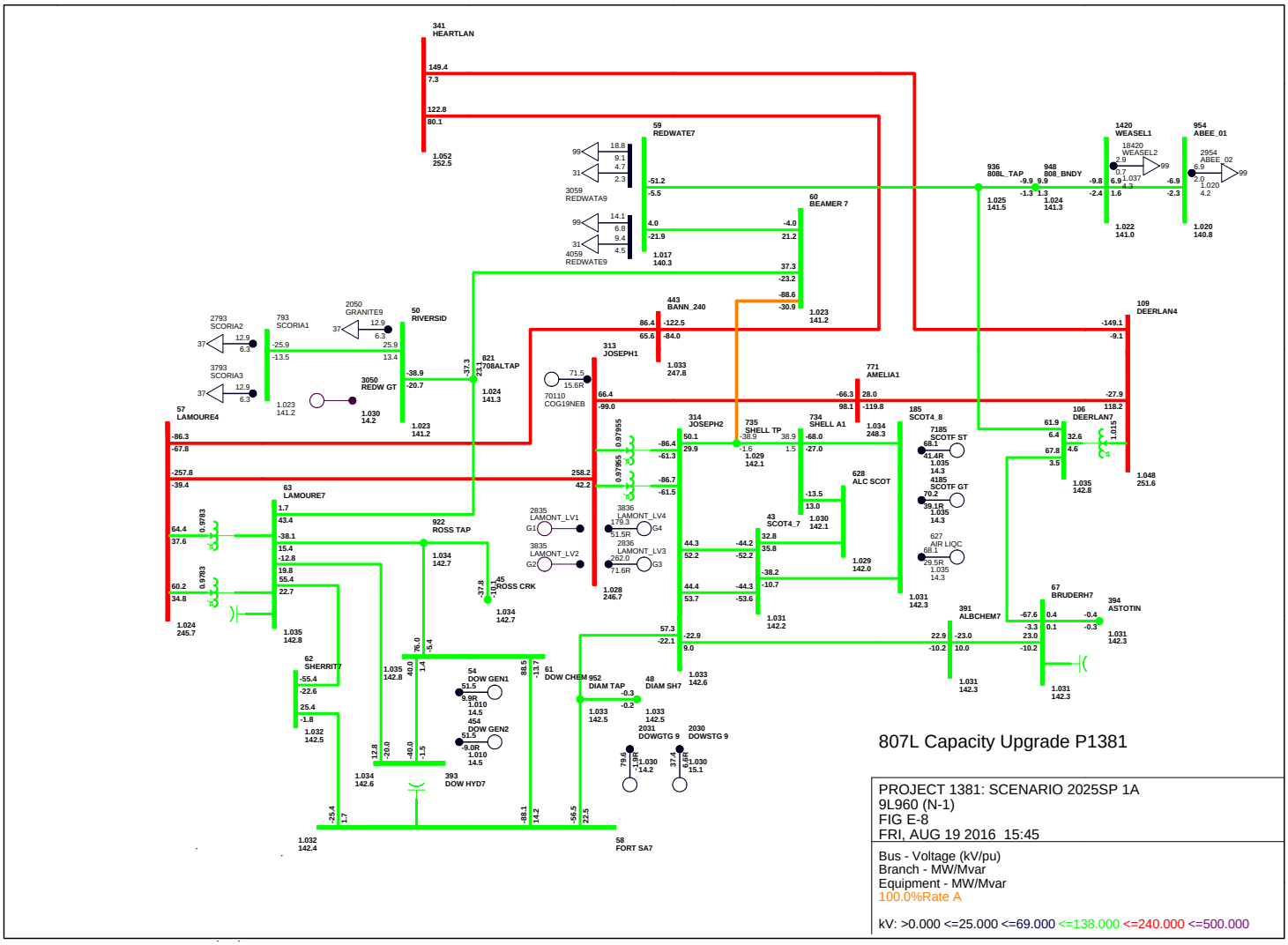
PROJECT 1381: SCENARIO 2025SP 1A
1120L (N-1)
FIG E-5
FRI, AUG 19 2016 15:44

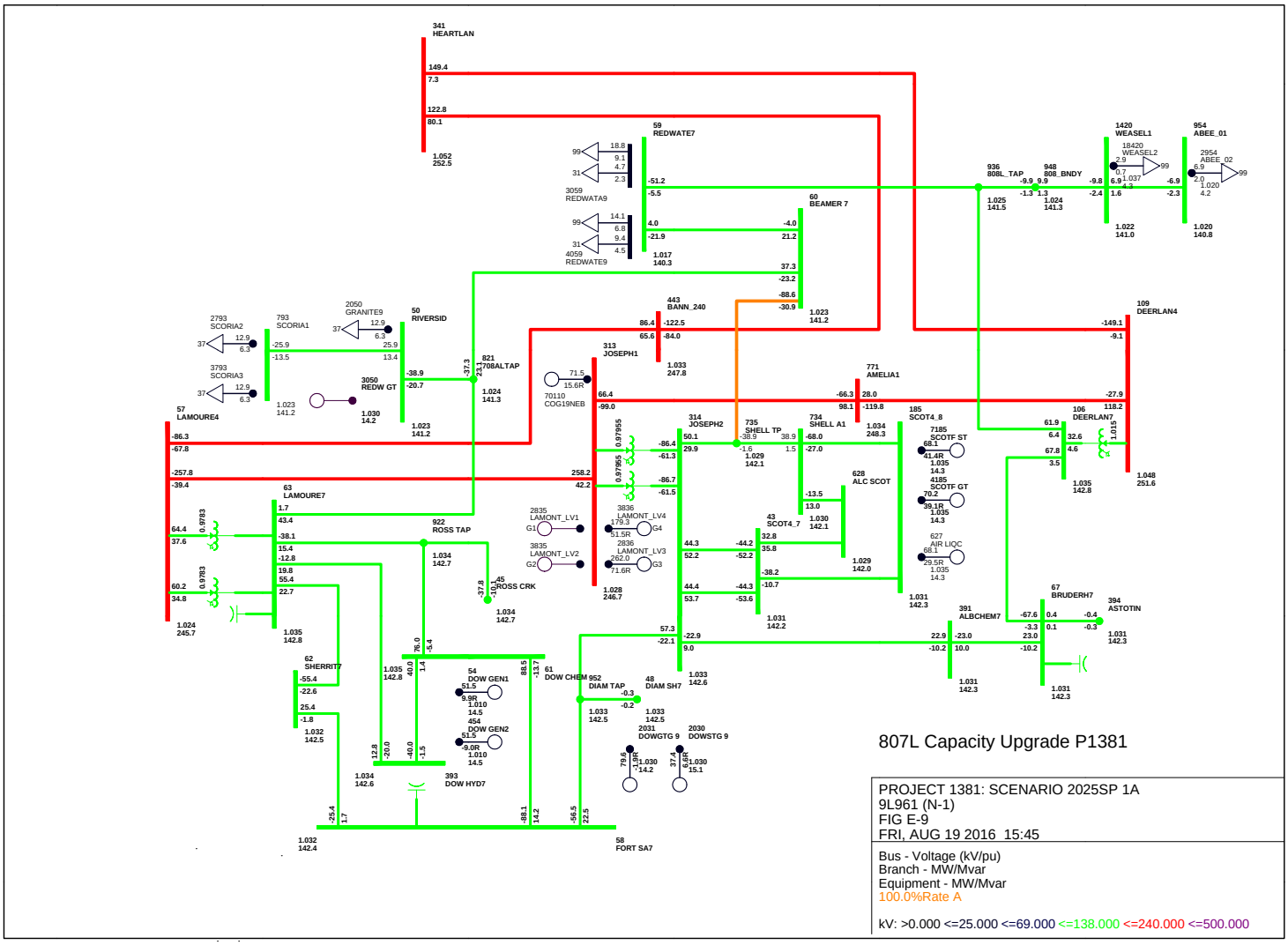
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
943L (N-1)
FIG E-6
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
1054L (N-1)
FIG E-7
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
149.4
7.3
122.8
80.1
1.052
252.5
59 REDWATE7
18.8
9.1
4.7
2.3
3059 REDWATA9
14.1
6.8
9.4
4.5
4059 REDWATE9
-51.2
-5.5
4.0
-21.9
1.017
140.3
60 BEAMER 7
-4.0
21.2
37.3
-23.2
-88.6
-30.9
1.023
141.2
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.025
141.5
1.024
141.3
1.022
141.0
1.020
140.8
2050 GRANITE9
2793 SCORIA2
793 SCORIA1
3793 SCORIA3
50 RIVERSID
3050 REDW GT
1.030
14.2
1.023
141.2
821 2708ALTAP
1.024
141.3
443 BANN_240
86.4
-122.5
65.6
-84.0
1.033
247.8
313 JOSEPH1
71.5
15.6R
70110 COG19NEB
66.4
-99.0
109 DEERLAN4
-149.1
-9.1
771 AMELIA1
-66.3
98.1
28.0
-119.8
-27.9
118.2
1.048
251.6
57 LAMOURE4
-86.3
-67.8
-257.8
-39.4
63 LAMOURE7
1.7
43.4
-38.1
15.4
-12.8
19.8
55.4
22.7
1.035
142.8
64.4
37.6
60.2
34.8
1.024
245.7
0.9783
0.9783
922 ROSS TAP
1.034
142.7
45 ROSS CRK
-37.8
-10.1
1.034
142.7
2835 LAMONT_LV1
2836 LAMONT_LV3
3835 LAMONT_LV2
3836 LAMONT_LV4
0.97955
0.97955
258.2
42.2
1.028
246.7
314 JOSEPH2
50.1
29.9
-86.4
-61.3
-86.7
-61.5
735 SHELL TP
-38.9
38.9
-1.6
1.5
1.029
142.1
734 SHELL A1
-68.0
-27.0
1.034
248.3
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
628 ALC SCOT
-13.5
13.0
1.030
142.1
1.029
142.0
43 SCOT4_7
44.3
52.2
-44.2
-52.2
32.8
35.8
-38.2
-10.7
44.4
53.7
-44.3
-53.6
1.031
142.2
1.031
142.3
106 DEERLAN7
61.9
6.4
32.6
4.6
67.8
3.5
1.035
142.8
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
-67.6
-3.3
0.4
0.1
-0.4
-0.3
1.031
142.3
1.031
142.3
57.3
-22.9
9.0
-22.1
22.9
-23.0
-10.2
10.0
-10.2
1.031
142.3
1.033
142.6
62 SHERRIT7
-55.4
-22.6
25.4
-1.8
1.032
142.5
1.035
142.8
40.0
1.4
76.0
5.4
54 DOW GEN1
51.5
9.9R
1.010
14.5
454 DOW GEN2
51.5
9.0R
1.010
14.5
61 DOW CHEM
88.5
-13.7
952 DIAM TAP
-0.3
-0.2
48 DIAM SH7
1.033
142.5
1.033
142.5
2031 DOWGTG 9
79.6
-1.0R
1.030
14.2
2030 DOWSTG 9
37.4
6.6R
1.030
15.1
12.8
-20.0
-40.0
-1.5
1.034
142.6
393 DOW HYD7
-25.4
1.7
-88.1
14.2
-56.5
22.5
1.032
142.4
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
9L960 (N-1)
FIG E-8
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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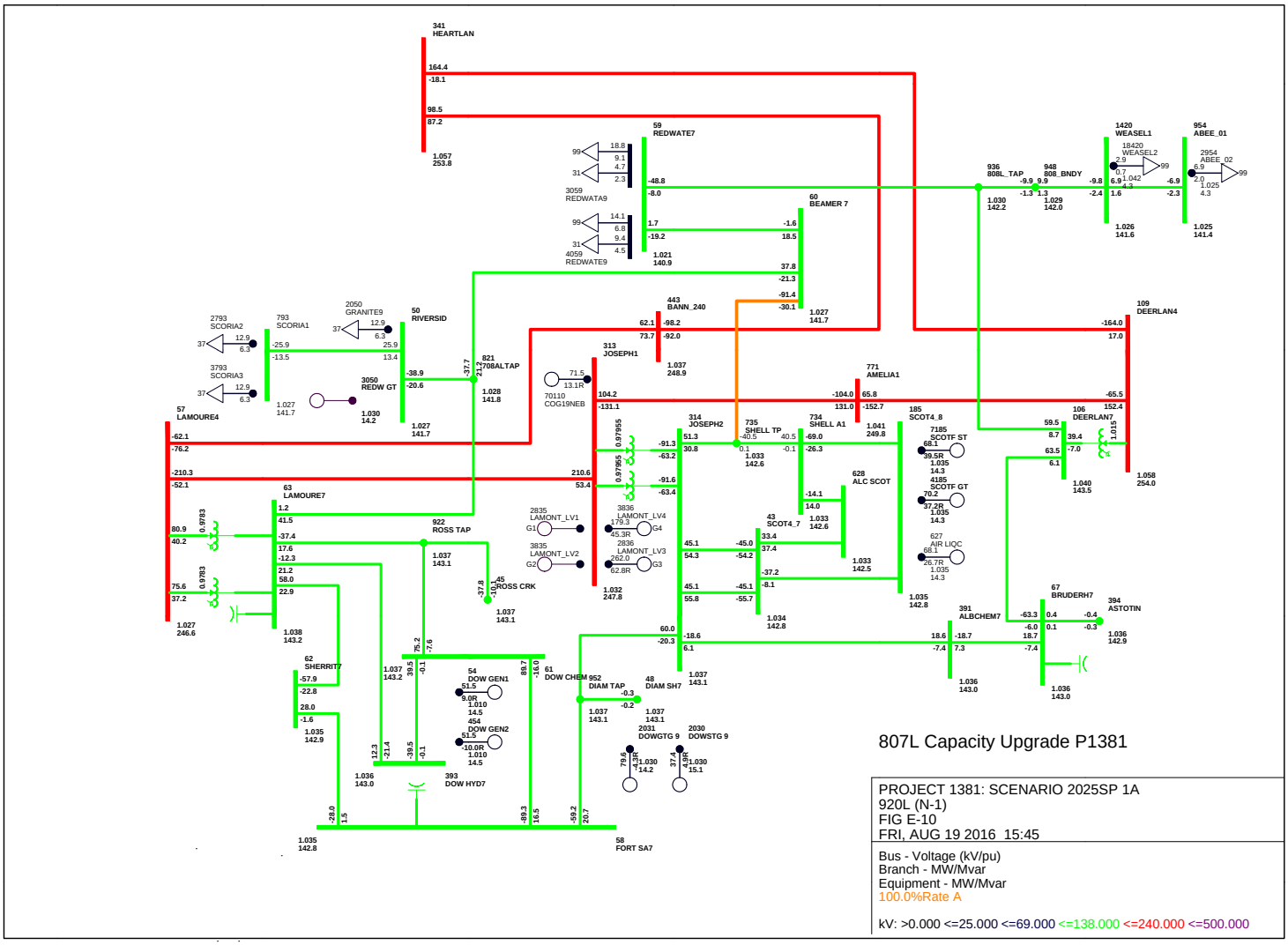
149.4
7.3
122.8
80.1
1.052
252.5
59
REDWATE7
3059
REDWATA9
4059
REDWATE9
60
BEAMER 7
1.017
140.3
1.023
141.2
443
BANN_240
1.033
247.8
313
JOSEPH1
821
2708ALTAP
1.024
141.3
1.023
141.2
50
RIVERSID
2050
GRANITE9
793
SCORIA1
2793
SCORIA2
3793
SCORIA3
3050
REDW GT
1.030
14.2
1.023
141.2
57
LAMOURE4
63
LAMOURE7
922
ROSS TAP
1.034
142.7
45
ROSS CRK
1.034
142.7
1.035
142.8
62
SHERRIT7
1.032
142.5
1.032
142.4
54
DOW GEN1
454
DOW GEN2
1.010
14.5
393
DOW HYD7
1.034
142.6
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
1.033
142.6
1.033
142.5
1.033
142.5
2031
DOWGTG 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
58
FORT SA7
2835
LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
71.6R
1.028
246.7
70110
COG19NEB
314
JOSEPH2
735
SHELL TP
1.029
142.1
734
SHELL A1
1.030
142.1
628
ALC SCOT
1.029
142.0
43
SCOT4_7
1.031
142.2
771
AMELIA1
1.034
248.3
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
1.031
142.3
391
ALBCHEM7
1.031
142.3
67
BRUDERH7
1.031
142.3
394
ASTOTIN
1.031
142.3
109
DEERLAN4
106
DEERLAN7
1.035
142.8
1.048
251.6
936
808L_TAP
948
808_BNDY
1.025
141.5
1.024
141.3
1420
WEASEL1
18420
WEASEL2
1.037
1.6
1.022
141.0
954
ABEE_01
2954
ABEE_02
1.020
4.2
1.020
140.8
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
9L961 (N-1)
FIG E-9
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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98.5
87.2
1.057
253.8
59 REDWATE7
18.8
9.1
4.7
2.3
99
31
3059 REDWATA9
-48.8
-8.0
14.1
6.8
9.4
4.5
4059 REDWATE9
1.7
-19.2
1.021
140.9
60 BEAMER 7
-1.6
18.5
37.8
-21.3
-91.4
-30.1
1.027
141.7
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.030 142.2
1.029 142.0
1.026 141.6
1.025 141.4
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.027 141.7
1.030 14.2
821 2708ALTAP
1.028 141.8
1.027 141.7
57 LAMOURE4
-62.1
-76.2
-210.3
-52.1
63 LAMOURE7
1.2
41.5
-37.4
17.6
-12.3
21.2
58.0
22.9
1.038 143.2
922 ROSS TAP
1.037 143.1
45 ROSS CRK
1.037 143.1
80.9
40.2
75.6
37.2
1.027 246.6
0.9783
62 SHERRIT7
-57.9
-22.8
28.0
-1.6
1.035 142.9
1.037 143.2
54 DOW GEN1
51.5
9.0R
1.010
14.5
454 DOW GEN2
51.5
-10.0R
1.010
14.5
61 DOW CHEM
1.036 143.0
393 DOW HYD7
1.035 142.8
58 FORT SA7
443 BANN_240
62.1
73.7
-98.2
-92.0
1.037 248.9
313 JOSEPH1
71.5
13.1R
70110 COG19NEB
104.2
-131.1
210.6
53.4
1.032 247.8
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
179.3
45.3R
2836 LAMONT_LV3
262.0
62.8R
0.97955
314 JOSEPH2
51.3
30.8
-91.3
-63.2
-91.6
-63.4
1.037 143.1
735 SHELL TP
-40.5
40.5
0.1
-0.1
1.033 142.6
734 SHELL A1
-69.0
-26.3
-14.1
14.0
1.033 142.6
628 ALC SCOT
1.033 142.5
43 SCOT4_7
33.4
37.4
-37.2
-8.1
1.034 142.8
45.1
54.3
-45.0
-54.2
45.1
55.8
-45.1
-55.7
60.0
-20.3
-18.6
6.1
1.037 143.1
952 DIAM TAP
-0.3
-0.2
48 DIAM SH7
1.037 143.1
2031 DOWGTG 9
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1.030
14.2
2030 DOWSTG 9
37.4
4.1R
1.030
15.1
771 AMELIA1
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131.0
-152.7
1.041 249.8
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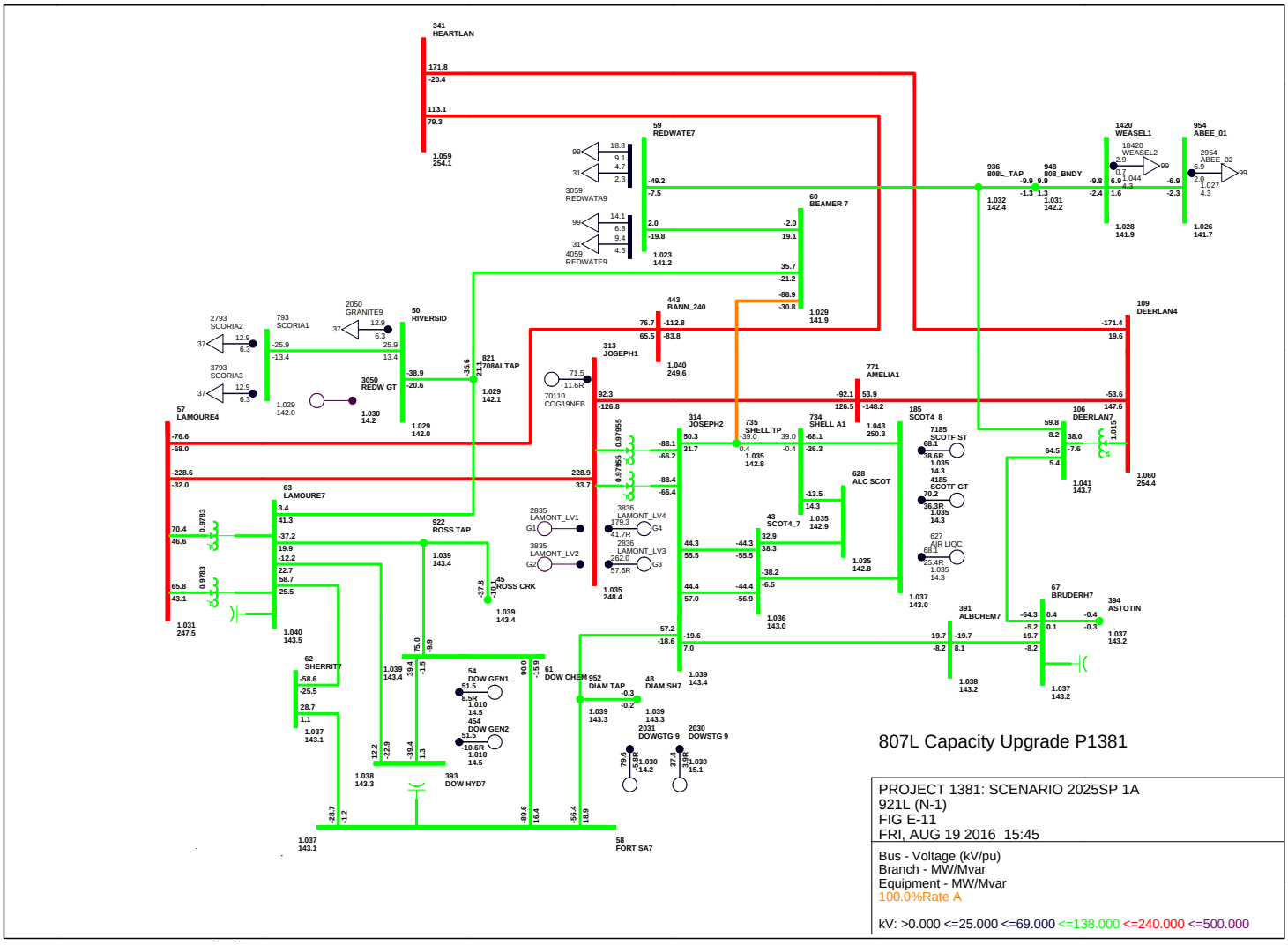
7185 SCOTF ST
68.1
39.5R
1.035
14.3
4185 SCOTF GT
70.2
37.2R
1.035
14.3
627 AIR LIQC
68.1
26.7R
1.035
14.3
1.035 142.8
391 ALBCHEM7
-63.3
-6.0
18.7
-18.7
7.3
1.036 143.0
67 BRUDERH7
0.4
0.1
-0.4
-0.3
-7.4
1.036 143.0
394 ASTOTIN
1.036 142.9
109 DEERLAN4
-164.0
17.0
-65.5
65.8
106 DEERLAN7
59.5
8.7
39.4
-7.0
63.5
6.1
1.040 143.5
1.058 254.0
152.4
1.015
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
920L (N-1)
FIG E-10
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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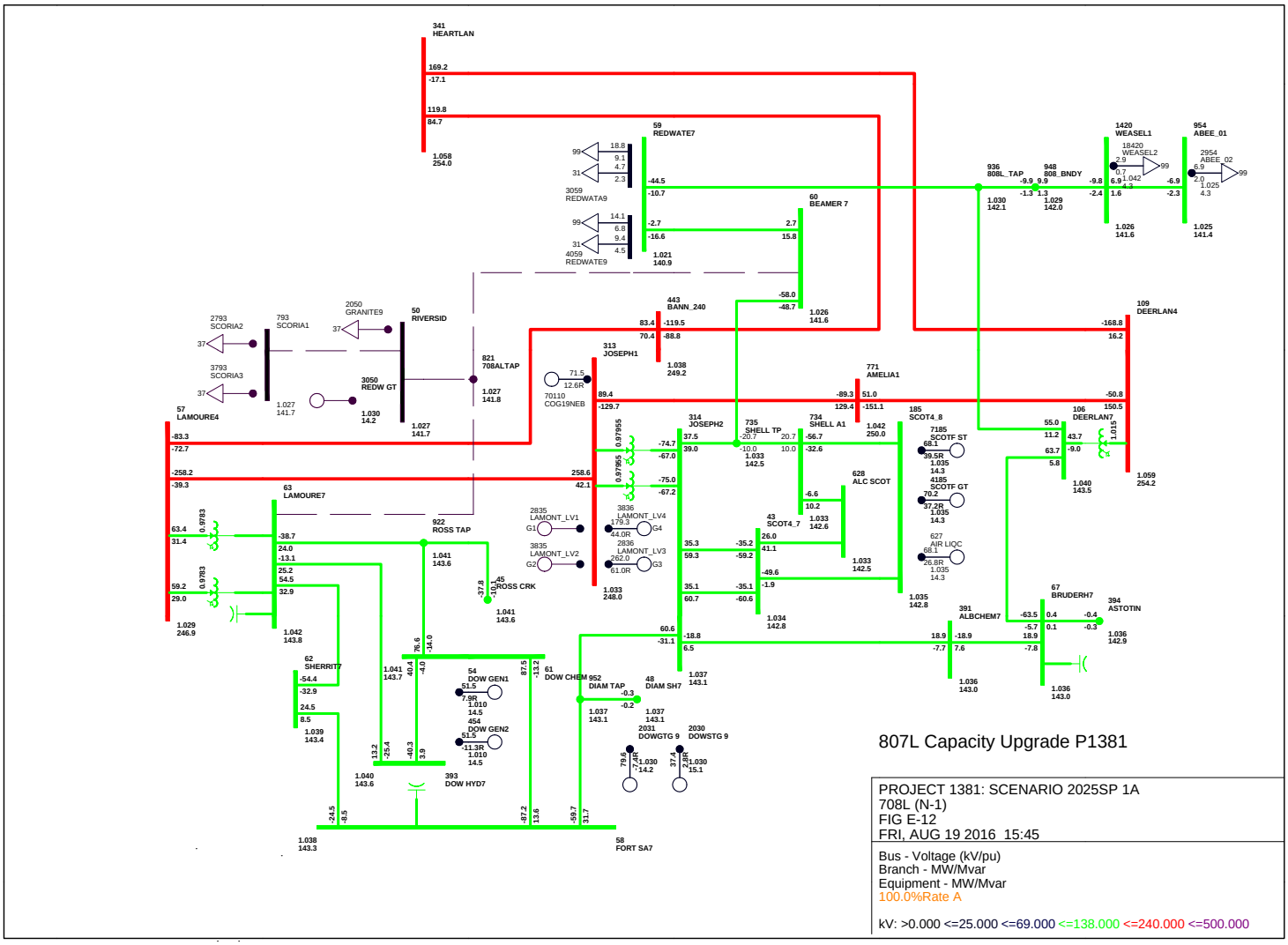
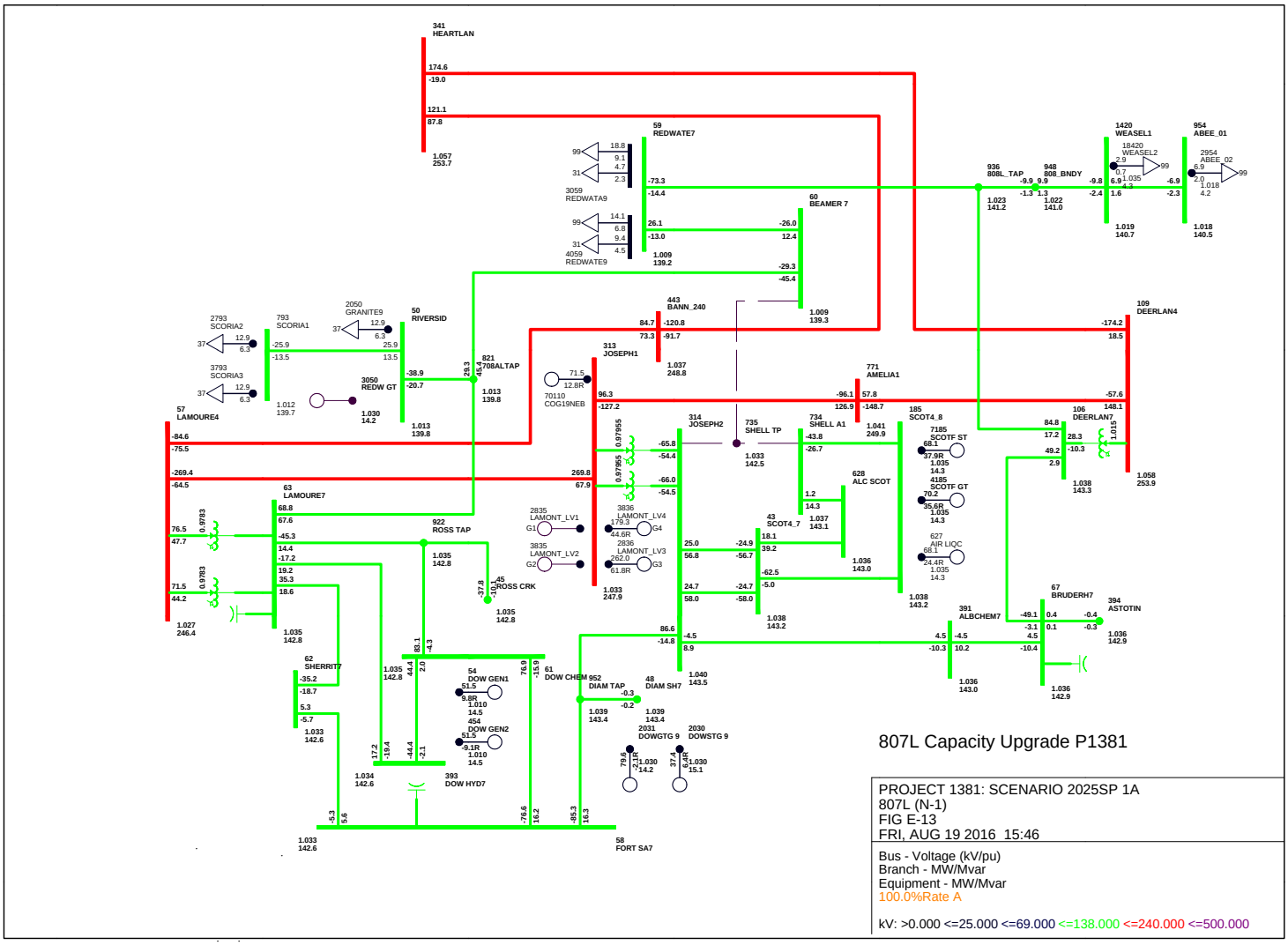
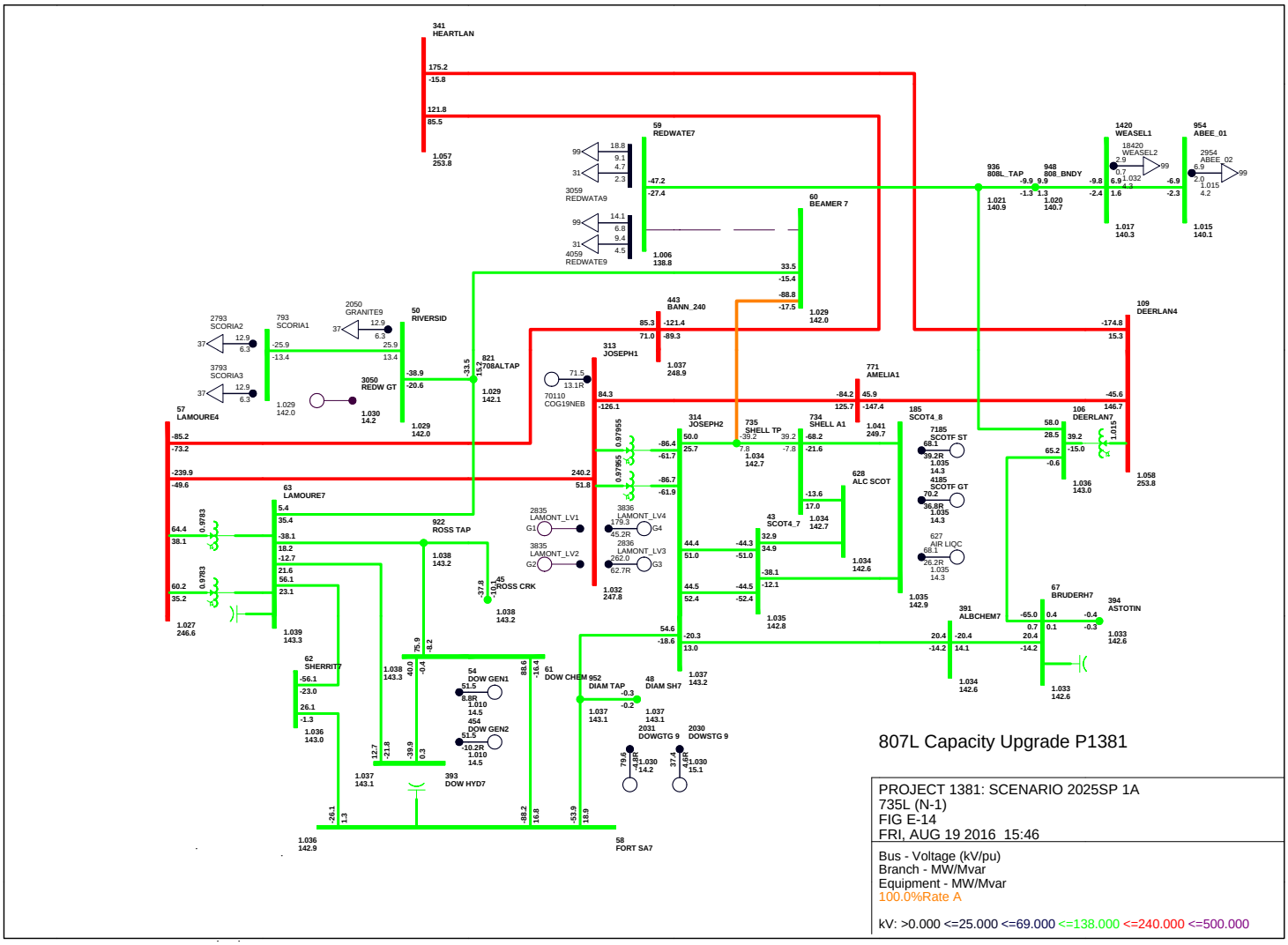
HEARTLAN
171.8
-20.4
113.1
79.3
1.059
254.1
59
REDWATE7
18.8
9.1
4.7
2.3
99
31
3059
REDWATA9
-49.2
-7.5
14.1
6.8
9.4
4.5
4059
REDWATE9
2.0
-19.8
1.023
141.2
60
BEAMER 7
-2.0
19.1
35.7
-21.2
-88.9
-30.8
1.029
141.9
936
808L_TAP
948
808_BNDY
1420
WEASEL1
18420
WEASEL2
954
ABEE_01
2954
ABEE_02
1.032
142.4
1.031
142.2
1.028
141.9
1.026
141.7
1.044
1.027
2050
GRANITE9
2793
SCORIA2
3793
SCORIA3
793
SCORIA1
50
RIVERSID
3050
REDW GT
1.030
14.2
1.029
142.0
821
1708ALTAP
1.029
142.1
1.029
142.0
443
BANN_240
76.7
-112.8
65.5
-83.8
1.040
249.6
313
JOSEPH1
71.5
11.6R
70110
COG19NEB
92.3
-126.8
771
AMELIA1
-92.1
126.5
53.9
-148.2
109
DEERLAN4
-171.4
19.6
-53.6
147.6
1.060
254.4
57
LAMOURE4
-76.6
-68.0
-228.6
-32.0
63
LAMOURE7
3.4
41.3
-37.2
19.9
-12.2
22.7
58.7
25.5
1.040
143.5
1.031
247.5
0.9783
0.9783
70.4
46.6
65.8
43.1
922
ROSS TAP
1.039
143.4
45
ROSS CRK
-37.8
-10.1
1.039
143.4
2835
LAMONT_LV1
G1
3835
LAMONT_LV2
G2
3836
LAMONT_LV4
179.3
41.7R
G4
2836
LAMONT_LV3
262.0
57.6R
G3
1.035
248.4
0.97955
0.97955
228.9
33.7
314
JOSEPH2
50.3
31.7
-88.1
-66.2
-88.4
-66.4
735
SHELL TP
-39.0
39.0
0.4
-0.4
1.035
142.8
734
SHELL A1
-68.1
-26.3
-13.5
14.3
1.035
142.9
1.043
250.3
628
ALC SCOT
1.035
142.8
185
SCOT4_8
7185
SCOTF ST
68.1
38.6R
1.035
14.3
4185
SCOTF GT
70.2
36.3R
1.035
14.3
627
AIR LIQC
68.1
25.4R
1.035
14.3
43
SCOT4_7
32.9
38.3
-38.2
-6.5
1.036
143.0
1.037
143.0
106
DEERLAN7
59.8
8.2
38.0
-7.6
64.5
5.4
1.015
1.041
143.7
67
BRUDERH7
-64.3
0.4
-0.4
0.1
-5.2
19.7
-8.2
1.037
143.2
394
ASTOTIN
1.037
143.2
391
ALBCHEM7
19.7
-19.7
8.1
1.038
143.2
44.3
55.5
-44.3
-55.5
44.4
57.0
-44.4
-56.9
57.2
-18.6
-19.6
7.0
1.039
143.4
62
SHERRIT7
-58.6
-25.5
28.7
1.1
1.037
143.1
1.039
143.4
39.4
-1.5
75.0
-9.9
54
DOW GEN1
51.5
8.5R
1.010
14.5
454
DOW GEN2
51.5
10.6R
1.010
14.5
90.0
-15.9
61
DOW CHEM
952
DIAM TAP
-0.3
-0.2
48
DIAM SH7
1.039
143.3
1.039
143.3
2031
DOWGTG 9
2030
DOWSTG 9
79.6
-5.1R
1.030
14.2
37.4
3.1R
1.030
15.1
12.2
-22.9
-39.4
1.3
1.038
143.3
393
DOW HYD7
-29.7
-1.2
-89.6
16.4
-56.4
18.9
1.037
143.1
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
921L (N-1)
FIG E-11
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
169.2
-17.1
119.8
84.7
1.058
254.0
59 REDWATE7
3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.021
140.9
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.030
142.1
1.029
142.0
1.026
141.6
1.025
141.4
443 BANN_240
1.026
141.6
109 DEERLAN4
1.059
254.2
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
821 708ALTAP
1.027
141.8
1.027
141.7
1.030
14.2
1.027
141.7
313 JOSEPH1
71.5
12.6R
70110 COG19NEB
1.038
249.2
771 AMELIA1
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
1.041
143.6
45 ROSS CRK
1.041
143.6
1.033
248.0
2835 LAMONT_LV1
3836 LAMONT_LV4
3835 LAMONT_LV2
2836 LAMONT_LV3
314 JOSEPH2
735 SHELL TP
734 SHELL A1
628 ALC SCOT
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
43 SCOT4_7
1.033
142.6
1.033
142.5
1.042
250.0
1.035
142.8
106 DEERLAN7
1.040
143.5
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
1.036
142.9
1.036
143.0
1.036
143.0
62 SHERRIT7
1.042
143.8
1.039
143.4
54 DOW GEN1
454 DOW GEN2
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.037
143.1
1.037
143.1
1.037
143.1
2031 DOWGTG 9
2030 DOWSTG 9
1.030
14.2
1.030
15.1
1.040
143.6
1.038
143.3
58 FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
708L (N-1)
FIG E-12
FRI, AUG 19 2016 15:45
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


341 HEARTLAN
174.6
-19.0
121.1
87.8
1.057
253.7
59 REDWATE7
18.8
9.1
4.7
2.3
3059 REDWATA9
14.1
6.8
9.4
4.5
4059 REDWATE9
-73.3
-14.4
26.1
-13.0
1.009
139.2
60 BEAMER 7
-26.0
12.4
-29.3
-45.4
1.009
139.3
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.023 141.2
1.022 141.0
1.019 140.7
1.018 140.5
2050 GRANITE9
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
50 RIVERSID
3050 REDW GT
1.012 139.7
1.030 14.2
821 708ALTAP
1.013 139.8
57 LAMOURE4
-84.6
-75.5
-269.4
-64.5
1.027 246.4
63 LAMOURE7
68.8
67.6
-45.3
14.4
-17.2
19.2
35.3
18.6
1.035 142.8
922 ROSS TAP
1.035 142.8
45 ROSS CRK
-37.8
-10.1
1.035 142.8
62 SHERRIT7
-35.2
-18.7
5.3
-5.7
1.033 142.6
1.034 142.6
393 DOW HYD7
17.2
-19.4
-44.4
-2.1
88.1
4.3
2.0
1.035 142.8
54 DOW GEN1
51.5
9.8R
1.010
14.5
454 DOW GEN2
51.5
-9.1R
1.010
14.5
61 DOW CHEM
76.9
-15.9
-76.6
16.2
-85.3
16.3
-6.3
5.6
1.033 142.6
58 FORT SA7
443 BANN_240
84.7
73.3
-120.8
-91.7
1.037 248.8
313 JOSEPH1
71.5
12.8R
70110 COG19NEB
96.3
-127.2
269.8
67.9
0.97955
0.97955
0.97955
314 JOSEPH2
-65.8
-54.4
-66.0
-54.5
735 SHELL TP
1.033 142.5
734 SHELL A1
-43.8
-26.7
1.2
14.3
1.037 143.1
771 AMELIA1
-96.1
126.9
57.8
-148.7
1.041 249.9
628 ALC SCOT
1.036 143.0
43 SCOT4_7
18.1
39.2
-62.5
-5.0
25.0
56.8
-24.9
-56.7
24.7
58.0
-24.7
-58.0
1.038 143.2
185 SCOT4_8
1.038 143.2
7185 SCOTF ST
68.1
37.9R
1.035
14.3
4185 SCOTF GT
70.2
35.6R
1.035
14.3
627 AIR LIQC
68.1
24.4R
1.035
14.3
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
179.3
44.6R
2836 LAMONT_LV3
262.0
61.8R
1.033 247.9
952 DIAM TAP
-0.3
-0.2
48 DIAM SH7
1.040 143.5
1.039 143.4
1.039 143.4
2031 DOWGTG 9
2030 DOWSTG 9
79.6
21.1R
1.030 14.2
37.4
6.4R
1.030 15.1
86.6
-14.8
-4.5
8.9
1.040 143.5
391 ALBCHEM7
-49.1
-3.1
4.5
0.4
0.1
-0.4
-0.3
4.5
-4.5
10.2
-10.3
-10.4
1.036 143.0
1.036 142.9
67 BRUDERH7
394 ASTOTIN
1.036 142.9
106 DEERLAN7
84.8
17.2
28.3
-10.3
49.2
2.9
1.015
1.038 143.3
109 DEERLAN4
-174.2
18.5
-57.6
148.1
1.058 253.9
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
807L (N-1)
FIG E-13
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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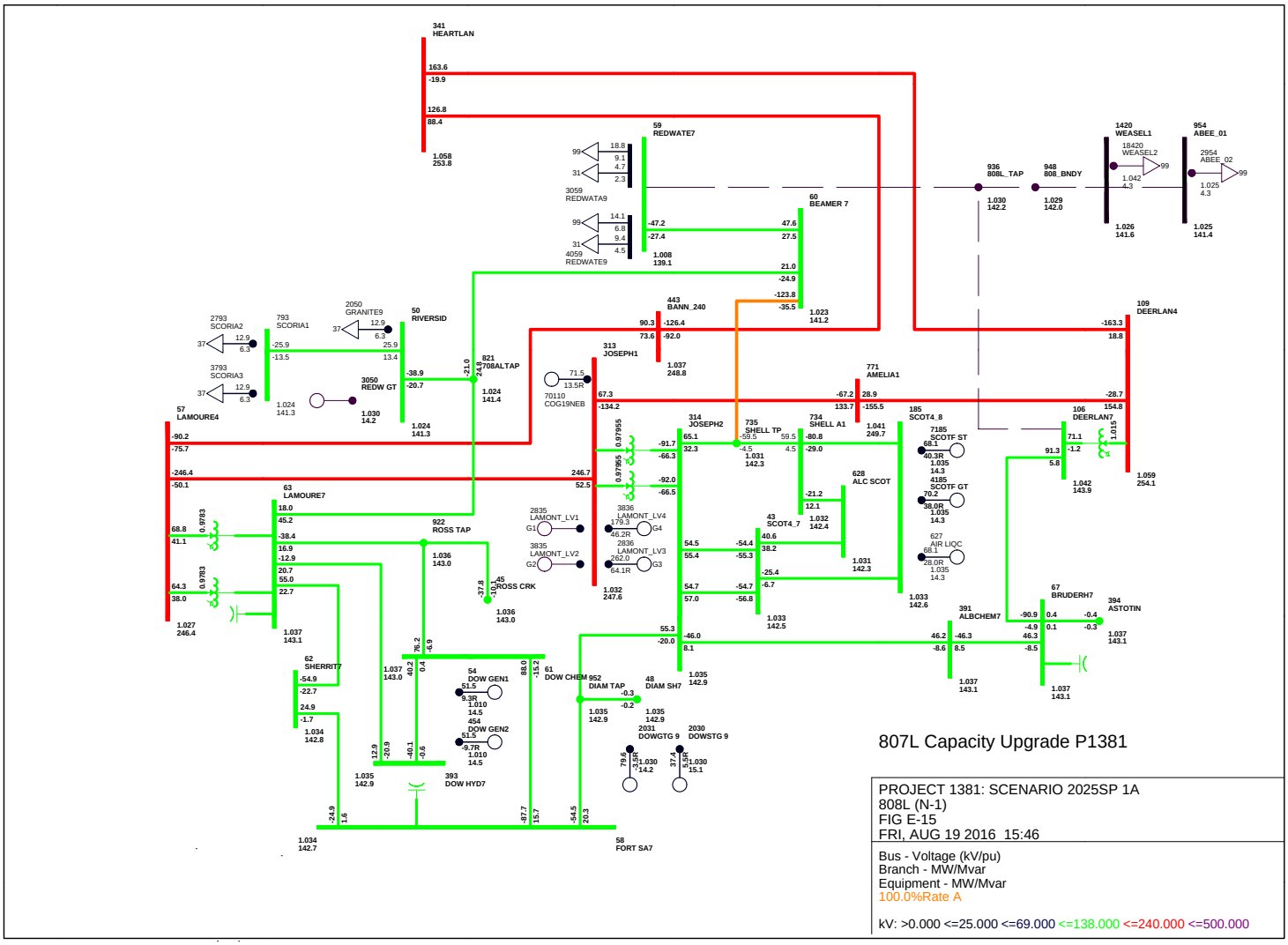
HEARTLAN
175.2
-15.8
121.8
85.5
1.057
253.8
59
REDWATE7
3059
REDWATA9
4059
REDWATE9
-47.2
-27.4
1.006
138.8
60
BEAMER 7
33.5
-15.4
-88.8
-17.5
1.029
142.0
443
BANN_240
85.3
71.0
-121.4
-89.3
1.037
248.9
313
JOSEPH1
71.5
13.1R
70110
COG19NEB
84.3
-126.1
771
AMELIA1
-84.2
125.7
45.9
-147.4
1.041
249.7
109
DEERLAN4
-174.8
15.3
-45.6
146.7
1420
WEASEL1
18420
WEASEL2
954
ABEE_01
2954
ABEE_02
936
808L_TAP
948
808_BNDY
1.021
140.9
1.020
140.7
1.017
140.3
1.015
140.1
2050
GRANITE9
2793
SCORIA2
3793
SCORIA3
793
SCORIA1
50
RIVERSID
821
1708ALTAP
1.029
142.1
3050
REDW GT
1.030
14.2
57
LAMOURE4
-85.2
-73.2
-239.9
-49.6
1.027
246.6
63
LAMOURE7
922
ROSS TAP
1.038
143.2
45
ROSS CRK
1.032
247.8
1.038
143.2
1.039
143.3
62
SHERRIT7
1.036
143.0
2835
LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
314
JOSEPH2
735
SHELL TP
1.034
142.7
734
SHELL A1
628
ALC SCOT
43
SCOT4_7
1.034
142.6
1.035
142.8
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
1.035
142.9
106
DEERLAN7
1.036
143.0
1.058
253.8
67
BRUDERH7
394
ASTOTIN
1.033
142.6
391
ALBCHEM7
1.034
142.6
54
DOW GEN1
454
DOW GEN2
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
1.037
143.2
1.037
143.1
2031
DOWGTG 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
393
DOW HYD7
1.037
143.1
1.036
142.9
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
735L (N-1)
FIG E-14
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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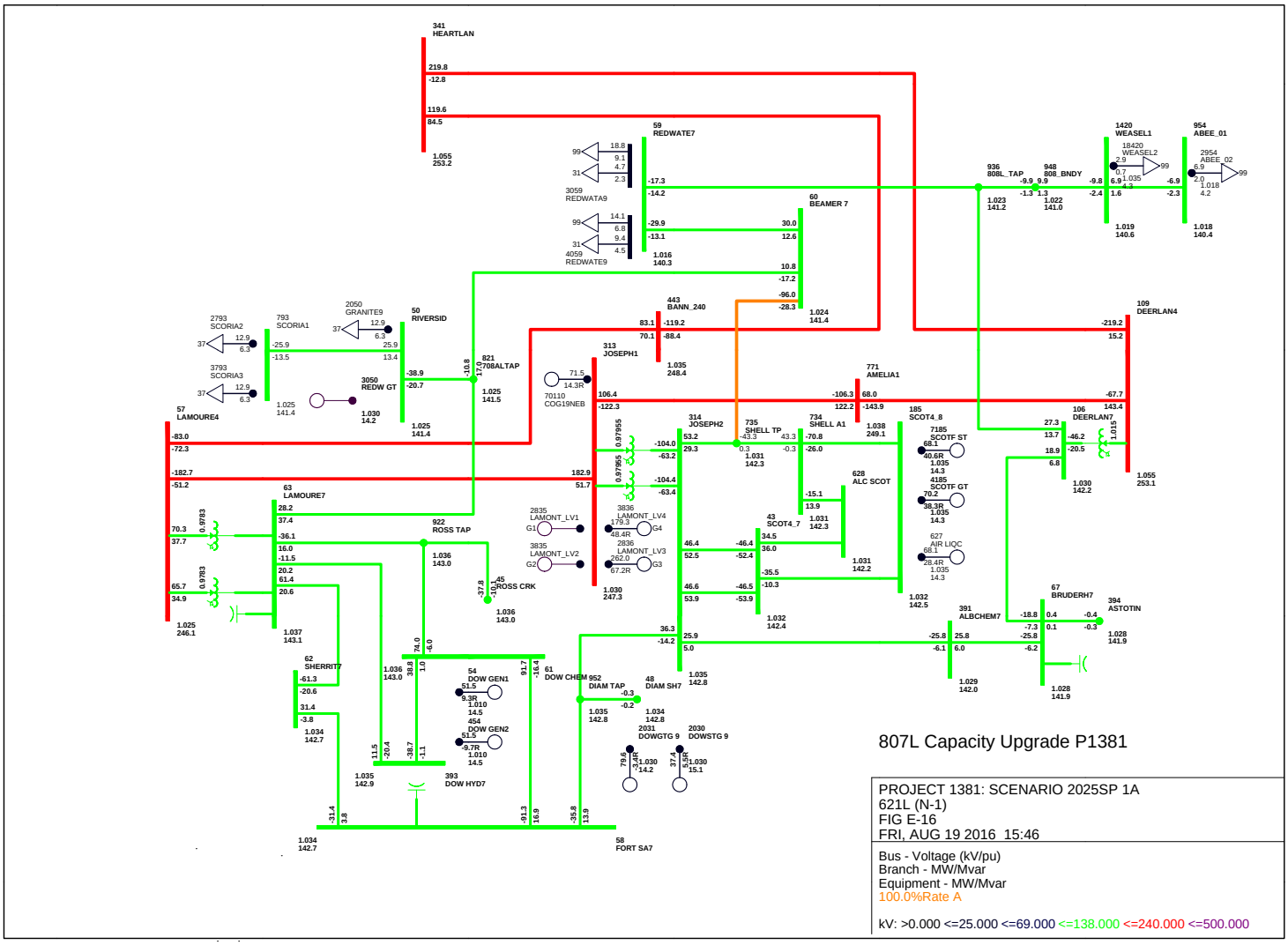
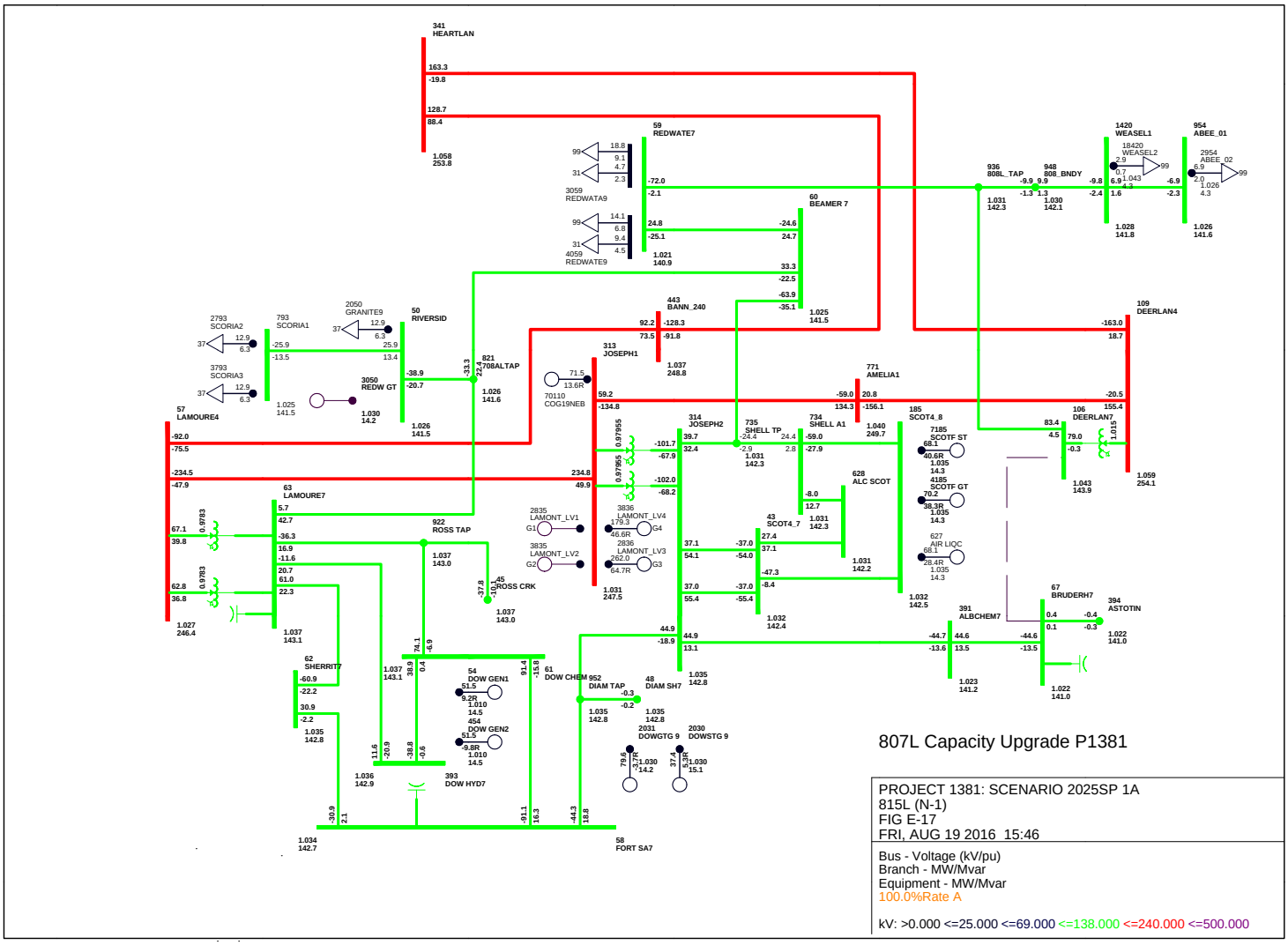
163.6
-19.9
126.8
88.4
1.058
253.8
59 REDWATE7
3059 REDWATA9
4059 REDWATE9
60 BEAMER 7
1.008
139.1
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.030 142.2
1.029 142.0
1.042
1.026 141.6
1.025 141.4
2050 GRANITE9
2793 SCORIA2
793 SCORIA1
3793 SCORIA3
50 RIVERSID
3050 REDW GT
1.024 141.3
1.030 14.2
821 4708ALTAP
1.024 141.4
443 BANN_240
1.037 248.8
1.023 141.2
109 DEERLAN4
313 JOSEPH1
70110 COG19NEB
771 AMELIA1
57 LAMOURE4
63 LAMOURE7
1.027 246.4
1.037 143.1
922 ROSS TAP
1.036 143.0
45 ROSS CRK
1.036 143.0
1.032 247.6
2835 LAMONT_LV1
3835 LAMONT_LV2
3836 LAMONT_LV4
2836 LAMONT_LV3
314 JOSEPH2
735 SHELL TP
734 SHELL A1
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
628 ALC SCOT
43 SCOT4_7
627 AIR LIQC
1.031 142.3
1.032 142.4
1.041 249.7
1.035 14.3
1.033 142.5
1.031 142.3
1.033 142.6
106 DEERLAN7
1.042 143.9
1.059 254.1
67 BRUDERH7
391 ALBCHEM7
394 ASTOTIN
1.037 143.1
62 SHERRIT7
1.034 142.8
54 DOW GEN1
454 DOW GEN2
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.035 142.9
2031 DOWGTG 9
2030 DOWSTG 9
1.030 14.2
1.030 15.1
58 FORT SA7
1.034 142.7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
808L (N-1)
FIG E-15
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
621L (N-1)
FIG E-16
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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HEARTLAN
163.3
-19.8
128.7
88.4
1.058
253.8
59
REDWATE7
3059
REDWATA9
4059
REDWATE9
-72.0
-2.1
24.8
-25.1
1.021
140.9
60
BEAMER 7
-24.6
24.7
33.3
-22.5
-63.9
-35.1
1.025
141.5
936
808L_TAP
948
808_BNDY
1420
WEASEL1
18420
WEASEL2
954
ABEE_01
2954
ABEE_02
1.031
142.3
1.030
142.1
1.028
141.8
1.026
141.6
2793
SCORIA2
3793
SCORIA3
793
SCORIA1
2050
GRANITE9
50
RIVERSID
3050
REDW GT
1.025
141.5
1.030
14.2
821
2708ALTAP
1.026
141.6
1.026
141.5
57
LAMOURE4
-92.0
-75.5
-234.5
-47.9
63
LAMOURE7
5.7
42.7
-36.3
16.9
-11.6
20.7
61.0
22.3
1.037
143.1
1.027
246.4
922
ROSS TAP
1.037
143.0
45
ROSS CRK
1.037
143.0
62
SHERRIT7
-60.9
-22.2
30.9
-2.2
1.035
142.8
1.034
142.7
393
DOW HYD7
1.036
142.9
54
DOW GEN1
51.5
9.2R
1.010
14.5
454
DOW GEN2
51.5
9.8R
1.010
14.5
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
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142.8
1.035
142.8
58
FORT SA7
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DOWGTG 9
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DOWSTG 9
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443
BANN_240
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1.037
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313
JOSEPH1
71.5
13.6R
70110
COG19NEB
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LAMONT_LV1
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LAMONT_LV2
3836
LAMONT_LV4
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LAMONT_LV3
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JOSEPH2
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-54.0
37.0
55.4
-37.0
-55.4
44.9
-18.9
44.9
13.1
1.035
142.8
1.032
142.4
735
SHELL TP
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24.4
-2.9
2.8
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142.3
43
SCOT4_7
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37.1
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SHELL A1
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249.7
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-27.9
-8.0
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1.031
142.3
628
ALC SCOT
1.031
142.2
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AMELIA1
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SCOTF ST
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4185
SCOTF GT
70.2
38.3R
1.035
14.3
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AIR LIQC
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BRUDERH7
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ASTOTIN
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DEERLAN7
83.4
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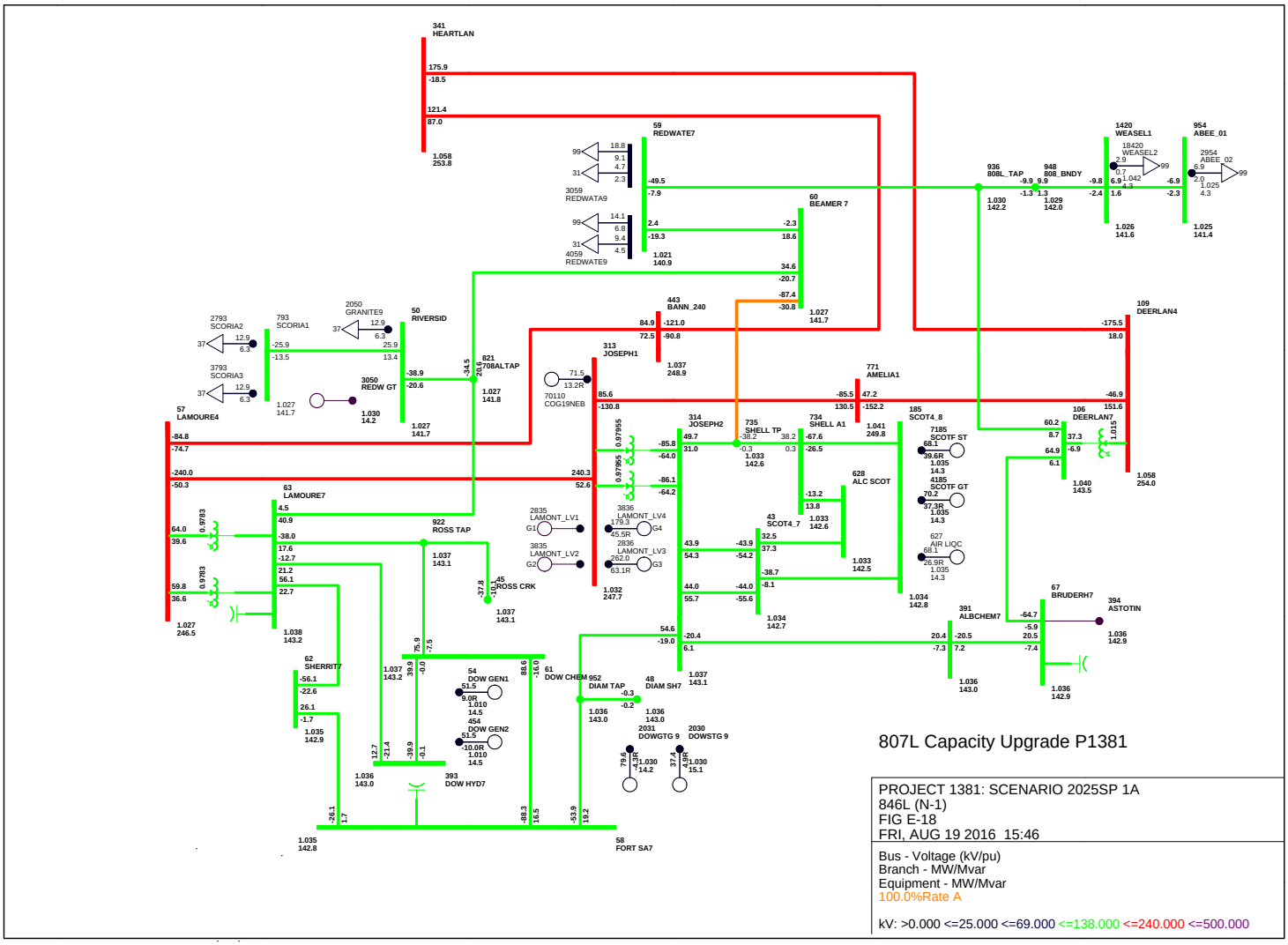
1.015
1.043
143.9
1.059
254.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
815L (N-1)
FIG E-17
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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175.9
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REDWATA9
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REDWATE9
60
BEAMER 7
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140.9
443
BANN_240
84.9
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72.5
-90.8
1.037
248.9
1.027
141.7
313
JOSEPH1
71.5
13.2R
70110
COG19NEB
85.6
-130.8
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AMELIA1
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130.5
47.2
-152.2
-46.9
151.6
1.041
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DEERLAN4
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1.058
254.0
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18420
WEASEL2
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ABEE_01
2954
ABEE_02
936
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948
808_BNDY
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1.026
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1.025
141.4
1.042
1.025
2793
SCORIA2
3793
SCORIA3
793
SCORIA1
2050
GRANITE9
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RIVERSID
3050
REDW GT
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141.7
1.030
14.2
821
2708ALTAP
1.027
141.8
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LAMOURE4
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-74.7
-240.0
-50.3
63
LAMOURE7
240.3
52.6
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ROSS TAP
1.037
143.1
45
ROSS CRK
1.032
247.7
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LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
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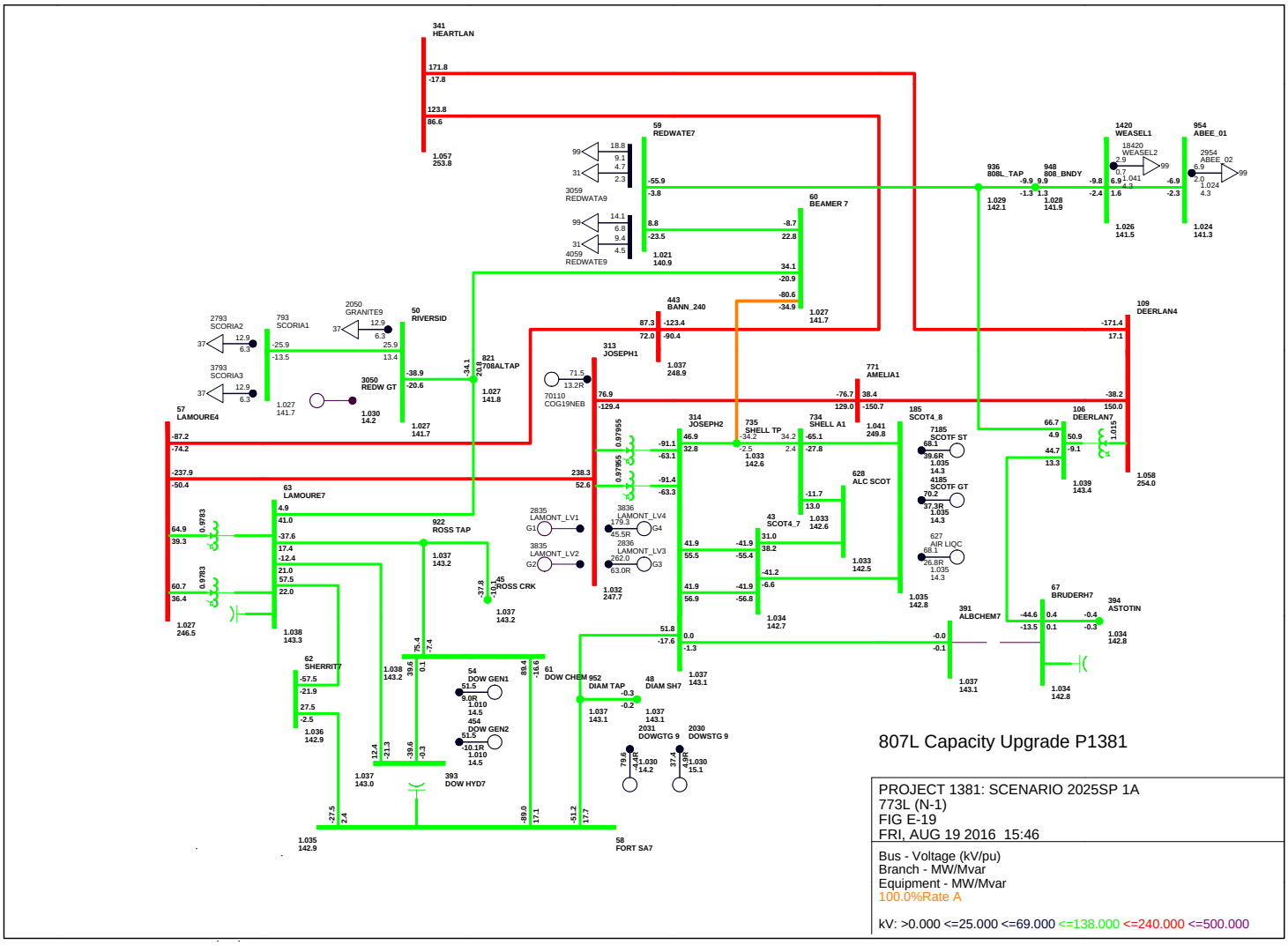
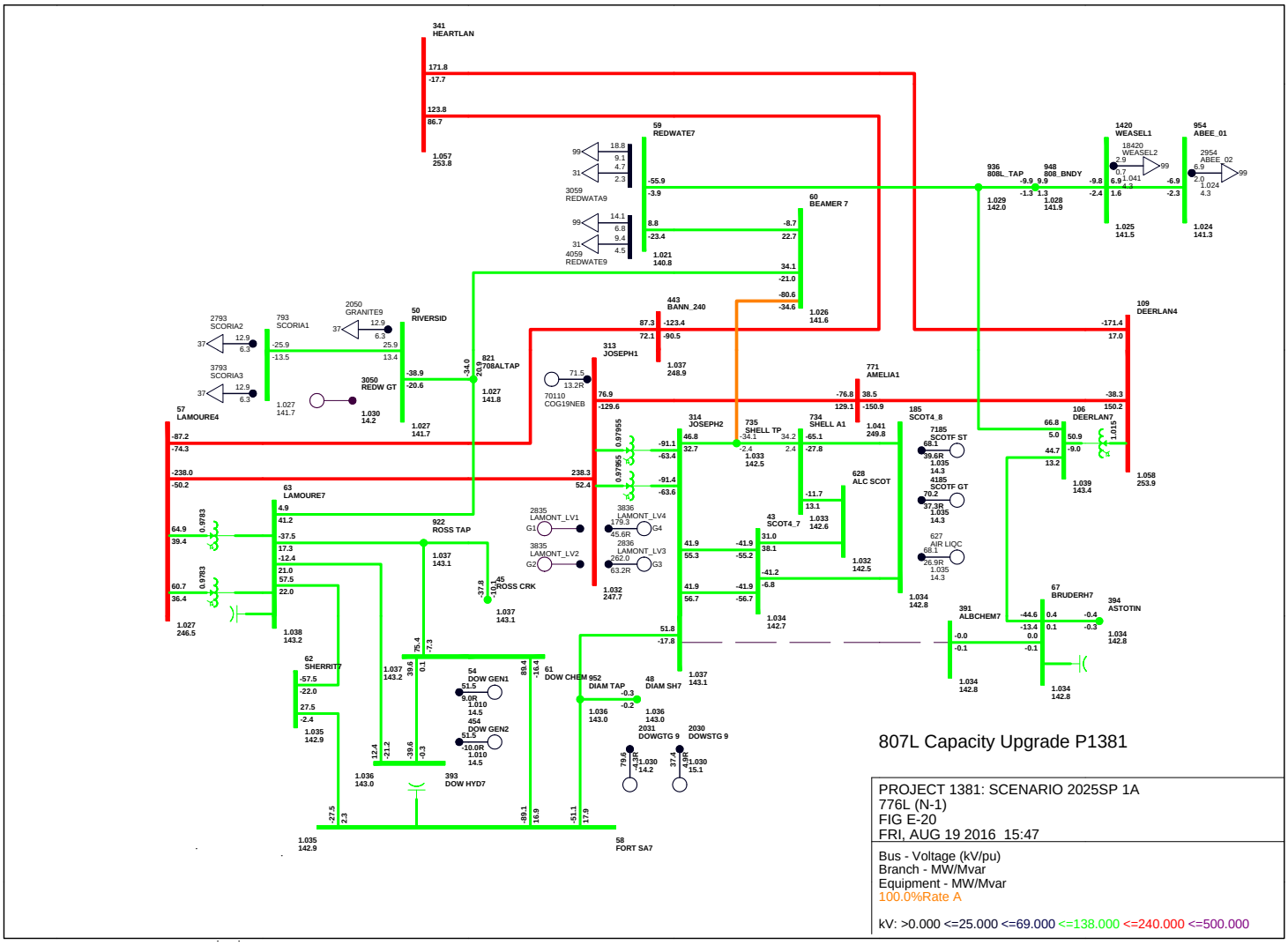
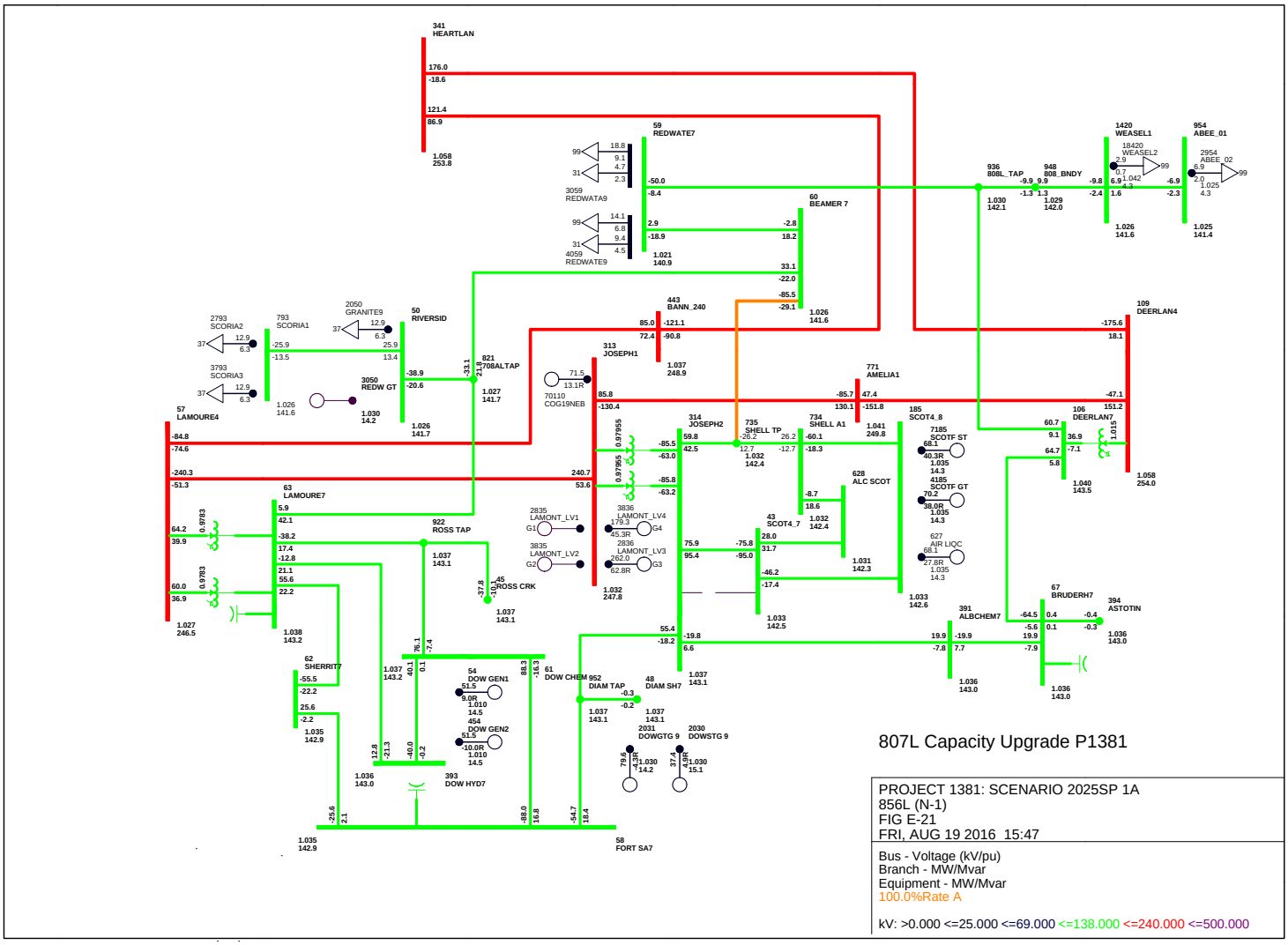
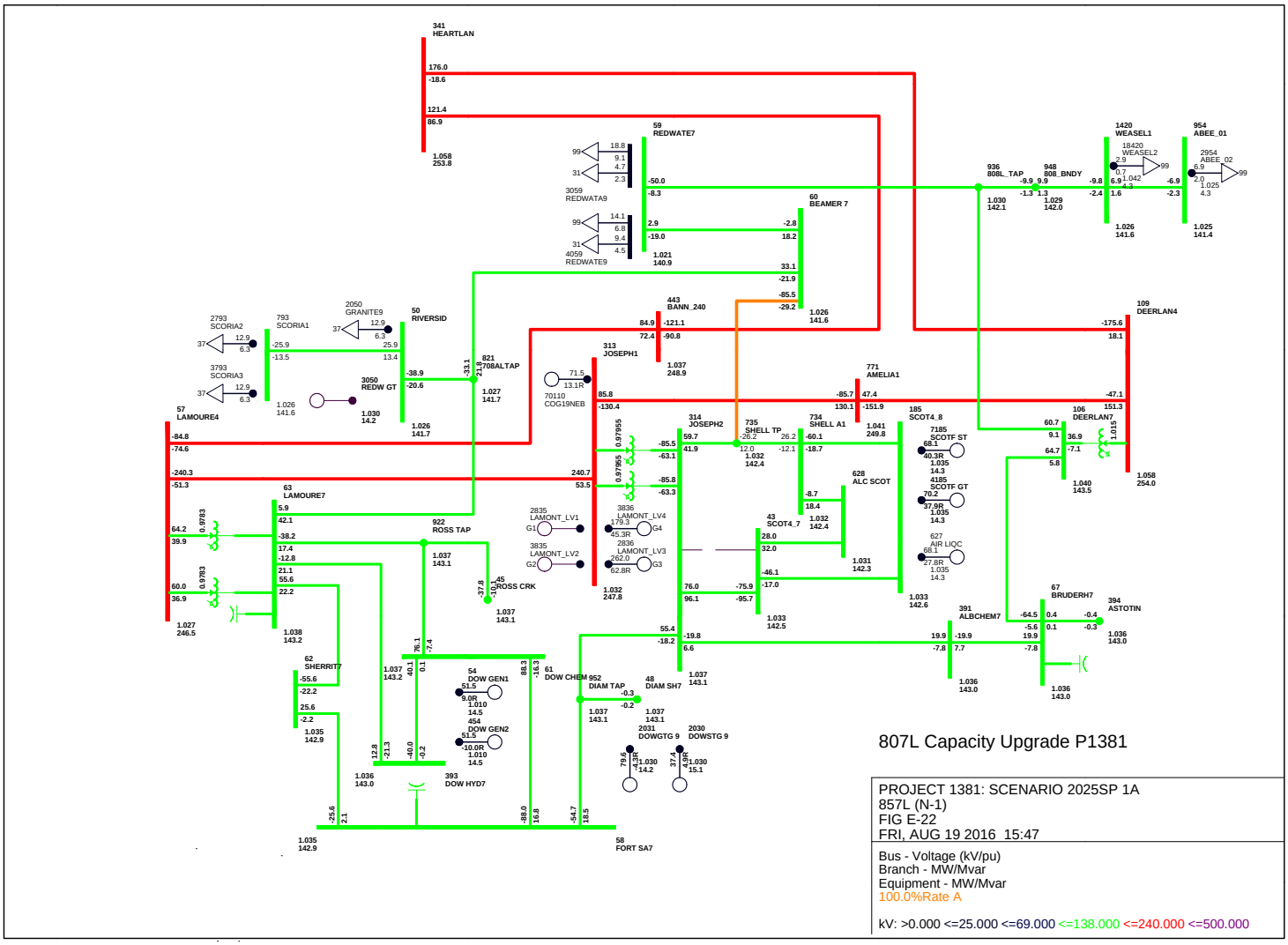
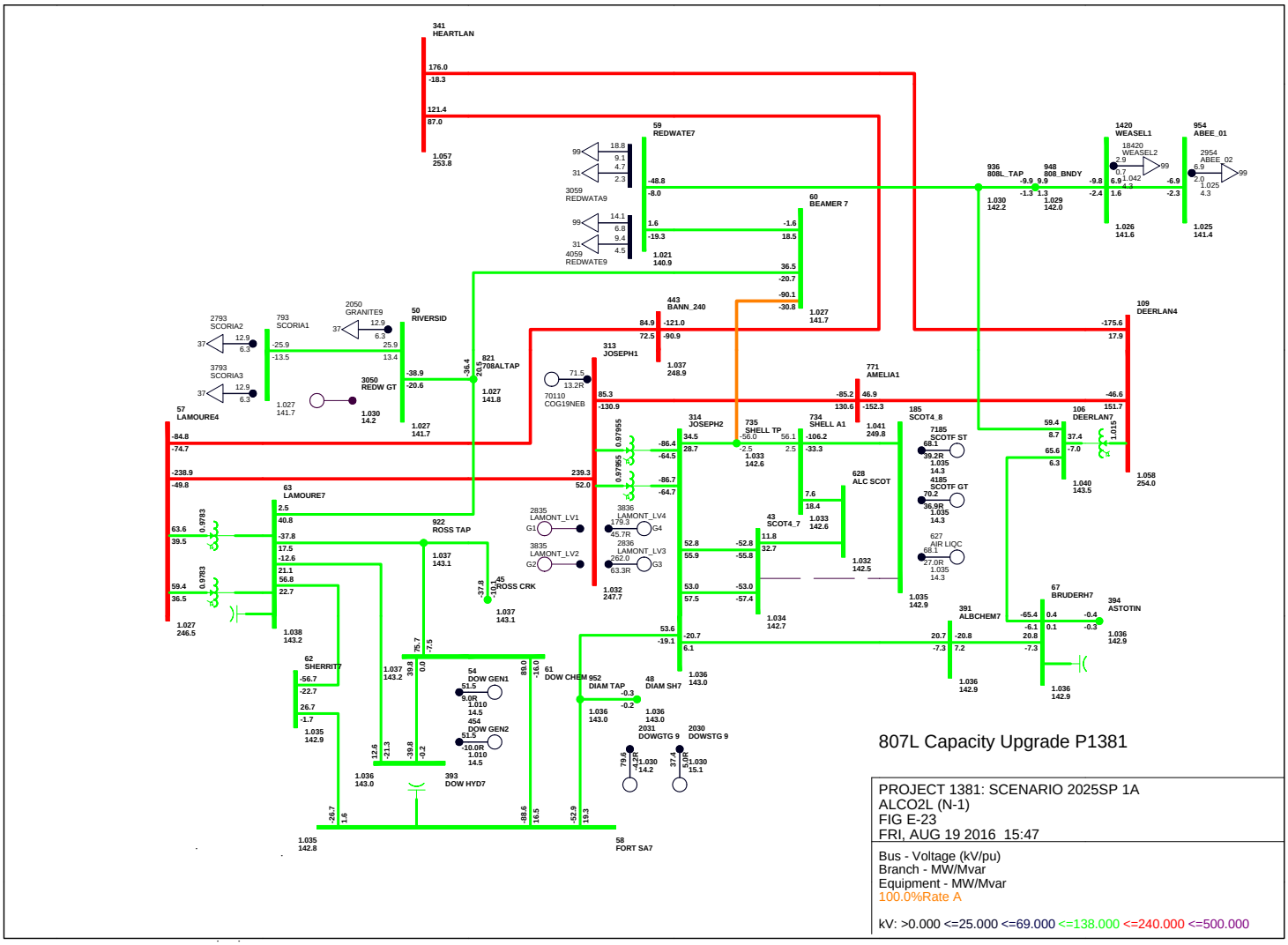
LAMONT_LV3
314
JOSEPH2
735
SHELL TP
734
SHELL A1
628
ALC SCOT
43
SCOT4_7
1.033
142.6
1.033
142.5
1.034
142.7
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
1.034
142.8
106
DEERLAN7
1.040
143.5
67
BRUDERH7
394
ASTOTIN
1.036
142.9
391
ALBCHEM7
1.036
143.0
62
SHERRIT7
1.035
142.9
1.038
143.2
54
DOW GEN1
454
DOW GEN2
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
1.037
143.1
1.036
143.0
2031
DOWGTG 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
393
DOW HYD7
1.035
142.8
58
FORT SA7
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
846L (N-1)
FIG E-18
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

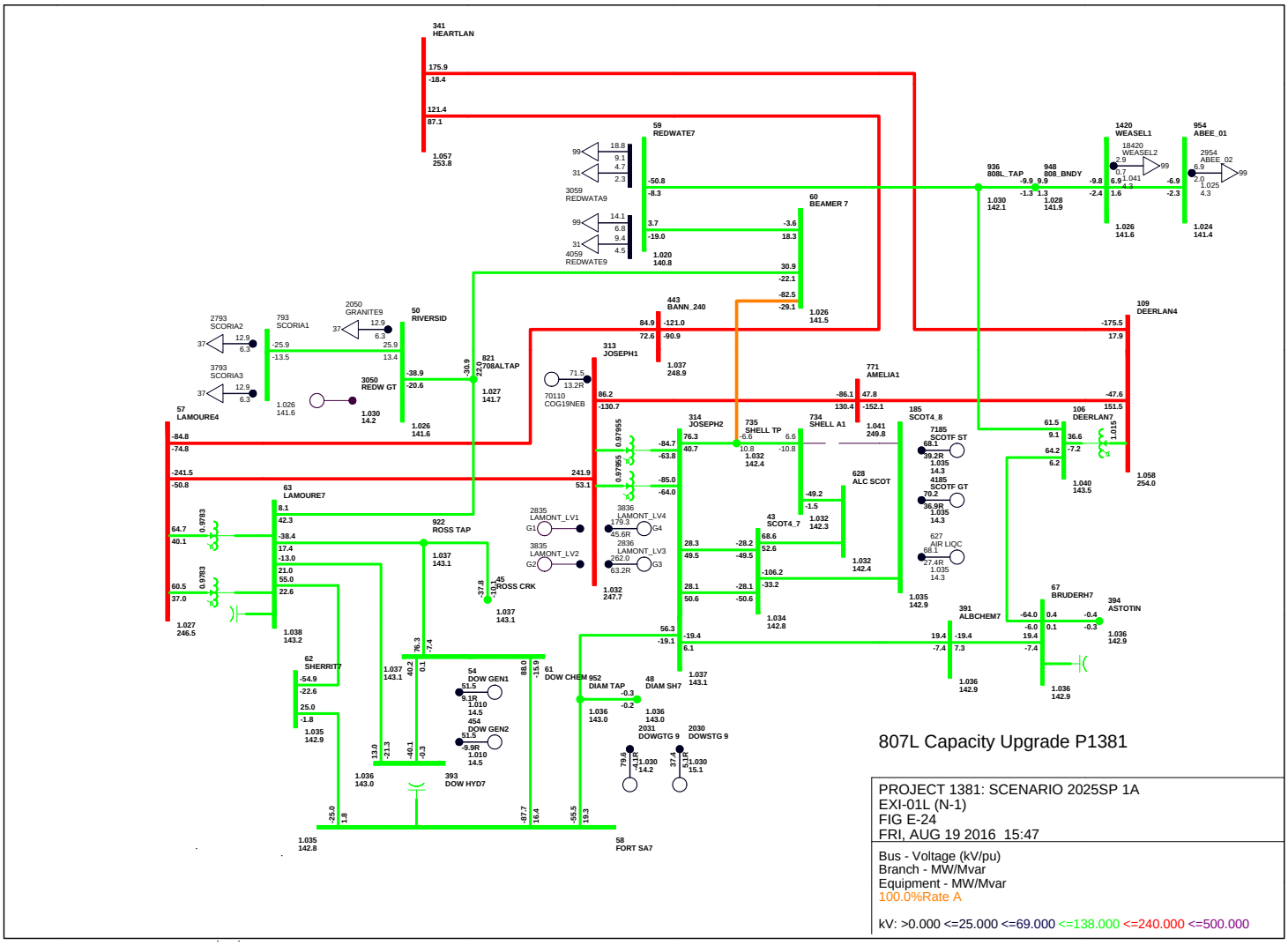

807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
773L (N-1)
FIG E-19
FRI, AUG 19 2016 15:46
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
776L (N-1)
FIG E-20
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
856L (N-1)
FIG E-21
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
857L (N-1)
FIG E-22
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
ALCO2L (N-1)
FIG E-23
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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2.3
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-8.3
3059
REDWATA9
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6.8
9.4
4.5
4058
REDWATE9
3.7
-19.0
1.020
140.8
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BEAMER 7
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30.9
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-82.5
-29.1
1.026
141.5
936
808L_TAP
948
808_BNDY
1420
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WEASEL2
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ABEE_01
2954
ABEE_02
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141.6
1.024
141.4
1.041
1.025
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BANN_240
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1.037
248.9
313
JOSEPH1
71.5
13.2R
70110
COG19NEB
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-130.7
771
AMELIA1
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130.4
47.8
-152.1
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DEERLAN4
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17.9
-47.6
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2050
GRANITE9
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SCORIA2
793
SCORIA1
3793
SCORIA3
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RIVERSID
3050
REDW GT
1.030
14.2
821
2708ALTAP
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141.6
1.027
141.7
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LAMOURE4
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241.9
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LAMOURE7
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22.6
64.7
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ROSS TAP
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ROSS CRK
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LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
179.3
45.6R
2836
LAMONT_LV3
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63.2R
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247.7
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314
JOSEPH2
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-64.0
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-19.1
-19.4
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SHELL TP
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734
SHELL A1
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249.8
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142.3
628
ALC SCOT
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43
SCOT4_7
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52.6
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142.8
185
SCOT4_8
7185
SCOTF ST
68.1
39.2R
1.035
14.3
4185
SCOTF GT
70.2
36.9R
1.035
14.3
627
AIR LIQC
68.1
27.4R
1.035
14.3
1.035
142.9
106
DEERLAN7
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6.2
1.040
143.5
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67
BRUDERH7
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0.1
-0.4
-0.3
-7.4
394
ASTOTIN
1.036
142.9
391
ALBCHEM7
19.4
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1.036
142.9
1.036
142.9
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SHERRIT7
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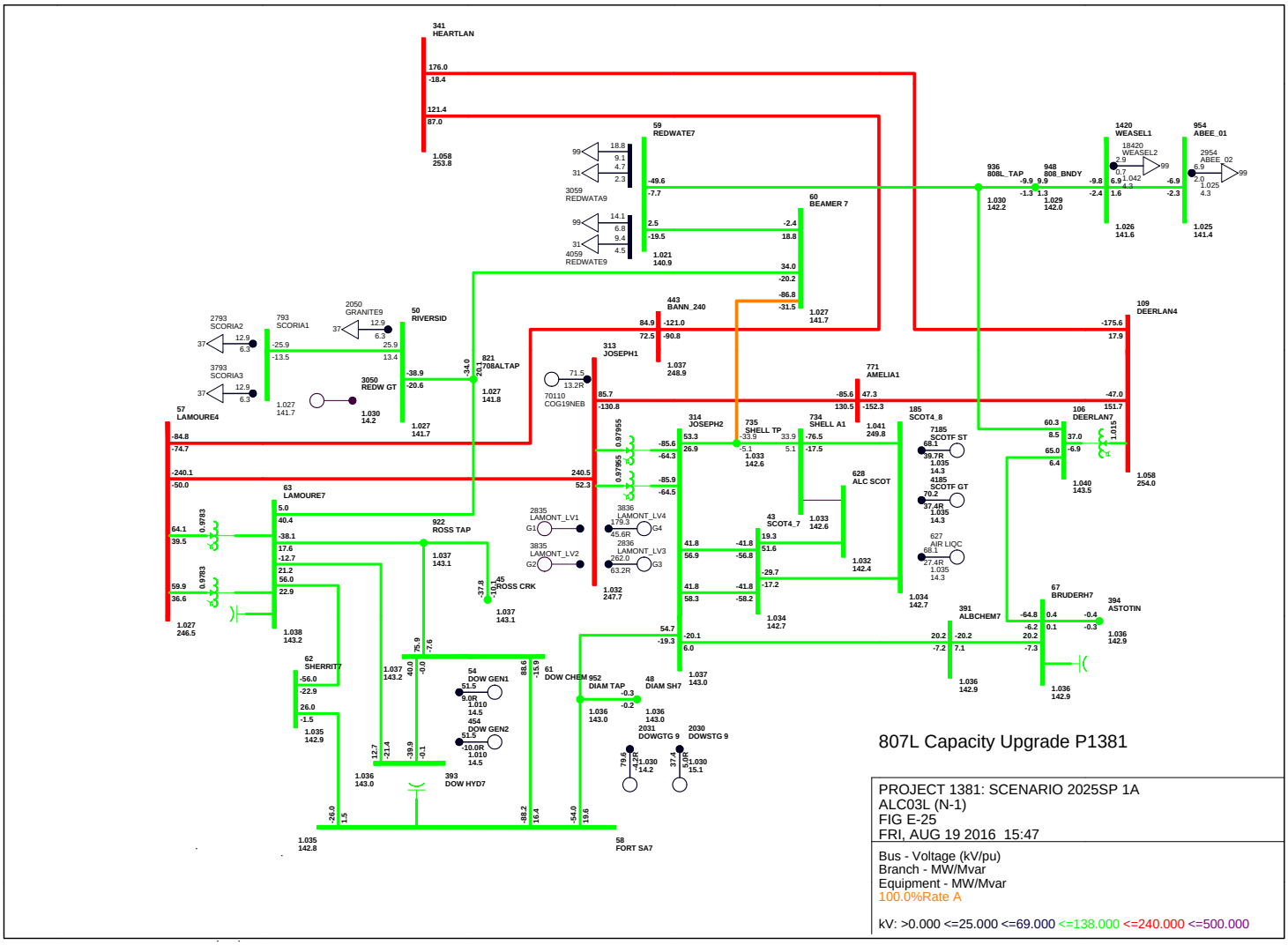
25.0
-1.8
1.035
142.9
54
DOW GEN1
51.5
9.1R
1.010
14.5
454
DOW GEN2
51.5
9.9R
1.010
14.5
393
DOW HYD7
1.036
143.0
61
DOW CHEM
952
DIAM TAP
-0.3
-0.2
1.036
143.0
48
DIAM SH7
1.037
143.1
2031
DOWGTG 9
79.6
41R
1.030
14.2
2030
DOWSTG 9
37.4
51R
1.030
15.1
58
FORT SA7
1.035
142.8
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
EXI-01L (N-1)
FIG E-24
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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REDWATA9
4059
REDWATE9
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BEAMER 7
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140.9
443
BANN_240
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72.5
-90.8
1.037
248.9
1.027
141.7
313
JOSEPH1
71.5
13.2R
70110
COG19NEB
85.7
-130.8
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2708ALTAP
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1.027
141.7
2050
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SCORIA2
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SCORIA3
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REDW GT
1.030
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LAMOURE7
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21.2
56.0
22.9
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143.2
922
ROSS TAP
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143.1
45
ROSS CRK
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-10.1
1.037
143.1
2835
LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
179.3
45.6R
2836
LAMONT_LV3
262.0
63.2R
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247.7
240.5
52.3
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JOSEPH2
53.3
26.9
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735
SHELL TP
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-5.1
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142.6
734
SHELL A1
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AMELIA1
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628
ALC SCOT
43
SCOT4_7
19.3
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SCOT4_8
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SCOTF ST
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SCOTF GT
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AIR LIQC
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BRUDERH7
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ASTOTIN
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DEERLAN7
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DEERLAN4
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DIAM TAP
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FORT SA7
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SHERRIT7
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ABEE_02
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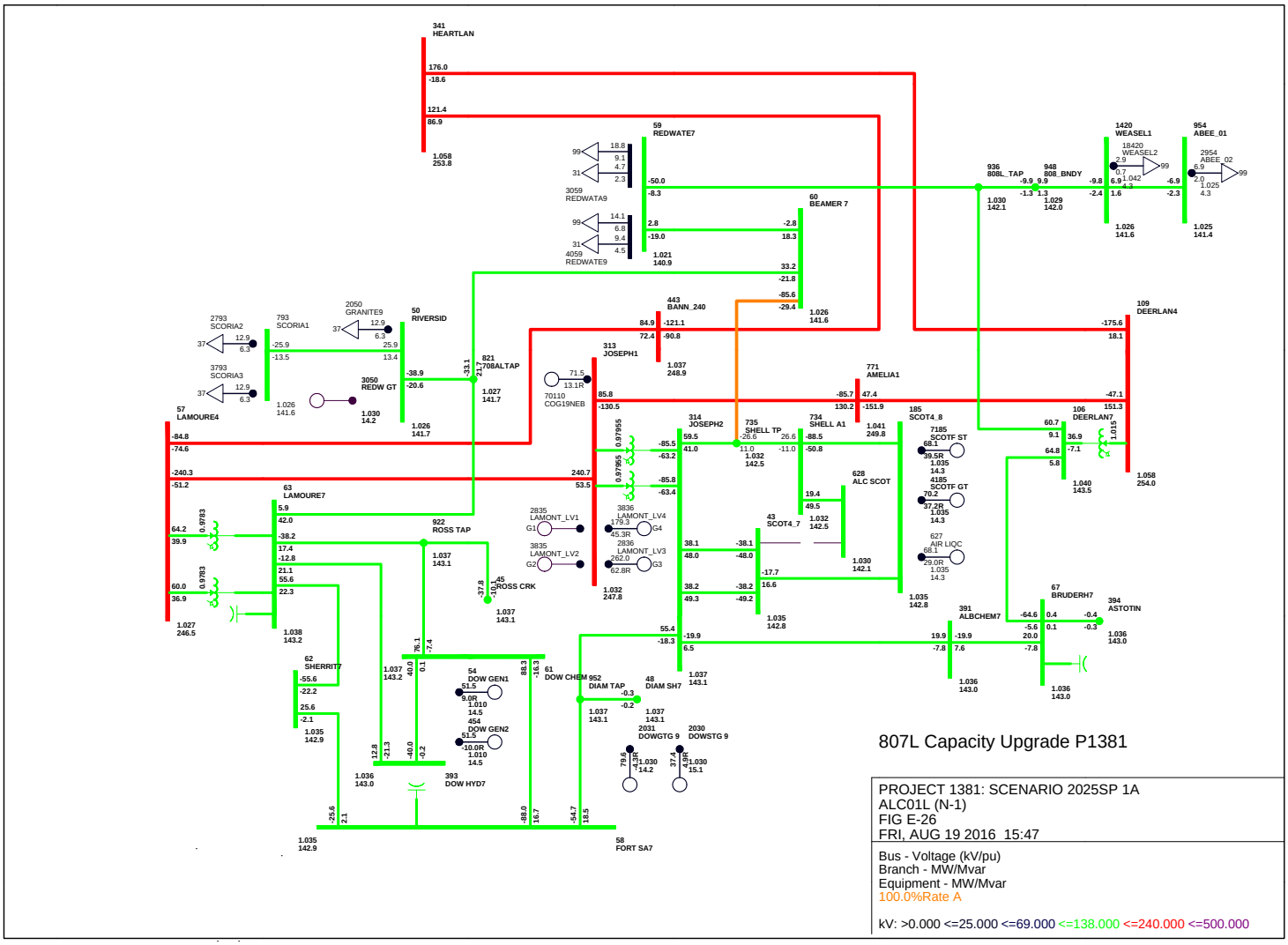
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
ALC03L (N-1)
FIG E-25
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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REDWATA9
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6.8
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REDWATE9
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BEAMER 7
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DOW HYD7
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FORT SA7
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248.9
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JOSEPH1
71.5
13.1R
70110
COG19NEB
85.8
-130.5
240.7
53.5
1.032
247.8
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LAMONT_LV1
3835
LAMONT_LV2
3836
LAMONT_LV4
2836
LAMONT_LV3
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314
JOSEPH2
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41.0
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-38.1
-48.0
38.2
49.3
-38.2
-49.2
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-18.3
-19.9
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1.037
143.1
952
DIAM TAP
48
DIAM SH7
1.037
143.1
2031
DOWGTG 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
735
SHELL TP
-26.6
26.6
11.0
-11.0
1.032
142.5
43
SCOT4_7
-17.7
16.6
1.035
142.8
734
SHELL A1
-88.5
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1.041
249.8
19.4
49.5
1.032
142.5
628
ALC SCOT
1.030
142.1
771
AMELIA1
-85.7
130.2
47.4
-151.9
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
1.035
142.8
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DEERLAN4
-175.6
18.1
-47.1
151.3
1.058
254.0
106
DEERLAN7
1.015
60.7
9.1
36.9
-7.1
64.8
5.8
1.040
143.5
391
ALBCHEM7
19.9
-19.9
7.6
-7.8
-64.6
-5.6
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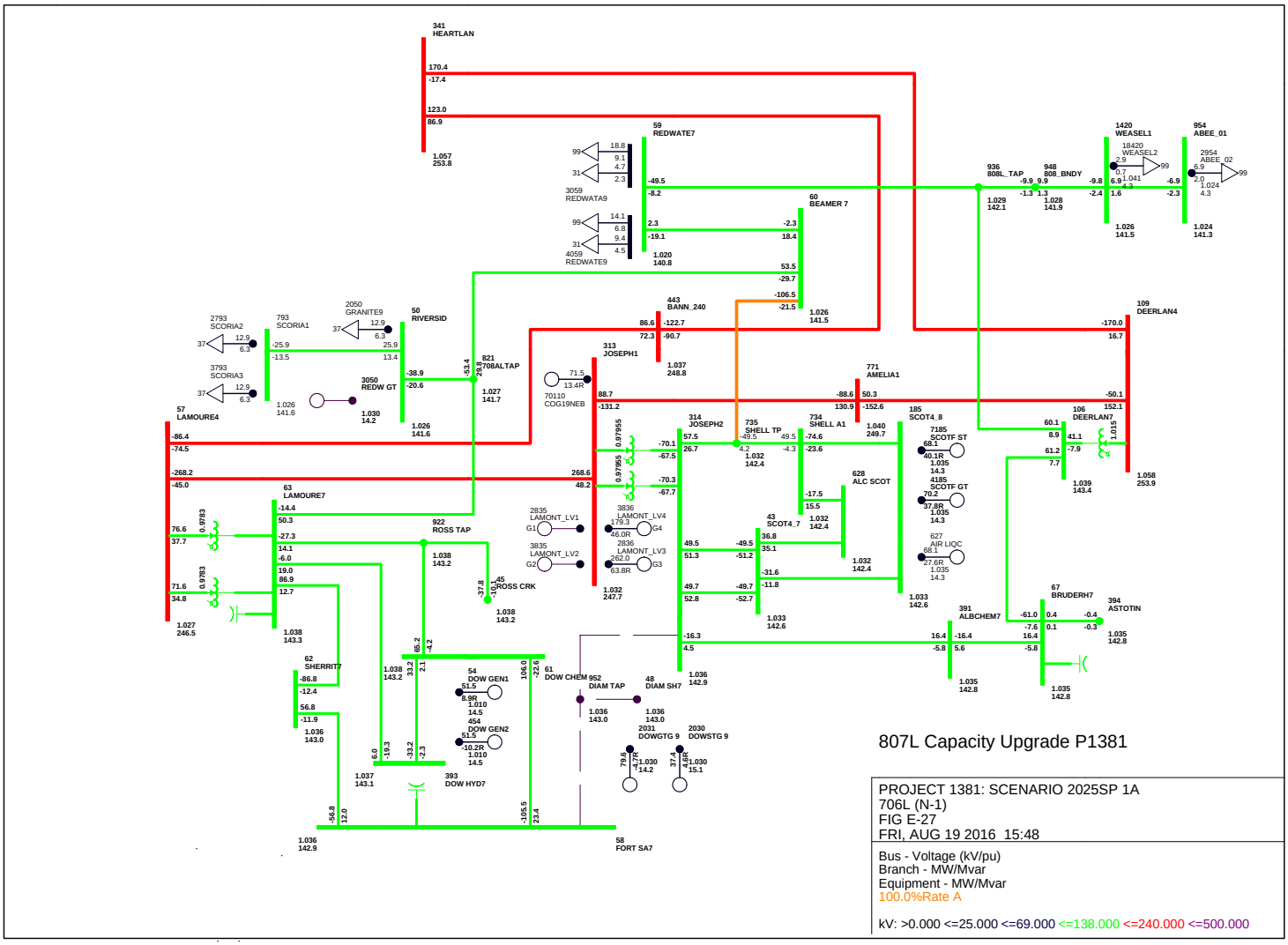
-7.8
0.4
0.1
-0.4
-0.3
67
BRUDERH7
1.036
143.0
394
ASTOTIN
1.036
143.0
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
ALC01L (N-1)
FIG E-26
FRI, AUG 19 2016 15:47
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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99
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3059
REDWATA9
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-8.2
14.1
6.8
9.4
4.5
4059
REDWATE9
2.3
-19.1
1.020
140.8
60
BEAMER 7
-2.3
18.4
53.5
-29.7
-106.5
-21.5
1.026
141.5
936
808L_TAP
948
808_BNDY
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WEASEL2
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ABEE_01
2954
ABEE_02
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1.024
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SCORIA2
3793
SCORIA3
793
SCORIA1
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RIVERSID
3050
REDW GT
1.026
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1.030
14.2
821
8708ALTAP
1.027
141.7
1.026
141.6
57
LAMOURE4
-86.4
-74.5
-268.2
-45.0
63
LAMOURE7
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-27.3
14.1
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86.9
12.7
1.038
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0.9783
0.9783
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37.7
71.6
34.8
1.027
246.5
922
ROSS TAP
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143.2
45
ROSS CRK
-37.8
-10.1
1.038
143.2
62
SHERRIT7
-86.8
-12.4
56.8
-11.9
1.036
143.0
1.037
143.1
393
DOW HYD7
6.0
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-33.2
-2.3
33.2
2.1
66.2
4.2
1.038
143.2
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DOW GEN1
51.5
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1.010
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454
DOW GEN2
51.5
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1.010
14.5
106.0
-22.6
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DOW CHEM
-105.5
23.4
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58
FORT SA7
952
DIAM TAP
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48
DIAM SH7
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DOWGTG 9
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DOWSTG 9
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37.4
44R
1.030
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313
JOSEPH1
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COG19NEB
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JOSEPH2
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SHELL TP
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SHELL A1
-74.6
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4.5
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2835
LAMONT_LV1
G1
3835
LAMONT_LV2
G2
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LAMONT_LV4
179.3
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G4
2836
LAMONT_LV3
262.0
63.8R
G3
1.032
247.7
771
AMELIA1
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50.3
-152.6
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SCOT4_8
7185
SCOTF ST
68.1
40.1R
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14.3
4185
SCOTF GT
70.2
37.8R
1.035
14.3
627
AIR LIQC
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27.6R
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14.3
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ALBCHEM7
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0.1
-0.4
-0.3
-5.8
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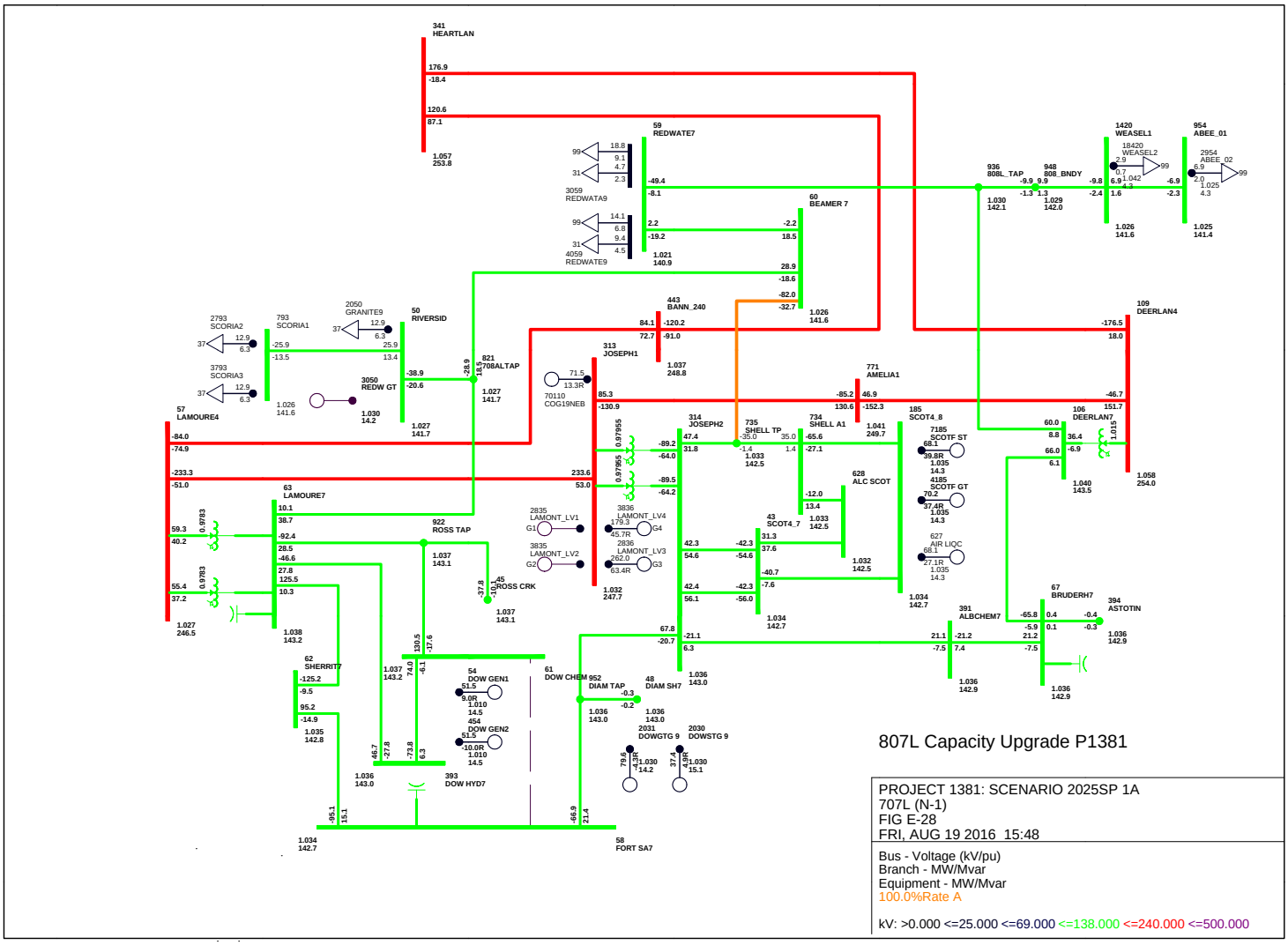
142.8
1.035
142.8
394
ASTOTIN
1.035
142.8
67
BRUDERH7
1.035
142.8
109
DEERLAN4
-170.0
16.7
-50.1
152.1
106
DEERLAN7
60.1
8.9
41.1
-7.9
61.2
7.7
1.015
1.039
143.4
1.058
253.9
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
706L (N-1)
FIG E-27
FRI, AUG 19 2016 15:48
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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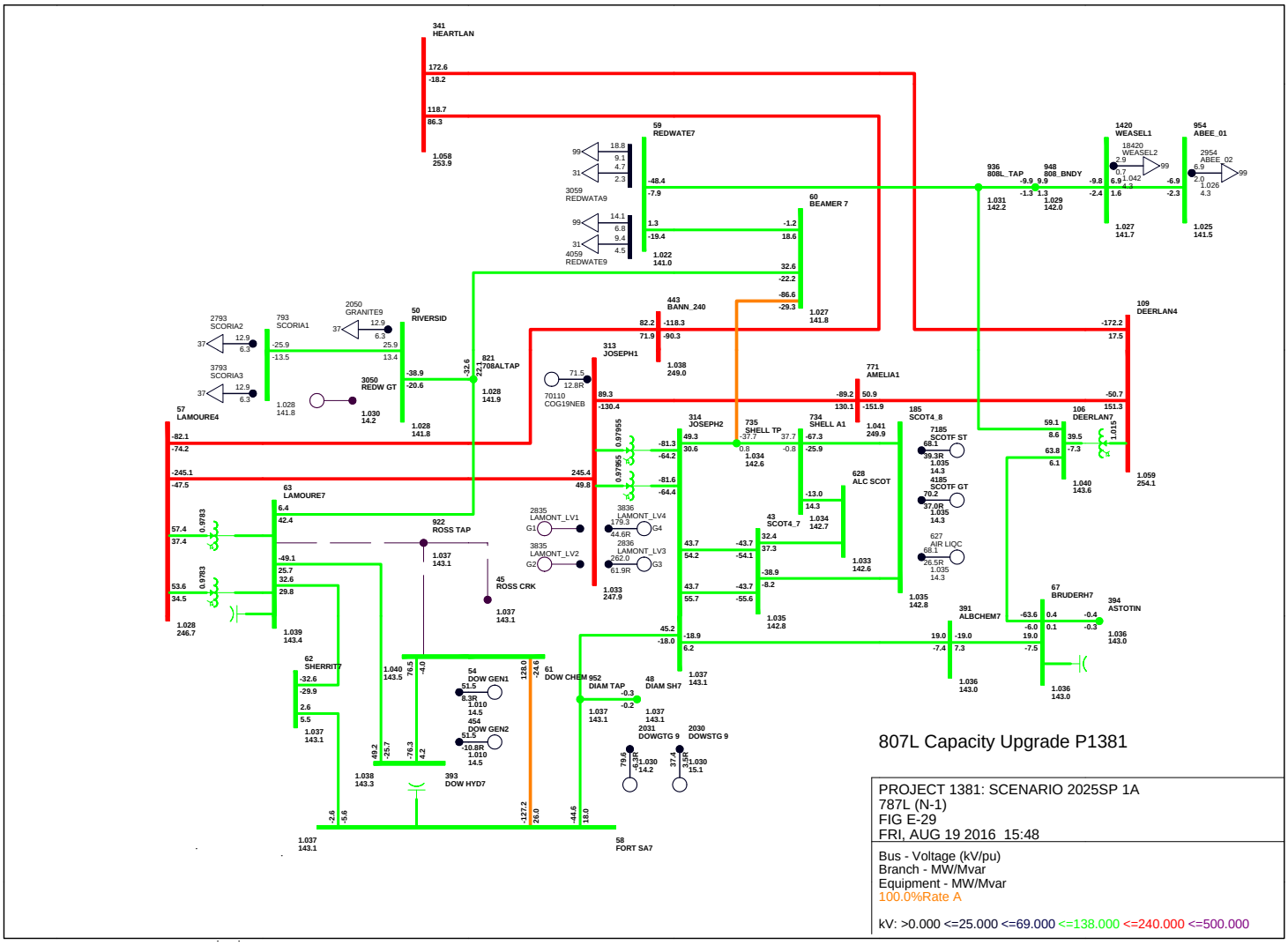
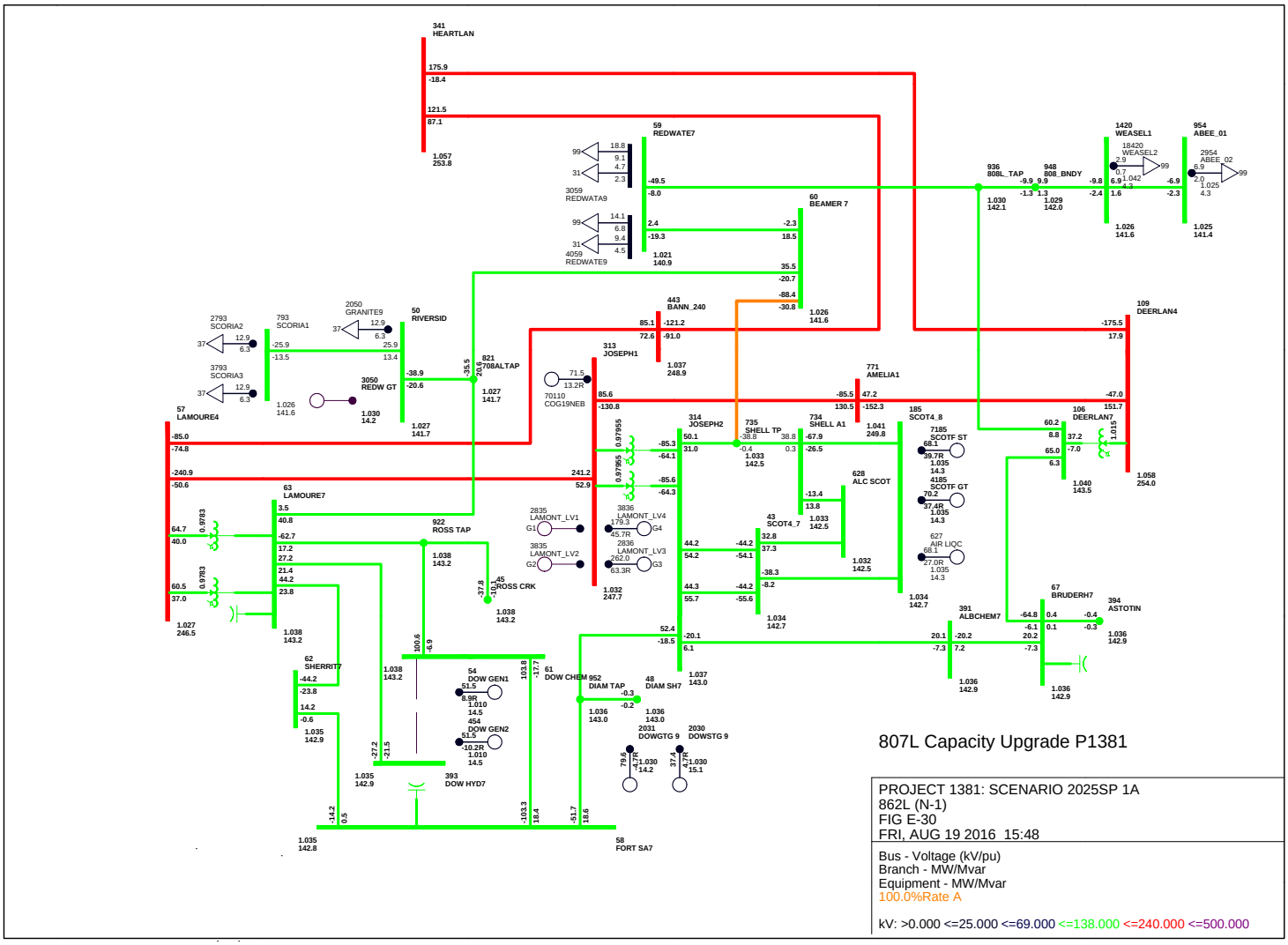
4059 REDWATE9
60 BEAMER 7
1.021
140.9
1.026
141.6
443 BANN_240
84.1
72.7
-120.2
-91.0
1.037
248.8
313 JOSEPH1
71.5
13.3R
70110 COG19NEB
85.3
-130.9
821 1708ALTAP
50 RIVERSID
1.027
141.7
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
2050 GRANITE9
3050 REDW GT
1.030
14.2
57 LAMOURE4
-84.0
-74.9
-233.3
-51.0
1.027
246.5
63 LAMOURE7
922 ROSS TAP
1.037
143.1
45 ROSS CRK
1.032
247.7
2835 LAMONT_LV1
2836 LAMONT_LV3
3835 LAMONT_LV2
3836 LAMONT_LV4
62 SHERRIT7
1.038
143.2
1.035
142.8
54 DOW GEN1
454 DOW GEN2
393 DOW HYD7
61 DOW CHEM
952 DIAM TAP
48 DIAM SH7
1.036
143.0
2031 DOWGTG 9
2030 DOWSTG 9
1.030
15.1
58 FORT SA7
1.034
142.7
314 JOSEPH2
47.4
31.8
-89.2
-64.0
-89.5
-64.2
735 SHELL TP
1.033
142.5
734 SHELL A1
1.041
249.7
771 AMELIA1
-85.2
130.6
-152.3
46.9
628 ALC SCOT
43 SCOT4_7
1.033
142.5
1.032
142.5
1.034
142.7
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
627 AIR LIQC
391 ALBCHEM7
1.036
142.9
109 DEERLAN4
-176.5
18.0
-46.7
1.058
254.0
106 DEERLAN7
1.040
143.5
67 BRUDERH7
394 ASTOTIN
1.036
142.9
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
1.042
1.025
936 808L_TAP
948 808_BNDY
1.030
142.1
1.029
142.0
1.026
141.6
1.025
141.4
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
707L (N-1)
FIG E-28
FRI, AUG 19 2016 15:48
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
787L (N-1)
FIG E-29
FRI, AUG 19 2016 15:48
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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REDWATE7
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REDWATA9
4059
REDWATE9
60
BEAMER 7
1.021
140.9
443
BANN_240
1.037
248.9
1.026
141.6
313
JOSEPH1
71.5
13.2R
70110
COG19NEB
821
2708ALTAP
1.027
141.7
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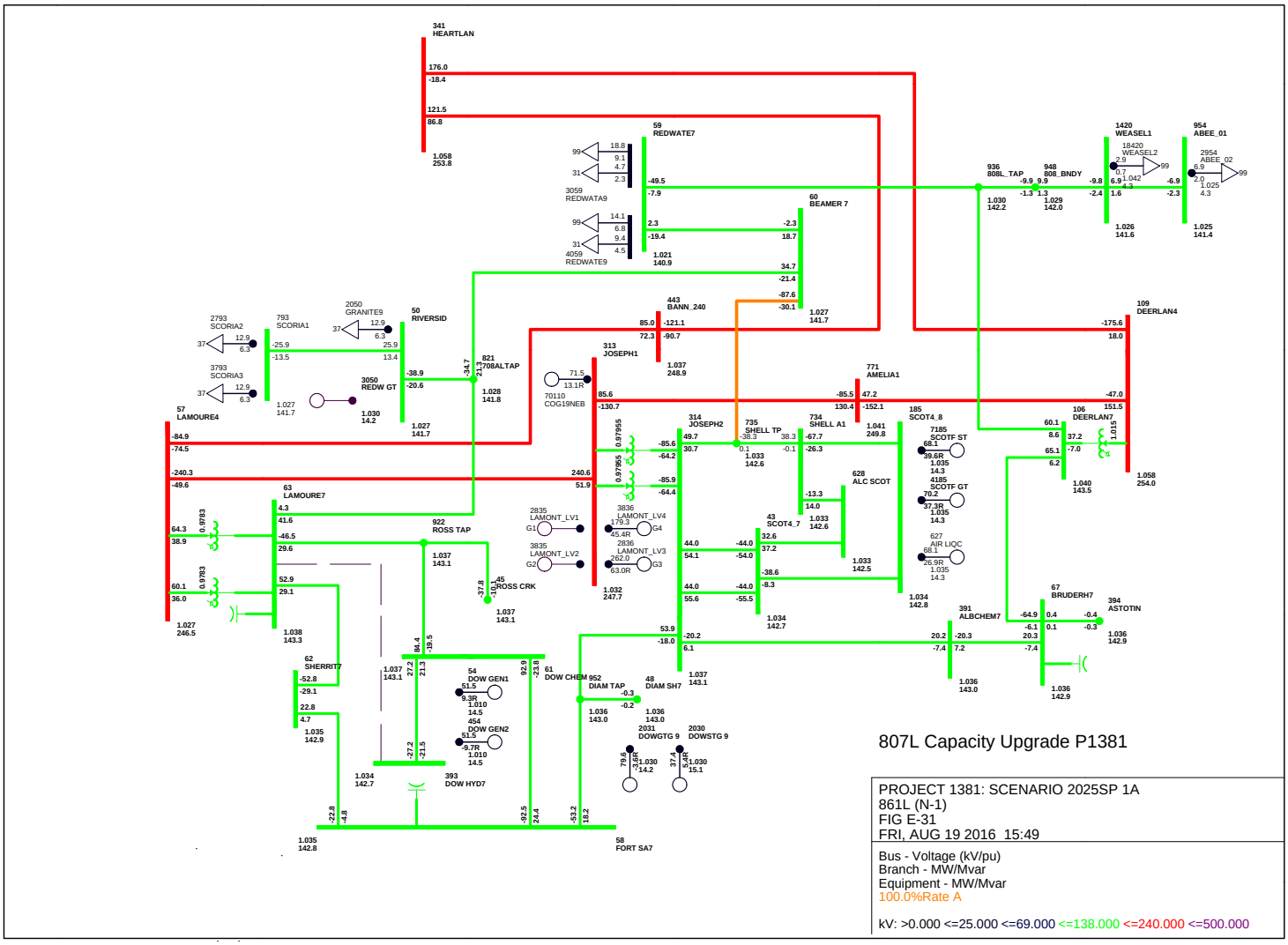
RIVERSID
2050
GRANITE9
2793
SCORIA2
793
SCORIA1
3793
SCORIA3
3050
REDW GT
1.026
141.6
1.030
14.2
57
LAMOURE4
1.027
246.5
63
LAMOURE7
1.038
143.2
922
ROSS TAP
45
ROSS CRK
1.032
247.7
2835
LAMONT_LV1
2836
LAMONT_LV3
3835
LAMONT_LV2
3836
LAMONT_LV4
62
SHERRIT7
1.035
142.9
54
DOW GEN1
454
DOW GEN2
393
DOW HYD7
61
DOW CHEM
952
DIAM TAP
48
DIAM SH7
1.036
143.0
1.037
143.0
2031
DOWGTO 9
2030
DOWSTG 9
1.030
14.2
1.030
15.1
58
FORT SA7
771
AMELIA1
109
DEERLAN4
1.058
254.0
314
JOSEPH2
735
SHELL TP
734
SHELL A1
1.041
249.8
628
ALC SCOT
43
SCOT4_7
1.033
142.5
1.032
142.5
1.034
142.7
185
SCOT4_8
7185
SCOTF ST
4185
SCOTF GT
627
AIR LIQC
1.035
14.3
106
DEERLAN7
1.040
143.5
67
BRUDERH7
391
ALBCHEM7
394
ASTOTIN
1.036
142.9
1.036
142.9
936
808L_TAP
948
808_BNDY
1.030
142.1
1.029
142.0
1420
WEASEL1
18420
WEASEL2
954
ABEE_01
2954
ABEE_02
1.026
141.6
1.025
141.4
1.042
1.025
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
862L (N-1)
FIG E-30
FRI, AUG 19 2016 15:48
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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140.9
443 BANN_240
85.0
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72.3
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1.037
248.9
1.027
141.7
313 JOSEPH1
71.5
13.1R
70110 COG19NEB
85.6
-130.7
771 AMELIA1
-85.5
130.4
47.2
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1.041
249.8
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18.0
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1.058
254.0
936 808L_TAP
948 808_BNDY
1.030
142.2
1.029
142.0
1420 WEASEL1
18420 WEASEL2
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954 ABEE_01
2954 ABEE_02
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1.026
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1.025
141.4
2793 SCORIA2
3793 SCORIA3
793 SCORIA1
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3050 REDW GT
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1.027
141.7
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143.1
45 ROSS CRK
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2835 LAMONT_LV1
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142.6
734 SHELL A1
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628 ALC SCOT
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1.033
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1.033
142.5
43 SCOT4_7
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142.7
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142.8
106 DEERLAN7
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8.6
37.2
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6.2
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143.5
1.015
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391 ALBCHEM7
394 ASTOTIN
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-18.0
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143.1
952 DIAM TAP
48 DIAM SH7
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1.036
143.0
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4.8
1.035
142.8
58 FORT SA7
2031 DOWGTG 9
2030 DOWSTG 9
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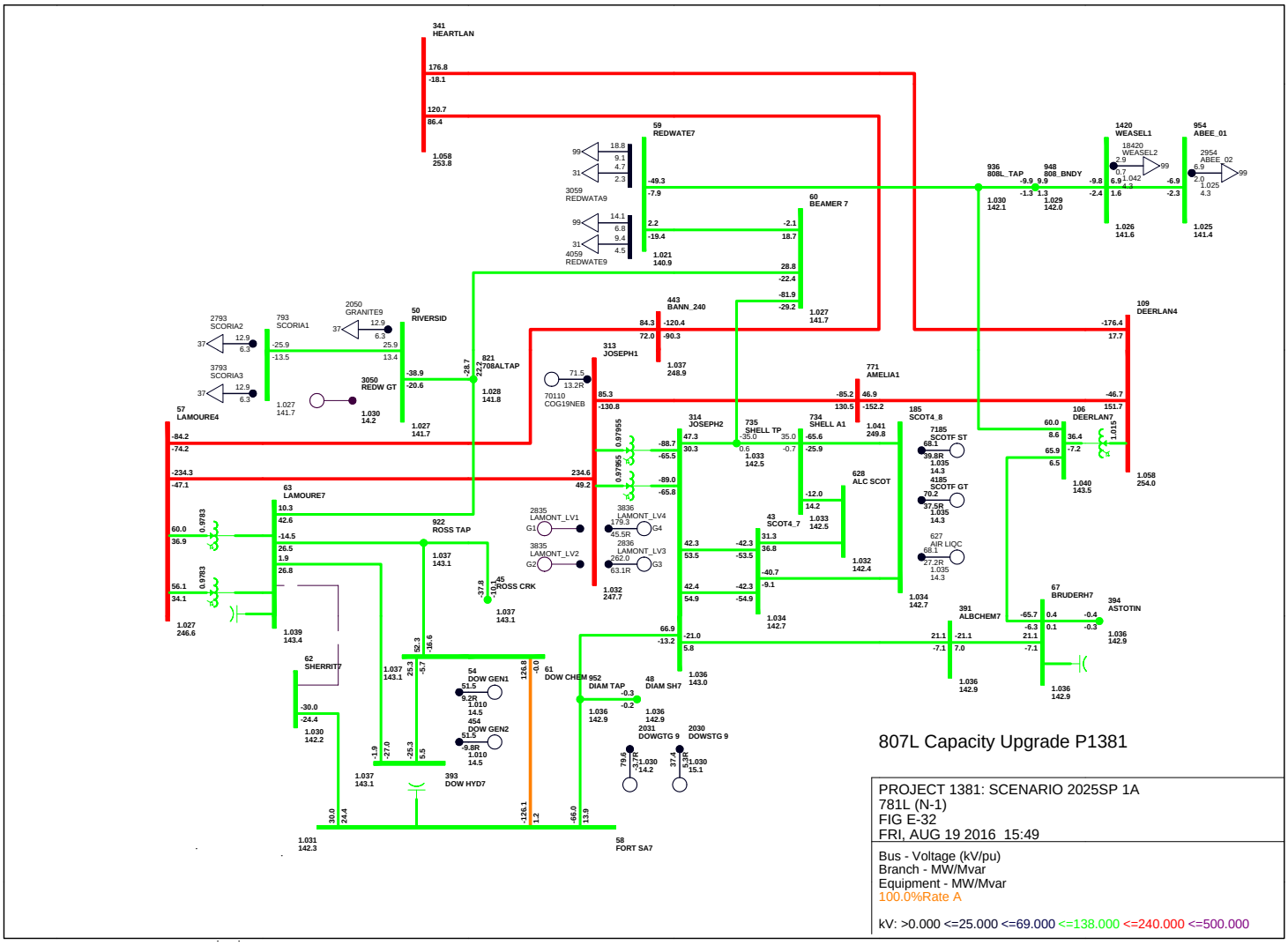
37.4
-5.4R
1.030
15.1
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
861L (N-1)
FIG E-31
FRI, AUG 19 2016 15:49
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000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REDWATE9
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BEAMER 7
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443
BANN_240
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-90.3
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JOSEPH1
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70110
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2708ALTAP
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REDW GT
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LAMOURE7
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ROSS CRK
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DOW GEN2
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DOW CHEM
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DIAM TAP
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DIAM SH7
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DOWSTG 9
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FORT SA7
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LAMONT_LV4
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LAMONT_LV3
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JOSEPH2
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SHELL TP
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SHELL A1
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ALC SCOT
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SCOT4_7
1.033
142.5
1.032
142.4
1.034
142.7
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AMELIA1
185
SCOT4_8
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SCOTF ST
4185
SCOTF GT
627
AIR LIQC
1.035
14.3
1.034
142.7
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ALBCHEM7
1.036
142.9
67
BRUDERH7
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ASTOTIN
1.036
142.9
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808L_TAP
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808_BNDY
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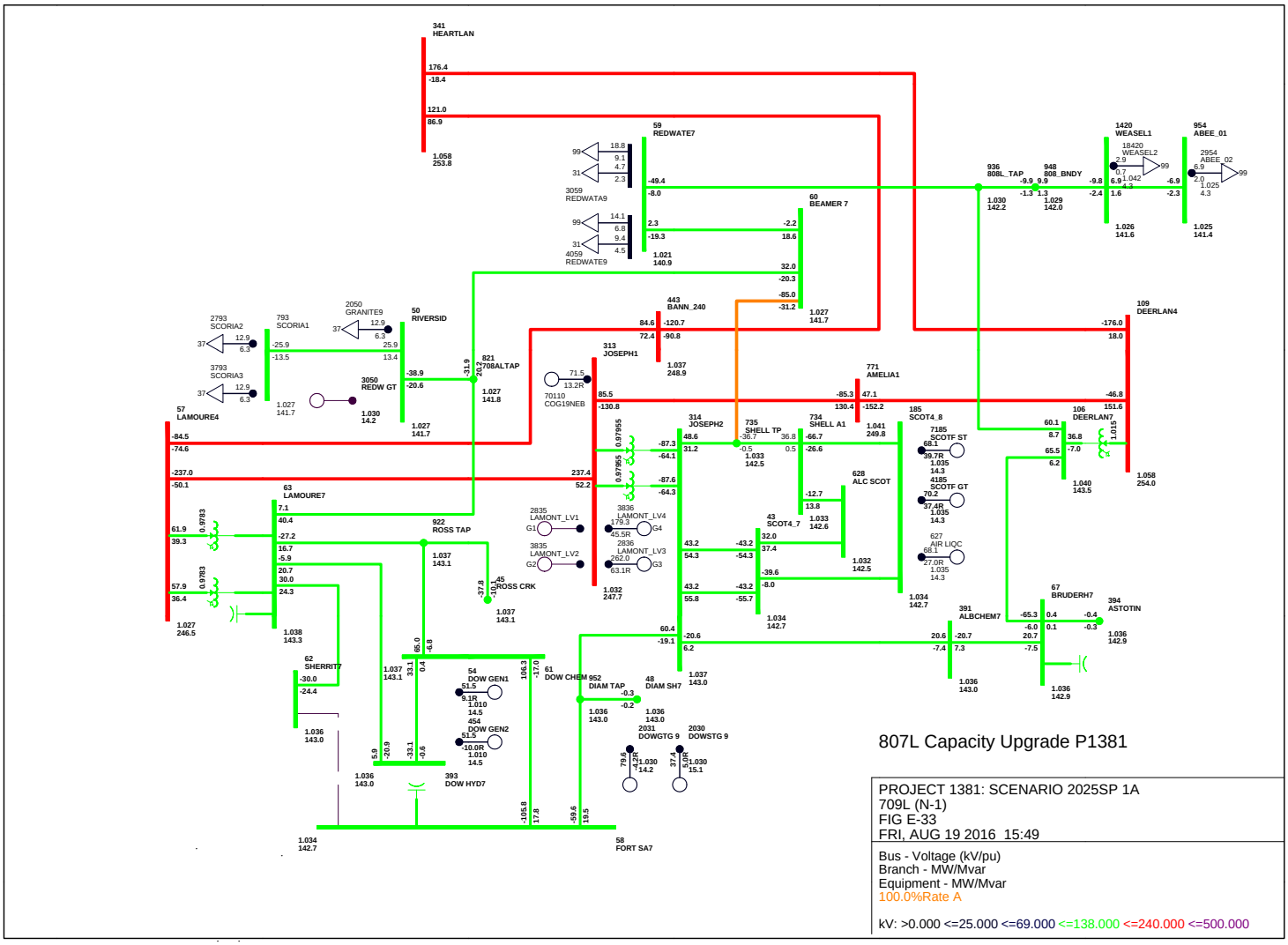
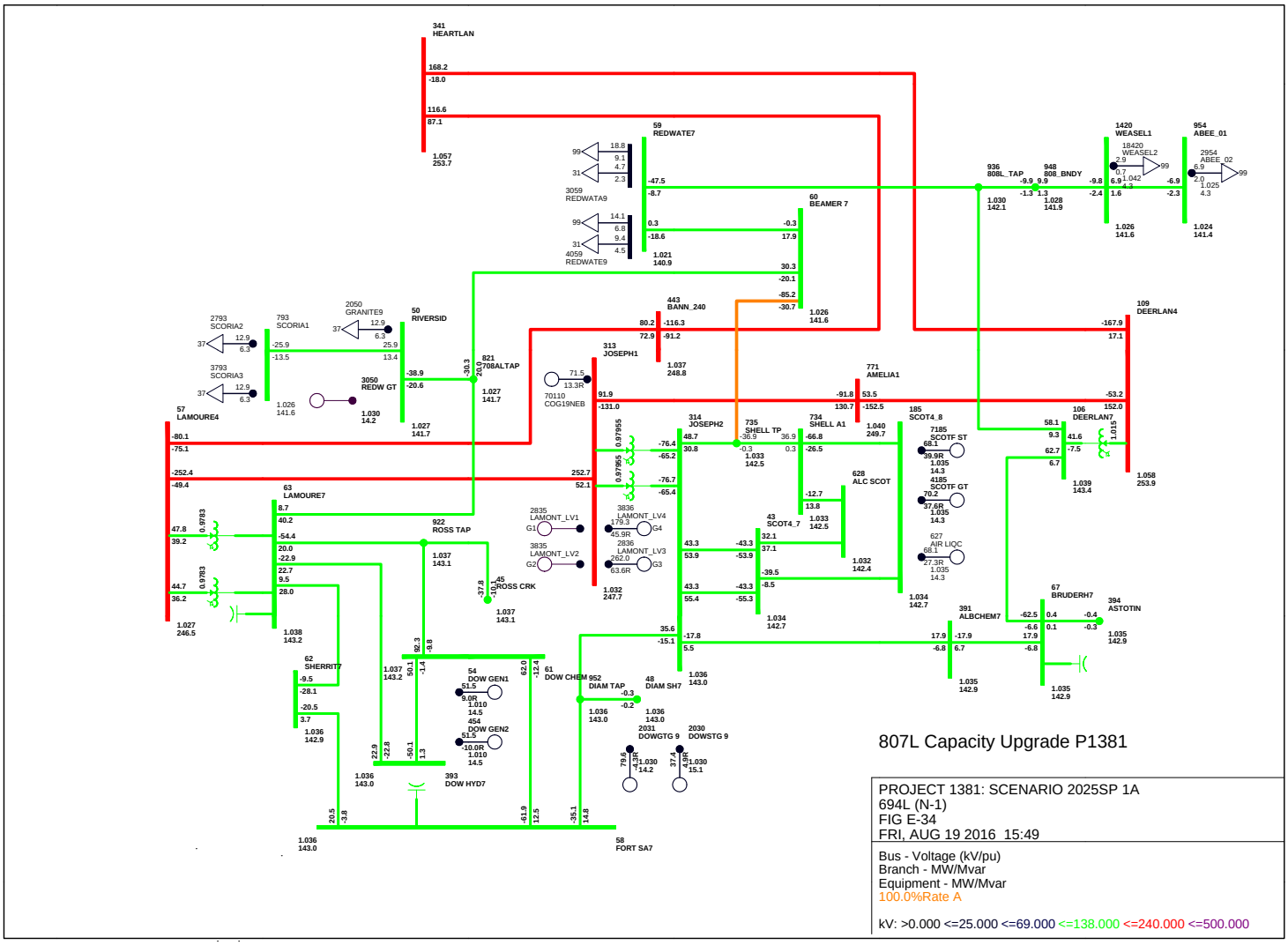
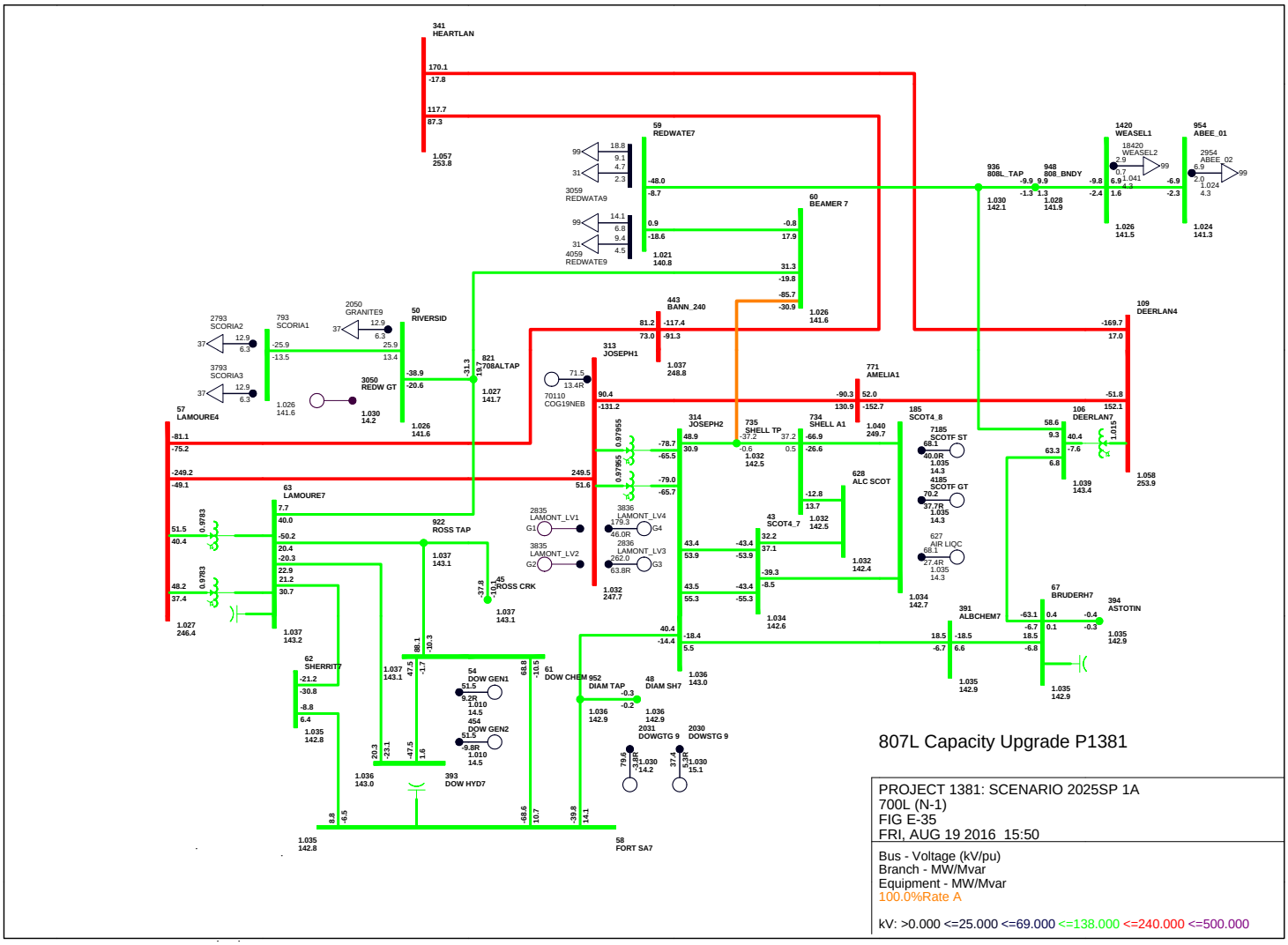
106
DEERLAN7
1.040
143.5
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
781L (N-1)
FIG E-32
FRI, AUG 19 2016 15:49
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
709L (N-1)
FIG E-33
FRI, AUG 19 2016 15:49
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
694L (N-1)
FIG E-34
FRI, AUG 19 2016 15:49
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

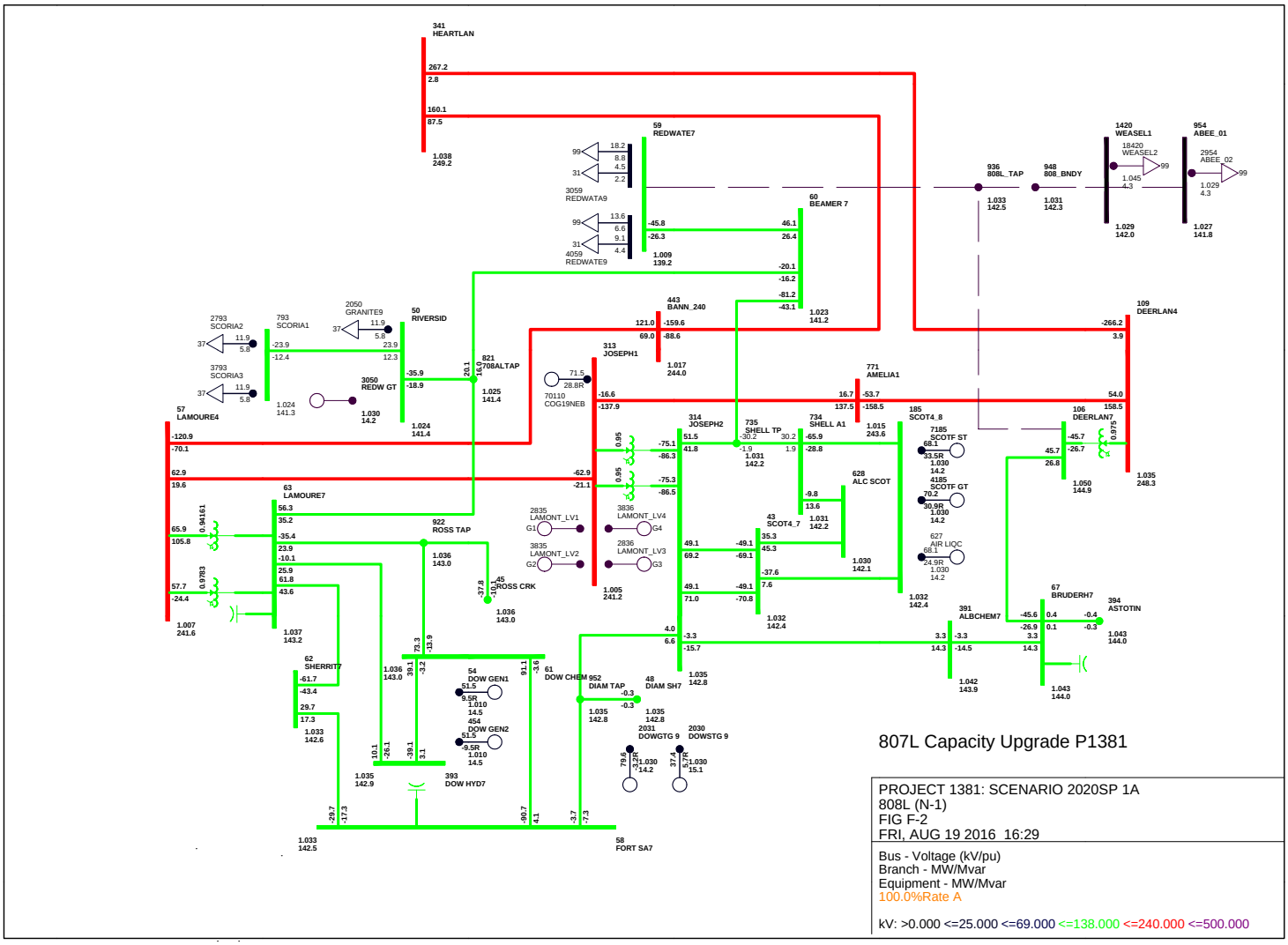

341 HEARTLAN
59 REDWATE7
60 BEAMER 7
3059 REDWATA9
4059 REDWATE9
443 BANN_240
313 JOSEPH1
821 708ALTAP
50 RIVERSID
2793 SCORIA2
793 SCORIA1
2050 GRANITE9
3793 SCORIA3
3050 REDW GT
70110 COG19NEB
57 LAMOURE4
63 LAMOURE7
922 ROSS TAP
45 ROSS CRK
62 SHERRIT7
54 DOW GEN1
454 DOW GEN2
61 DOW CHEM
393 DOW HYD7
952 DIAM TAP
48 DIAM SH7
2031 DOWGTG 9
2030 DOWSTG 9
58 FORT SA7
936 808L_TAP
948 808_BNDY
1420 WEASEL1
18420 WEASEL2
954 ABEE_01
2954 ABEE_02
109 DEERLAN4
771 AMELIA1
185 SCOT4_8
7185 SCOTF ST
4185 SCOTF GT
106 DEERLAN7
67 BRUDERH7
394 ASTOTIN
391 ALBCHEM7
627 AIR LIQC
628 ALC SCOT
43 SCOT4_7
734 SHELL A1
735 SHELL TP
314 JOSEPH2
2835 LAMONT_LV1
2836 LAMONT_LV3
3835 LAMONT_LV2
3836 LAMONT_LV4
807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
700L (N-1)
FIG E-35
FRI, AUG 19 2016 15:50
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

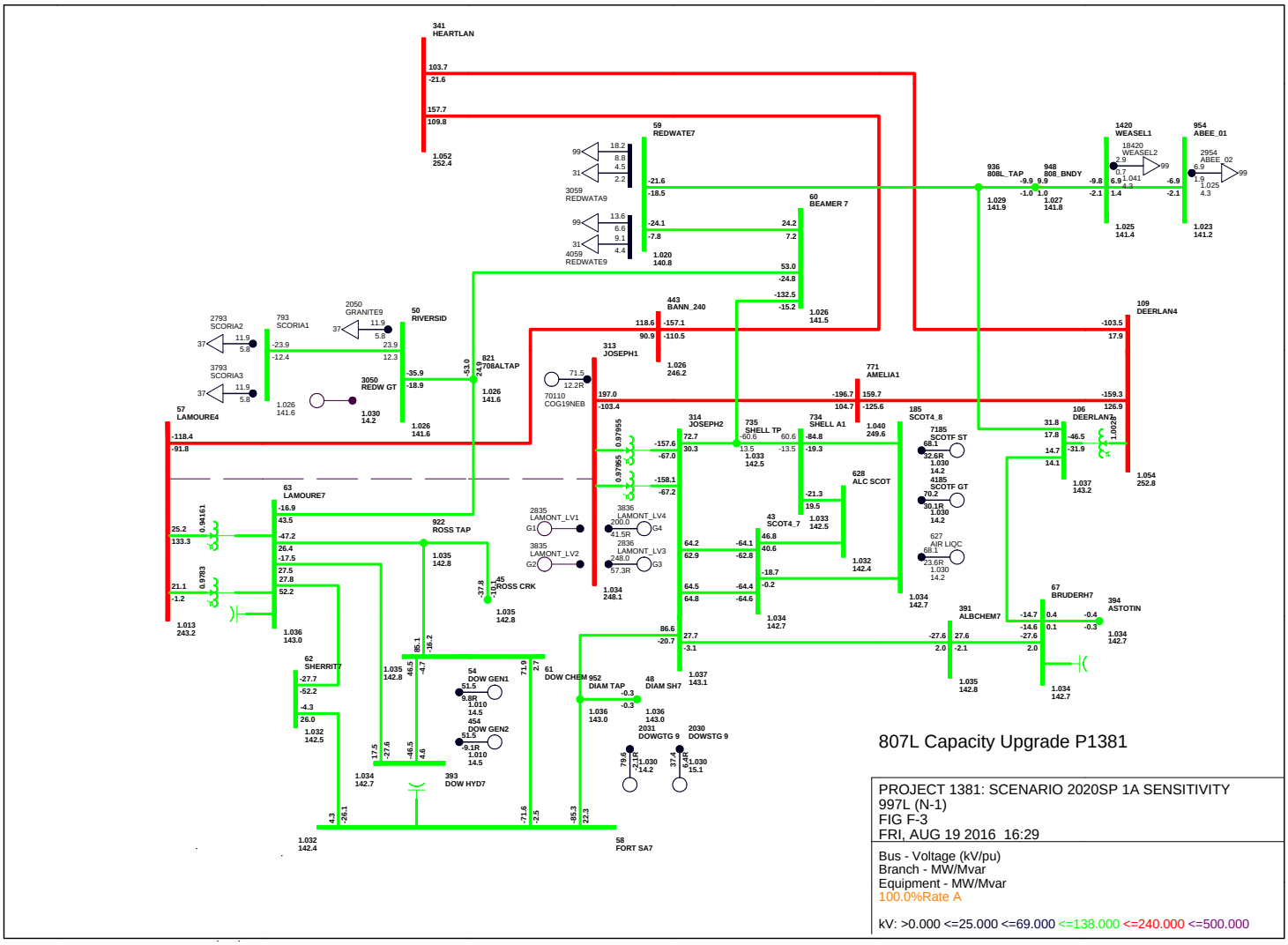
Attachment F

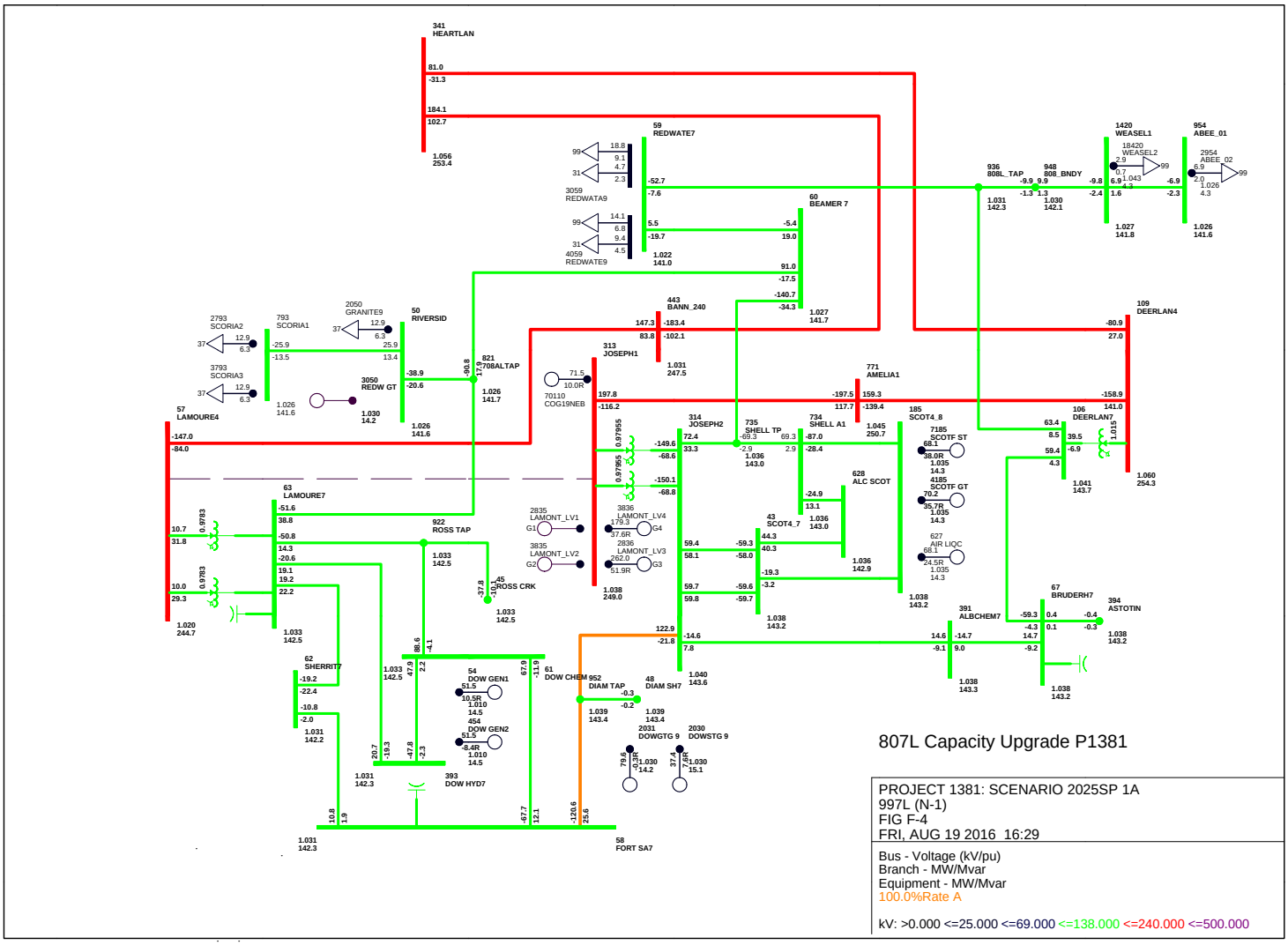
Proposed Transmission Development Assessment

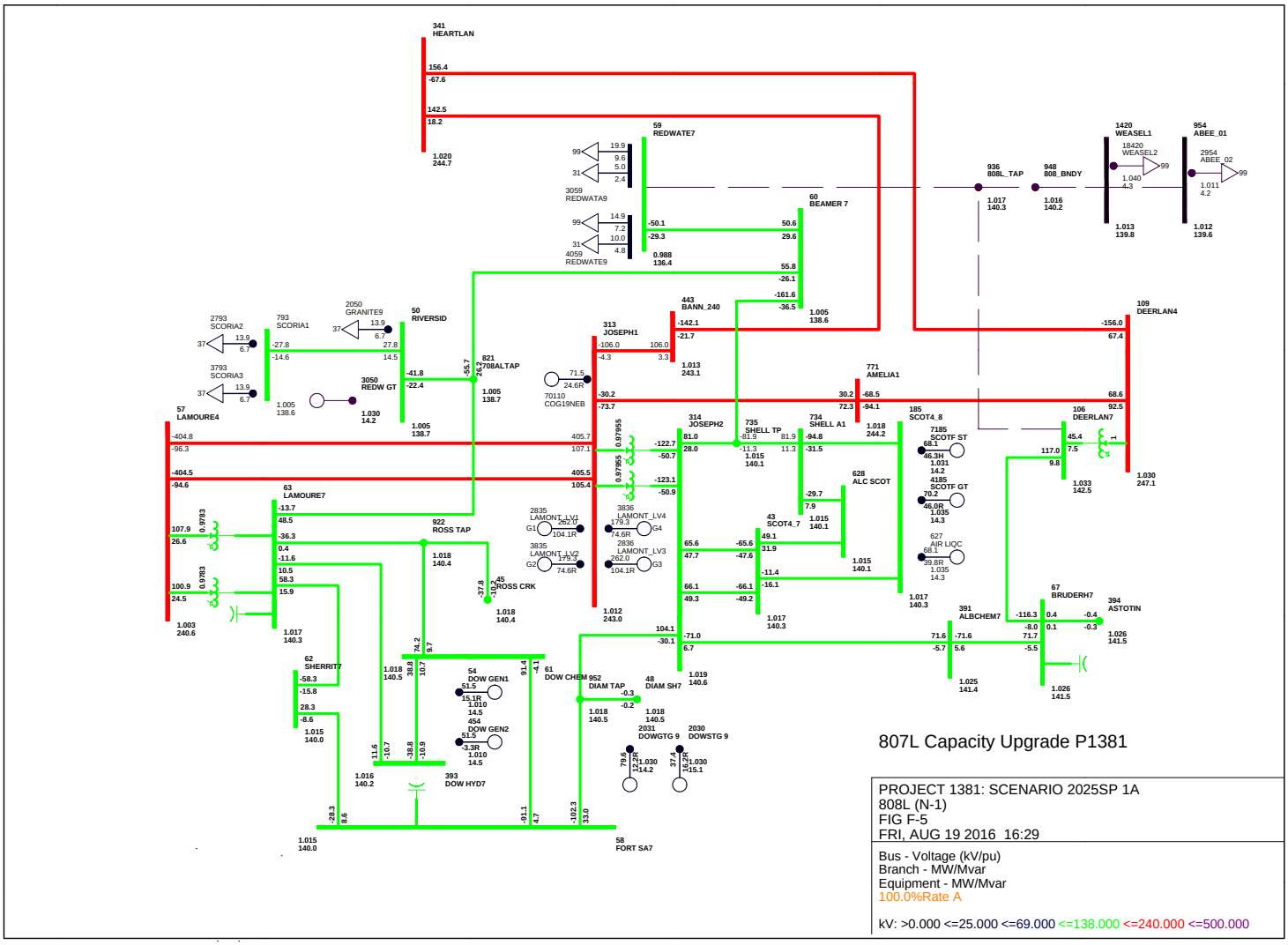
Table F-1: Worst Contingency Lists for Proposed Transmission Development Assessment

Figure #	Scenario	Condition	
F-1	17_1a	708L (N-1)	233S Beamer to 71S Lamoureux
F-2	20_1a	808L (N-1)	171S Redwater to 13S Deerland
F-3	20_1a_Sen	997L (N-1)	71S Lamoureux to 410S Josephburg
F-4	25_1a	997L (N-1)	71S Lamoureux to 410S Josephburg
F-5	35_1a	808L (N-1)	171S Redwater to 13S Deerland


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A
808L (N-1)
FIG F-2
FRI, AUG 19 2016 16:29
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2020SP 1A SENSITIVITY
997L (N-1)
FIG F-3
FRI, AUG 19 2016 16:29
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
997L (N-1)
FIG F-4
FRI, AUG 19 2016 16:29
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000


807L Capacity Upgrade P1381
PROJECT 1381: SCENARIO 2025SP 1A
808L (N-1)
FIG F-5
FRI, AUG 19 2016 16:29
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=25.000 <=69.000 <=138.000 <=240.000 <=500.000

Attachment G

Short-circuit Study Results

Short-circuit Analysis

Short-circuit analysis was performed based on system data[2] available to the AESO for the Fort Saskatchewan Planning Area. Listed below are the basic assumptions adopted in the short-circuit analysis:

Study Years

2017: System model consists of facilities assumed to be in service as of 2017

Study Cases Used: 2017SP

4. Generation dispatch: All generators in and around Fort Saskatchewan Area dispatched
5. All transmission elements: In service
6. Series capacitors: In service
7. HVDC: Blocked
8. PSS/E Version used: Version 33

Three-phase faults and single line-to-ground faults were applied at the 240 kV and 138 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 807L Upgrades project. The proposed transmission development does 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.

[2] Short-circuit current calculation is based on modeling information provided to the AESO by third parties. Short-circuit estimation is subject to change.

Table G-1: Short-circuit Current Levels – Pre & Post 807L Increase (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.)
Josephburg 410S	240	1.042	16.9965	14.7919	0.002503+j0.014531	0.003154+j0.021179
Josephburg 410S	138	1.032	25.8449	23.6074	0.003269+j0.016377	0.002856+j0.021388
Lamoureux 71S	240	1.043	20.0133	17.6761	0.002294+j0.012325	0.002615+j0.017371
Lamoureux 71S	138	1.035	27.7503	26.0133	0.003247+j0.015267	0.002507+j0.018661
Deerland 13S	240	1.059	14.1763	11.6665	0.002789+j0.017754	0.004395+j0.029334
Deerland 13S	138	1.042	12.6743	12.8017	0.006553+j0.033753	0.003293+j0.033385
Beamer 233S	138	1.026	20.1309	15.7586	0.005292+j0.020647	0.007615+j0.038459
Redwater ISD	138	1.028	17.4343	13.8008	0.005814+j0.023964	0.008029+j0.043606
Redwater 171S	138	1.022	10.5030	7.4522	0.013433+j0.038416	0.025456+j0.087190