NON-CONFIDENTIAL

Request IR-1:

With respect to Section 1.8, please provide the reports summarizing the system planning studies that establish the feasibility of connecting Muskrat Falls to Churchill Falls and the associated operating limits.

Response IR-1:

Please refer to Attachment 1 and Attachment 2.

REGISTERED PROFESSIONAL ENGINEER
P. THOMAS
SIGNATURE
Nov 12/10
PROVINCE OF NEWFOUNDLAND

Approved for Release | Date Aug 25 2011

PRELIMINARY TRANSMISSION SYSTEM ANALYSIS

MUSKRAT FALLS TO CHURCHILL FALLS TRANSMISSION VOLTAGE

Date: November 2010

System Planning Department

newfoundland labrador hydro
a nalcor energy company

EXECUTIVE SUMMARY

Given the potential of development of Muskrat Falls prior to Gull Island, a preliminary transmission analysis is warranted to determine the appropriate transmission operating voltage for the Muskrat Falls to Churchill Falls transmission system. The purpose of this analysis is to provide guidance on the appropriate transmission voltage level for project costing.

Preliminary analysis indicates that at least four single conductor per circuit 230 kV transmission lines would be required between Muskrat Falls an Churchill Falls for stable operation of the power system during expected contingencies. Moving to a two conductor bundle at 230 kV results in a minimum of three 230 kV transmission lines between Muskrat Falls and Churchill Falls to provide reasonable assurances of stable system operation.

Alternatively, moving to the 362 kV transmission class indicates that a minimum of two 315 kV or two 345 kV transmission lines can be expected to provide reasonable system performance. There are advantages and disadvantages of each the 315 kV and 345 kV operating voltage.

For project costing it is recommended that two 345 kV transmission lines with a two conductor bundle of 795 MCM 26/7 ACSR “DRAKE” per phase be assumed. In addition, to ensure acceptable voltage control on line open end conditions four 345 kV, 45 MVAR shunt reactors (one per each transmission line end) be included.

Detailed stability studies in final design will be required to determine the technical applicability of moving to a 315 kV operating voltage level.

Further analysis is required to determine if application of on load tap changers on the 735/345 kV autotransformers can be sized to provide the necessary voltage control and eliminate the need for independent shunt reactors. This will ultimately be a decision of economics and operability in final project design.

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INTRODUCTION

The Lower Churchill Project (LCP) consists of a 2250 MW hydroelectric generating station at Gull Island and an 824 MW hydroelectric generating station at Muskrat Falls. Gull Island and Muskrat Falls are located 225 km and 285 km downstream of the Upper Churchill hydro electric facility respectively. Once completed, the project is expected to include high voltage ac transmission lines between Churchill Falls and Gull Island, Gull Island and the Province of Québec, Gull Island and Muskrat Falls, Muskrat Falls and Happy Valley and an HVdc transmission line between Labrador and the Island of Newfoundland.

Given that the total project capacity exceeds the provincial requirements, project construction requires access to the electricity market in northeastern North America. The size of the combined market, and route(s) to those markets, will ultimately determine the timeline and which component(s) of the project are completed.

The purpose of this preliminary transmission system analysis is to determine an acceptable transmission voltage level between Muskrat Falls and Churchill Falls for project costing. The HVdc transmission line between Muskrat Falls in Labrador and Soldier's Pond on the Island of Newfoundland is assumed to be part of the Muskrat Falls first scenario.

Figure 1 provides an overview of the proposed transmission layout of the Muskrat Falls site. High voltage power cables will be used to connect the high voltage winding of the generator unit step up transformers to an ac switchyard on the south bank of the Churchill River. There will be two connections from the ac switchyard to the HVdc converter station, which will also be located on the south bank. An HVdc bipole transmission line will connect the Muskrat Falls Converter Station to the Soldiers Pond Converter Station on the Island of Newfoundland approximately 1100 km away. High voltage ac transmission lines will be used to connect the Muskrat Falls ac switchyard to the Labrador Interconnected Transmission System located on the north side of the Churchill River. A tap station is proposed on the north bank of the Churchill River for termination of the 138 kV transmission system to Happy Valley – Goose Bay. Location of this tap station on the north side of the river limits the number of ac transmission line crossings of the river, thereby minimizing line congestion on the relatively narrow crossing path. Ac transmission lines following the existing TL240 (L1301) route will connect the tap station on the north side of the river to Churchill Falls.

The analysis does not address the economics of Muskrat Falls before Gull Island, the constructability of such a concept, or any water management issues. The analysis is completed using the Siemens Power Technologies Int. software package PSS/E version 30.2.

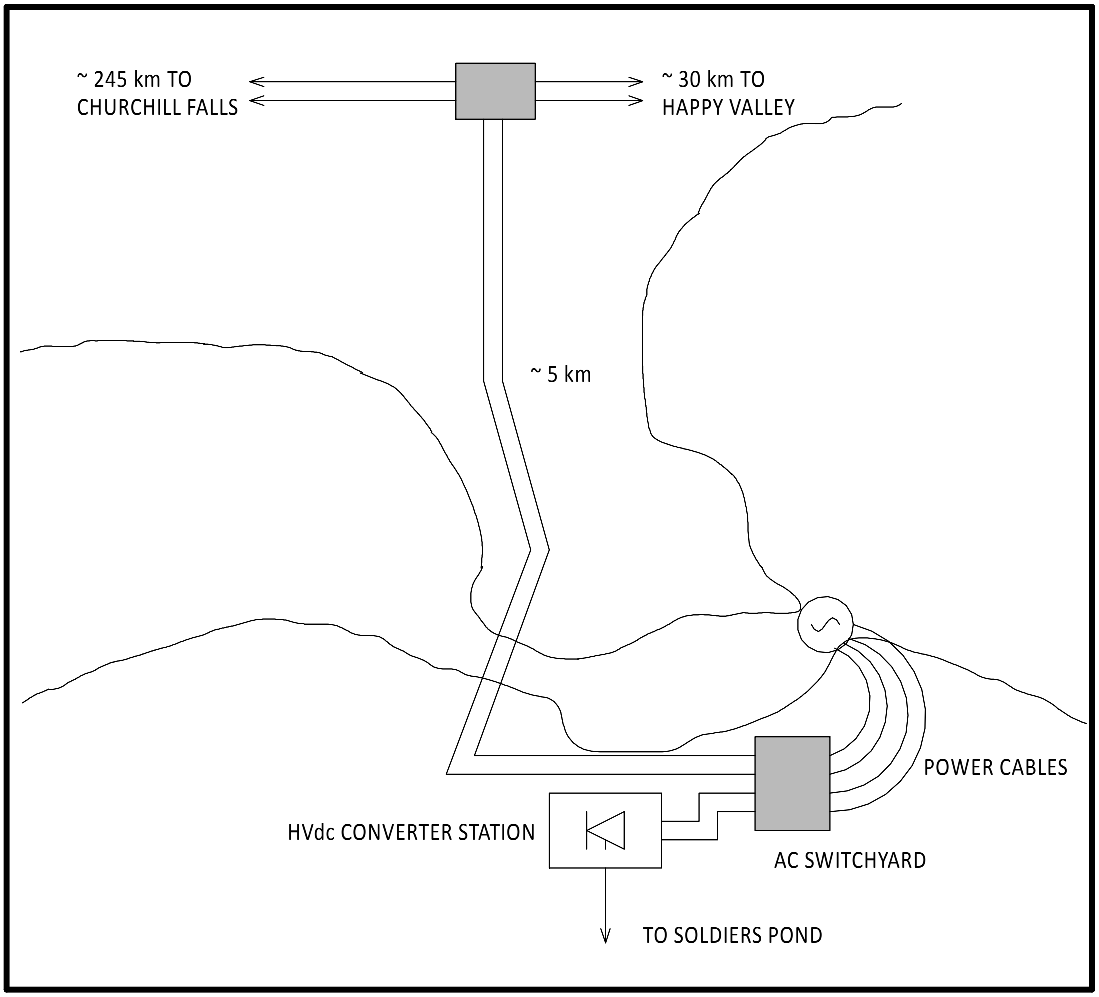

Figure 1 – Muskrat Falls Transmission Layout

TRANSMISSION PLANNING CRITERIA

On at least two occasions in Newfoundland and Labrador Hydro (NLH) has been reviewed by independent consultants appointed by the Public Utilities Board of Newfoundland and Labrador. On each occasion the following list has been provided as summary of NLH's Transmission Planning Practices:

- NLH's bulk transmission system is planned to be capable of sustaining the single contingency loss of any transmission element without loss of system stability;
- In the event a transmission element is out of service, power flow in all other elements of the power system should be at or below normal rating;
- The NLH system is planned to be able to sustain a successful single pole reclose for a line to ground fault based on the premise that all system generation is available;
- Transformer additions at all major terminal stations (i.e. two or more transformers per voltage class) are planned on the basis of being able to withstand the loss of the largest unit;
- For single transformer stations there is a back-up plan in place which utilizes NLH's and/or Newfoundland Power's mobile equipment to restore service;
- For normal operations, the system is planned on the basis that all voltages be maintained between 95% and 105%; and
- For contingency or emergency situations voltages between 90% and 110% is considered acceptable.

TRANSMISSION VOLTAGE LEVEL

Under normal operation it is expected that the HVdc transmission line to the Island of Newfoundland (the Island Link) will be loaded to near 824 MW during peak load periods. With the full capacity of the Muskrat Falls Generating Station being transmitted over the Island Link, the transmission system between Churchill Falls and Muskrat Falls would be required to deliver the peak load of the Happy Valley – Goose Bay area. The forecast peak for this region is on the order of 85 MW in the 2017 time frame assuming a 20 MW electric boiler load at 5 Wing Goose Bay. Given the relatively low load to be delivered by the transmission system between Churchill Falls and Muskrat Falls, one would assume that a relatively "slight" transmission system consisting of a single or double 230 kV transmission line would suffice. However, there are a number of factors that must be assessed in selecting the number of transmission lines and the transmission voltage level between Churchill Falls and Muskrat Falls.

With respect to the number of transmission lines between Churchill Falls and Muskrat Falls standard transmission planning criteria stipulate that one must be able to serve the load for loss of a single transmission element, such as a transmission line[1]. In the case of the Muskrat Falls interconnection, loss of a single transmission line between Churchill Falls and Muskrat Falls would mean a shortfall of 85 MW of capacity during peak load conditions. Either the load in Happy Valley - Goose Bay would have to be curtailed, or the deliveries to Newfoundland via the Island Link would have to be reduced. Should the deliveries to Newfoundland be used to meet firm load on the Island, the loss of a single transmission line between Churchill Falls and Muskrat Falls followed by a reduction in Island Link loading to continue supply to Happy Valley – Goose Bay would result in an inability to supply firm load on the Island. This, in turn, would be a violation of the transmission planning criteria. As there has been no decision as to whether or not power delivered via the Island Link will be considered non-firm delivery for, say the maritime market, the transmission in Labrador must be planned for firm deliveries with one transmission element out of service. Therefore, a minimum of two transmission lines will be required between Churchill Falls and Muskrat Falls.

In considering the power transfer capability between Churchill Falls and Muskrat Falls, one must look beyond the normal operation where only the peak load at Happy Valley – Goose Bay must be supplied. During an outage to a generating unit at Muskrat Falls (either forced or maintenance outage), it is expected that the 206 MW capacity reduction will be supplied by generation at Churchill Falls under a water management agreement. That being said, the transmission system between Churchill Falls and Muskrat Falls would need to be capable of delivering the 206 MW generation deficit at

[1] NERC Standard TPL-002-0a – System Performance Following Loss of a Single BES Element Table I stipulates for Category B contingencies (events resulting in the loss of a single element – 2. Transmission circuit) there will be no loss of demand or curtailment of firm transfers. This criterion has been applied to the bulk system on the Island Interconnected Transmission System with the exception that loss of a generator will initiate under frequency load shedding given the isolated nature of the system.

Muskrat Falls plus the 85 MW peak load of Happy Valley – Goose Bay, or 291 MW in total.

Further, the Island Link is being designed and integrated into the transmission system on the Island of Newfoundland such that the Island Interconnected Transmission System will remain stable for a temporary pole-to-pole fault on the overhead HVdc transmission line. In the event of a temporary HVdc pole-to-pole fault the HVdc system will shutdown to clear the fault, then restart following a preset time to allow for the arc to extinguish and the air to de-ionize. The total time that the Island Link will be out of service is set at 350 msec (21 cycles). To ensure that the Island Interconnected Transmission System remains stable during this temporary outage, system upgrades including high inertia synchronous condensers are being added to maintain an acceptable voltage level and system frequency for restart of the converter station at Soldiers Pond. There will be a corresponding impact to the Labrador Interconnected Transmission System due to this temporary outage. With the shutdown of the Island Link for the 350 msec, there will be up to 824 MW of excess power on the Labrador Interconnected Transmission System that must handled in the short term. With the Labrador Interconnected Transmission System being connected to the much larger Hydro Québec TransÉnergie (HQT) transmission system[2], the HQT system will act as the dynamic “shock absorber” accepting the swing of 824 MW into its system for the 350 msec restart time. Clearly, if the Labrador Interconnected Transmission System is to remain stable during the temporary HVdc pole-to-pole fault, the transmission system between Churchill Falls and Muskrat Falls must be capable of dynamically delivering up to 824 MW into the 735 kV transmission system at Churchill Falls without loss of angular stability at Muskrat Falls.

A preliminary load flow analysis is used to assess the steady state angular displacement between the Muskrat Falls generators and both the Churchill Falls generators and the HQT system during the temporary HVdc pole-to-pole outage. Steady state angular displacements above 30˚ - 35˚ are indicative of conditions that may experience angular stability issues during dynamic events such as the temporary loss of the Island link.

For the preliminary analysis the Muskrat Falls generator terminal voltage is held at 15 kV (1.00 pu.), the Churchill Falls 735 kV bus voltage is held at 735 kV with the plant at 5428 MW and the Montagnais 735 kV bus voltage is held at 735 kV.

Given that the voltage levels in Churchill Falls are 230 kV and 735 kV, the analysis begins with single circuit, single conductor per phase 230 kV transmission lines. Typical conductor sizes for Newfoundland and Labrador Hydro range from 636 kcmil, 26/7 ACSR

[2] The Hydro Québec System consists of approximately 30,000 MW of generation compared to the proposed 6252 MW Labrador System (5428 MW Churchill Falls Generating Station plus 824 MW Muskrat Falls Generating Station).

"GROSBEAK" to 1431 kcmil, 54/19 ACSR "PLOVER". An 1192.5 kcmil, 54/19 ACSR "GRACKLE" conductor was selected for the single conductor per phase analysis.
The 1999 EHV Transmission Lines in Labrador report by RSW – EDM Joint Venture recommended that the 230 kV transmission system between Gull Island and Muskrat Falls consist of a double circuit line with a two conductor bundle of 1354 kcmil 48/7 ACSR "BERSFORT" per phase. As part of the preliminary analysis of transmission voltage versus steady state angular displacement, 230 kV transmission lines with a two conductor bundle consisting of 1354 kcmil 48/7 ACSR "BERSFORT" is included.

Beyond the 230 kV voltage level, the next voltage level is the 362 kV voltage class. HQT operates 315 kV transmission lines throughout its network including a 315 kV transmission line originating at its Montagnais Substation. Both NB Power and Nova Scotia Power operate 345 kV transmission lines in their respective transmission systems. For this preliminary analysis a two conductor bundle of 795 kcmil 26/7 ACSR "DRAKE" is used for the 362 kV class transmission lines.

Table 1 summarizes the results of the preliminary analysis considering single conductor 230 kV, two conductor bundle 230 kV, two conductor bundle 315 kV and two conductor bundle 345 kV transmission lines.

Table 1
Preliminary Analysis – Angular Displacement
824 MW from Muskrat Falls to Churchill Falls

kV	Circuits	Angle MF to CF	Angle MF to HQT
230	Three 1C x 1192.5 kcmil ACSR "GRACKLE"	39.2˚	56.6˚
230	Four 1C x 1192.5 kcmil ACSR "GRACKLE"	28.0˚	45.4˚
230	Two 2C x 1354 kcmil ACSR "BERSFORT"	44.2˚	61.6˚
230	Three 2C x 1354 kcmil ACSR "BERSFORT"	26.9˚	44.4˚
315	Two 2C x 795 kcmil ACSR "DRAKE"	23.3˚	40.8˚
345	Two 2C x 795 kcmil ACSR "DRAKE"	19.1˚	36.6˚

The results indicate that at least four single conductor per phase 230 kV transmission lines, three double conductor bundle 230 kV transmission lines, or two 315/345 kV transmission lines are required to provide reasonable angular stability between Muskrat Falls and Churchill Falls.

Application of the St. Clair curve can be used to verify the preliminary results prior to detailed stability analysis. The St. Clair curve determines transmission line loadability using the surge impedance loading (SIL) of the line and the line length. For a 250 km long transmission line the St. Clair curve sets the load limit at approximately 1.4 times its

SIL. Table 2 summarizes the transmission requirements for the Muskrat Falls to Churchill Falls transmission route based upon the St. Clair curve.

Table 2 Muskrat Falls to Churchill Falls Transmission Requirements Based upon St. Clair Curve 824 MW Transfer Limit – 250 km			
Option	SIL MW	Max MW per circuit	Req'd # of circuits
230 kV – 1C x 1192.5 kcmil ACSR "GRACKLE"	140	196	4.2
230 kV – 2C x 1192.5 kcmil ACSR "GRACKLE"	194	272	3.0
315 kV – 2C x 795 kcmil ACSR "DRAKE"	328	459	1.8
345 kV – 2C x 795 kcmil ACSR "DRAKE"	393	550	1.5

Based upon the St. Clair curve an adequate stability margin should be obtainable with three double conductor bundle 230 kV transmission lines or two 315/345 kV transmission lines. To minimize the width of the transmission corridor between Muskrat Falls and Churchill Falls, the 362 kV class transmission solution is selected for further analysis. Both 315 kV and 345 kV each have advantages and disadvantages.

At 315 kV there is a 14.9% over voltage margin for 362 kV class station equipment, while at 345 kV there is a 4.9% margin. Consequently, one can expect tighter voltage operating limits at 345 kV.

The application of 315 kV leaves provisions for a 315 kV transmission system to Labrador West with future connection to HQT's 315 kV system at Mount Wright.

Application of 315 kV results in higher phase currents and subsequently higher line losses assuming the same conductor and load transfer than 345 kV transfer. However, as the dominant transfer is via the HVdc Island Link and not the connection to Churchill Falls, a transmission line loss evaluation is not expected to be a deciding fact for the interconnection voltage.

The application of 315 kV for the Muskrat Falls interconnection will have lower transmission line charging (approximately 20 MVAR less per circuit than the corresponding 345 kV circuit) with corresponding lower open circuit line end voltages during restoration with potentially lower rated shunt reactors, if required. However the lower line charging results in a reduction in maximum power transfer as indicated by a 315 kV SIL of 328 MW versus a 345 kV SIL of 393 MW.

It is common practice to employ shunt reactors to assist in voltage control on 362 kV class transmission systems. At NB Power 37.5 MVAR shunt reactors are connected to the tertiary windings of 345 kV autotransformers to provide the necessary voltage control on its 345 kV network. At Nova Scotia Power shunt reactors range in size from 25 MAR to 50 MVAR depending on the 345 kV line length. At HQT 315 kV shunt reactors on the north east axis are sized at 110 - 150 MVAR. Studies completed by SNC-Lavalin for the Lower Churchill Development Corporation in 1980 considered 40 MVAR shunt reactors for a 345 kV transmission system between Muskrat Falls and Churchill Falls. Preliminary analysis of energization of a single 345 kV line from the Churchill Falls end indicates that the Muskrat Falls 345 kV bus voltage will reach 370.8 kV (1.075 p.u.) without voltage reduction equipment. A nominal 45 MVAR shunt reactor at Muskrat Falls reduces the 345 kV bus voltage to 354.4 kV (1.027 p.u.), which is more acceptable for synchronizing the Muskrat Falls generators.

CONCLUSIONS

Preliminary analysis indicates that at least four single conductor per circuit 230 kV transmission lines would be required between Muskrat Falls an Churchill Falls for stable operation of the power system during expected contingencies. Moving to a two conductor bundle at 230 kV results in a minimum of three 230 kV transmission lines between Muskrat Falls and Churchill Falls to provide reasonable assurances of stable system operation.

Alternatively, moving to the 362 kV transmission class indicates that a minimum of two 315 kV or two 345 kV transmission lines can be expected to provide reasonable system performance. There are advantages and disadvantages of each the 315 kV and 345 kV operating voltage.

For project costing it is recommended that two 345 kV transmission lines with a two conductor bundle of 795 MCM 26/7 ACSR "DRAKE" per phase be assumed. In addition, to ensure acceptable voltage control on line open end conditions four 345 kV, 45 MVAR shunt reactors (one per each transmission line end) be included.

Detailed stability studies in final design will be required to determine the technical applicability of moving to a 315 kV operating voltage level.

Further analysis is required to determine if application of on load tap changers on the 735/345 kV autotransformers can be sized to provide the necessary voltage control and eliminate the need for independent shunt reactors. This will ultimately be a decision of economics and operability in final project design.

Document Front Sheet

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LOWER CHURCHILL PROJECT

Contractor

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NE-LCP

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHOD OR MATERIAL DEVELOPLENT OR SELECTED BY CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTURAL OR OTHER OBLIGATIONS.

- ☐ 01 – REVIEWED AND ACCEPTED – NO COMMENTS
- ☐ 02 – REVIEWED – INCORPORATE COMMENTS, REVISE AND RESUBMIT
- ☐ 03 – REVIEWED - NOT ACCEPTED
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General Comments:

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Lower Churchill Project

Churchill Falls – Muskrat Falls Transmission Link Technical Report

SLI Document No. 505573-480A-47ER-0001-00

Nalcor Reference No. MFA-SN-CD-6140-TL-RP-0001-01-B1

Date: 13-Sep-2011

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Verified by: Peter Anderson

Approved by: Satish Sud

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PA	UA	PA	SS	16-Jun-2011	-	Issued for Review (internal)

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1 EXECUTIVE SUMMARY

This report presents the results of the studies carried out to investigate the dynamic performance of the Churchill Falls/Muskrat Falls system using either 315 kV or 345 kV as the transmission voltage for the link between the two stations. The results indicate that both voltage levels are essentially similar and that 345 kV is only technically superior for multiple severe outages.

A cost comparison between a 315 kV line and a 345 kV line indicated that the cost of the 315 kV line would be of the order of 3% - 4% lower than that of a 345 kV line. Using a base cost of CAD $700,000/km for the 345 kV line, this would result in total savings of approximately CAD $10 - $14 million for both 250 km of circuits.

SLI recommends the use of 315 kV as the transmission voltage for the Churchill Falls-Muskrat Falls link since it would be less costly than 345 kV and is a standard voltage on the Hydro-Quebec (Trans-energie) system.

In the planned detailed studies, the 315 kV transmission would be optimized for best possible performance.

2 INTRODUCTION

This report presents the results of the studies carried out to determine the relative capabilities and performance of the transmission link between Churchill Falls and Muskrat Falls for two possible transmission voltages: 315 kV and 345 kV. This transmission link will replace the existing 138 kV line from Churchill Falls that supplies Happy Valley. The link will comprise:

- Two 245 km, 315 kV or 345 kV transmission lines from a new 735/315 kV or 735/345 kV substation at Churchill Falls to a new 315/138 kV or 345/138 kV substation (Muskrat Falls Tap substation) near to the Muskrat Falls Pumping Station.
- Two 5 km, 315 kV or 345 kV transmission lines from the Muskrat Falls substation to the Muskrat Falls powerhouse.
- The supply to Happy Valley will be provided at 138 kV on the existing line from the new Muskrat Falls tap substation.

In the present Design Basis, this transmission link is defined as being at 345 kV. However, this voltage is only used in New Brunswick and Nova Scotia. Within the neighbouring Trans-energie system of Hydro-Quebec, 315 kV is used as a standard voltage. Potential reinforcements in Western Labrador have raised the possibility of implementing a 315 kV interconnection across the Quebec-Labrador boundary with a potential back-up supply at 315 kV from Churchill Falls. The use of 315 kV for the Churchill Falls-Muskrat Falls transmission link would, therefore, provide some additional flexibility with respect to future developments.

Under normal circumstances, this transmission link will supply the shortfall between the output of Muskrat Falls (824 MW maximum) and the Happy Valley load and the export over the HVDC link to Soldiers Pond. These circuits will therefore be lightly loaded for most of the time.

In the event of a temporary loss of the bi-pole between Muskrat Falls and Soldiers Pond, the output of Muskrat Falls will be sent to Churchill Falls via two circuits to ensure that Muskrat Falls continues to operate in a stable manner such that, when the bi-pole (or one pole) returns to service in approximately 400 ms, the transfer from Muskrat Falls to Soldiers Pond can be re-established immediately.

2.1 OBJECTIVE & SCOPE OF STUDY

The objective of this study was to validate the system stability in Year 2017 with the 245 km transmission lines between Muskrat Falls and Churchill Falls modeled at the 315 kV and the 345 kV voltage levels. A line energization study was also conducted to determine the need for line reactors on either end of this 245 km transmission line.

The most onerous condition that might lead to a temporary loss of the bi-pole was considered to be the following:

- A 3-phase fault at the Muskrat Falls substation on one of the circuits to Churchill Falls
- The temporary loss of the converters at Muskrat Falls due to commutation failure as a result of the depressed voltage due to the fault
- The post-fault outage of one of the circuits between Churchill Falls and Muskrat Falls substation
- The recovery of the converters 400 ms after fault clearing and the re-establishment of the DC power flow to Soldiers Pond.

Other fault conditions were also examined to illustrate any significant differences between the performances at the two transmission voltage levels considered.

3 INPUT DATA & SYSTEM MODEL

NALCOR provided a PSS®E case of the Labrador system for the Year 2014 which was used by SLI as a starting point to create the system for the 2017 study year. The dynamic file for the Labrador system was also provided which contained the dynamic data for Muskrat Falls and the synchronous condensers at Wabush in the western portion of Labrador. The dynamic data is included in Appendix B of this report.

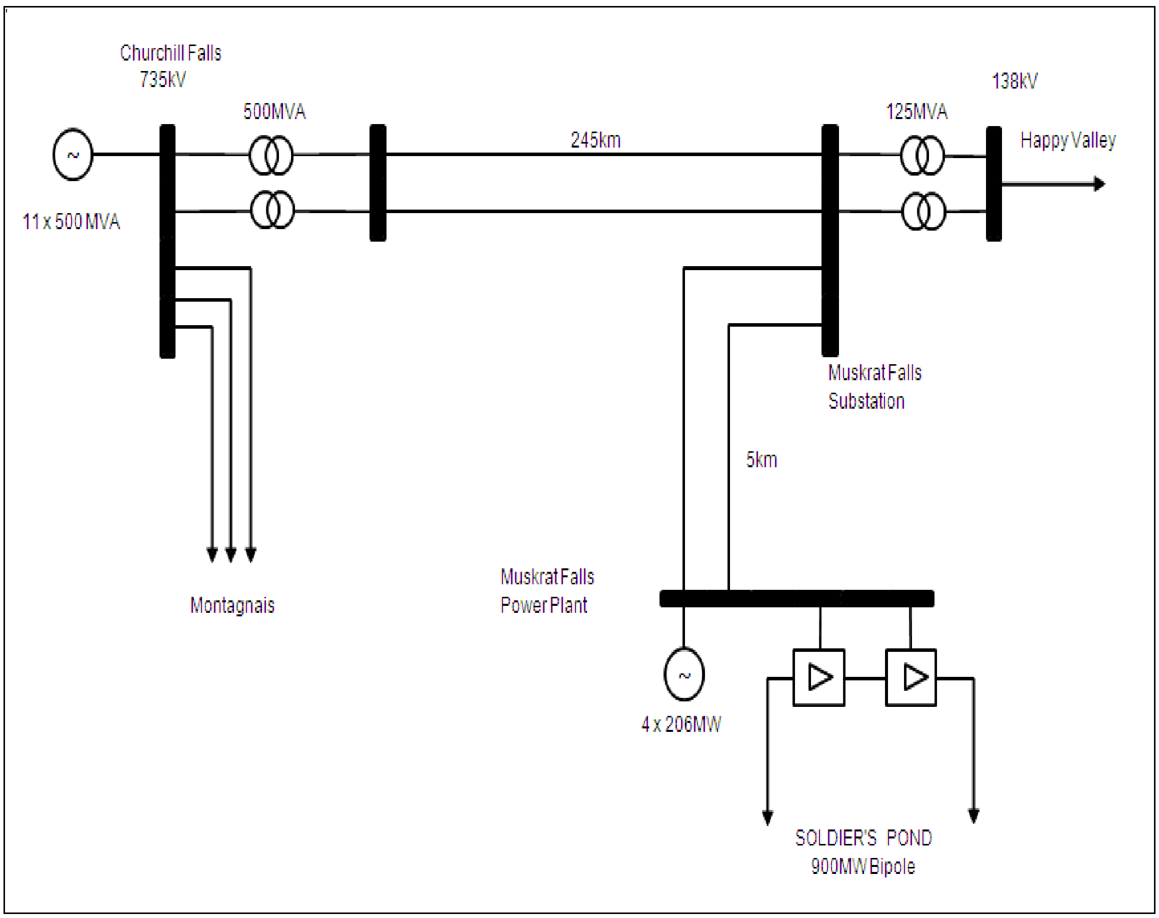


Figure 3-1: General System Diagram

The general system diagram is illustrated in Figure 3-1 above. The system model included 11 generation units of 500 MVA each at the Churchill Falls power plant. From the Churchill Falls 735 kV bus, three circuits to the Montagnais equivalent of

Hydro Quebec were also included. Two new 500 MVA transformers were modeled to step the voltage down from 735 kV to either 315 kV or 345 kV at Churchill Falls.

Two new 245 km long circuits were modeled at either voltage level to terminate at the Muskrat Falls substation, where two new 125 MVA transformers were modeled to step the voltage down to the 138 kV supply to Happy Valley. The latter was modeled with a load and the generator was included as a synchronous condenser. Approximately 11.4 MVAR of switched capacitors were also included in the model at Happy Valley.

Two new 5 km long circuits connected the Muskrat Falls substation with the Muskrat Falls power plant which was modeled with four 206 MW generation units. The 900 MW DC bi-pole to Soldier's Pond was modeled as a fixed load with parameters for real power and reactive power at 50% of the real power. The AC filters were represented as a shunt capacitor bank which was modeled so as to supply approximately 50% of the reactive requirement of the converter.

The data for all the equipment in the system model, both the new and the existing components, are included in Appendix B of this report.

4 BASIS OF THE STUDIES

4.1 LINE ENERGIZATION STUDY

Steady state studies were conducted in order to determine whether or not line reactors would be needed in order to maintain voltages within acceptable standards. The study's outcome also defined the ideal tap changer position of the 735/345 kV transformers at Churchill Falls prior to energizing the 345 kV double circuit 245 km transmission lines between Churchill Falls and Muskrat Falls.

The 345 kV double circuit 245 km transmission line was energized under the scenarios summarized in Table 4-1 below, without any line or bus reactors in service.

Table 4-1: Cases Studied for Energizing the Line

CASE #	BUS NAME / CONDITION		DESCRIPTION OF EVENT
	From	To	
Case A-1	Churchill Falls 345kV (Maintained at 1 p.u.)	Muskrat Falls 345 kV Substation (Open Ended)	Energize L1 with open-ended bus
Case A-2		Muskrat Falls 345 kV Substation (Loaded)	Energize L2 with loads connected
Case B-1	Churchill Falls 345 kV (Maintained at 1.05 p.u.)	Muskrat Falls 345 kV Substation (Open Ended)	Energize L1 with open-ended bus
Case B-2		Muskrat Falls 345 kV Substation (Loaded)	Energize L2 with loads connected
Case C	Churchill Falls 345kV (Maintained at 1 p.u.)	Muskrat Falls 345 kV Substation (Open Ended)	Energize both L1 & L2 simultaneously

The bus voltages at the 345 kV Muskrat Falls Substation are summarized in Table 4-2. In Cases A1 and A2, where the 345 kV Churchill Falls bus is maintained at 1 pu, the bus voltage at the receiving end does not exceed 1.05 pu. When the 345 kV Churchill Falls bus is maintained at 1.05 pu, the bus voltage at the receiving end for Cases B1 and B2 are at or above the 1.10 pu criterion.

Table 4-2: Results of the Cases Studied for Line Energization

CASE #	Bus Voltage (p.u.)		Line Charging (MVar)	
	345 kV Churchill Falls	345 kV Muskrat Falls	L1	L2
Case A-1	1.00	1.05	130	-
Case A-2	1.00	1.05	129	129
Case B-1	1.05	1.11	143	-
Case B-2	1.05	1.10	141	141
Case C	1.00	1.05	130	130

Therefore, with voltage control implemented at the 345 kV Churchill Falls bus, the voltage at the receiving end can be maintained well below 1.10 pu upon energizing the 245 km transmission line and thereby eliminate the need for line reactors. The above results would be equally applicable for a transmission voltage of 315 kV.

4.2 INITIAL CONDITIONS

The system studies were conducted for the 2017 study year. Load flow analysis was conducted for both the 315 kV and the 345 kV voltage levels. For each voltage level, the base case was created and validated for voltage range as well as line/transformer loading under normal (N-0) condition, as per the NALCOR planning criteria provided.

4.2.1 Load Flow Results

The results of the load flow indicate that the voltages at the system buses were satisfactory. The single line diagrams for both the 315 kV and the 345 kV voltage levels which illustrate these results are appended to this report in Figure A1 and Figure A2 of Appendix A. Load flow results of key interest are detailed in Table 4-3 for the scenarios when the DC is at its rated level of 900 MW and when the DC is not in service.

The system performance for both voltage levels was satisfactory under N-1 conditions with no overloads or voltage violations.

Table 4-3: Base case load flow results - 315 kV

Base Case Load Flows - 315 kV			Scenario	
			DC @ 900 MW	DC @ 0 MW
Generation	*Real Power (MW)*	Muskrat Falls	824	824
		Churchill Falls	5428	5428
	Apparent Power (MVAR)	Muskrat Falls	171	62
		Churchill Falls	864	1037
Line Loading (MW)	*From*	Churchill Falls	146	-754
	To	Muskrat Falls Substation		
	From	Muskrat Falls Substation	80	-822
	To	Muskrat Falls Power Plant		
	From	Muskrat Falls Tap	66	66
	To	Happy Valley		
	From	Churchill Falls	4860	5733
	To	Montagnais		

The real power at Muskrat Falls and Churchill Falls is the same for both scenarios where the DC is either at 900 MW or out of service. In the scenario where the DC is at its full potential, exporting 900 MW to the island, the line loading is such that 146 MW flows from Churchill Falls to the Muskrat Falls Substation. When not exporting to the island, Hydro Quebec absorbs the balance of the output from Muskrat Falls. The latter is shown in Table 4-3 by the reversal of power flow between Churchill Falls and Muskrat Falls substation as well as the increase in export to Montagnais.

5 SYSTEM STABILITY STUDIES: MF-CF 315 KV & 345 KV

Stability analysis was conducted to assess the security of the system following a major disturbance. Both the machine rotor angles, with respect to the reference machine at Montagnais, and bus voltages at Churchill Falls and Muskrat Falls were monitored to ascertain the system's ability to recover from the contingencies.

The fault contingencies were applied to the load flow cases for both the 315 kV and 345 kV AC transmission line voltage levels.

5.1 CONTINGENCY CASES

5.1.1 315 kV Voltage Level

Table 5-1 outlines six distinct contingency cases where the 245 km AC transmission line to Churchill Falls was modeled at the 315 kV voltage level.

Table 5-1: Contingency Cases - 315 kV

CASE #		1A	2A	3A	4A	5A	6A
Fault Description	Duration	100 ms (6 Cycles)					
	Type	3-Phase Bus Fault					
	Location	Muskrat Falls 315 kV Substation					
DC Blocked	Pole 1	✓	✓	✓	×	×	×
	Pole 2	✓	✓	✓	×	×	×
Trip One T.L. to Churchill Falls		✓	✓	✓	✓	✓	✓
Duration DC Blocked After Fault Clearing		400 ms	400 ms	400 ms	-	-	-
DC De-Blocked	Pole 1	✓	✓	×	×	×	×
	Pole 2	✓	×	×	×	×	×
Muskrat Falls Power Plant	No. of Units	4	4	4	4	2	3
	Power (MW)	824	824	824	824	412	618

Case 1A simulated a temporary bi-pole outage whereas Cases 2A and 3A simulated a permanent single-pole outage and permanent bi-pole outage respectively. Cases 4A to 6A simulated the pre-fault scenario where the DC was out of service and the number of machines at the Muskrat Falls Power Plant was varied.

5.1.2 345 kV Voltage Level

Table 5-2 outlines four distinct contingency cases where the 245 km AC transmission line to Churchill Falls was modeled at the 345 kV voltage level.

Table 5-2: Contingency Cases - 345 kV

CASE #		1B	2B	3B	4B
Fault Description	Duration	100 ms (6 Cycles)			
	Type	3-Phase Bus Fault			
	Location	Muskrat Falls **345 kV** Substation			
DC Blocked	Pole 1	✓	✓	✓	×
	Pole 2	✓	✓	✓	×
Trip One T.L. to Churchill Falls		✓	✓	✓	✓
Duration DC Blocked After Fault Clearing		400 ms	400 ms	400 ms	-
DC De-Blocked	Pole 1	✓	✓	×	×
	Pole 2	✓	×	×	×
Muskrat Falls Power Plant	No. of Units	4	4	4	4
	Power (MW)	824	824	824	824

Case 1B simulated a temporary bi-pole outage whereas Cases 2B and 3B simulated a permanent single-pole outage and permanent bi-pole outage respectively. Case 4B simulated a more onerous condition where, in the pre-fault scenario, the DC was out of service.

5.1.3 Sequence of Events

The following figure illustrates the performance of the HVDC link for a temporary loss of the bi-pole due to commutation failure.

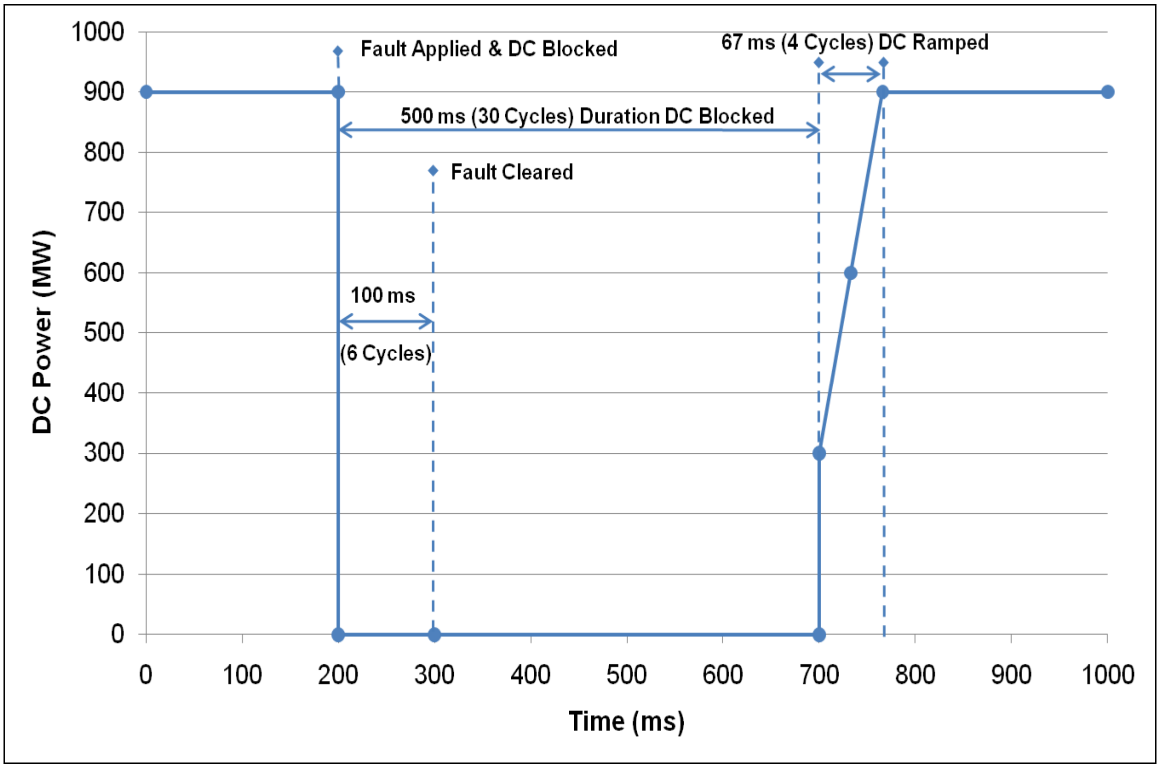


Figure 5-1: HVDC Power Level during/after an AC system fault

In the pre-fault scenario where the DC is at 900 MW, a 3-phase fault is applied at the Muskrat Falls substation (315 kV or 345 kV) and the DC is simultaneously blocked. The fault is cleared after 6-cycles (100 ms) while the DC remains blocked for an additional 24-cycles (400 ms) after fault clearing. The DC was ramped in 300 MW intervals every 2-cycles to reach its maximum capacity of 900 MW within 4-cycles (67 ms).

5.2 STUDY RESULTS & ANALYSIS

5.2.1 Case 1A (315 kV) & Case 1B (345 kV) – Temporary DC Bi-Pole Outage

For both the 315 kV and 345 kV voltage levels, a 3-phase fault was applied at the Muskrat Falls bus for a duration of 6-cycles after which it was cleared by disconnecting one of the transmission lines to Churchill Falls. The DC was blocked simultaneously with the application of the bus fault and both poles of the DC were de-blocked 400 ms (24-cycles) after fault clearance. The DC was ramped in 300 MW intervals every 2-cycles to reach its maximum capacity of 900 MW within 4-cycles.

Case 1A (315 kV)

The simulation results indicated a stable system when the DC was de-blocked and ramped to its full potential. However, the system was poorly damped as indicated by the extended duration needed to achieve steady state.

The initial machine angle swing at Muskrat Falls peaked at approximately +142^{o}. Due to the poorly damped system, the oscillation itself took approximately 15 seconds to subside before reaching steady state.

As illustrated in Figure 5-3, the bus voltage at Muskrat Falls 315 kV oscillated between a maximum of 1.18 pu and minimum at 0.35 pu before eventually stabilizing. The voltages shown in all the results correspond to the positive phase-sequence component.

Case 1B (345 kV)

At the 345 kV voltage level, the simulation results also indicated a stable system when the DC was de-blocked and ramped to its full potential. However, unlike the 315 kV Case 1A, this system was well damped.

As demonstrated in Figure 5-2, the initial swing of the machine angle at Muskrat Falls peaked at 125^{o}. The oscillation reached steady state within 7 seconds from the time the disturbance was applied; which is almost half the time needed by the 315 kV system to recover. With respect to the bus voltage, although the peaks were similar at both voltage levels, the system at 345 kV did not drop below 0.60 pu and regained stability faster with smaller variations.

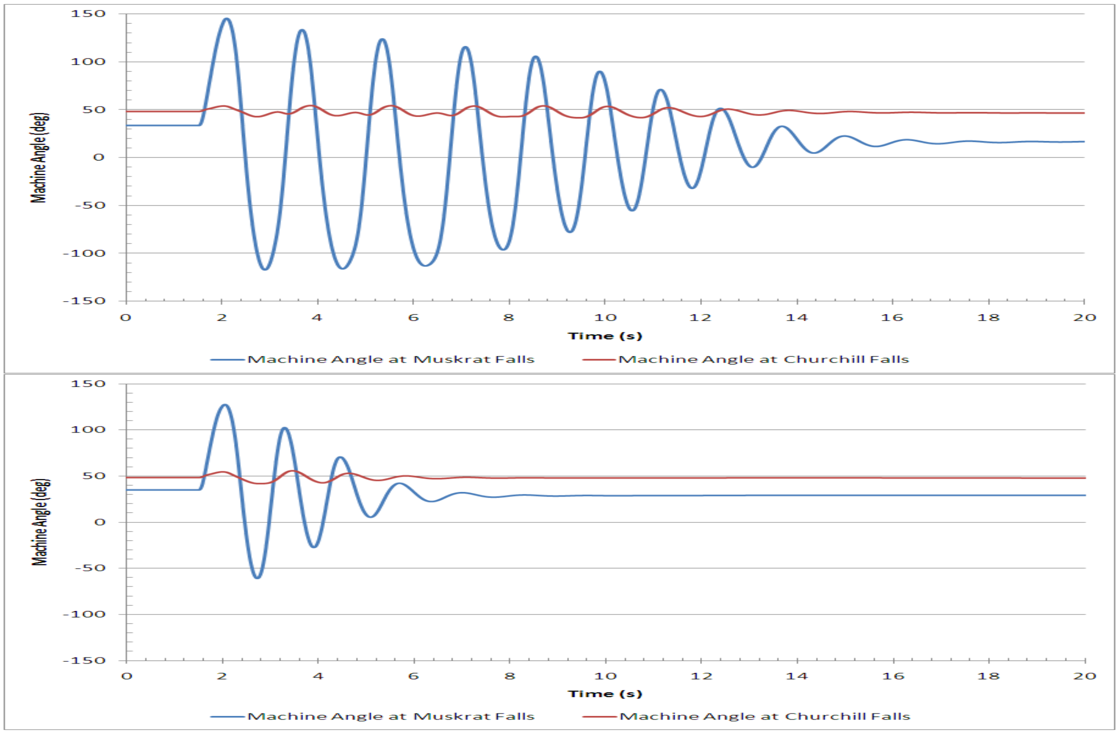


Figure 5-2: Case 1A (315 kV) & Case 1B (345 kV) Machine Angle

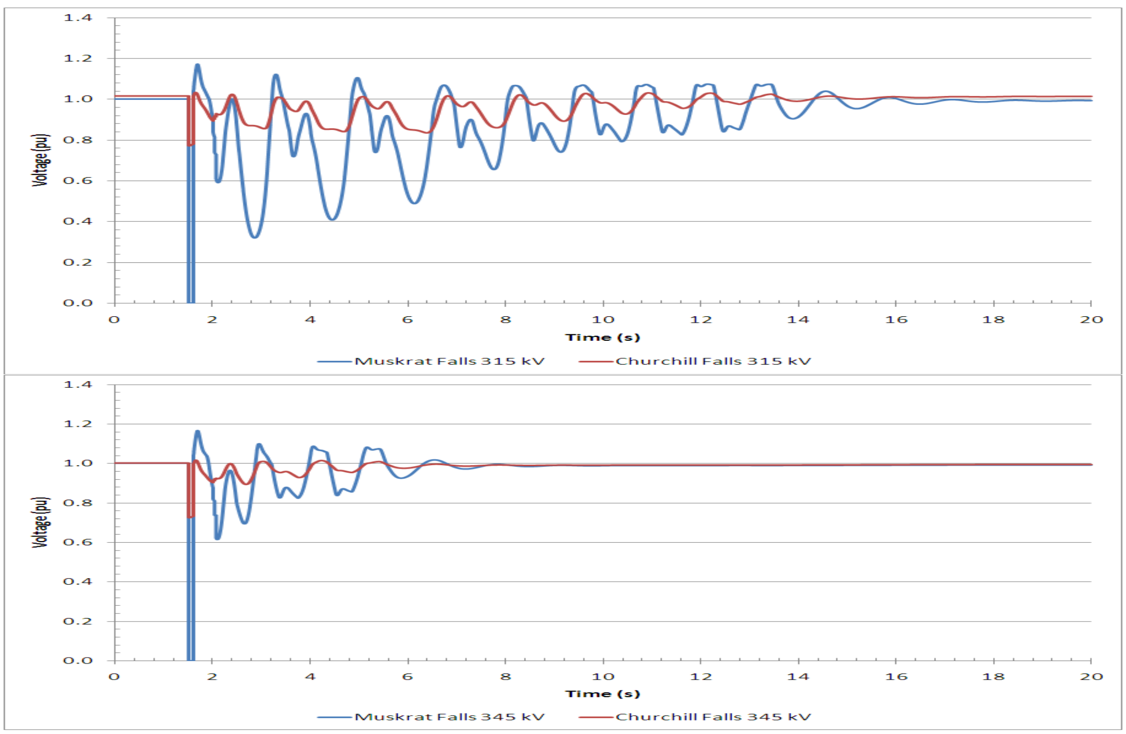


Figure 5-3: Case 1A (315 kV) & Case 1B (345 kV) Bus Voltage

5.2.2 Case 2A (315 kV) & Case 2B (345 kV) – Permanent DC Pole Outage

For both the 315 kV and 345 kV voltage levels, a 3-phase fault was applied at the Muskrat Falls bus for a duration of 6-cycles after which it was cleared by disconnecting one of the transmission lines to the Churchill Falls bus. The DC was blocked simultaneously with the application of the bus fault. However, unlike Cases 1A & 1B, only one DC pole was de-blocked 400 ms after fault clearing.

Case 2A (315 kV)

The simulation results indicated a stable and damped system when the DC was de-blocked and ramped to half its potential.

The machine angle at Muskrat Falls oscillated between 0^{o} and 150^{0} and achieved steady state in approximately 7 seconds. The bus voltage oscillated between 0.75 pu and 1.16 pu, eventually reached a steady state voltage of approximately 1.023 pu.

Case 2B (345 kV)

As anticipated, the dynamic system performance at 345 kV was stable and damped; similar to the 315 kV voltage level.

The machine angle at Muskrat Falls had a lower magnitude oscillation with its peaks approximately 25^{o} less than that found at 315 kV. The bus voltage oscillated between 0.77 pu and 1.06 pu, eventually reached a steady state voltage of approximately 1.025 pu.

It is to be noted that at both voltage levels, the bus voltage remained below 1.2 pu and the machine angles were well damped.

The system being stable at both voltage levels under this contingency, where only one pole is recovered, signifies that the healthy pole does not need to be loaded above 450 MW in order to enable the AC system to survive.

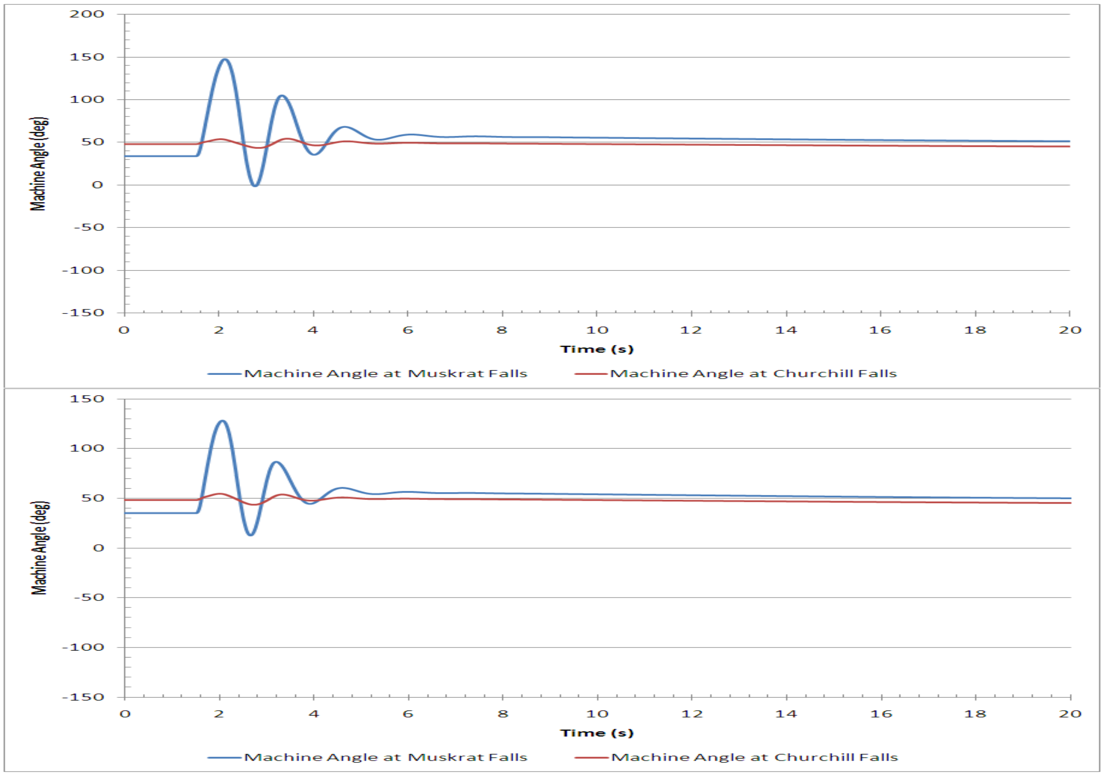


Figure 5-4: Case 2A (315 kV) & Case 2B (345 kV) Machine Angle

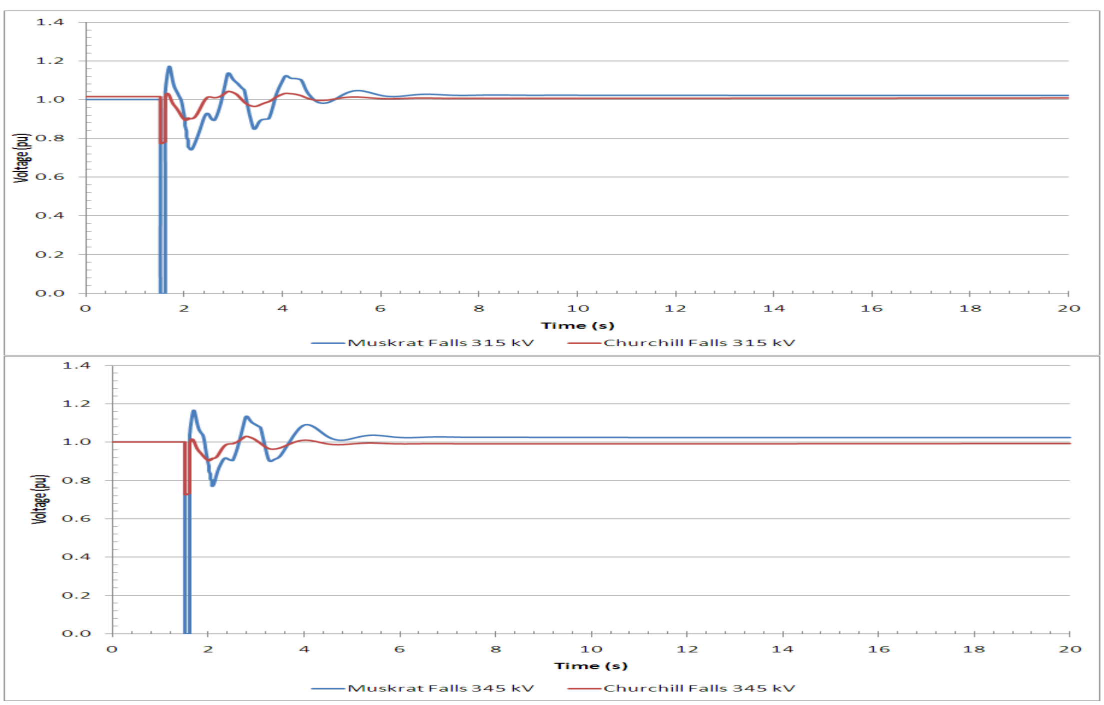


Figure 5-5: Case 2A (315 kV) & Case 2B (345 kV) Bus Voltage

5.2.3 Case 3A (315 kV) & Case 3B (345 kV) – Permanent DC Bi-Pole Outage

For both the 315 kV and 345 kV voltage levels, a 3-phase bus fault was applied at the Muskrat Falls bus for a duration of 6-cycles after which it was cleared by disconnecting one of the transmission lines to the Churchill Falls bus. Although the DC was blocked simultaneously with the application of the bus fault, unlike Cases 1A & 1B, the DC was never de-blocked.

This is the only contingency where a difference in the stability performance of the two voltage levels was found. It is worth mentioning however that this scenario is very unlikely to occur as it assumes the loss of not only one of the 245 km transmission lines to Churchill Falls but also the permanent loss of both DC poles.

Case 3A

The simulation results indicated that the system was unstable as illustrated in Figure 5-6 and Figure 5-7.

Case 3B

Unlike the 315 kV voltage level, the dynamic system performance at 345 kV indicated that the system was both stable and damped.

The machine angle at Muskrat Falls peaked at 125^{o} and although the oscillation was initially damped, the return towards steady state took longer than 20 seconds. The bus voltage oscillated between 1.17 pu and 0.73 pu and reached a new steady state operating point of approximately 1.03 pu.

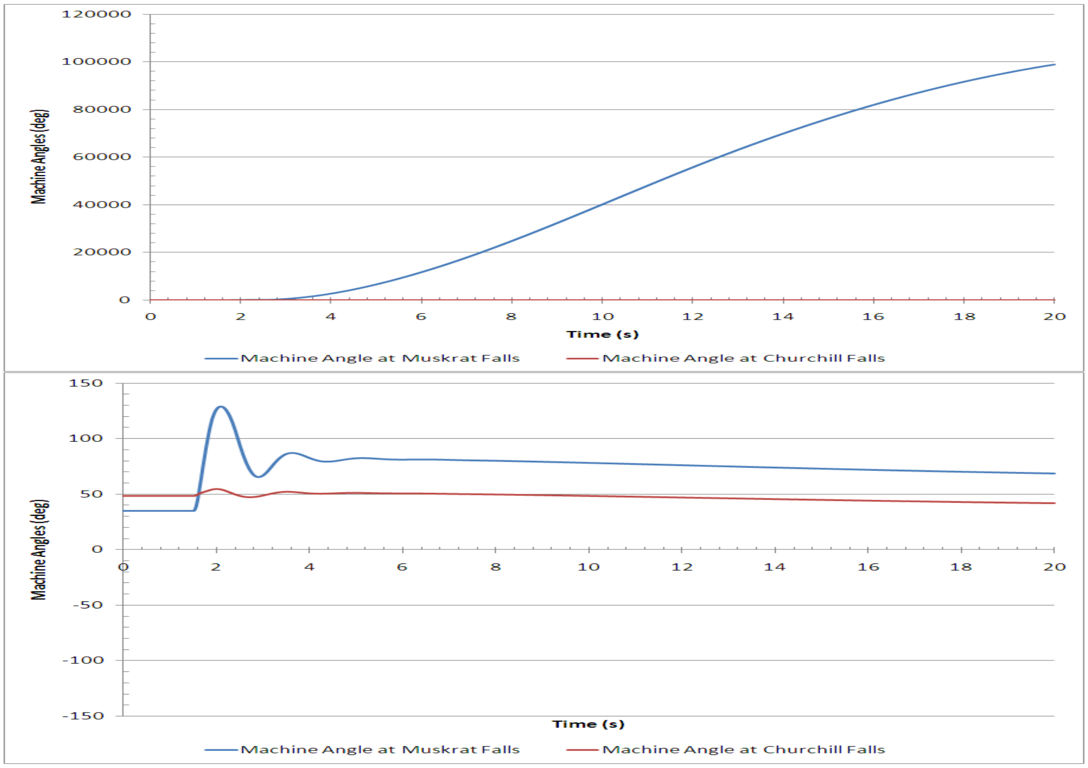


Figure 5-6: Case 3A (315 kV) & Case 3B (345 kV) Machine Angle

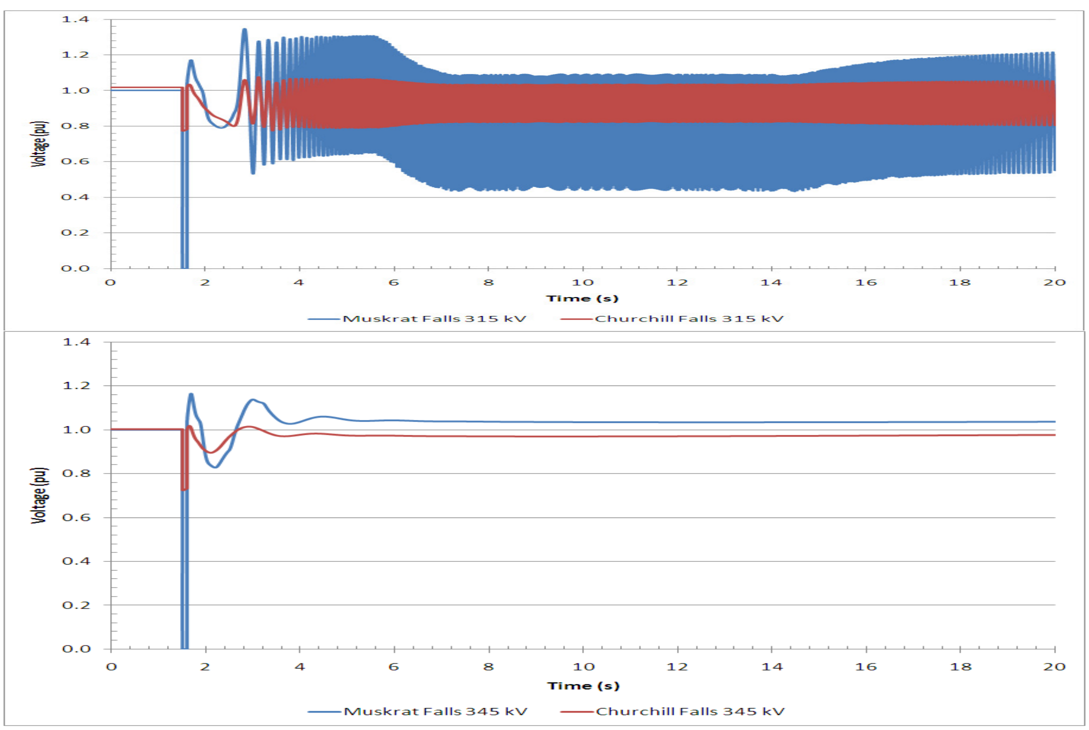


Figure 5-7: Case 3A (315 kV) & Case 3B (345 kV) Bus Voltage

5.2.4 Case 4A (315 kV) & Case 4B (345 kV) – DC Not Operational (4 Units at MF)

For both the 315 kV and 345 kV voltage levels, a 3-phase bus fault was applied at the Muskrat Falls bus for a duration of 6-cycles after which it was cleared by disconnecting one of the transmission lines to the Churchill Falls bus. This case simulated the scenario in which the entire DC was not operational to start with.

Case 4A

Under this contingency, the simulation results portray an unstable system when the full output of 824 MW from the four machines at the Muskrat Falls Power Plant is transmitted through only one 245 km line towards the 315 kV Churchill Falls bus. With the absence of the DC, the difference in the angle of the machines at Muskrat Falls and Churchill Falls was initially large due to most of the 824 MW being transmitted on the two 245 km lines. The applied disturbance further increased the difference in machine angle thereby driving the system towards instability.

Case 4B

Similar to Case 4A at 315 kV, the dynamic system performance at 345 kV was also unstable.

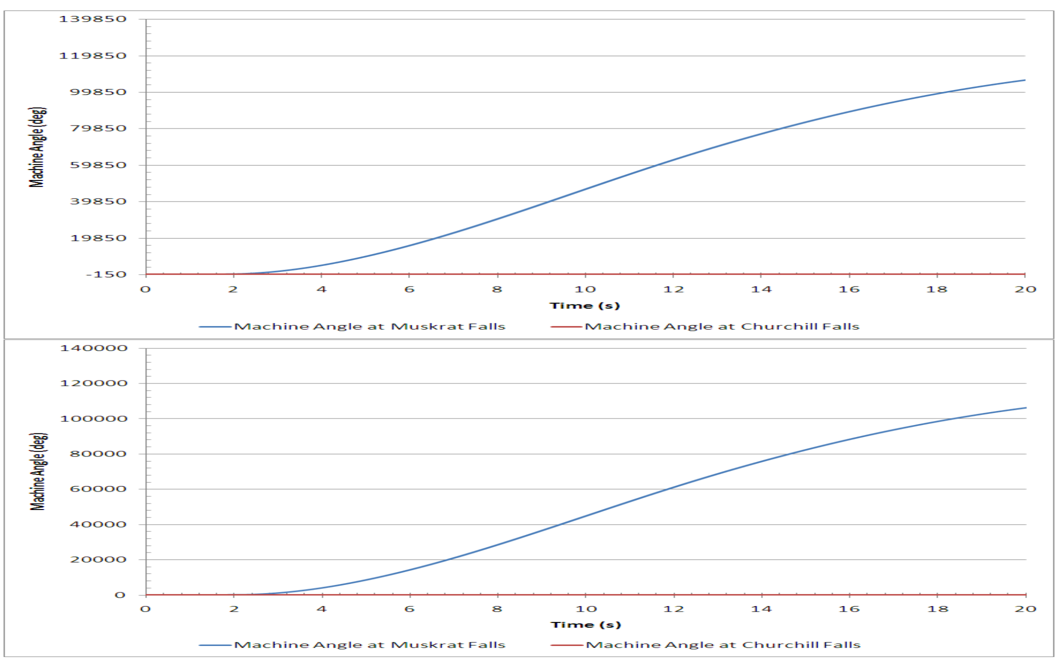


Figure 5-8: Case 4A (315 kV) & Case 4B (345 kV) Machine Angle

5.2.5 Case 5A (315 kV) – DC Is Not Operational (2 Units at MF)

In order to determine the amount of power that can be transmitted between the 315 kV Muskrat Falls Substation and the 315 kV Churchill Falls bus through one 245 km line without destabilizing the system, the contingency in Case 4A was simulated again with only two machines in service at the Muskrat Falls Power Plant providing a total power of 412 MW.

With the loss of one 245 km line and the absence of the DC, the simulation results indicated a stable system which was well damped and reached steady state in minimal time. From these results, it is inferred that the system will also be stable at 345 kV.

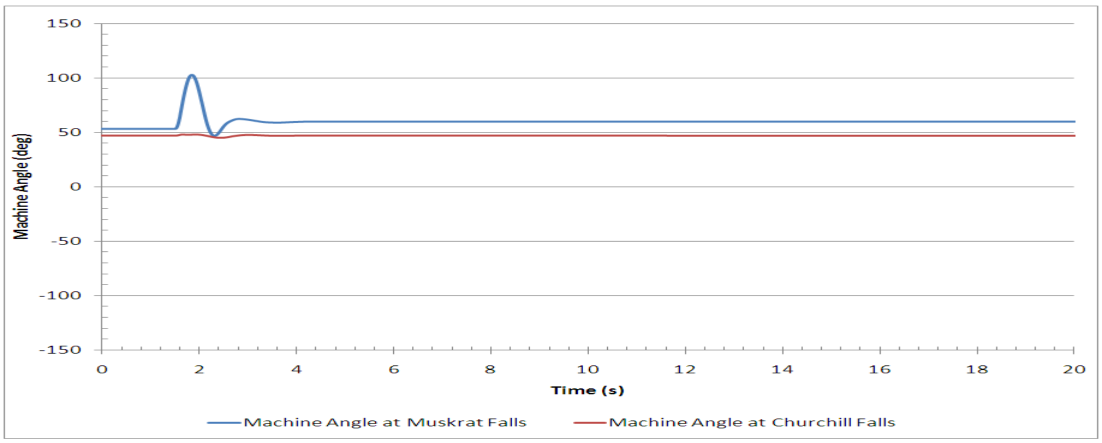


Figure 5-9: (Case 5A) Machine Angle at Muskrat Falls and Churchill Falls

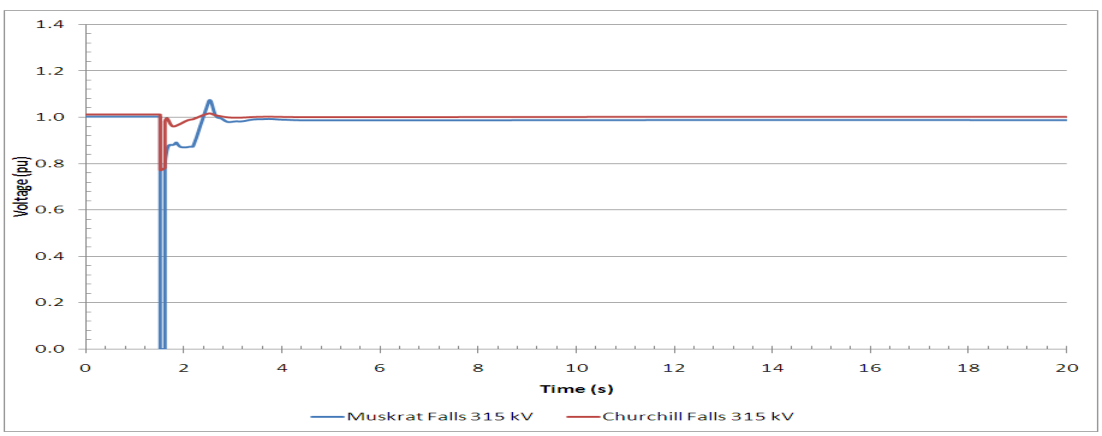


Figure 5-10: (Case 5A) Bus Voltage at Muskrat Falls 315 kV and Churchill Falls 315 kV

5.2.6 Case 6A (315 kV) – DC Is Not Operational (3 Units at MF)

A 3-phase bus fault was applied and cleared similar to the previous cases along with the contingency of not having the DC in service as in Cases 4A and 5A. A third machine was now placed in service to determine if the system remains stable while transmitting 618 MW from Muskrat Falls to Churchill Falls on one 245 km line.

The system was stable and well damped. From these results, it is inferred that the system will also be stable at 345 kV. However, it is apparent from Case 4A studied earlier that four machines in service under such conditions would result in system instability.

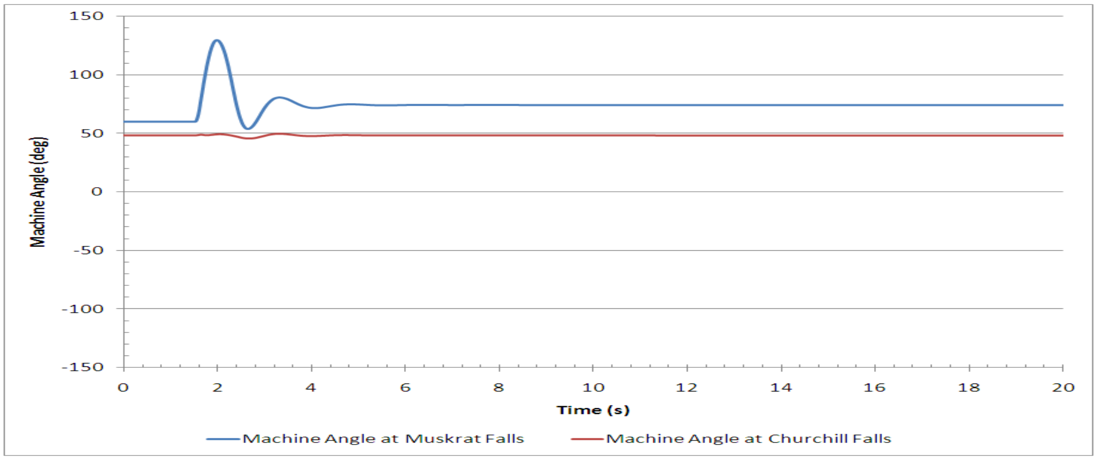


Figure 5-11: (Case 6A) Machine Angle at Muskrat Falls and Churchill Falls

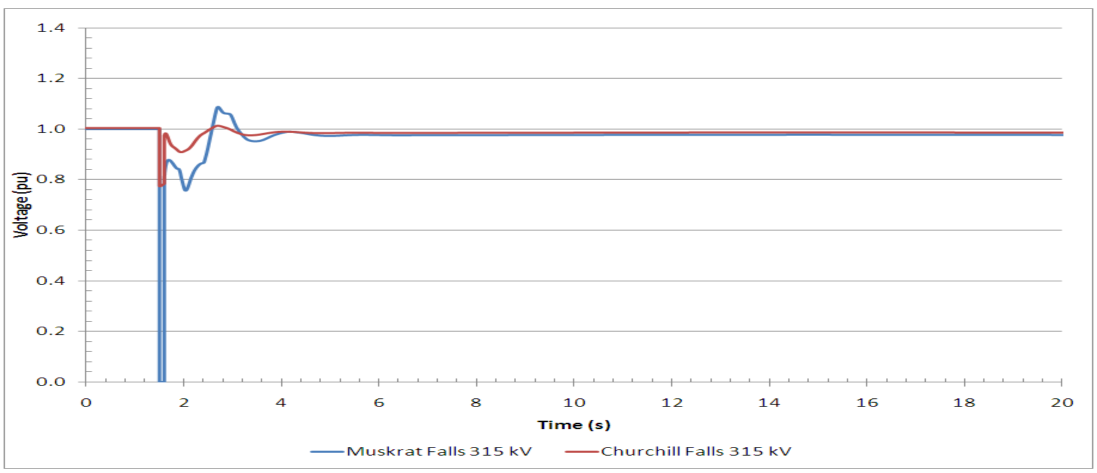


Figure 5-12: (Case 6A) Bus Voltage at Muskrat Falls 315 kV and Churchill Falls 315 kV

6 ADDITIONAL STABILITY STUDIES

NALCOR requested that SLI carry out a number of additional fault cases to complete the analysis of the 315 kV alternative. These cases comprised the following:

Case 1C: A single line to ground fault at the Muskrat Falls substation on one circuit to Churchill Falls with successful single phase reclosing.

Case 2C: A single line to ground fault at the Muskrat Falls substation on one circuit to Churchill Falls with unsuccessful single phase reclosing, resulting in a line outage.

Case 3C: A three phase fault at Churchill Falls 735 kV resulting in the tripping of two generating units at Churchill Falls.

Case 4C: A three phase fault at the Muskrat Falls tap substation 138 kV bus resulting in the tripping of the 138 kV line to Happy Valley.

For all of these cases, the DC power was unchanged during and after the fault period. The major objective of these studies was to examine the voltage profile at the converter AC bus to determine if there was any potential for commutation failure due to depressed voltage levels.

6.1 STUDY RESULTS & ANALYSIS

6.1.1 Case 1C – Successful Single Phase Reclosing

In order to simulate a successful single pole reclose, a 6-cycle single line to ground (SLG) fault was applied at the 315 kV Muskrat Falls Substation on one circuit to Churchill Falls. The fault was cleared by opening one phase of the circuit. Following a dead time of 400 ms, the open phase was reclosed.

The system was stable and well damped. As illustrated in Figure 6-1, the initial swing of the machine angle at Muskrat Falls oscillated between 21° and 38° before it reached steady state. Upon applying the SLG fault, the initial voltage dropped only to 0.66 pu since the power still flowed thorough the two healthy phases. The voltage rose to 0.9 pu in the 400 ms period post fault clearing. After the phase was successfully reclosed, the voltage peaked at 1.07 pu before the system returned to the pre-fault steady state value.

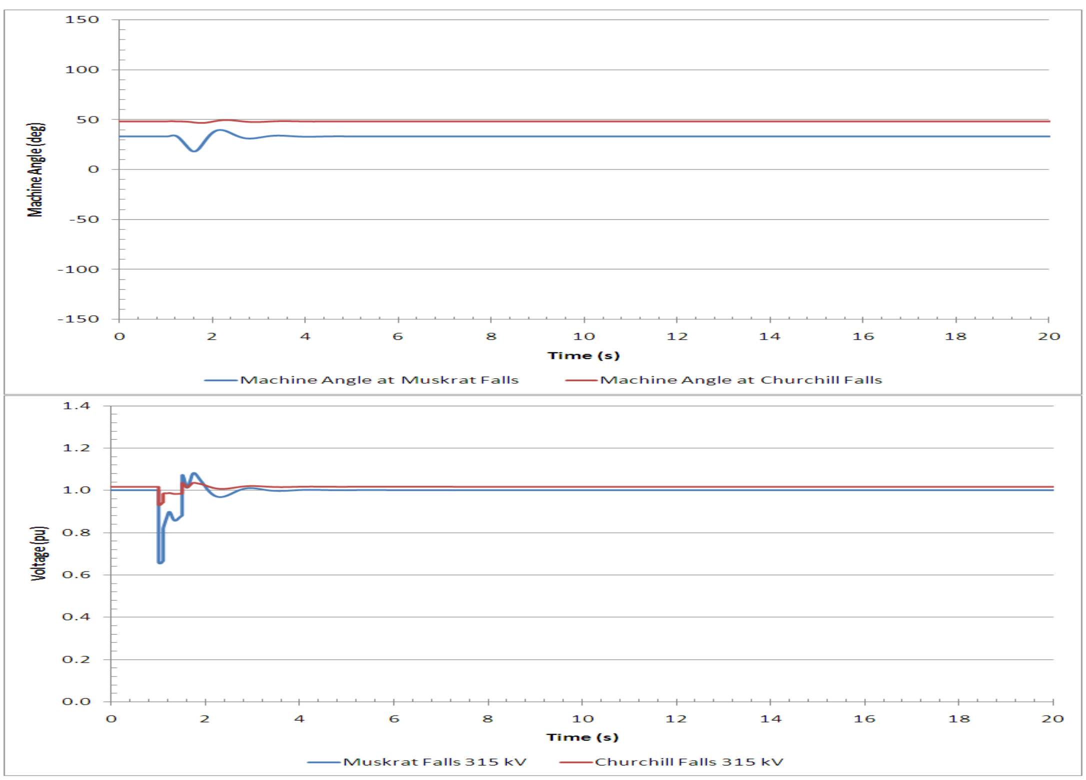


Figure 6-1: (Case 1C) Successful Single Pole Reclosing

6.1.2 Case 2C – Unsuccessful Single Pole Reclosing

In order to simulate an unsuccessful single pole reclosing, a 6-cycle single line to ground (SLG) fault was applied at the 315 kV Muskrat Falls substation on one circuit to Churchill Falls. One phase of the circuit was opened for 400 ms while still maintaining the SLG fault. The open phase was reclosed, while the SLG fault was maintained, and 6-cycles later the entire circuit was disconnected in order to clear the fault.

The system was stable and damped. As illustrated in Figure 6-2, the initial swing of the machine angle at Muskrat Falls oscillated between 17° and 36° before achieving steady state. Similar to the previous case, the initial voltage dropped only to 0.66 pu upon applying the SLG fault since the power still flowed thorough the two healthy phases. The voltage rose to 0.87 pu in the 400 ms period post fault attempted clearing. After an unsuccessful attempt to clear the fault, the voltage dropped to 0.58 pu when the open phase was closed onto the existing SLG fault. After six cycles, the circuit was tripped in order to clear the fault and the voltage peaked at 1.12 pu before the system achieved steady state.

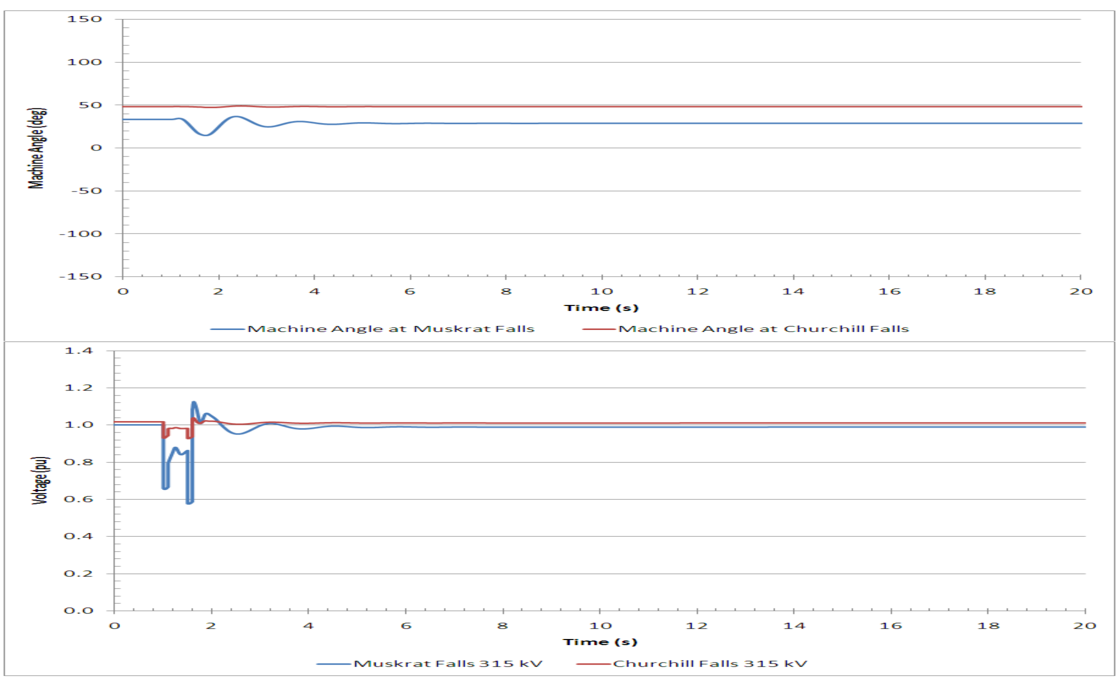


Figure 6-2: (Case 2C) Unsuccessful Single Pole Reclosing

6.1.3 Case 3C – 3-Phase Fault at Churchill Falls 735 kV

A 3-phase fault was applied at the Churchill Falls 735 kV bus for a duration of 6-cycles which resulted in the loss of two generators at Churchill Falls.

The system was stable and damped. As illustrated in Figure 6-3, the initial swing of the machine angle at Churchill Falls is more severe than that at Muskrat Falls where the former oscillated between 90° and 21°. The voltage at Muskrat Falls 315 kV oscillated between 1.06 pu and 0.87 pu before the system achieved steady state.

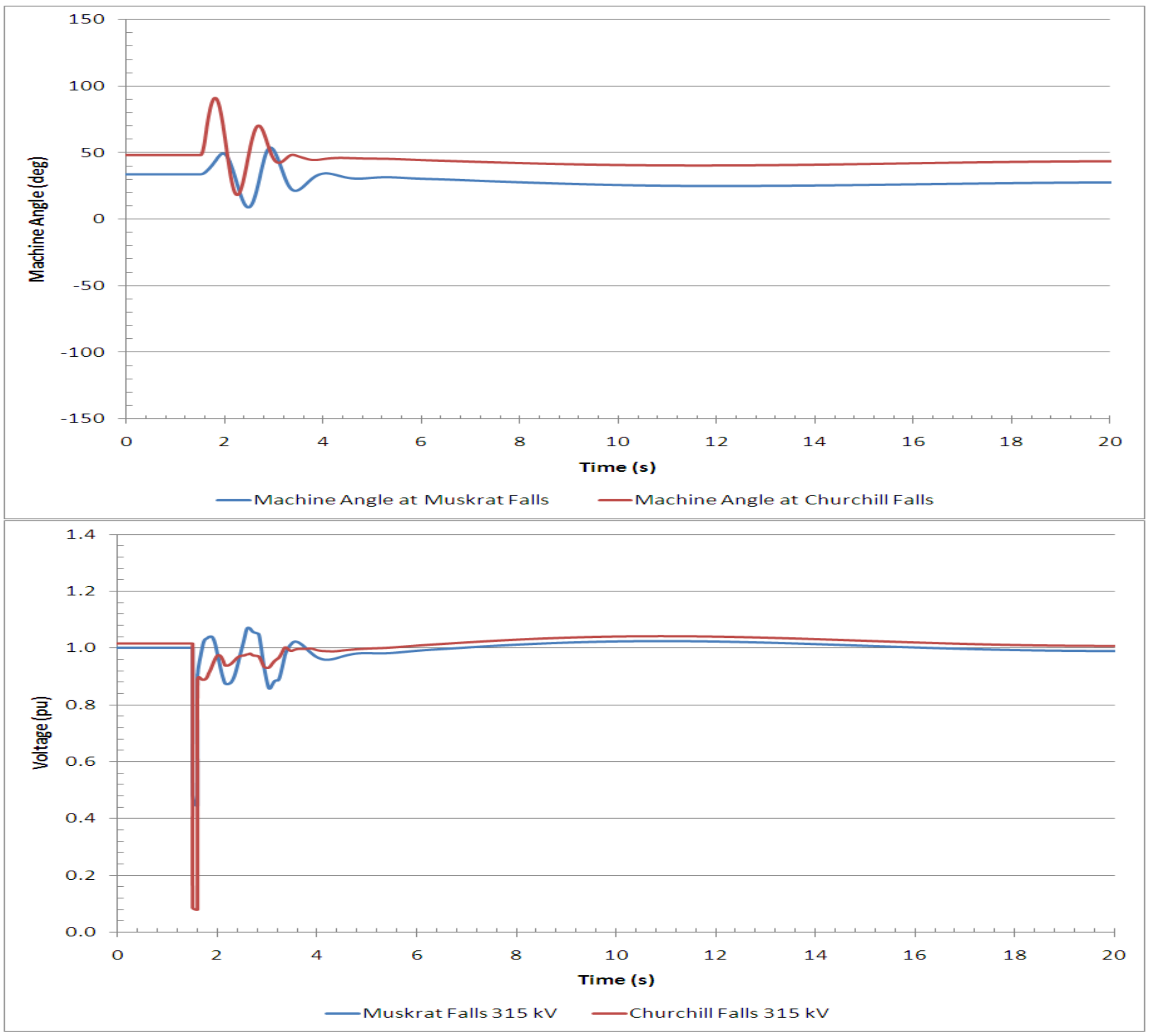


Figure 6-3: (Case 3C) 3-Phase Fault at Churchill Falls 735 kV

6.1.4 Case 4C – 3-Phase Fault at Muskrat Falls 138 kV

A 3-phase fault was applied at the Muskrat Falls 138 kV tap substation for a 6-cycle duration which resulted in the tripping of the line to Happy Valley.

As illustrated in Figure 6-4, the system is stable and well damped. The minor variations in machine angles at both Churchill Falls and Muskrat Falls demonstrated a minimal impact to the system under such a contingency. This is also corroborated by the fast recovery of the voltage, which dipped to 0.39 pu before the system achieved steady state. The voltage depression at the 315 kV level during the fault period may be sufficient to cause commutation failure of the converters.

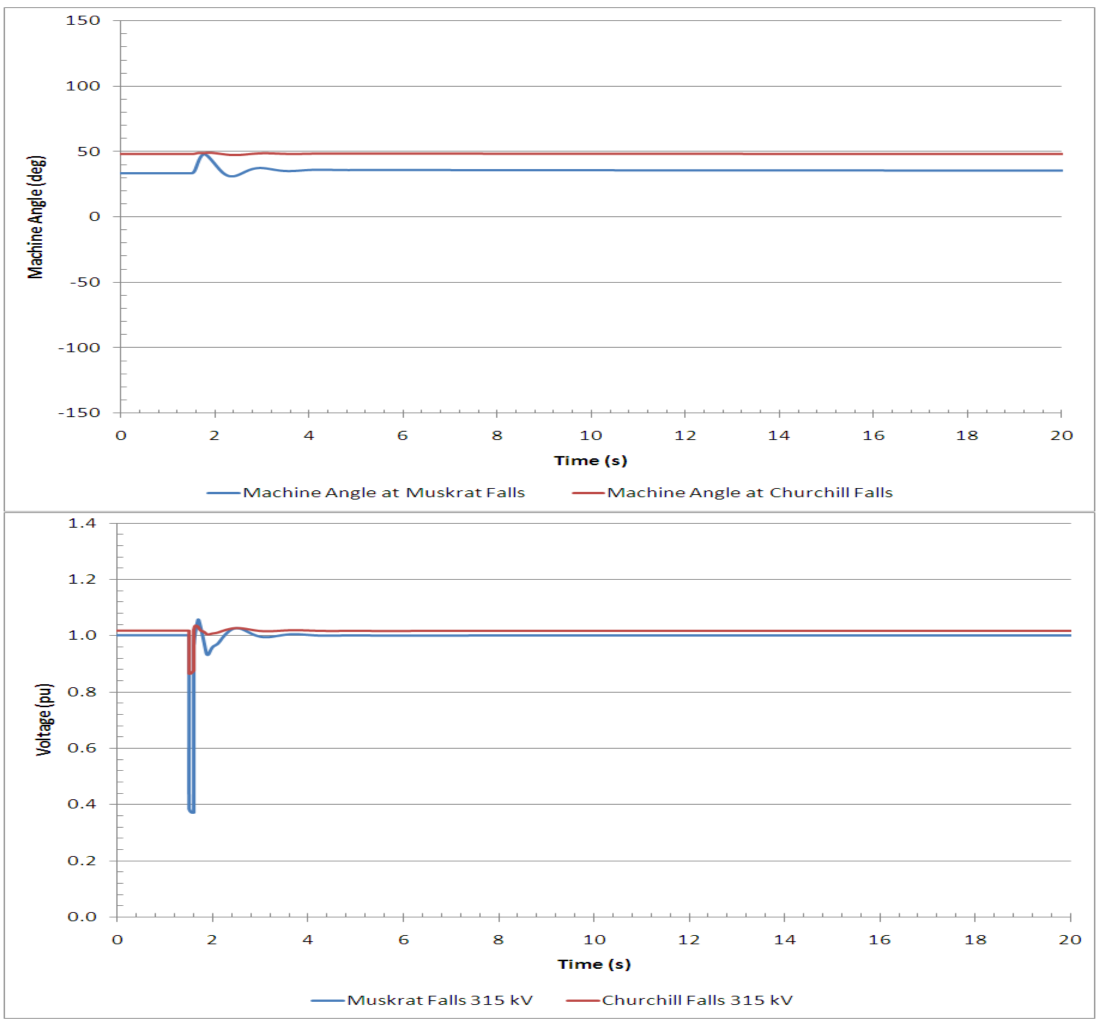


Figure 6-4: (Case 4C) 3-Phase Fault at Muskrat Falls 138 kV Tap Substation

6.1.5 Case 5C – 3-Phase Fault at Muskrat Falls 138 kV (Temp Bi-Pole Outage)

Due to the voltage depression during the fault period being sufficient in Case 4C to cause commutation failure of the converters, Case 5C studied the impact on the system performance with a commutation failure in effect.

A 3-phase fault was applied at the Muskrat Falls 138 kV tap substation for a duration of 6-cycles after which it was cleared by disconnecting the transmission line to Happy Valley. The DC was blocked simultaneously with the application of the bus fault and both poles of the DC were de-blocked 400 ms (24-cycles) after fault clearance. The DC was ramped in 300 MW intervals every 2-cycles to reach its maximum capacity of 900 MW within 4-cycles.

This case demonstrated that the system performance remained stable at the 315 kV alternative when a commutation failure of the DC converters occurred and when the DC was ramped back to its full potential. As illustrated in Figure 6-5, the machine angle at Muskrat Falls oscillated between 93° and 3° before it stabilized. The voltage depression during the fault reached 0.44 pu and rose to 1.19 pu upon clearing the fault. The voltage dipped to 0.8 pu as the DC was ramped back to 900 MW before it eventually stabilized.

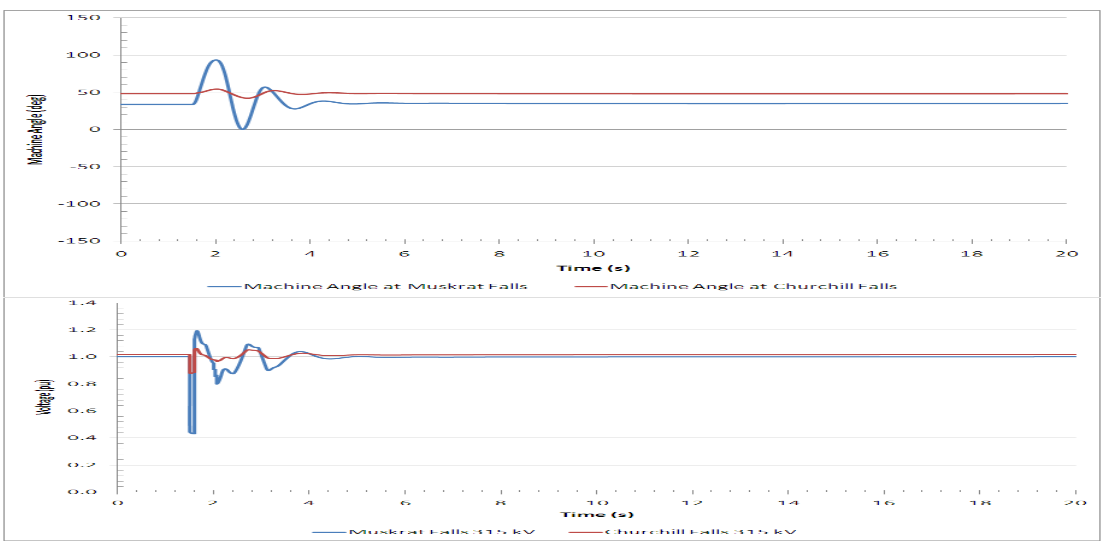


Figure 6-5: (Case 5C) 3-Phase Fault at Muskrat Falls 138 kV with Temporary Bi-Pole Loss

7 FURTHER STUDIES

Initial studies indicated that the post fault voltage at the 315 kV level had oscillations with voltage dips low enough at times to cause concern over successive DC commutation failures. These studies also identified the operational limitation of having to maintain a maximum of three generators at Muskrat Falls when the DC bi-pole was not operational. Further to a request from NALCR, subsequent studies were carried out to accomplish the following objectives:

Case 1D: To improve the post fault recovery of the AC voltage by modification of the power system stabilizer settings of the Muskrat Falls generating units.

Case 2D: Impact of cross-tripping one unit at Muskrat Falls for the 3-phase fault at Muskrat Falls followed by loss of one 315 kV transmission line and permanent outage to the HVDC bi-pole.

7.1 STUDY RESULTS & ANALYSIS

7.1.1 Case 1D – Effect of Modifying Power System Stabilizer Settings

In Section 5 of this report, the studies conducted for the 315 kV alternative indicated that for a 6-cycle (100 ms) 3-phase fault at the Muskrat Falls substation on one of the transmission lines to Churchill Falls, the system remained stable for a 24-cycle (400 ms) temporary shutdown and recovery of the HVDC bi-pole to Soldiers Pond.

However, the results also indicated that the voltage recovery at Muskrat Falls was poorly damped and that the post-fault voltage dips may lead to successive commutation failures on the HVDC converters. It was suggested that modifications to the supplementary stabilizers on the excitation systems of the Muskrat Falls generating units could improve the voltage recovery.

Figure 7-1 illustrates the voltage response at Muskrat Falls when the original parameters for the stabilizers are used compared to the use of modified values for the time constants which alter the frequency response of these control loops.

Modification of the stabilizers improved both the worst post-fault voltage dip from a minimum voltage of 0.3 pu to that of 0.5 pu and also significantly improved the damping of the oscillations. In both scenarios where the stabilizer parameters were unchanged and the other where they were modified, the HVDC export to Soldiers Pond was modeled as a simple constant real power load and a constant impedance reactive load.

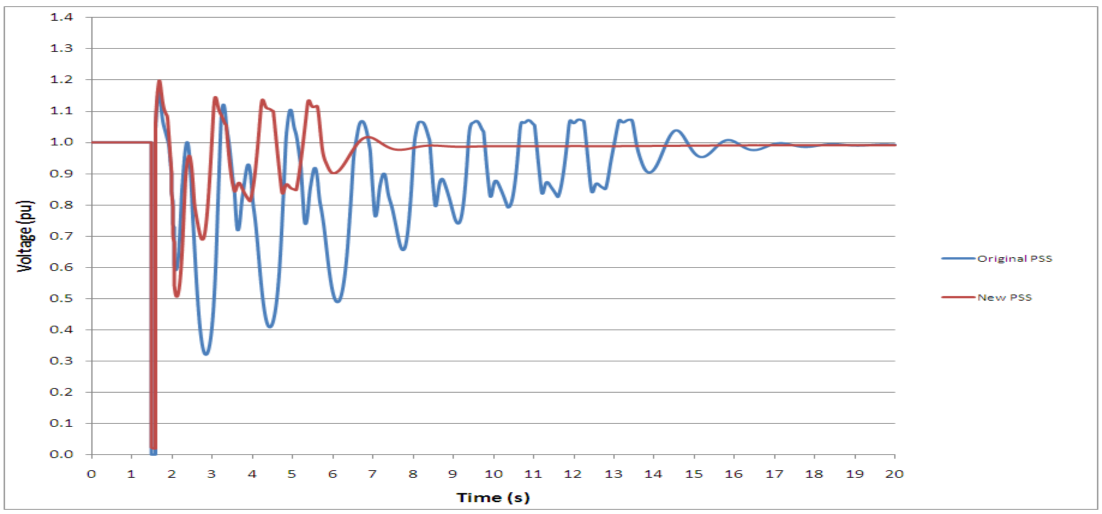


Figure 7-1: Muskrat Falls bus voltage with original and modified settings of Muskrat Falls PSS HVDC modeled as real constant P and reactive constant Z

Figure 7-2 illustrates the comparison of the previous scenarios but with the HVDC load modeled as a constant current load for both the real and reactive power. This is a rough approximation of the Voltage Dependent Current Order Limit (VDCOL) control used in rectifiers to modify the DC power as a function of the AC bus voltage. It is mainly applied during the recovery phase of a converter so that the stress on the AC system is lowered during the recovery period to maintain a reasonable AC voltage. It can also operate following the recovery of the ordered DC power level in order to alleviate the stress on the AC system. With the use of VDCOL, it is apparent from Figure 7-2 that the worst post-fault voltage dip was further alleviated as the voltage now only dipped to a value of 0.58 pu. The system damping was also improved as a result of this type of load modeling. It is reasonable to assume that the future detailed studies, which will explicitly model this type of control function, will provide enhanced performance compared to the simple model used here.

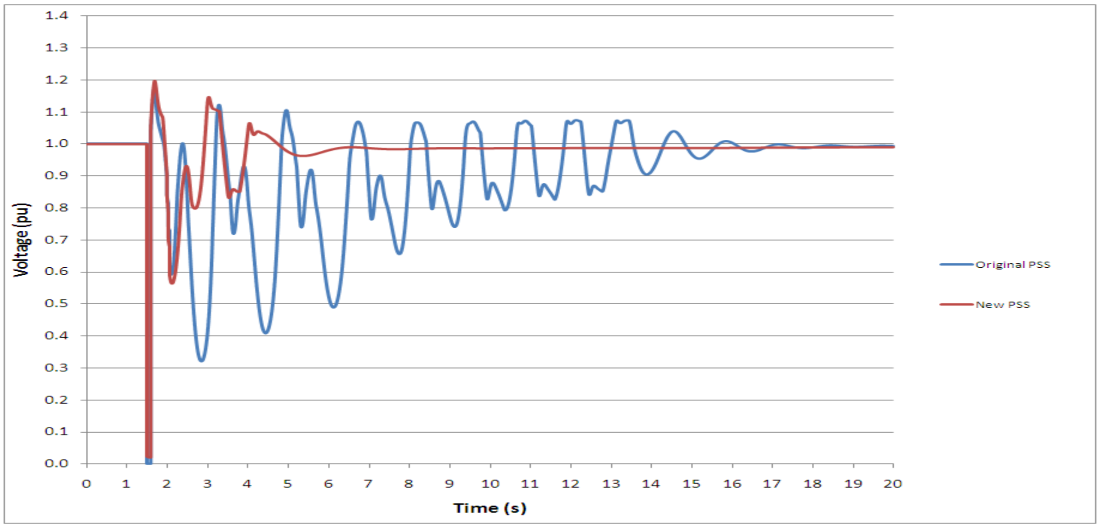


Figure 7-2: Muskrat Falls bus voltage with original and modified settings of Muskrat Falls PSS HVDC modeled as constant current

Figure 7-3 illustrates the variation in DC power post fault clearance with the two variants of the load models described above. It is apparent that the DC power is reduced during periods of lower AC voltage and increased during periods of higher AC voltage. Future detailed studies will examine the impact of such modulation of the DC power at the rectifier end and on the AC system frequency at the inverter end.

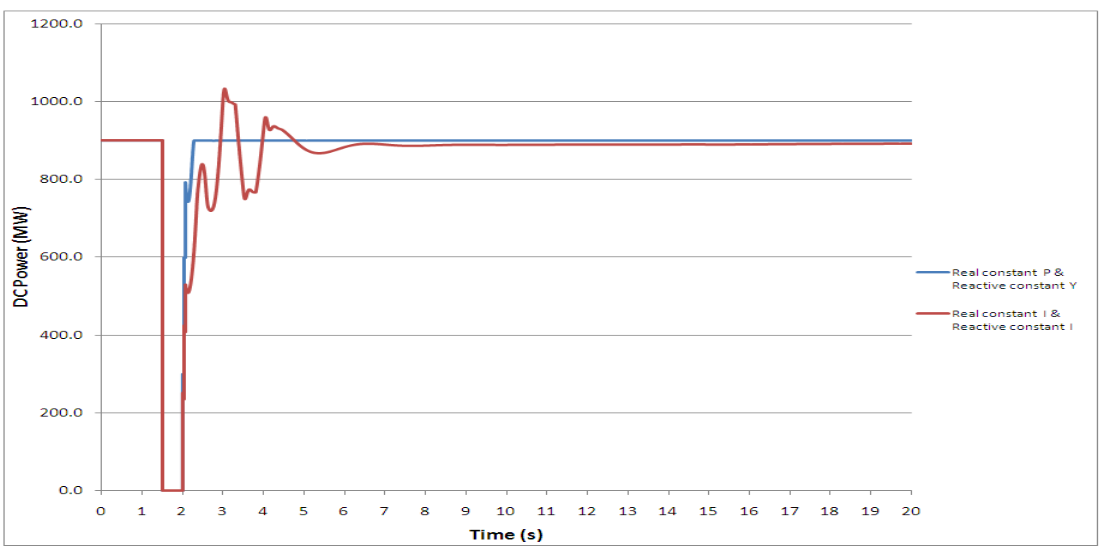


Figure 7-3: HVDC power with different load representations

7.1.2 Case 2D – Determine Maximum Allowable Time to Trip Generator

Analysis of Cases 3A and 4A/B in Section 5 of this report identified that the system was unstable for both 315 kV and 345 kV voltage alternatives in the following event:

- A 6-cycle, 3-phase fault at the Muskrat Falls substation on one of the 315 kV lines to Churchill Falls,
- The permanent shutdown of the HVDC bi-pole to Soldiers Pond (Case 3A - 900 MW pre-fault loading and Case 4A 0 MW pre-fault loading),
- The post-fault outage of 1 x 315 kV line between Churchill Falls and the Muskrat Falls substation.

However, the results of Case 6A demonstrated that for such a scenario, a maximum of three generators could be connected at Muskrat Falls to avoid a loss of synchronism between the Muskrat Falls units and the Churchill Falls units.

Based on NALCOR's request, the above scenario was repeated for the 315 kV alternative considering the following conditions:

- Muskrat Falls was operated initially with four units at rated output (824 MW total),
- Following the application of the fault at the Muskrat Falls Tap substation, one unit at Muskrat Falls was tripped to leave three units remaining connected post-fault,
- The time delay between fault application and the cross-tripping of the generating unit was varied to determine the maximum time delay that would result in a stable post-fault recovery.

The following figures show the machine angle of the three remaining generators, with respect to the Hydro-Quebec equivalent generator at Montagnais, for three different timings of the tripping of the fourth machine as follows:

- 6-cycles after fault clearance,
- 42-cycles after fault clearance,
- 48-cycles after fault clearance.

In the first instance where one generator was tripped 6 cycles after fault clearance, the system remained stable with a very low-frequency oscillation. In the second instance, the generator was tripped 42 cycles after fault clearance and the system remained stable although with a few more oscillations. With the tripping sequence delayed by an additional 6 cycles before the cross-tripping of one machine, for a total of 48 cycles after fault clearing, the system was unstable.

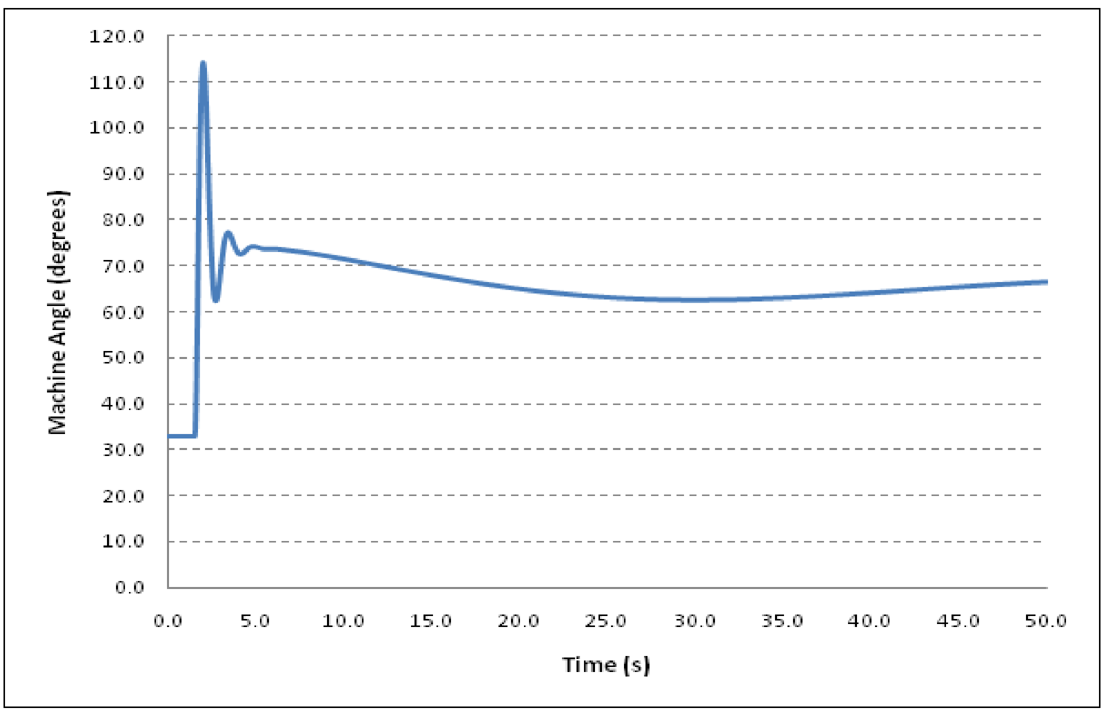


Figure 7-4: Machine angle of Muskrat Falls generators following a three phase fault and a permanent HVDC outage with tripping one machine after 6 cycles

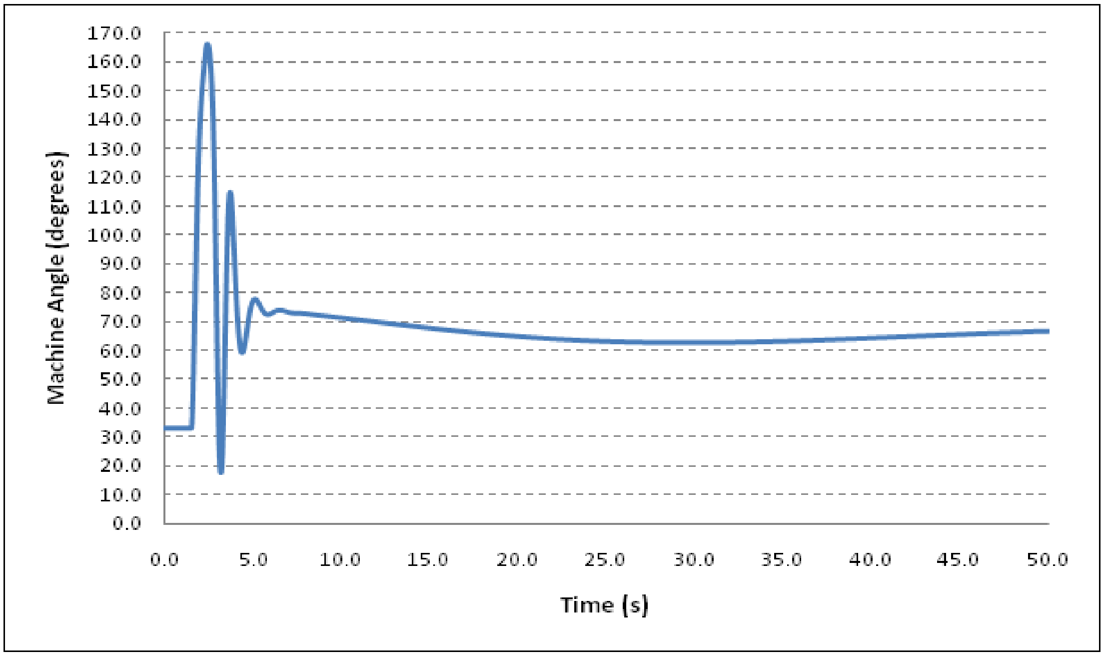


Figure 7-5: Machine angle of Muskrat Falls generators following a three phase fault and a permanent HVDC outage with tripping one machine after 42 cycles

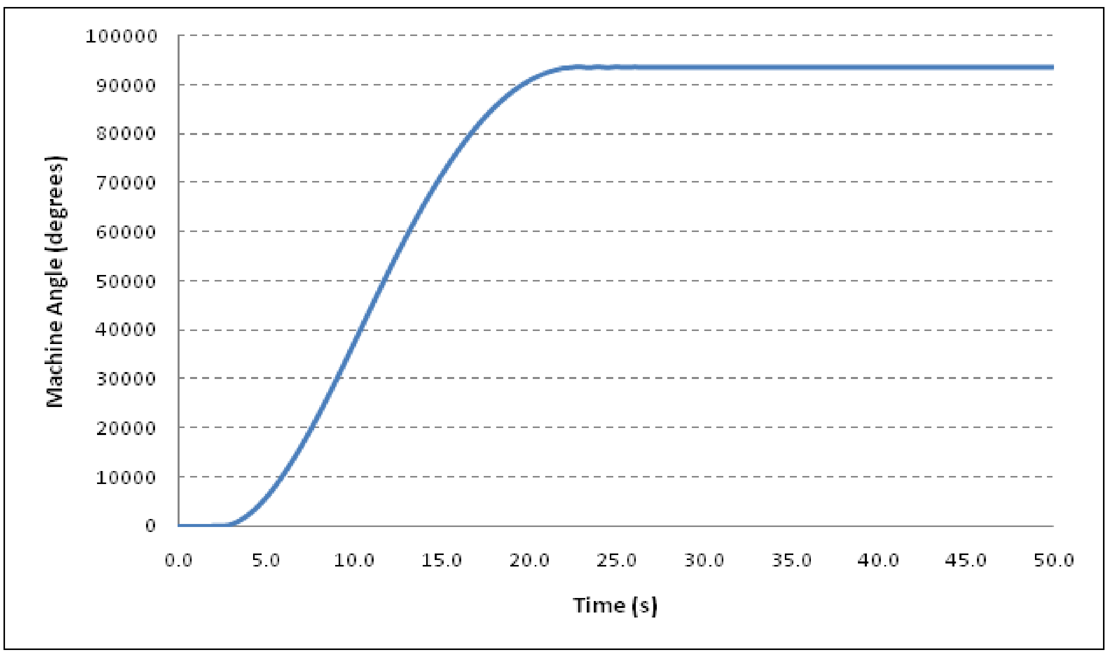


Figure 7-6: Machine angle of Muskrat Falls generators following a three phase fault and a permanent HVDC outage with tripping one machine after 48 cycles

An inter-tripping scheme could be developed which would trip one generator at Muskrat Falls (if all four are in operation) when a 315 kV line outage and the shutdown of the HVDC link to Soldiers Pond occurred simultaneously, as a result of a 315 kV line fault between Churchill Falls and the Muskrat Falls substation. The generator will need to be tripped within 42 cycles (700 ms) after the tripping of the 315 kV line between Churchill Falls and Muskrat Falls.

If the shutdown of the HVDC link is a result of the operation of the converter AC breakers, it would be relatively straightforward to develop an inter-tripping scheme that could operate significantly faster than the 42 cycles mentioned above. In the situation where the HVDC link is shut down by the converters themselves without any breaker operation, a re-start of the HVDC link (either one or both poles) may be necessary. There is sufficient time available before the generator must be tripped in order to allow for a re-start of the HVDC link to occur. As shown earlier, the system remains stable when the HVDC is restarted with four units operating at Muskrat Falls.

It can therefore be concluded that with a 315 kV transmission link (2-circuits) between Churchill Falls and Muskrat Falls, the system can remain stable for the severe fault case examined and that sufficient time is available to cross-trip one of the Muskrat Falls generating units to ensure system stability.

8 CONCLUSION AND RECOMMENDATIONS

The dynamic system performance of both the 315 kV and 345 kV voltage levels demonstrated similar characteristics. However, the system recovery was faster at the 345 kV as compared to that at the 315 kV voltage level. For severe, multiple outages, the system at 345 kV is clearly stable whereas it is unstable at 315 kV. Both systems have a restriction on the output of Muskrat Falls, up to three machines, when the DC power is at zero. A summary of the cases studied and the corresponding system performance is detailed in Table 8-1.

Table 8-1: Summary of cases and corresponding dynamic system performance

CASE #	315 kV	1A	2A	3A	4A	5A	6A
	345 kV	1B	2B	3B	4B		
Fault Description	Duration	100 ms (6 Cycles)					
	Type	3-Phase Bus Fault					
	Location	Muskrat Falls Substation					
DC Blocked	Pole 1	✓	✓	✓	×	×	×
	Pole 2	✓	✓	✓	×	×	×
Trip One T.L. to Churchill Falls		✓	✓	✓	✓	✓	✓
Duration DC Blocked After Fault Clearing		400 ms	400 ms	400 ms	-	-	-
DC De-Blocked	Pole 1	✓	✓	×	×	×	×
	Pole 2	✓	×	×	×	×	×
Muskrat Falls Power Plant	No. of Units	4	4	4	4	2	3
	Power (MW)	824	824	824	824	412	618
Dynamic System Performance	315 kV	Stable & Poorly Damped	Stable & Damped	Unstable	Unstable	Stable & Damped	Stable & Damped
	345 kV	Stable & Damped	Stable & Damped	Stable & Damped	Unstable	Stable* & Damped	Stable* & Damped

* Inferred: Since the system was stable at 315 kV, it will also be stable at 345 kV

Further analysis of Cases 3A and 4A/B demonstrated that with a 315 kV transmission link (2-circuits) between Churchill Falls and Muskrat Falls, the system can remain stable for the severe fault case examined by cross-tripping one of the Muskrat Falls generating units.

Due to instances of post fault voltage dips which were low enough to raise concern over successive DC commutation failures at the 315 kV level, subsequent studies with modified stabilizer settings were conducted to improve the post fault recovery of the AC voltage. Further optimization will be performed in the planned detailed studies in order to enhance the system's performance.

Additional contingencies were carried out on the 315 kV alternative and the system performance under these conditions is summarized in Table 8-2.

Table 8-2: Summary of additional cases and corresponding system performance

Case #	Description	System Performance
1C	SLG fault at the Muskrat Falls substation *(successful single phase reclosing)*	Stable and Damped
2C	SLG fault at the Muskrat Falls substation *(unsuccessful single phase reclosing)*	Stable and Damped
3C	3-Phase fault at Churchill Falls 735 kV *(tripping of two generating units at Churchill Falls)*	Stable and Damped
4C	3-Phase fault at the Muskrat Falls tap substation 138 kV bus *(tripping of the 138 kV line to Happy Valley)*	Stable and Damped
5C	3-Phase fault at the Muskrat Falls tap substation 138 kV bus with Temporary Bi-Pole Loss *(tripping of the 138 kV line to Happy Valley)*	Stable and Damped

In addition to the technical viability, the choice between the 315 kV and the 345 kV voltage levels also has an influence on the economics and the compatibility with neighbouring systems. It is evident that designing the two 250 km transmission lines between Churchill Falls and Muskrat Falls at 315 kV is more cost effective than doing so at the 345 kV voltage level.

A cost comparison between a 315 kV line and a 345 kV line indicated that the cost of the 315 kV line would be of the order of 3% - 4% lower than that of a 345 kV line. Using a base cost of CAD $700,000/km for the 345 kV line, this would result in total savings of approximately CAD $10 - $14 million for both 250 km of circuits. With 315 kV being a standard voltage level in the neighbouring Hydro-Quebec system, the choice of 315 kV between Churchill Falls and Muskrat Falls would provide some additional flexibility in terms of any future expansion.

Based on the system dynamic performance and the impacts of both voltage levels, it is recommended that the transmission link between Churchill Falls and Muskrat Falls be designed and built at the 315 kV voltage level.

APPENDIX A - Single Line Diagrams

Figure A1 - SLD (315 kV Alternative)

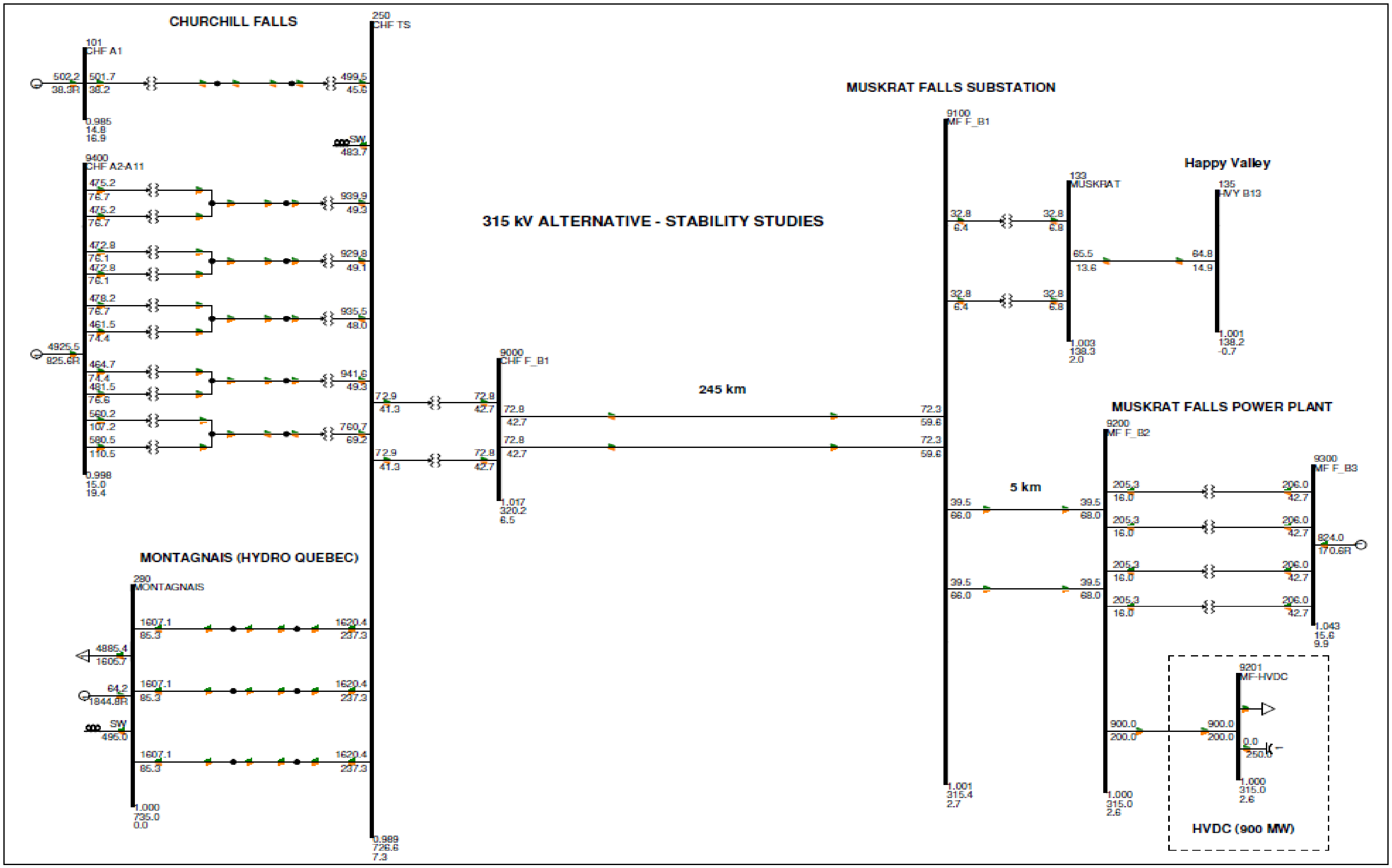
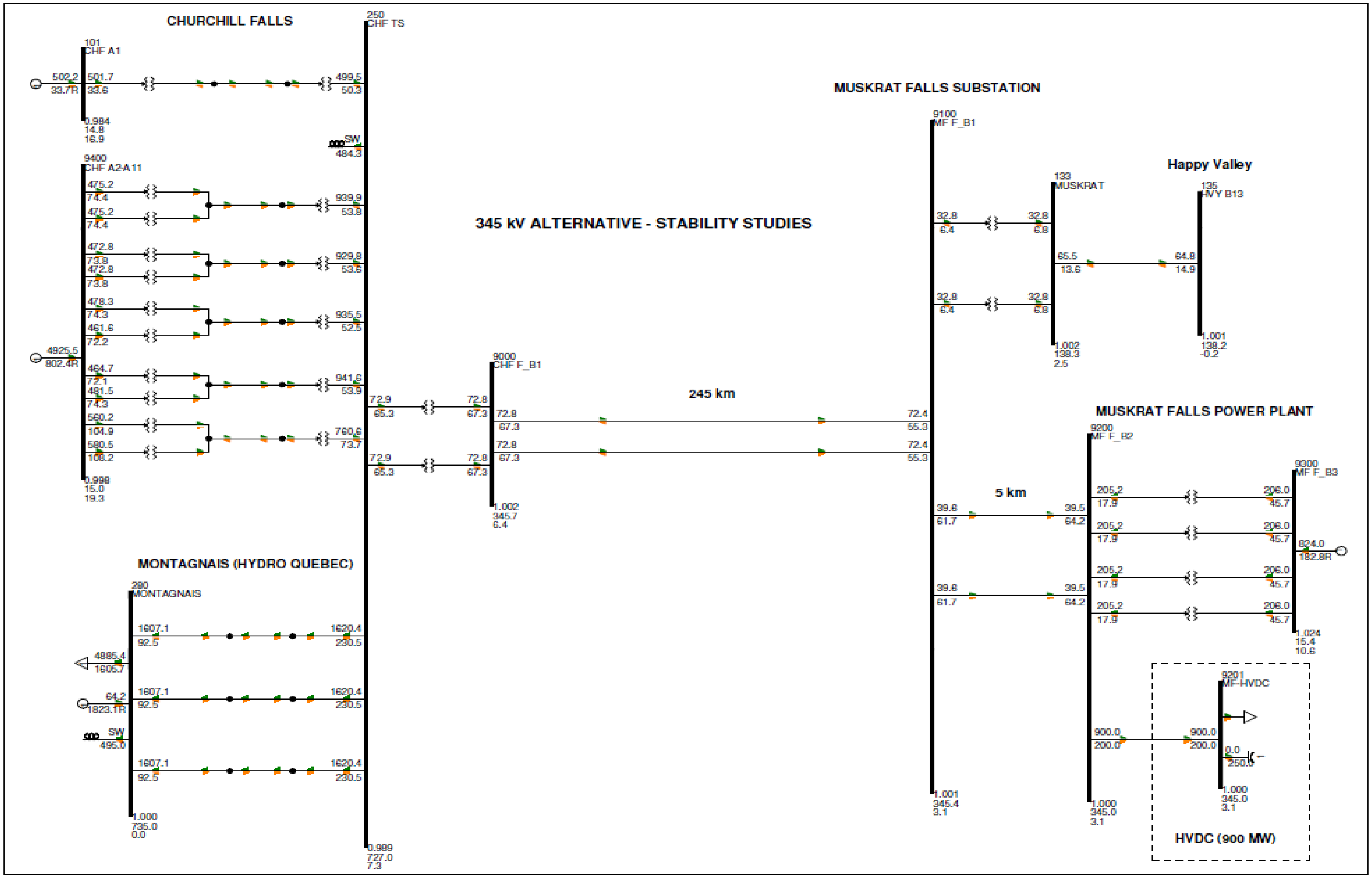


Figure A2 - SLD (345 kV Alternative)



APPENDIX B - System Data

PSS/E System Data (315 kV Alternative)

```
0,   100.00, 32, 0, 1, 60.00     / PSS®E-32.0    FRI, JUN 10 2011  10:33
C3E-S01: VALIDATE STABILITY OF MUSKRAT -- CHURCHILL FALLS
STABILITY (315KV) : BASE CASE
   101,'CHF A1      ',  15.0000,2,   1,  99,   1,0.98522,  16.8581
   102,'CHF A2      ',  15.0000,4,   1,  99,   1,1.00000,  19.5608
   103,'CHF A3      ',  15.0000,4,   1,  99,   1,1.00000,  19.8482
   104,'CHF A4      ',  15.0000,4,   1,  99,   1,1.00000,  20.0990
   105,'CHF A5      ',  15.0000,4,   1,  99,   1,1.00000,  20.0990
   106,'CHF A6      ',  15.0000,4,   1,  99,   1,1.00000,  20.3464
   107,'CHF A7      ',  15.0000,4,   1,  99,   1,1.00000,  20.0957
   108,'CHF A8      ',  15.0000,4,   1,  99,   1,1.00000,  19.7151
   109,'CHF A9      ',  15.0000,4,   1,  99,   1,1.00000,  19.8042
   110,'CHF A10     ',  15.0000,4,   1,  99,   1,0.99506,  16.8613
   111,'CHF A11     ',  15.0000,4,   1,  99,   1,0.99533,  17.0598
   114,'GULL G1-8   ',  15.0000,4,   1,   1,   1,1.00000,   0.0000
   115,'MUSK G1-4   ',  15.0000,4,   1,   1,   1,1.00000,   0.0000
   131,'CHF L1301   ', 138.0000,4,   2,   1,   2,1.00000,   0.0000
   132,'GULL ISLAND ', 138.0000,4,   2,   1,   2,1.00000,   0.0000
   133,'MUSKRAT     ', 138.0000,1,   2,   1,   2,0.99897,   2.0406
   134,'MUSKRAT     ',  25.0000,1,   2,   1,   2,0.96767,   1.9224
   135,'HVY B13     ', 138.0000,1,   2,   1,   2,0.98450,  -0.5118
   136,'HVY B11 B12 ',  25.0000,1,   2,   1,   2,0.95525,  -8.0637
   137,'HVY G1      ',  13.8000,2,   2,   1,   2,0.91376,  -8.0637
   201,'CHF A1 B21  ', 230.0000,1,   1,   1,   1,1.04000,  10.7781
   202,'CHF A2 & A3 ', 230.0000,1,   1,   1,   1,1.04532,  13.9137
   203,'CHF A4 & A5 ', 230.0000,1,   1,   1,   1,1.04519,  13.7446
   204,'CHF A6 & A7 ', 230.0000,1,   1,   1,   1,1.04538,  13.8793
   205,'CHF A8& A9  ', 230.0000,1,   1,   1,   1,1.04543,  13.8420
   206,'CHF B23     ', 230.0000,1,   1,   1,   1,1.04000,  12.6741
   207,'GULL        ', 230.0000,4,   1,   1,   1,1.00000,   0.0000
   208,'MUSKRAT     ', 230.0000,4,   1,   1,   1,1.00000,   0.0000
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   212,'TWIN L24    ', 230.0000,1,   3,   1,   3,1.01557,   9.1992
   213,'WABUSH TS   ', 230.0000,1,   3,   1,   3,0.92454,  -9.6120
   221,'WTS BUS 1   ',  46.0000,1,   3,   1,   3,1.01300, -14.3214
   222,'WTS BUS 2   ',  46.0000,1,   3,   1,   3,1.01300, -15.7893
   223,'WTS SC1     ',  13.8000,2,   3,   1,   3,1.01785, -14.6001
   224,'WTS SC2     ',  13.8000,2,   3,   1,   3,1.04262, -16.1397
   225,'WTS T13     ',  46.0000,4,   1,   1,   1,1.00000,   0.0000
   226,'WTS SC3     ',  13.8000,4,   3,   1,   3,1.00000,   0.0000
   231,'LAB CITY    ',  46.0000,1,   3,   1,   2,1.01300, -15.7894
   232,'WAB NLH     ',  46.0000,1,   3,   1,   2,1.01301, -15.7902
   233,'CHANTAL     ',  46.0000,4,   3,   1,   6,1.00000,   0.0000
   250,'CHF TS      ', 735.0000,1,   1,   1,   1,0.98855,   7.2841
   251,'GUL TS      ', 735.0000,4,   1,   1,   1,1.00000,   0.0000
   261,'POINT X L1  ', 735.0000,1,   1,   1,   1,0.99974,  -3.3003
   262,'POINT X L2  ', 735.0000,1,   1,   1,   1,0.99974,  -3.3003
   263,'POINT X L3  ', 735.0000,1,   1,   1,   1,0.99974,  -3.3003
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 264,'POINT Y L4  ', 735.0000,4,   1,   1,   1,1.00000,   0.0000
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 272,'SERCOM 2    ', 735.0000,1,   4,   1,   6,0.99901,  -4.6880
 273,'SERCOM 3    ', 735.0000,1,   4,   1,   6,0.99901,  -4.6880
 274,'SERCOM 4    ', 735.0000,4,   4,   1,   6,1.00000,   0.0000
 280,'MONTAGNAIS  ', 735.0000,3,   4,   1,   6,1.00000,   0.0000
 281,'MONT 2      ', 735.0000,4,   4,   1,   6,1.00000,   0.0000
 351,'CHF X151    ',  13.8000,1,   1,  98,   1,1.00983,  12.1860
 352,'CHF X152    ',  13.8000,1,   1,  98,   1,1.01147,  12.4166
 361,'CHF T02 SS1 ',  13.8000,1,   1,  98,   1,1.03998,  12.0548
 362,'CHF T03 SS2 ',  13.8000,1,   1,  98,   1,1.04137,  12.1747
 371,'CHF TWN 1   ',  13.8000,1,   1,  10,   1,0.99476,  10.4894
 372,'CHF TWN 2   ',  13.8000,1,   1,  10,   1,0.99621,  10.6136
 701,'WTS STN SER1',   0.5750,1,   3,   1,   3,1.01300, -14.3214
 702,'WTS STN SER2',   0.5750,1,   3,   1,   3,1.01300, -15.7893
 901,'HVY MID T1  ',  25.0000,1,   2,   1,   2,0.95553,  -8.6331
 902,'HVY TERT T1 ',  13.8000,1,   2,   1,   2,0.95553,  -8.6331
 903,'HVY MID T2  ',  25.0000,1,   2,   1,   2,0.95519,  -7.9199
 904,'HVY TERT T2 ',  13.8000,1,   2,   1,   2,0.95519,  -7.9199
 931,'CHF MID T31 ', 138.0000,1,   2,   1,   2,0.99048,  10.7781
 932,'CHF MID T32 ', 138.0000,1,   2,   1,   2,0.99048,  10.7781
 933,'CHF TERT T31',   4.1600,1,   2,   1,   2,0.99048,  10.7781
 934,'CHF TERT T32',   4.1600,1,   2,   1,   2,0.99048,  10.7781
 971,'CHF MID T71 ', 230.0000,1,   1,  99,   1,1.04017,  11.4944
 972,'CHF MID T72 ', 230.0000,1,   1,  99,   1,1.04396,  13.5188
 973,'CHF MID T73 ', 230.0000,1,   1,  99,   1,1.04788,  15.0738
 974,'CHF MID T74 ', 230.0000,1,   1,  99,   1,1.04405,  13.4888
 975,'CHF MID T75 ', 230.0000,1,   1,  99,   1,1.04813,  15.1714
 976,'CHF MID T76 ', 230.0000,1,   1,  99,   1,1.03926,  12.3511
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 983,'CHF TERT T73',  13.8000,1,   1,   1,   1,1.01518,  13.5048
 984,'CHF TERT T74',  13.8000,1,   1,   1,   1,1.01750,  13.4888
 985,'CHF TERT T75',  13.8000,1,   1,   1,   1,1.02147,  15.1714
 986,'CHF TERT T76',  13.8000,1,   1,   1,   1,1.01283,  12.3511
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1332,'MF F_TER2   ',  13.8000,1,   2,   1,   2,0.99897,   2.0406
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1341,'MF CP       ', 138.0000,4,   2,   1,   2,1.05093,   3.1348
1603,'IOC MINE    ',  46.0000,2,   3,   1,   4,1.01300, -15.7893
1604,'SUB 604     ',  46.0000,1,   3,   1,   4,1.01300, -15.7893
1605,'SUB 605     ',  46.0000,1,   3,   1,   4,1.01300, -14.3214
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1609,'IOC FDR4    ',  46.0000,1,   3,   1,   4,1.01364, -14.3338
1611,'IOC FDR2    ',  46.0000,1,   3,   1,   4,1.01300, -14.3214
1612,'IOC FDR1    ',  46.0000,1,   3,   1,   4,1.01300, -14.3214
1652,'WABMINE1    ',  46.0000,2,   3,   1,   5,1.01300, -15.7893
1653,'WABMINE2    ',  46.0000,2,   3,   1,   5,1.01300, -15.7893
1698,'IOC FDR6    ',  46.0000,1,   3,   1,   4,1.01300, -15.7893
1699,'IOC FDR3    ',  46.0000,1,   3,   1,   4,1.01364, -14.3338
1701,'S607 T1     ',  13.8000,1,   3,   1,   4,1.01425, -15.8031
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1702,'S607 T5     ', 13.8000,1,   3,   1,   4,1.01425, -15.8031
1703,'CON3 T5     ', 13.8000,1,   3,   1,   4,1.01364, -14.3338
1704,'BOILER 1    ', 13.8000,1,   3,   1,   4,1.01425, -15.8031
1705,'BOILER 5    ', 13.8000,1,   3,   1,   4,1.01425, -15.8031
1708,'CON3 BLR    ', 13.8000,1,   3,   1,   4,1.01364, -14.3338
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1803,'PP2 T7      ',  4.2000,1,   3,   1,   4,1.01300, -14.3214
1804,'PP2 T6      ',  4.2000,1,   3,   1,   4,1.01300, -14.3214
1805,'PP2 T5      ',  4.2000,1,   3,   1,   4,1.01300, -14.3214
1806,'PP1 T5      ',  4.2000,1,   3,   1,   4,1.01300, -14.3214
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1811,'PP1 T1      ',  4.2000,1,   3,   1,   4,1.01300, -14.3214
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1815,'CON3 T2     ',  4.2000,1,   3,   1,   4,1.01364, -14.3338
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1819,'CON1 T2     ',  4.2000,1,   3,   1,   4,1.01425, -15.8031
1820,'CON1 T1     ',  4.2000,1,   3,   1,   4,1.01982, -15.8207
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1859,'PP2  859    ',  4.2000,1,   3,   1,   4,1.01300, -14.3214
1860,'BM 12 13    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1861,'PP2  861    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1862,'PP2 MC6A    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1863,'PP2 MC6B    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1864,'PP2 MC5A    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1865,'PP2 MC5B    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1866,'BM 9 10     ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1867,'PP2  867    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1868,'BM14 MCC    ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
1869,'PP1 MC4     ',  4.2000,2,   3,   1,   4,1.01300, -14.3214
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1884,'BM104MCC    ',  4.2000,2,   3,   1,   4,1.01364, -14.3338
1885,'MILL 10     ',  4.2000,2,   3,   1,   4,1.01901, -14.3562
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1886,'CON3 MCC    ',   4.2000,2,   3,   1,   4,1.01364, -14.3338
1887,'MILL 9      ',   4.2000,2,   3,   1,   4,1.01901, -14.3562
1888,'CON1 MCC    ',   4.2000,2,   3,   1,   4,1.01425, -15.8031
1889,'MILL 12     ',   4.2000,2,   3,   1,   4,1.02028, -15.8294
1890,'CON1 MCC    ',   4.2000,2,   3,   1,   4,1.01425, -15.8031
1891,'MILL 11     ',   4.2000,2,   3,   1,   4,1.02028, -15.8294
6600,'CHF 66 STN  ',  13.8000,1,   1,  98,   1,1.04137,  12.1741
6601,'CHF T601    ',  66.0000,1,   1,  98,   1,1.08712,  10.7491
6602,'CHF T602    ',  66.0000,1,   1,  98,   1,1.03923,  12.3511
6610,'CHF AIRPORT ',  66.0000,1,   1,  98,   1,1.08558,  10.5591
6611,'JACWHITE    ',  66.0000,1,   1,  98,   1,1.08298,  10.2486
6612,'LOGANTWR    ',  66.0000,1,   1,  98,   1,1.08356,  10.3150
6617,'TWIN TAP    ',  66.0000,1,   1,  98,   1,1.08242,  10.1564
6618,'ATIKONAK    ',  66.0000,1,   1,  98,   1,1.06606,   9.4199
6619,'LOB LODGE   ',  66.0000,1,   1,  98,   1,1.06550,   9.4027
6622,'LOB TAP     ',  66.0000,1,   1,  98,   1,1.06494,   9.3858
6623,'GABBRO      ',  66.0000,1,   1,  98,   1,1.06378,   9.3502
8000,'CHF ESS SER ',   0.6000,1,   1,   1,   1,1.03998,  12.0546
8131,'CHF A1 AUX  ',   0.6000,2,   1,  97,   1,0.99029,   6.5345
8132,'CHF A2 AUX  ',   0.6000,2,   1,  97,   1,0.99029,   6.5345
8133,'CHF A3 AUX  ',   0.6000,2,   1,  97,   1,0.99029,   6.5345
8134,'CHF A4 AUX  ',   0.6000,2,   1,  97,   1,0.99029,   6.5345
8135,'CHF A5 AUX  ',   0.6000,2,   1,  97,   1,0.99029,   6.5345
8136,'CHF A6 AUX  ',   0.6000,2,   1,  97,   1,0.99176,   6.6699
8137,'CHF A7 AUX  ',   0.6000,2,   1,  97,   1,0.99176,   6.6699
8138,'CHF A8 AUX  ',   0.6000,2,   1,  97,   1,0.99176,   6.6699
8139,'CHF A9 AUX  ',   0.6000,2,   1,  97,   1,0.99176,   6.6699
8140,'CHF A10 AUX ',   0.6000,2,   1,  97,   1,0.99176,   6.6699
8141,'CHF A11 AUX ',   0.6000,2,   1,  97,   1,0.99176,   6.6699
8159,'CHF EAST A&E',  13.8000,1,   1,  98,   1,1.03998,  12.0546
8160,'CHF WEST A&E',  13.8000,1,   1,  98,   1,1.04136,  12.1745
8615,'CHF EAST AUX',   0.6000,2,   1,  98,   1,0.99029,   6.5345
8616,'CHF EAST ESS',   0.6000,2,   1,  98,   1,1.03998,  12.0546
8618,'CHF WEST ESS',   0.6000,2,   1,  98,   1,1.04136,  12.1745
8619,'CHF WEST AUX',   0.6000,2,   1,  98,   1,0.99176,   6.6699
8621,'CHF A1 SER  ',   0.6000,2,   1,  98,   1,0.97776,  15.9782
8622,'CHF A2 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.7069
8623,'CHF A3 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.9943
8624,'CHF A4 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.2451
8625,'CHF A5 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.2451
8626,'CHF A6 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.4925
8627,'CHF A7 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.2418
8628,'CHF A8 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.8612
8629,'CHF A9 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.9503
8630,'CHF A10 SER ',   0.6000,4,   1,  98,   1,0.98768,  15.9989
8631,'CHF A11 SER ',   0.6000,4,   1,  98,   1,0.98795,  16.1978
9000,'CHF F_B1    ', 315.0000,1,   1,   1,   1,1.01657,   6.4608
9001,'CHF F_TER1  ',  13.8000,1,   1,   1,   1,1.01657,   6.4608
9002,'CHF F_TER2  ',  13.8000,1,   1,   1,   1,1.01657,   6.4608
9100,'MF F_B1     ', 315.0000,1,   2,   1,   2,1.00118,   2.6865
9200,'MF F_B2     ', 315.0000,1,   2,   1,   2,1.00000,   2.6494
9201,'MF-HVDC     ', 315.0000,1,   5,   1,   2,1.00000,   2.6494
9300,'MF F_B3     ',  15.0000,2,   2,   1,   2,1.04564,   9.8652
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  9400,'CHF A2-A11  ',  15.0000,2,   1,  99,   1,0.99836,  19.3567
0 / END OF BUS DATA, BEGIN LOAD DATA
   101,'1 ',1,   1,  99,     0.215,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   134,'1 ',1,   2,   1,     0.067,     0.030,     0.000,     0.000,
0.000,     0.000,   2,1
   136,'1 ',1,   2,  20,    63.847,     6.409,     0.000,     0.000,
0.000,     0.000,   2,1
   207,'1 ',1,   1,   1,   258.200,    84.866,     0.000,     0.000,
0.000,     0.000,   1,1
   221,'1 ',1,   1,  30,   150.000,    49.303,     0.000,     0.000,
0.000,     0.000,   4,1
   222,'1 ',1,   1,  30,    72.000,    23.665,     0.000,     0.000,
0.000,     0.000,   4,1
   222,'2 ',1,   1,  33,    54.000,    15.958,     0.000,     0.000,
0.000,     0.000,   5,1
   222,'3 ',1,   1,  35,    69.000,    17.294,     0.000,     0.000,
0.000,     0.000,   2,1
   231,'1 ',0,   3,  35,    50.000,     8.000,     0.000,     0.000,
0.000,     0.000,   2,1
   232,'1 ',0,   3,  35,    13.400,     2.300,     0.000,     0.000,
0.000,     0.000,   2,1
   280,'1 ',1,   4,   1,  4885.400,  1605.744,     0.000,     0.000,
0.000,     0.000,   6,1
   281,'1 ',0,   4,   1,  1911.044,     0.000,     0.000,     0.000,
0.000,     0.000,   6,1
   371,'1 ',1,   1,  10,     4.000,     0.912,     0.000,     0.000,
0.000,     0.000,   1,1
   372,'1 ',1,   1,  10,     4.000,     0.912,     0.000,     0.000,
0.000,     0.000,   1,1
   971,'1 ',1,   1,  99,     0.221,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   972,'1 ',1,   1,  99,     0.204,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   973,'1 ',1,   1,  99,     0.221,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   974,'1 ',1,   1,  99,     0.204,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   975,'1 ',1,   1,  99,     0.221,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   976,'1 ',1,   1,  99,     0.204,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
  1340,'1 ',1,   2,   1,     3.700,     1.269,     0.000,     0.000,
0.000,     0.000,   2,1
  6610,'1 ',1,   1,  98,     0.400,     0.131,     0.000,     0.000,
0.000,     0.000,   1,1
  6611,'1 ',1,   1,  98,     1.500,     0.493,     0.000,     0.000,
0.000,     0.000,   1,1
  6612,'1 ',1,   1,  98,     0.200,     0.066,     0.000,     0.000,
0.000,     0.000,   1,1
  6617,'1 ',1,   1,  98,     0.400,     0.131,     0.000,     0.000,
0.000,     0.000,   1,1
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  6618,'1 ',1,   1,  98,     0.100,     0.033,     0.000,     0.000,
0.000,     0.000,   1,1
  6622,'1 ',1,   1,  98,     1.400,     0.460,     0.000,     0.000,
0.000,     0.000,   1,1
  6623,'1 ',1,   1,  98,     1.000,     0.329,     0.000,     0.000,
0.000,     0.000,   1,1
  8615,'1 ',1,   1,  98,     2.000,     0.600,     0.000,     0.000,
0.000,     0.000,   1,1
  8619,'1 ',1,   1,  98,     2.000,     0.600,     0.000,     0.000,
0.000,     0.000,   1,1
  8621,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8622,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8623,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8624,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8625,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8626,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8627,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8628,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8629,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8630,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8631,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  9201,'1 ',1,   5,   1,   300.000,   150.000,     0.000,     0.000,
0.000,     0.000,   2,1
  9201,'2 ',1,   5,   1,   300.000,   150.000,     0.000,     0.000,
0.000,     0.000,   2,1
  9201,'3 ',1,   5,   1,   300.000,   150.000,     0.000,     0.000,
0.000,     0.000,   2,1
  9400,'1 ',1,   1,  99,     2.770,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
0 / END OF LOAD DATA, BEGIN FIXED SHUNT DATA
  1885,'1 ',1,     0.000,     1.010
  1887,'1 ',1,     0.000,     1.010
  1889,'1 ',1,     0.000,     1.010
  1891,'1 ',1,     0.000,     1.010
  9000,'1 ',0,     0.000,   -45.000
  9000,'2 ',0,     0.000,   -45.000
  9100,'1 ',0,     0.000,   -45.000
  9100,'2 ',0,     0.000,   -45.000
  9201,'1 ',1,     0.000,   250.000
0 / END OF FIXED SHUNT DATA, BEGIN GENERATOR DATA
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   101,'1 ',   502.200,    38.329,   155.999,  -155.999,1.04000,   201,
500.000, 1.10000E-3, 2.20000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
   114,'1 ',  2264.000,   568.473,  1098.000, -1098.000,1.01500,     0,
2520.000, 0.00000E+0, 2.54000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
2264.000,     0.000,   1,1.0000
   115,'1 ',   824.000,    93.785,   271.000,  -271.000,1.00000,     0,
868.000, 0.00000E+0, 2.54000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
824.000,     0.000,   1,1.0000
   137,'1 ',    -0.560,    19.541,    23.800,   -10.000,1.02300,     0,
26.567, 0.00000E+0, 1.58000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
33.000,    -0.600,   1,1.0000
   223,'1 ',    -1.110,    35.236,    60.000,   -40.000,1.01300,   221,
60.000, 0.00000E+0, 1.80000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
   224,'1 ',    -1.110,    51.753,    60.000,   -40.000,1.01300,   222,
60.000, 0.00000E+0, 1.80000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
   226,'1 ',    -1.100,    24.036,    60.000,   -20.000,1.01300,   222,
69.294, 0.00000E+0, 1.40000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   1,1.0000
   280,'1 ',    63.607,  1845.120,  9998.988, -9998.990,1.00000,     0,
35000.000, 0.00000E+0, 2.00000E-1, 1.22500E-1, 4.16150E+0,1.00000,1,  100.0,
9998.990, -9999.000,   1,1.0000
  1603,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.19150E+0, 1.19144E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1652,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.96800E-1, 3.96810E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   5,1.0000
  1653,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.96800E-1, 3.96810E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   5,1.0000
  1821,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.06940E+0, 2.67345E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1853,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.71500E-1, 1.48523E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1854,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.96000E-1, 9.90150E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1856,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 4.45100E-1, 1.11276E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1857,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.88400E-1, 9.71130E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1858,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.06940E+0, 2.67338E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
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  1860,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.67200E-1, 6.08570E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1861,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.32300E-1, 3.30700E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1862,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.41000E-1, 3.88010E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1863,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.45200E-1, 4.07010E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1864,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.47700E-1, 4.08610E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1865,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.23000E-1, 3.37660E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1866,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.66800E-1, 6.08565E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1867,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 2.02950E-1, 6.02340E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1868,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.94900E-1, 9.87270E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1869,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.97000E-2, 2.34820E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1870,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.95000E-2, 2.50910E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1871,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.97000E-2, 2.55110E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1872,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 9.28000E-2, 3.04930E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1873,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.01100E-1, 7.53080E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1876,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.14400E-1, 7.86300E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1884,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.85000E-2, 1.53450E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1885,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.78000E-2, 1.52140E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
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  1886,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.80000E-2, 1.45110E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1887,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.94000E-2, 1.56500E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1888,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 8.23000E-2, 2.13570E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1889,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 9.49000E-2, 2.82280E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1890,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 9.55000E-2, 2.41830E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1891,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 8.57000E-2, 2.50320E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  8131,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8132,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8133,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8134,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8135,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8136,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8137,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8138,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8139,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8140,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8141,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
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  8615,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.51580E+1, 2.10948E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8616,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 4.98000E+0, 3.79370E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8618,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 5.30300E+0, 4.11260E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8619,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 1.22320E+2, 7.33921E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8621,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.80300E+0, 3.20730E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8622,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8623,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8624,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8625,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8626,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8627,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8628,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8629,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8630,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8631,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,    0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  9300,'1 ',   824.000,   189.887,   271.000,  -271.000,1.00000,  9200,
868.000, 0.00000E+0, 2.54000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
824.000,     0.000,   1,1.0000
  9400,'1 ',  4925.500,   825.761,  1528.320, -1528.320,1.04000,   206,
5000.000, 1.10000E-3, 2.20000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
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   131,   132,'1 ', 1.20000E-1, 4.76600E-1,   0.13388,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 196.40,   2,1.0000
   131,   931,'1 ',-1.10000E-4,-2.80000E-3,   0.00000,   42.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   2,1.0000
   131,   932,'1 ',-1.10000E-4,-2.80000E-3,   0.00000,   42.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   2,1.0000
   131,  1341,'1 ', 5.10100E-2, 5.19380E-1,   0.21443,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 260.00,   2,1.0000
   132,   133,'1 ', 2.86000E-2, 1.17600E-1,   0.02978,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  45.94,   2,1.0000
   133,   135,'1 ', 1.68000E-2, 6.92000E-2,   0.01754,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,  26.92,   2,1.0000
   133,  1341,'1 ', 3.18000E-3, 1.28700E-2,   0.00323,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   5.00,   2,1.0000
   136,   901,'1 ',-6.90000E-4,-2.20800E-2,   0.00000,   50.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   2,1.0000
   136,   903,'1 ', 5.00000E-4, 9.99000E-3,   0.00000,   28.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   2,1.0000
   201,   971,'1 ',-1.00000E-4,-2.70000E-3,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   202,   972,'2 ', 1.00000E-4, 8.00000E-4,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   203,   973,'3 ',-1.00000E-4,-2.70000E-3,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   204,   974,'4 ', 1.00000E-4, 8.00000E-4,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   205,   975,'5 ',-1.00000E-4,-2.70000E-3,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   206,   211,'1 ', 6.40000E-3, 3.56000E-2,   0.06300,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   206,   212,'1 ', 6.40000E-3, 3.56000E-2,   0.06300,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   206,   976,'6 ', 1.00000E-4, 8.00000E-4,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   207,   208,'1 ', 2.59000E-3, 3.90600E-2,   0.15116, 1120.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  60.00,   1,1.0000
   207,   208,'2 ', 2.59000E-3, 3.90600E-2,   0.15116, 1120.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  60.00,   1,1.0000
   211,   213,'1 ', 3.08000E-2, 1.71600E-1,   0.30400,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   3,1.0000
   212,   213,'1 ', 3.08000E-2, 1.71600E-1,   0.30400,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   3,1.0000
   221,   222,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   3,1.0000
   221,   225,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,   72.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   3,1.0000
   221,  1609,'1 ', 2.12200E-2, 6.23800E-2,   0.00000,   53.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   221,  1611,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   221,  1612,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
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   221,  1699,'1 ', 2.12200E-2, 6.23800E-2,   0.00000,   53.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   222,   225,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,   72.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   3,1.0000
   222,   231,'1 ', 1.01000E-2, 3.25000E-2,   0.00016,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   222,   232,'1 ', 9.87000E-2, 8.30000E-2,   0.00031,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   2,1.0000
   222,   233,'1 ', 1.47360E-1, 4.75830E-1,   0.00232,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,  25.74,   1,1.0000
   222,  1608,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   222,  1652,'1 ', 1.60700E-2, 4.67900E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   5,1.0000
   222,  1653,'1 ', 1.60700E-2, 4.67900E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   5,1.0000
   222,  1698,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   250,   251,'1 ', 4.10000E-4, 1.24100E-2,   5.41703, 5200.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 203.00,   1,1.0000
   250,   261,'1 ', 4.00000E-4, 1.12000E-2,   4.72378, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   250,   262,'1 ', 4.00000E-4, 1.12000E-2,   4.72378, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   250,   263,'1 ', 4.00000E-4, 1.12000E-2,   4.72378, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   251,   264,'1 ', 6.20000E-4, 1.90700E-2,   8.52891, 5200.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 317.00,   1,1.0000
   261,   271,'1 ', 1.00000E-4, 1.50000E-3,   0.64028, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   262,   272,'1 ', 1.00000E-4, 1.50000E-3,   0.64028, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   263,   273,'1 ', 1.00000E-4, 1.50000E-3,   0.64028, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   264,   274,'1 ', 6.00000E-5, 1.98500E-3,   0.88786, 5200.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  33.00,   1,1.0000
   271,   280,'1 ', 0.00000E+0,-5.08000E-3,   0.00000, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   272,   280,'1 ', 0.00000E+0,-5.08000E-3,   0.00000, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   273,   280,'1 ', 0.00000E+0,-5.08000E-3,   0.00000, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   274,   281,'1 ', 0.00000E+0,-1.00000E-4,   0.00000, 2920.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   6,1.0000
   280,   281,'1 ', 9.00000E-5, 1.85000E-3,   0.80000, 7130.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   6,1.0000
   351,   982,'1 ', 0.00000E+0, 1.73280E-1,   0.00000,   16.70,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
   352,   983,'1 ', 0.00000E+0, 1.73280E-1,   0.00000,   16.70,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
   361,   371,'1 ', 9.07090E-1, 9.13020E-1,   0.00003,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   4.00,   1,1.0000
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   361,  8159,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   362,   372,'1 ', 9.07090E-1, 9.13020E-1,   0.00003,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
   362,  6600,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   362,  8160,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
  1603,  1604,'1 ', 8.83700E-2, 1.81000E-1,   0.00000,   44.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1604,  1698,'1 ', 1.22900E-2, 1.27600E-2,   0.00000,   44.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1605,  1612,'1 ', 5.20000E-3, 2.03200E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1606,  1607,'1 ', 7.56000E-3, 1.70100E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1607,  1608,'1 ', 2.33000E-3, 8.62000E-3,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1701,  1704,'1 ', 1.21000E-3, 2.14000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1702,  1705,'1 ', 2.46000E-3, 4.35000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1703,  1708,'1 ', 8.06000E-3, 1.42600E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1801,  1858,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1801,  1859,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1802,  1860,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1802,  1861,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1803,  1862,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1803,  1863,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1804,  1864,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1804,  1865,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1805,  1866,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1805,  1867,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1806,  1868,'1 ', 1.81800E-2, 5.82700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1807,  1869,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1809,  1870,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1810,  1871,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
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  1811,  1872,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1813,  1884,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1814,  1885,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1815,  1886,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1816,  1887,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1817,  1888,'1 ', 1.58400E-2, 2.91800E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1818,  1889,'1 ', 1.51400E-2, 4.44100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1819,  1890,'1 ', 1.51400E-2, 4.44100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1820,  1891,'1 ', 1.51400E-2, 4.44100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1822,  1873,'1 ', 1.33000E-2, 2.35400E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1823,  1876,'1 ', 2.66000E-2, 4.70800E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1824,  1850,'1 ', 2.37000E-3, 4.93000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1825,  1850,'1 ', 4.75000E-3, 9.86000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1850,  1853,'1 ', 1.99500E-2, 3.53100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1850,  1854,'1 ', 1.99500E-2, 3.53100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1850,  1856,'1 ', 2.66000E-2, 4.70800E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1850,  1857,'1 ', 2.31140E-1, 4.62280E-1,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1851,  1858,'1 ', 1.21350E+0, 2.31140E+0,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1851,  1858,'2 ', 1.21350E+0, 2.31140E+0,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  6601,  6610,'1 ', 3.20000E-2, 7.78000E-2,   0.00138,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6610,  6612,'1 ', 4.47000E-2, 1.08900E-1,   0.00193,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6611,  6612,'1 ', 1.28000E-2, 3.11000E-2,   0.00055,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
  6611,  6617,'1 ', 2.56000E-2, 6.22000E-2,   0.00111,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6617,  6618,'1 ', 6.53400E-1, 6.33300E-1,   0.00828,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6618,  6619,'1 ', 1.98000E-2, 1.92000E-2,   0.00025,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6619,  6622,'1 ', 1.98000E-2, 1.92000E-2,   0.00025,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
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  6622,  6623,'1 ', 9.92000E-2, 9.60000E-2,   0.00125,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8000,  8616,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8000,  8618,'1 ', 0.00000E+0, 1.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   1,1.0000
  8000,  8621,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8622,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8623,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8624,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8625,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8626,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8627,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8628,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8629,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8630,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8631,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8131,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8132,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8133,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8134,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8135,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8136,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8137,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8138,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8139,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8140,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8141,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8615,  8616,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
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  8618,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  9000,  9100,'1 ', 9.22600E-3, 9.39330E-2,   1.05279, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1, 245.00,   2,1.0000
  9000,  9100,'2 ', 9.22600E-3, 9.39330E-2,   1.05279, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1, 245.00,   2,1.0000
  9100,  9200,'1 ', 1.88000E-4, 1.91700E-3,   0.02149, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   5.00,   2,1.0000
  9100,  9200,'2 ', 1.88000E-4, 1.91700E-3,   0.02149, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   5.00,   2,1.0000
  9200,  9201,'1 ', 0.00000E+0, 1.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   2,1.0000
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
   101,   201,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T1      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   101,  8621,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A1 SER  ',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   102,  8622,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A2 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   103,  8623,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A3 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   104,  8624,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A4 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   105,  8625,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A5 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   106,  8626,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A6 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
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1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   107,  8627,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A7 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   108,  8628,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A8 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   109,  8629,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A9 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   110,  8630,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A10 SER ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   111,  8631,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A11 SER ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   207,   114,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'GUL T1 - T8 ',0,
1,1.0000
 1.10000E-4, 4.76000E-3,   100.00
1.00000,   0.000,   0.000,  2520.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   208,   115,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MUSK T1-T4  ',0,
1,1.0000
 2.30000E-4, 1.38000E-2,   100.00
1.00000,   0.000,   0.000,   868.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   201,   131,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T33     ',0,
2,1.0000
 1.63000E-3, 7.49200E-2,   100.00
1.05000,   0.000,   0.000,    75.00,   100.00,   125.00, 0,      0, 1.05000,
0.95000, 1.50000, 0.51000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   133,   134,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MUF T1      ',1,
2,1.0000
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 1.62300E-1, 2.96060E+0,   100.00
1.03125,   0.000,   0.000,     2.00,     0.00,     0.00, 1,    134, 1.10000,
0.90000, 1.01250, 1.00000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   133,  1331,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
2,1.0000
 0.00000E+0, 3.29000E-2,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   133,  1332,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
2,1.0000
 0.00000E+0, 3.29000E-2,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9100,   133,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B1_T1  ',1,
2,1.0000
 3.50300E-3, 3.50250E-2,   100.00
1.00000,   0.000,   0.000,    75.00,   100.00,   125.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9100,   133,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B1_T2  ',1,
2,1.0000
 3.50300E-3, 3.50250E-2,   100.00
1.00000,   0.000,   0.000,    75.00,   100.00,   125.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   135,   901,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T1      ',1,
2,1.0000
 9.85000E-3, 3.15610E-1,   100.00
1.02500,   0.000,   0.000,    50.00,     0.00,     0.00, 1,    136, 1.05000,
0.85000, 1.04400, 1.02000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   135,   903,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T2      ',1,
2,1.0000
 2.59000E-2, 5.16020E-1,   100.00
1.02500,   0.000,   0.000,    28.00,     0.00,     0.00, 1,    136, 1.05000,
0.85000, 1.04400, 1.02000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   136,   137,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T3      ',1,
2,1.0000
 1.16500E-2, 3.03540E-1,   100.00
1.04540,   0.000,   0.000,    40.00,     0.00,     0.00, 0,      0, 1.09770,
0.99320, 1.50000, 1.02000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   201,   931,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T31     ',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.05000,   0.000,   0.000,    42.00,     0.00,     0.00, 0,      0, 1.05000,
0.95000, 1.50000, 0.51000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
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   201,   932,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T32     ',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.05000,   0.000,   0.000,    42.00,     0.00,     0.00, 0,      0, 1.05000,
0.95000, 1.50000, 0.51000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   202,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T2      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   202,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T3      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   203,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T4      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   203,     0,'5 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T5      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   204,     0,'6 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T6      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   204,     0,'7 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T7      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   205,     0,'8 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T8      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   205,     0,'9 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T9      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
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1.00000,   0.000
  9400,   206,     0,'10',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T10     ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   206,     0,'11',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T11     ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   251,   207,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'GULL EQUIV  ',0,
1,1.0000
 8.00000E-5, 3.67000E-3,   100.00
1.00000,   0.000,   0.000,  3999.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T1      ',1,
3,1.0000
 1.08000E-2, 2.47100E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T2      ',1,
3,1.0000
 7.70000E-3, 2.39800E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T3      ',1,
3,1.0000
 7.60000E-3, 2.43500E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'8 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'WTS T8      ',1,
3,1.0000
 4.91000E-3, 1.76130E-1,   100.00
0.91300,   0.000,   0.000,    83.30,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T4      ',1,
3,1.0000
 1.05000E-2, 2.46300E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'5 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T5      ',1,
3,1.0000
 1.27000E-2, 2.49000E-1,   100.00
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0.91300,   0.000,   0.000,    65.00,      0.00,      0.00, 0,       0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'6 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T6      ',1,
3,1.0000
 8.20000E-3, 2.50500E-1,   100.00
0.91300,   0.000,   0.000,    65.00,      0.00,      0.00, 0,       0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'7 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'WTS T7      ',1,
3,1.0000
 5.16000E-3, 1.72920E-1,   100.00
0.91300,   0.000,   0.000,    83.30,      0.00,      0.00, 0,       0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   221,   223,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T11     ',1,
3,1.0000
 8.30000E-3, 1.65000E-1,   100.00
1.05430,   0.000,   0.000,    60.00,      0.00,      0.00, 0,       0, 1.05000,
1.00000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   221,   701,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS GT1     ',1,
3,1.0000
 0.00000E+0, 8.00000E+0,   100.00
1.00000,   0.000,   0.000,     0.50,      0.00,      0.00, 0,       0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   222,   224,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T12     ',1,
3,1.0000
 8.30000E-3, 1.65000E-1,   100.00
1.05430,   0.000,   0.000,    60.00,      0.00,      0.00, 0,       0, 1.05000,
1.00000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   222,   702,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS GT2     ',1,
3,1.0000
 0.00000E+0, 8.00000E+0,   100.00
1.00000,   0.000,   0.000,     0.50,      0.00,      0.00, 0,       0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   225,   226,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T13 FUT ',0,
3,1.0000
 8.30000E-3, 1.65000E-1,   100.00
1.05430,   0.000,   0.000,    72.00,      0.00,      0.00, 0,       0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   971,   250,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T71     ',1,
1,1.0000
 3.00000E-4, 1.43000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,      0.00,      0.00, 0,       0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   972,   250,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T72     ',1,
1,1.0000
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 1.00000E-4, 1.13000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   973,   250,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T73     ',1,
1,1.0000
 3.00000E-4, 1.43000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   974,   250,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T74     ',1,
1,1.0000
 1.00000E-4, 1.13000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   975,   250,     0,'5 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T75     ',1,
1,1.0000
 3.00000E-4, 1.43000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   976,   250,     0,'6 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T76     ',1,
1,1.0000
 1.00000E-4, 1.13000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   250,  9000,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF F_T1    ',1,
1,1.0000
 5.71000E-4, 1.99920E-2,   100.00
0.98000,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   250,  9000,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF F_T2    ',1,
1,1.0000
 5.71195E-4, 1.99918E-2,   100.00
0.98000,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   351,   361,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T02     ',1,
1,1.0000
 5.30000E-3, 4.17000E-2,   100.00
0.97000,   0.000,   0.000,    15.00,    16.80,     0.00, 1,    361, 1.12000,
0.88000, 1.04500, 1.03750,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   352,   362,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T03     ',1,
1,1.0000
 5.30000E-3, 4.17000E-2,   100.00
0.97000,   0.000,   0.000,    15.00,    16.80,     0.00, 1,    362, 1.12000,
0.88000, 1.04500, 1.03750,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
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   901,   902,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T1 TERT ',1,
2,1.0000
 5.48000E-3, 1.75510E-1,   100.00
1.00000,   0.000,   0.000,     3.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   903,   904,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T2 TERT ',1,
2,1.0000
 1.45400E-2, 2.89640E-1,   100.00
1.00000,   0.000,   0.000,     3.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   931,   933,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T31 TERT',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   932,   934,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T32 TERT',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   971,   981,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T71 TERT',1,
1,1.0000
 0.00000E+0, 2.52200E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   972,   982,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T72 TERT',1,
1,1.0000
 0.00000E+0, 2.13000E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   973,   983,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T73 TERT',1,
1,1.0000
 0.00000E+0, 2.52200E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   974,   984,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T74 TERT',1,
1,1.0000
 0.00000E+0, 2.13000E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   975,   985,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T75 TERT',1,
1,1.0000
 0.00000E+0, 2.52200E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
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1.00000,   0.000
   976,   986,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T76 TERT',1,
1,1.0000
 0.00000E+0, 2.13000E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  6602,   986,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T602    ',1,
1,1.0000
 2.54000E-2, 5.08300E-1,   100.00
1.02607,   0.000,   0.000,    20.00,     0.00,     0.00, 1,   6602, 1.26960,
0.93840, 1.04587, 1.03631,  39, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1341,  1340,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MRF T1      ',0,
2,1.0000
 9.99000E-3, 2.99880E-1,   100.00
1.04375,   0.000,   0.000,    30.00,    40.00,    50.00, 1,   1340, 1.05000,
0.85000, 1.02400, 1.00000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1605,  1824,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 8.63700E-2, 1.03640E+0,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     6.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1605,  1825,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 9.55000E-2, 1.14600E+0,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     6.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1606,  1822,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 9.63300E-2, 1.15600E+0,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     5.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1606,  1823,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 8.02200E-2, 9.62660E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     5.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1607,  1701,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 1.77600E-2, 3.55110E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    18.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1607,  1702,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 1.63700E-2, 3.27370E-1,   100.00
```

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1.00000,   0.000,   0.000,     0.00,     0.00,    18.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1607,  1821,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.33900E-2, 4.21020E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1817,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.77400E-2, 4.99230E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1818,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.00500E-2, 5.40830E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1819,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.00500E-2, 5.40830E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1820,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.00500E-2, 5.40830E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1609,  1815,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1609,  1816,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.77400E-2, 4.99230E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1806,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.76000E-2, 4.96730E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1807,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
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 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1809,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
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1.00000,   0.000
  1611,  1810,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1811,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1801,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1802,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1803,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.49200E-2, 5.23840E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1804,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1805,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
```

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  1699,  1703,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
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 6.69900E-2, 8.37330E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     8.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1699,  1813,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1699,  1814,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.77400E-2, 4.99230E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  6601,  6600,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T601    ',1,
1,1.0000
 2.66000E-2, 5.32300E-1,   100.00
1.04550,   0.000,   0.000,    20.00,     0.00,     0.00, 0,      0, 1.10000,
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1.00000,   0.000
  8159,  8615,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF EAST AUX',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8159,  8616,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF EAST ESS',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8160,  8618,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF WEST ESS',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8160,  8619,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF WEST AUX',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9000,  9001,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
1,1.0000
 0.00000E+0, 1.85000E-2,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
```

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1.00000,   0.000
  9000,  9002,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
1,1.0000
 0.00000E+0, 1.85000E-2,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     0.00, 0,      0, 1.10000,
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1.00000,   0.000
  9200,  9300,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T1  ',1,
1,1.0000
 1.81900E-3, 6.54769E-2,   100.00
0.98000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T2  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
0.98000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T3  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
0.98000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T4  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
0.98000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
0 / END OF TRANSFORMER DATA, BEGIN AREA DATA
   1,     0,     0.000,    10.000,'CHURCHILL   '
   2,     0,     0.000,    10.000,'LAB EAST    '
   3,     0,     0.000,    10.000,'LAB WEST    '
   4,     0,     0.000,    10.000,'QUEBEC      '
   5,     0,     0.000,    10.000,'HVDC        '
0 / END OF AREA DATA, BEGIN TWO-TERMINAL DC DATA
0 / END OF TWO-TERMINAL DC DATA, BEGIN VSC DC LINE DATA
0 / END OF VSC DC LINE DATA, BEGIN IMPEDANCE CORRECTION DATA
0 / END OF IMPEDANCE CORRECTION DATA, BEGIN MULTI-TERMINAL DC DATA
0 / END OF MULTI-TERMINAL DC DATA, BEGIN MULTI-SECTION LINE DATA
0 / END OF MULTI-SECTION LINE DATA, BEGIN ZONE DATA
   1,'LABRADOR    '
  10,'CHF TOWN    '
  20,'NLH HVY     '
  30,'IOCC        '
  33,'WABUSH MINES'
  35,'NLH LAB WEST'
  97,'CHF UNIT SER'
  98,'CHF AUX SER '
  99,'TRF NL LOSS '
0 / END OF ZONE DATA, BEGIN INTER-AREA TRANSFER DATA
```

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0 / END OF INTER-AREA TRANSFER DATA, BEGIN OWNER DATA
   1,'CFLCO       '
   2,'NLH         '
   3,'TWINCO      '
   4,'IOCC        '
   5,'WABUSH MINES'
   6,'HYDRO QUEBEC'
0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
0 / END OF FACTS DEVICE DATA, BEGIN SWITCHED SHUNT DATA
   136,0,0,1,1.06520,1.01450,   135,  100.0,'            ',   11.40, 1,
2.40, 1,    2.40, 1,    3.00, 1,    3.60
   221,0,0,1,1.00000,1.00000,     0,  100.0,'            ',   25.20, 1,
25.20
   222,0,0,1,1.00000,1.00000,     0,  100.0,'            ',   25.20, 1,
25.20
   226,0,0,1,1.00000,1.00000,     0,  100.0,'            ',    0.00, 1,  -
27.55
   250,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -495.00, 1, -
165.00, 1, -165.00, 1, -165.00
   251,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -330.00, 1, -
165.00, 1, -330.00
   280,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -495.00, 4, -
165.00, 2, -330.00
   281,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -165.00, 1, -
165.00
  1340,0,0,1,1.00000,1.00000,     0,  100.0,'            ',    9.00, 1,
3.00, 1,    3.00, 1,    3.00, 1,    3.00
0 / END OF SWITCHED SHUNT DATA, BEGIN GNE DATA
0 / END OF GNE DATA
Q
```

PSS/E System Data (345 kV Alternative)

```
0,   100.00, 32, 0, 1, 60.00     / PSS®E-32.0    FRI, JUN 10 2011  10:36
C3E-S01: VALIDATE STABILITY OF MUSKRAT -- CHURCHILL FALLS
STABILITY (345KV) : BASE CASE
   101,'CHF A1      ',  15.0000,2,   1,  99,   1,0.98427,  16.8569
   102,'CHF A2      ',  15.0000,4,   1,  99,   1,1.00000,  19.5608
   103,'CHF A3      ',  15.0000,4,   1,  99,   1,1.00000,  19.8482
   104,'CHF A4      ',  15.0000,4,   1,  99,   1,1.00000,  20.0990
   105,'CHF A5      ',  15.0000,4,   1,  99,   1,1.00000,  20.0990
   106,'CHF A6      ',  15.0000,4,   1,  99,   1,1.00000,  20.3464
   107,'CHF A7      ',  15.0000,4,   1,  99,   1,1.00000,  20.0957
   108,'CHF A8      ',  15.0000,4,   1,  99,   1,1.00000,  19.7151
   109,'CHF A9      ',  15.0000,4,   1,  99,   1,1.00000,  19.8042
   110,'CHF A10     ',  15.0000,4,   1,  99,   1,0.99506,  16.8613
   111,'CHF A11     ',  15.0000,4,   1,  99,   1,0.99533,  17.0598
   114,'GULL G1-8   ',  15.0000,4,   1,   1,   1,1.00000,   0.0000
   115,'MUSK G1-4   ',  15.0000,4,   1,   1,   1,1.00000,   0.0000
   131,'CHF L1301   ', 138.0000,4,   2,   1,   2,1.00000,   0.0000
   132,'GULL ISLAND ', 138.0000,4,   2,   1,   2,1.00000,   0.0000
   133,'MUSKRAT     ', 138.0000,1,   2,   1,   2,1.00223,   2.4689
   134,'MUSKRAT     ',  25.0000,1,   2,   1,   2,0.97083,   2.3514
   135,'HVY B13     ', 138.0000,1,   2,   1,   2,1.00117,  -0.2436
   136,'HVY B11 B12 ',  25.0000,1,   2,   1,   2,1.00874,  -7.4224
   137,'HVY G1      ',  13.8000,2,   2,   1,   2,1.02300,  -7.6536
   201,'CHF A1 B21  ', 230.0000,1,   1,   1,   1,1.04000,  10.7696
   202,'CHF A2 & A3 ', 230.0000,1,   1,   1,   1,1.04532,  13.9035
   203,'CHF A4 & A5 ', 230.0000,1,   1,   1,   1,1.04520,  13.7344
   204,'CHF A6 & A7 ', 230.0000,1,   1,   1,   1,1.04538,  13.8691
   205,'CHF A8& A9  ', 230.0000,1,   1,   1,   1,1.04543,  13.8318
   206,'CHF B23     ', 230.0000,1,   1,   1,   1,1.04000,  12.6639
   207,'GULL        ', 230.0000,4,   1,   1,   1,1.00000,   0.0000
   208,'MUSKRAT     ', 230.0000,4,   1,   1,   1,1.00000,   0.0000
   211,'TWIN L23    ', 230.0000,1,   3,   1,   3,1.01557,   9.1890
   212,'TWIN L24    ', 230.0000,1,   3,   1,   3,1.01557,   9.1890
   213,'WABUSH TS   ', 230.0000,1,   3,   1,   3,0.92454,  -9.6222
   221,'WTS BUS 1   ',  46.0000,1,   3,   1,   3,1.01300, -14.3316
   222,'WTS BUS 2   ',  46.0000,1,   3,   1,   3,1.01300, -15.7995
   223,'WTS SC1     ',  13.8000,2,   3,   1,   3,1.01785, -14.6103
   224,'WTS SC2     ',  13.8000,2,   3,   1,   3,1.04262, -16.1499
   225,'WTS T13     ',  46.0000,4,   1,   1,   1,1.00000,   0.0000
   226,'WTS SC3     ',  13.8000,4,   3,   1,   3,1.00000,   0.0000
   231,'LAB CITY    ',  46.0000,1,   3,   1,   2,1.01300, -15.7995
   232,'WAB NLH     ',  46.0000,1,   3,   1,   2,1.01301, -15.8004
   233,'CHANTAL     ',  46.0000,4,   3,   1,   6,1.00000,   0.0000
   250,'CHF TS      ', 735.0000,1,   1,   1,   1,0.98911,   7.2770
   251,'GUL TS      ', 735.0000,4,   1,   1,   1,1.00000,   0.0000
   261,'POINT X L1  ', 735.0000,1,   1,   1,   1,0.99948,  -3.3012
   262,'POINT X L2  ', 735.0000,1,   1,   1,   1,0.99948,  -3.3012
   263,'POINT X L3  ', 735.0000,1,   1,   1,   1,0.99948,  -3.3012
   264,'POINT Y L4  ', 735.0000,4,   1,   1,   1,1.00000,   0.0000
   271,'SERCOM 1    ', 735.0000,1,   4,   1,   6,0.99864,  -4.6892
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 272,'SERCOM 2    ', 735.0000,1,   4,   1,   6,0.99864,  -4.6892
 273,'SERCOM 3    ', 735.0000,1,   4,   1,   6,0.99864,  -4.6892
 274,'SERCOM 4    ', 735.0000,4,   4,   1,   6,1.00000,   0.0000
 280,'MONTAGNAIS  ', 735.0000,3,   4,   1,   6,1.00000,   0.0000
 281,'MONT 2      ', 735.0000,4,   4,   1,   6,1.00000,   0.0000
 351,'CHF X151    ',  13.8000,1,   1,  98,   1,1.00986,  12.1757
 352,'CHF X152    ',  13.8000,1,   1,  98,   1,1.01136,  12.4062
 361,'CHF T02 SS1 ',  13.8000,1,   1,  98,   1,1.04002,  12.0445
 362,'CHF T03 SS2 ',  13.8000,1,   1,  98,   1,1.04125,  12.1643
 371,'CHF TWN 1   ',  13.8000,1,   1,  10,   1,0.99480,  10.4792
 372,'CHF TWN 2   ',  13.8000,1,   1,  10,   1,0.99609,  10.6028
 701,'WTS STN SER1',   0.5750,1,   3,   1,   3,1.01300, -14.3316
 702,'WTS STN SER2',   0.5750,1,   3,   1,   3,1.01300, -15.7995
 901,'HVY MID T1  ',  25.0000,1,   2,   1,   2,1.01176,  -7.9424
 902,'HVY TERT T1 ',  13.8000,1,   2,   1,   2,1.01176,  -7.9424
 903,'HVY MID T2  ',  25.0000,1,   2,   1,   2,1.00799,  -7.2907
 904,'HVY TERT T2 ',  13.8000,1,   2,   1,   2,1.00799,  -7.2907
 931,'CHF MID T31 ', 138.0000,1,   2,   1,   2,0.99048,  10.7696
 932,'CHF MID T32 ', 138.0000,1,   2,   1,   2,0.99048,  10.7696
 933,'CHF TERT T31',   4.1600,1,   2,   1,   2,0.99048,  10.7696
 934,'CHF TERT T32',   4.1600,1,   2,   1,   2,0.99048,  10.7696
 971,'CHF MID T71 ', 230.0000,1,   1,  99,   1,1.04005,  11.4862
 972,'CHF MID T72 ', 230.0000,1,   1,  99,   1,1.04400,  13.5083
 973,'CHF MID T73 ', 230.0000,1,   1,  99,   1,1.04777,  15.0640
 974,'CHF MID T74 ', 230.0000,1,   1,  99,   1,1.04409,  13.4784
 975,'CHF MID T75 ', 230.0000,1,   1,  99,   1,1.04801,  15.1617
 976,'CHF MID T76 ', 230.0000,1,   1,  99,   1,1.03930,  12.3407
 981,'CHF TERT T71',  13.8000,1,   1,   1,   1,1.01360,  11.4862
 982,'CHF TERT T72',  13.8000,1,   1,   1,   1,1.01319,  12.7759
 983,'CHF TERT T73',  13.8000,1,   1,   1,   1,1.01507,  13.4947
 984,'CHF TERT T74',  13.8000,1,   1,   1,   1,1.01753,  13.4784
 985,'CHF TERT T75',  13.8000,1,   1,   1,   1,1.02136,  15.1617
 986,'CHF TERT T76',  13.8000,1,   1,   1,   1,1.01286,  12.3407
1340,'MUSKRAT     ',  25.0000,4,   2,   1,   2,1.03058,   2.4764
1341,'MF CP       ', 138.0000,4,   2,   1,   2,1.05093,   3.1348
1603,'IOC MINE    ',  46.0000,2,   3,   1,   4,1.01300, -15.7995
1604,'SUB 604     ',  46.0000,1,   3,   1,   4,1.01300, -15.7995
1605,'SUB 605     ',  46.0000,1,   3,   1,   4,1.01300, -14.3316
1606,'TAILINGS    ',  46.0000,1,   3,   1,   4,1.01425, -15.8133
1607,'SUB 607     ',  46.0000,1,   3,   1,   4,1.01425, -15.8133
1608,'IOC FDR5    ',  46.0000,1,   3,   1,   4,1.01425, -15.8133
1609,'IOC FDR4    ',  46.0000,1,   3,   1,   4,1.01364, -14.3440
1611,'IOC FDR2    ',  46.0000,1,   3,   1,   4,1.01300, -14.3316
1612,'IOC FDR1    ',  46.0000,1,   3,   1,   4,1.01300, -14.3316
1652,'WABMINE1    ',  46.0000,2,   3,   1,   5,1.01300, -15.7995
1653,'WABMINE2    ',  46.0000,2,   3,   1,   5,1.01300, -15.7995
1698,'IOC FDR6    ',  46.0000,1,   3,   1,   4,1.01300, -15.7995
1699,'IOC FDR3    ',  46.0000,1,   3,   1,   4,1.01364, -14.3440
1701,'S607 T1     ',  13.8000,1,   3,   1,   4,1.01425, -15.8133
1702,'S607 T5     ',  13.8000,1,   3,   1,   4,1.01425, -15.8133
1703,'CON3 T5     ',  13.8000,1,   3,   1,   4,1.01364, -14.3440
1704,'BOILER 1    ',  13.8000,1,   3,   1,   4,1.01425, -15.8133
1705,'BOILER 5    ',  13.8000,1,   3,   1,   4,1.01425, -15.8133
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1708,'CON3 BLR    ',  13.8000,1,   3,   1,   4,1.01364, -14.3440
1801,'PP2 T9      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1802,'PP2 T8      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1803,'PP2 T7      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1804,'PP2 T6      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1805,'PP2 T5      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1806,'PP1 T5      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1807,'PP1 T4      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1809,'PP1 T3      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1810,'PP1 T2      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1811,'PP1 T1      ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1813,'CON3 T4     ',   4.2000,1,   3,   1,   4,1.01364, -14.3440
1814,'CON3 T3     ',   4.2000,1,   3,   1,   4,1.01878, -14.3602
1815,'CON3 T2     ',   4.2000,1,   3,   1,   4,1.01364, -14.3440
1816,'CON3 T1     ',   4.2000,1,   3,   1,   4,1.01878, -14.3602
1817,'CON1 T4     ',   4.2000,1,   3,   1,   4,1.01425, -15.8133
1818,'CON1 T3     ',   4.2000,1,   3,   1,   4,1.01982, -15.8308
1819,'CON1 T2     ',   4.2000,1,   3,   1,   4,1.01425, -15.8133
1820,'CON1 T1     ',   4.2000,1,   3,   1,   4,1.01982, -15.8308
1821,'HTHW PLT    ',   4.2000,2,   3,   1,   4,1.01425, -15.8133
1822,'S606 T7     ',   4.2000,1,   3,   1,   4,1.01425, -15.8133
1823,'S606 T8     ',   4.2000,1,   3,   1,   4,1.01425, -15.8133
1824,'S605 T6A    ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1825,'S605 T6B    ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1850,'PROCES W    ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1851,'  851       ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1853,'57 P 1 2    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1854,'57 P 345    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1856,'57 P 711    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1857,'COLINSCV    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1858,'BLENDMCC    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1859,'PP2  859    ',   4.2000,1,   3,   1,   4,1.01300, -14.3316
1860,'BM 12 13    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1861,'PP2  861    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1862,'PP2 MC6A    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1863,'PP2 MC6B    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1864,'PP2 MC5A    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1865,'PP2 MC5B    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1866,'BM 9 10     ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1867,'PP2  867    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1868,'BM14 MCC    ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1869,'PP1 MC4     ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1870,'PP1 MC3     ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1871,'PP1 MC2     ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1872,'PP1 MC1     ',   4.2000,2,   3,   1,   4,1.01300, -14.3316
1873,'TAIL PH     ',   4.2000,2,   3,   1,   4,1.01425, -15.8133
1876,'TAIL PH     ',   4.2000,2,   3,   1,   4,1.01425, -15.8133
1884,'BM104MCC    ',   4.2000,2,   3,   1,   4,1.01364, -14.3440
1885,'MILL 10     ',   4.2000,2,   3,   1,   4,1.01901, -14.3664
1886,'CON3 MCC    ',   4.2000,2,   3,   1,   4,1.01364, -14.3440
1887,'MILL 9      ',   4.2000,2,   3,   1,   4,1.01901, -14.3664
1888,'CON1 MCC    ',   4.2000,2,   3,   1,   4,1.01425, -15.8133
1889,'MILL 12     ',   4.2000,2,   3,   1,   4,1.02028, -15.8396
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   1890,'CON1 MCC    ',   4.2000,2,   3,   1,   4,1.01425, -15.8133
   1891,'MILL 11     ',   4.2000,2,   3,   1,   4,1.02028, -15.8396
   6600,'CHF 66 STN  ',  13.8000,1,   1,  98,   1,1.04125,  12.1637
   6601,'CHF T601    ',  66.0000,1,   1,  98,   1,1.08699,  10.7384
   6602,'CHF T602    ',  66.0000,1,   1,  98,   1,1.03926,  12.3407
   6610,'CHF AIRPORT ',  66.0000,1,   1,  98,   1,1.08546,  10.5484
   6611,'JACWHITE    ',  66.0000,1,   1,  98,   1,1.08286,  10.2378
   6612,'LOGANTWR    ',  66.0000,1,   1,  98,   1,1.08343,  10.3041
   6617,'TWIN TAP    ',  66.0000,1,   1,  98,   1,1.08229,  10.1455
   6618,'ATIKONAK    ',  66.0000,1,   1,  98,   1,1.06593,   9.4089
   6619,'LOB LODGE   ',  66.0000,1,   1,  98,   1,1.06538,   9.3917
   6622,'LOB TAP     ',  66.0000,1,   1,  98,   1,1.06481,   9.3748
   6623,'GABBRO      ',  66.0000,1,   1,  98,   1,1.06365,   9.3392
   8000,'CHF ESS SER ',   0.6000,1,   1,   1,   1,1.04001,  12.0443
   8131,'CHF A1 AUX  ',   0.6000,2,   1,  97,   1,0.99032,   6.5245
   8132,'CHF A2 AUX  ',   0.6000,2,   1,  97,   1,0.99032,   6.5245
   8133,'CHF A3 AUX  ',   0.6000,2,   1,  97,   1,0.99032,   6.5245
   8134,'CHF A4 AUX  ',   0.6000,2,   1,  97,   1,0.99032,   6.5245
   8135,'CHF A5 AUX  ',   0.6000,2,   1,  97,   1,0.99032,   6.5245
   8136,'CHF A6 AUX  ',   0.6000,2,   1,  97,   1,0.99163,   6.6582
   8137,'CHF A7 AUX  ',   0.6000,2,   1,  97,   1,0.99163,   6.6582
   8138,'CHF A8 AUX  ',   0.6000,2,   1,  97,   1,0.99163,   6.6582
   8139,'CHF A9 AUX  ',   0.6000,2,   1,  97,   1,0.99163,   6.6582
   8140,'CHF A10 AUX ',   0.6000,2,   1,  97,   1,0.99163,   6.6582
   8141,'CHF A11 AUX ',   0.6000,2,   1,  97,   1,0.99163,   6.6582
   8159,'CHF EAST A&E',  13.8000,1,   1,  98,   1,1.04001,  12.0443
   8160,'CHF WEST A&E',  13.8000,1,   1,  98,   1,1.04125,  12.1640
   8615,'CHF EAST AUX',   0.6000,2,   1,  98,   1,0.99032,   6.5245
   8616,'CHF EAST ESS',   0.6000,2,   1,  98,   1,1.04001,  12.0443
   8618,'CHF WEST ESS',   0.6000,2,   1,  98,   1,1.04125,  12.1640
   8619,'CHF WEST AUX',   0.6000,2,   1,  98,   1,0.99163,   6.6582
   8621,'CHF A1 SER  ',   0.6000,2,   1,  98,   1,0.97680,  15.9753
   8622,'CHF A2 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.7069
   8623,'CHF A3 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.9943
   8624,'CHF A4 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.2451
   8625,'CHF A5 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.2451
   8626,'CHF A6 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.4925
   8627,'CHF A7 SER  ',   0.6000,4,   1,  98,   1,0.99265,  19.2418
   8628,'CHF A8 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.8612
   8629,'CHF A9 SER  ',   0.6000,4,   1,  98,   1,0.99265,  18.9503
   8630,'CHF A10 SER ',   0.6000,4,   1,  98,   1,0.98768,  15.9989
   8631,'CHF A11 SER ',   0.6000,4,   1,  98,   1,0.98795,  16.1978
   9000,'CHF F_B1    ', 345.0000,1,   1,   1,   1,1.00200,   6.4134
   9100,'MF F_B1     ', 345.0000,1,   2,   1,   2,1.00107,   3.1386
   9200,'MF F_B2     ', 345.0000,1,   2,   1,   2,1.00000,   3.1080
   9201,'MF-HVDC     ', 345.0000,1,   5,   1,   2,1.00000,   3.1080
   9300,'MF F_B3     ',  15.0000,2,   2,   1,   2,1.02427,  10.6282
   9400,'CHF A2-A11  ',  15.0000,2,   1,  99,   1,0.99790,  19.3499
0 / END OF BUS DATA, BEGIN LOAD DATA
    101,'1 ',1,   1,  99,      0.215,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
    134,'1 ',1,   2,   1,      0.067,     0.030,     0.000,     0.000,
0.000,     0.000,   2,1
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   136,'1 ',1,   2,  20,    63.847,     6.409,     0.000,     0.000,
0.000,     0.000,   2,1
   207,'1 ',1,   1,   1,   258.200,    84.866,     0.000,     0.000,
0.000,     0.000,   1,1
   221,'1 ',1,   1,  30,   150.000,    49.303,     0.000,     0.000,
0.000,     0.000,   4,1
   222,'1 ',1,   1,  30,    72.000,    23.665,     0.000,     0.000,
0.000,     0.000,   4,1
   222,'2 ',1,   1,  33,    54.000,    15.958,     0.000,     0.000,
0.000,     0.000,   5,1
   222,'3 ',1,   1,  35,    69.000,    17.294,     0.000,     0.000,
0.000,     0.000,   2,1
   231,'1 ',0,   3,  35,    50.000,     8.000,     0.000,     0.000,
0.000,     0.000,   2,1
   232,'1 ',0,   3,  35,    13.400,     2.300,     0.000,     0.000,
0.000,     0.000,   2,1
   280,'1 ',1,   4,   1,  4885.400,  1605.744,     0.000,     0.000,
0.000,     0.000,   6,1
   281,'1 ',0,   4,   1,  1911.044,     0.000,     0.000,     0.000,
0.000,     0.000,   6,1
   371,'1 ',1,   1,  10,     4.000,     0.912,     0.000,     0.000,
0.000,     0.000,   1,1
   372,'1 ',1,   1,  10,     4.000,     0.912,     0.000,     0.000,
0.000,     0.000,   1,1
   971,'1 ',1,   1,  99,     0.221,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   972,'1 ',1,   1,  99,     0.204,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   973,'1 ',1,   1,  99,     0.221,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   974,'1 ',1,   1,  99,     0.204,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   975,'1 ',1,   1,  99,     0.221,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
   976,'1 ',1,   1,  99,     0.204,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
  1340,'1 ',1,   2,   1,     3.700,     1.269,     0.000,     0.000,
0.000,     0.000,   2,1
  6610,'1 ',1,   1,  98,     0.400,     0.131,     0.000,     0.000,
0.000,     0.000,   1,1
  6611,'1 ',1,   1,  98,     1.500,     0.493,     0.000,     0.000,
0.000,     0.000,   1,1
  6612,'1 ',1,   1,  98,     0.200,     0.066,     0.000,     0.000,
0.000,     0.000,   1,1
  6617,'1 ',1,   1,  98,     0.400,     0.131,     0.000,     0.000,
0.000,     0.000,   1,1
  6618,'1 ',1,   1,  98,     0.100,     0.033,     0.000,     0.000,
0.000,     0.000,   1,1
  6622,'1 ',1,   1,  98,     1.400,     0.460,     0.000,     0.000,
0.000,     0.000,   1,1
  6623,'1 ',1,   1,  98,     1.000,     0.329,     0.000,     0.000,
0.000,     0.000,   1,1
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  8615,'1 ',1,   1,  98,     2.000,     0.600,     0.000,     0.000,
0.000,     0.000,   1,1
  8619,'1 ',1,   1,  98,     2.000,     0.600,     0.000,     0.000,
0.000,     0.000,   1,1
  8621,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8622,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8623,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8624,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8625,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8626,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8627,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8628,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8629,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8630,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  8631,'1 ',1,   1,  97,     0.300,     0.100,     0.000,     0.000,
0.000,     0.000,   1,1
  9201,'1 ',1,   5,   1,   300.000,   150.000,     0.000,     0.000,
0.000,     0.000,   2,1
  9201,'2 ',1,   5,   1,   300.000,   150.000,     0.000,     0.000,
0.000,     0.000,   2,1
  9201,'3 ',1,   5,   1,   300.000,   150.000,     0.000,     0.000,
0.000,     0.000,   2,1
  9400,'1 ',1,   1,  99,     2.770,     0.000,     0.000,     0.000,
0.000,     0.000,   1,1
0 / END OF LOAD DATA, BEGIN FIXED SHUNT DATA
  1885,'1 ',1,     0.000,     1.010
  1887,'1 ',1,     0.000,     1.010
  1889,'1 ',1,     0.000,     1.010
  1891,'1 ',1,     0.000,     1.010
  9000,'1 ',0,     0.000,   -45.000
  9000,'2 ',0,     0.000,   -45.000
  9100,'1 ',0,     0.000,   -45.000
  9100,'2 ',0,     0.000,   -45.000
  9201,'1 ',1,     0.000,   250.000
0 / END OF FIXED SHUNT DATA, BEGIN GENERATOR DATA
   101,'1 ',   502.200,    33.743,   155.999,  -155.999,1.04000,   201,
500.000, 1.10000E-3, 2.20000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
   114,'1 ',  2264.000,   568.473,  1098.000, -1098.000,1.01500,     0,
2520.000, 0.00000E+0, 2.54000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
2264.000,     0.000,   1,1.0000
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   115,'1 ',   824.000,    93.785,   271.000,  -271.000,1.00000,     0,
868.000, 0.00000E+0, 2.54000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
824.000,     0.000,   1,1.0000
   137,'1 ',    -0.560,    19.595,    23.800,   -10.000,1.02300,     0,
26.567, 0.00000E+0, 1.58000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
33.000,    -0.600,   1,1.0000
   223,'1 ',    -1.110,    35.236,    60.000,   -40.000,1.01300,   221,
60.000, 0.00000E+0, 1.80000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
   224,'1 ',    -1.110,    51.753,    60.000,   -40.000,1.01300,   222,
60.000, 0.00000E+0, 1.80000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
   226,'1 ',    -1.100,    24.036,    60.000,   -20.000,1.01300,   222,
69.294, 0.00000E+0, 1.40000E-1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   1,1.0000
   280,'1 ',    64.196,  1823.128,  9998.988, -9998.990,1.00000,     0,
35000.000, 0.00000E+0, 2.00000E-1, 1.22500E-1, 4.16150E+0,1.00000,1,  100.0,
9998.990, -9999.000,   1,1.0000
  1603,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.19150E+0, 1.19144E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1652,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.96800E-1, 3.96810E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   5,1.0000
  1653,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.96800E-1, 3.96810E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   5,1.0000
  1821,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.06940E+0, 2.67345E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1853,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.71500E-1, 1.48523E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1854,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.96000E-1, 9.90150E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1856,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 4.45100E-1, 1.11276E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1857,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.88400E-1, 9.71130E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1858,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.06940E+0, 2.67338E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1860,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.67200E-1, 6.08570E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1861,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.32300E-1, 3.30700E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
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  1862,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.41000E-1, 3.88010E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1863,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.45200E-1, 4.07010E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1864,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.47700E-1, 4.08610E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1865,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.23000E-1, 3.37660E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1866,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.66800E-1, 6.08565E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1867,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 2.02950E-1, 6.02340E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1868,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.94900E-1, 9.87270E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1869,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.97000E-2, 2.34820E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1870,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.95000E-2, 2.50910E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1871,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.97000E-2, 2.55110E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1872,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 9.28000E-2, 3.04930E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1873,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.01100E-1, 7.53080E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1876,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.14400E-1, 7.86300E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1884,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.85000E-2, 1.53450E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1885,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.78000E-2, 1.52140E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1886,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.80000E-2, 1.45110E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1887,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.94000E-2, 1.56500E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
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  1888,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 8.23000E-2, 2.13570E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1889,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 9.49000E-2, 2.82280E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1890,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 9.55000E-2, 2.41830E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  1891,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 8.57000E-2, 2.50320E+0, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
9999.000, -9999.000,   4,1.0000
  8131,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8132,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8133,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8134,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.68930E+1, 3.41359E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8135,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8136,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8137,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8138,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8139,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8140,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8141,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 7.89160E+1, 4.73497E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8615,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.51580E+1, 2.10948E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8616,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 4.98000E+0, 3.79370E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
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  8618,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 5.30300E+0, 4.11260E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8619,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 1.22320E+2, 7.33921E+2, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8621,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.80300E+0, 3.20730E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8622,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8623,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8624,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8625,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8626,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8627,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8628,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8629,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8630,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.84800E+0, 3.26080E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  8631,'1 ',     0.000,     0.000,     0.000,     0.000,1.00000,     0,
100.000, 3.81300E+0, 3.21900E+1, 0.00000E+0, 0.00000E+0,1.00000,0,  100.0,
0.000,     0.000,   1,1.0000
  9300,'1 ',   824.000,   182.807,   271.000,  -271.000,1.00000,  9200,
868.000, 0.00000E+0, 2.54000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
824.000,     0.000,   1,1.0000
  9400,'1 ',  4925.500,   802.416,  1528.320, -1528.320,1.04000,   206,
5000.000, 1.10000E-3, 2.20000E-1, 0.00000E+0, 0.00000E+0,1.00000,1,  100.0,
9999.000, -9999.000,   1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
   131,   132,'1 ', 1.20000E-1, 4.76600E-1,   0.13388,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 196.40,   2,1.0000
   131,   931,'1 ',-1.10000E-4,-2.80000E-3,   0.00000,   42.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   2,1.0000
   131,   932,'1 ',-1.10000E-4,-2.80000E-3,   0.00000,   42.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   2,1.0000
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   131,  1341,'1 ', 5.10100E-2, 5.19380E-1,   0.21443,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 260.00,   2,1.0000
   132,   133,'1 ', 2.86000E-2, 1.17600E-1,   0.02978,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  45.94,   2,1.0000
   133,   135,'1 ', 1.68000E-2, 6.92000E-2,   0.01754,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,  26.92,   2,1.0000
   133,  1341,'1 ', 3.18000E-3, 1.28700E-2,   0.00323,  105.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   5.00,   2,1.0000
   136,   901,'1 ',-6.90000E-4,-2.20800E-2,   0.00000,   50.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   2,1.0000
   136,   903,'1 ', 5.00000E-4, 9.99000E-3,   0.00000,   28.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   2,1.0000
   201,   971,'1 ',-1.00000E-4,-2.70000E-3,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   202,   972,'2 ', 1.00000E-4, 8.00000E-4,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   203,   973,'3 ',-1.00000E-4,-2.70000E-3,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   204,   974,'4 ', 1.00000E-4, 8.00000E-4,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   205,   975,'5 ',-1.00000E-4,-2.70000E-3,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   206,   211,'1 ', 6.40000E-3, 3.56000E-2,   0.06300,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   206,   212,'1 ', 6.40000E-3, 3.56000E-2,   0.06300,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   206,   976,'6 ', 1.00000E-4, 8.00000E-4,   0.00000, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   207,   208,'1 ', 2.59000E-3, 3.90600E-2,   0.15116, 1120.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  60.00,   1,1.0000
   207,   208,'2 ', 2.59000E-3, 3.90600E-2,   0.15116, 1120.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  60.00,   1,1.0000
   211,   213,'1 ', 3.08000E-2, 1.71600E-1,   0.30400,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   3,1.0000
   212,   213,'1 ', 3.08000E-2, 1.71600E-1,   0.30400,  209.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   3,1.0000
   221,   222,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   3,1.0000
   221,   225,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,   72.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   3,1.0000
   221,  1609,'1 ', 2.12200E-2, 6.23800E-2,   0.00000,   53.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   221,  1611,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   221,  1612,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   221,  1699,'1 ', 2.12200E-2, 6.23800E-2,   0.00000,   53.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   222,   225,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,   72.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   3,1.0000
   222,   231,'1 ', 1.01000E-2, 3.25000E-2,   0.00016,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
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   222,   232,'1 ', 9.87000E-2, 8.30000E-2,   0.00031,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   2,1.0000
   222,   233,'1 ', 1.47360E-1, 4.75830E-1,   0.00232,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,  25.74,   1,1.0000
   222,  1608,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   222,  1652,'1 ', 1.60700E-2, 4.67900E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   5,1.0000
   222,  1653,'1 ', 1.60700E-2, 4.67900E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   5,1.0000
   222,  1698,'1 ', 1.18100E-2, 6.04900E-2,   0.00000,   81.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   250,   251,'1 ', 4.10000E-4, 1.24100E-2,   5.41703, 5200.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 203.00,   1,1.0000
   250,   261,'1 ', 4.00000E-4, 1.12000E-2,   4.72378, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   250,   262,'1 ', 4.00000E-4, 1.12000E-2,   4.72378, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   250,   263,'1 ', 4.00000E-4, 1.12000E-2,   4.72378, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   251,   264,'1 ', 6.20000E-4, 1.90700E-2,   8.52891, 5200.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1, 317.00,   1,1.0000
   261,   271,'1 ', 1.00000E-4, 1.50000E-3,   0.64028, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   262,   272,'1 ', 1.00000E-4, 1.50000E-3,   0.64028, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   263,   273,'1 ', 1.00000E-4, 1.50000E-3,   0.64028, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   264,   274,'1 ', 6.00000E-5, 1.98500E-3,   0.88786, 5200.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,  33.00,   1,1.0000
   271,   280,'1 ', 0.00000E+0,-5.08000E-3,   0.00000, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   272,   280,'1 ', 0.00000E+0,-5.08000E-3,   0.00000, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   273,   280,'1 ', 0.00000E+0,-5.08000E-3,   0.00000, 2500.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   274,   281,'1 ', 0.00000E+0,-1.00000E-4,   0.00000, 2920.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   6,1.0000
   280,   281,'1 ', 9.00000E-5, 1.85000E-3,   0.80000, 7130.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   6,1.0000
   351,   982,'1 ', 0.00000E+0, 1.73280E-1,   0.00000,   16.70,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
   352,   983,'1 ', 0.00000E+0, 1.73280E-1,   0.00000,   16.70,    0.00,
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   361,   371,'1 ', 9.07090E-1, 9.13020E-1,   0.00003,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   4.00,   1,1.0000
   361,  8159,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
   362,   372,'1 ', 9.07090E-1, 9.13020E-1,   0.00003,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
   362,  6600,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
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   362,  8160,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
  1603,  1604,'1 ', 8.83700E-2, 1.81000E-1,   0.00000,   44.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1604,  1698,'1 ', 1.22900E-2, 1.27600E-2,   0.00000,   44.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1605,  1612,'1 ', 5.20000E-3, 2.03200E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1606,  1607,'1 ', 7.56000E-3, 1.70100E-2,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1607,  1608,'1 ', 2.33000E-3, 8.62000E-3,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1701,  1704,'1 ', 1.21000E-3, 2.14000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1702,  1705,'1 ', 2.46000E-3, 4.35000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1703,  1708,'1 ', 8.06000E-3, 1.42600E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1801,  1858,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1801,  1859,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1802,  1860,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1802,  1861,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1803,  1862,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1803,  1863,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1804,  1864,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1804,  1865,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1805,  1866,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1805,  1867,'1 ', 2.89500E-2, 6.01700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1806,  1868,'1 ', 1.81800E-2, 5.82700E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1807,  1869,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1809,  1870,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1810,  1871,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1811,  1872,'1 ', 3.03000E-2, 9.71100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1813,  1884,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1814,  1885,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
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  1815,  1886,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1816,  1887,'1 ', 1.08400E-2, 2.25200E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1817,  1888,'1 ', 1.58400E-2, 2.91800E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1818,  1889,'1 ', 1.51400E-2, 4.44100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1819,  1890,'1 ', 1.51400E-2, 4.44100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1820,  1891,'1 ', 1.51400E-2, 4.44100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1822,  1873,'1 ', 1.33000E-2, 2.35400E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1823,  1876,'1 ', 2.66000E-2, 4.70800E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1824,  1850,'1 ', 2.37000E-3, 4.93000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1825,  1850,'1 ', 4.75000E-3, 9.86000E-3,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1850,  1853,'1 ', 1.99500E-2, 3.53100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1850,  1854,'1 ', 1.99500E-2, 3.53100E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1850,  1856,'1 ', 2.66000E-2, 4.70800E-2,   0.00000,    0.00,    0.00,
100.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1850,  1857,'1 ', 2.31140E-1, 4.62280E-1,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   4,1.0000
  1851,  1858,'1 ', 1.21350E+0, 2.31140E+0,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  1851,  1858,'2 ', 1.21350E+0, 2.31140E+0,   0.00000,    0.00,    0.00,
780.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   4,1.0000
  6601,  6610,'1 ', 3.20000E-2, 7.78000E-2,   0.00138,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6610,  6612,'1 ', 4.47000E-2, 1.08900E-1,   0.00193,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6611,  6612,'1 ', 1.28000E-2, 3.11000E-2,   0.00055,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,2,   0.00,   1,1.0000
  6611,  6617,'1 ', 2.56000E-2, 6.22000E-2,   0.00111,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6617,  6618,'1 ', 6.53400E-1, 6.33300E-1,   0.00828,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6618,  6619,'1 ', 1.98000E-2, 1.92000E-2,   0.00025,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6619,  6622,'1 ', 1.98000E-2, 1.92000E-2,   0.00025,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  6622,  6623,'1 ', 9.92000E-2, 9.60000E-2,   0.00125,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8000,  8616,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8000,  8618,'1 ', 0.00000E+0, 1.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,1,   0.00,   1,1.0000
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  8000,  8621,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8622,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8623,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8624,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8625,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8626,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8627,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8628,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8629,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8630,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8000,  8631,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8131,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8132,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8133,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8134,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8135,  8615,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8136,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8137,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8138,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8139,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8140,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8141,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   1,1.0000
  8615,  8616,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  8618,  8619,'1 ', 0.00000E+0, 2.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,0,2,   0.00,   1,1.0000
  9000,  9100,'1 ', 7.69100E-3, 7.83070E-2,   1.26287, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1, 245.00,   2,1.0000
  9000,  9100,'2 ', 7.69100E-3, 7.83070E-2,   1.26287, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1, 245.00,   2,1.0000
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  9100,  9200,'1 ', 1.57000E-4, 1.59800E-3,   0.02577, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   5.00,   2,1.0000
  9100,  9200,'2 ', 1.57000E-4, 1.59800E-3,   0.02577, 1000.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   5.00,   2,1.0000
  9200,  9201,'1 ', 0.00000E+0, 1.00000E-4,   0.00000,    0.00,    0.00,
0.00,  0.00000,  0.00000,  0.00000,  0.00000,1,1,   0.00,   2,1.0000
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
   101,   201,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T1      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   101,  8621,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A1 SER  ',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   102,  8622,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A2 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   103,  8623,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A3 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   104,  8624,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A4 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   105,  8625,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A5 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   106,  8626,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A6 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   107,  8627,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A7 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
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1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   108,  8628,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A8 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   109,  8629,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A9 SER  ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   110,  8630,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A10 SER ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   111,  8631,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF A11 SER ',0,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   207,   114,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'GUL T1 - T8 ',0,
1,1.0000
 1.10000E-4, 4.76000E-3,   100.00
1.00000,   0.000,   0.000,  2520.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   208,   115,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MUSK T1-T4  ',0,
1,1.0000
 2.30000E-4, 1.38000E-2,   100.00
1.00000,   0.000,   0.000,   868.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   201,   131,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T33     ',0,
2,1.0000
 1.63000E-3, 7.49200E-2,   100.00
1.05000,   0.000,   0.000,    75.00,   100.00,   125.00, 0,      0, 1.05000,
0.95000, 1.50000, 0.51000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   133,   134,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MUF T1      ',1,
2,1.0000
 1.62300E-1, 2.96060E+0,   100.00
1.03125,   0.000,   0.000,     2.00,     0.00,     0.00, 1,    134, 1.10000,
0.90000, 1.01250, 1.00000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9100,   133,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B1_T1  ',1,
2,1.0000
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 3.50300E-3, 3.50250E-2,   100.00
1.00000,   0.000,   0.000,    75.00,   100.00,   125.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9100,   133,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B1_T2  ',1,
2,1.0000
 3.50300E-3, 3.50250E-2,   100.00
1.00000,   0.000,   0.000,    75.00,   100.00,   125.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   135,   901,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T1      ',1,
2,1.0000
 9.85000E-3, 3.15610E-1,   100.00
1.02500,   0.000,   0.000,    50.00,     0.00,     0.00, 1,    136, 1.05000,
0.85000, 1.04400, 1.02000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   135,   903,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T2      ',1,
2,1.0000
 2.59000E-2, 5.16020E-1,   100.00
1.02500,   0.000,   0.000,    28.00,     0.00,     0.00, 1,    136, 1.05000,
0.85000, 1.04400, 1.02000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   136,   137,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T3      ',1,
2,1.0000
 1.16500E-2, 3.03540E-1,   100.00
1.04540,   0.000,   0.000,    40.00,     0.00,     0.00, 0,      0, 1.09770,
0.99320, 1.50000, 1.02000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   201,   931,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T31     ',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.05000,   0.000,   0.000,    42.00,     0.00,     0.00, 0,      0, 1.05000,
0.95000, 1.50000, 0.51000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   201,   932,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T32     ',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.05000,   0.000,   0.000,    42.00,     0.00,     0.00, 0,      0, 1.05000,
0.95000, 1.50000, 0.51000,   5, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   202,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T2      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   202,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T3      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
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  9400,   203,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T4      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   203,     0,'5 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T5      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   204,     0,'6 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T6      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   204,     0,'7 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T7      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   205,     0,'8 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T8      ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   205,     0,'9 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T9      ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   206,     0,'10',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T10     ',1,
1,1.0000
 6.00000E-4, 2.22000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9400,   206,     0,'11',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T11     ',1,
1,1.0000
 6.00000E-4, 2.30000E-2,   100.00
0.94240,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   251,   207,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'GULL EQUIV  ',0,
1,1.0000
 8.00000E-5, 3.67000E-3,   100.00
1.00000,   0.000,   0.000,  3999.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,   5, 0, 0.00000, 0.00000,  0.000
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1.00000,   0.000
   213,   221,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T1      ',1,
3,1.0000
 1.08000E-2, 2.47100E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T2      ',1,
3,1.0000
 7.70000E-3, 2.39800E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T3      ',1,
3,1.0000
 7.60000E-3, 2.43500E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   221,     0,'8 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'WTS T8      ',1,
3,1.0000
 4.91000E-3, 1.76130E-1,   100.00
0.91300,   0.000,   0.000,    83.30,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T4      ',1,
3,1.0000
 1.05000E-2, 2.46300E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'5 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T5      ',1,
3,1.0000
 1.27000E-2, 2.49000E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'6 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T6      ',1,
3,1.0000
 8.20000E-3, 2.50500E-1,   100.00
0.91300,   0.000,   0.000,    65.00,     0.00,     0.00, 0,      0, 0.96000,
0.91000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   213,   222,     0,'7 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'WTS T7      ',1,
3,1.0000
 5.16000E-3, 1.72920E-1,   100.00
0.91300,   0.000,   0.000,    83.30,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   221,   223,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T11     ',1,
3,1.0000
 8.30000E-3, 1.65000E-1,   100.00
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1.05430,   0.000,   0.000,    60.00,     0.00,     0.00, 0,      0, 1.05000,
1.00000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   221,   701,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS GT1     ',1,
3,1.0000
 0.00000E+0, 8.00000E+0,   100.00
1.00000,   0.000,   0.000,     0.50,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   222,   224,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T12     ',1,
3,1.0000
 8.30000E-3, 1.65000E-1,   100.00
1.05430,   0.000,   0.000,    60.00,     0.00,     0.00, 0,      0, 1.05000,
1.00000, 1.05000, 0.95000,   2, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   222,   702,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS GT2     ',1,
3,1.0000
 0.00000E+0, 8.00000E+0,   100.00
1.00000,   0.000,   0.000,     0.50,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   225,   226,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'WTS T13 FUT ',0,
3,1.0000
 8.30000E-3, 1.65000E-1,   100.00
1.05430,   0.000,   0.000,    72.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   971,   250,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T71     ',1,
1,1.0000
 3.00000E-4, 1.43000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   972,   250,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T72     ',1,
1,1.0000
 1.00000E-4, 1.13000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   973,   250,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T73     ',1,
1,1.0000
 3.00000E-4, 1.43000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   974,   250,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T74     ',1,
1,1.0000
 1.00000E-4, 1.13000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   975,   250,     0,'5 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T75     ',1,
1,1.0000
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 3.00000E-4, 1.43000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   976,   250,     0,'6 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T76     ',1,
1,1.0000
 1.00000E-4, 1.13000E-2,   100.00
1.05480,   0.000,   0.000,  1000.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   250,  9000,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF F_T1    ',1,
1,1.0000
 5.71195E-4, 1.99918E-2,   100.00
1.00000,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   250,  9000,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF F_T2    ',1,
1,1.0000
 5.71195E-4, 1.99918E-2,   100.00
1.00000,   0.000,   0.000,   500.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   351,   361,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T02     ',1,
1,1.0000
 5.30000E-3, 4.17000E-2,   100.00
0.97000,   0.000,   0.000,    15.00,    16.80,     0.00, 1,    361, 1.12000,
0.88000, 1.04500, 1.03750,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   352,   362,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T03     ',1,
1,1.0000
 5.30000E-3, 4.17000E-2,   100.00
0.97000,   0.000,   0.000,    15.00,    16.80,     0.00, 1,    362, 1.12000,
0.88000, 1.04500, 1.03750,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   901,   902,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T1 TERT ',1,
2,1.0000
 5.48000E-3, 1.75510E-1,   100.00
1.00000,   0.000,   0.000,     3.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   903,   904,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'HVY T2 TERT ',1,
2,1.0000
 1.45400E-2, 2.89640E-1,   100.00
1.00000,   0.000,   0.000,     3.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   931,   933,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T31 TERT',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
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   932,   934,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T32 TERT',1,
2,1.0000
 1.07900E-2, 2.73000E-1,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   971,   981,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T71 TERT',1,
1,1.0000
 0.00000E+0, 2.52200E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   972,   982,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T72 TERT',1,
1,1.0000
 0.00000E+0, 2.13000E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   973,   983,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T73 TERT',1,
1,1.0000
 0.00000E+0, 2.52200E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   974,   984,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T74 TERT',1,
1,1.0000
 0.00000E+0, 2.13000E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   975,   985,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T75 TERT',1,
1,1.0000
 0.00000E+0, 2.52200E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
   976,   986,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T76 TERT',1,
1,1.0000
 0.00000E+0, 2.13000E-1,   100.00
1.02610,   0.000,   0.000,    30.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  6602,   986,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T602    ',1,
1,1.0000
 2.54000E-2, 5.08300E-1,   100.00
1.02607,   0.000,   0.000,    20.00,     0.00,     0.00, 1,   6602, 1.26960,
0.93840, 1.04587, 1.03631,  39, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1341,  1340,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MRF T1      ',0,
2,1.0000
 9.99000E-3, 2.99880E-1,   100.00
1.04375,   0.000,   0.000,    30.00,    40.00,    50.00, 1,   1340, 1.05000,
0.85000, 1.02400, 1.00000,  33, 0, 0.00000, 0.00000,  0.000
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1.00000,   0.000
  1605,  1824,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 8.63700E-2, 1.03640E+0,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     6.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1605,  1825,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 9.55000E-2, 1.14600E+0,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     6.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1606,  1822,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 9.63300E-2, 1.15600E+0,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     5.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1606,  1823,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 8.02200E-2, 9.62660E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     5.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1607,  1701,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 1.77600E-2, 3.55110E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    18.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1607,  1702,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 1.63700E-2, 3.27370E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    18.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1607,  1821,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.33900E-2, 4.21020E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1817,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.77400E-2, 4.99230E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1818,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.00500E-2, 5.40830E-1,   100.00
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1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1819,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.00500E-2, 5.40830E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1608,  1820,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 3.00500E-2, 5.40830E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1609,  1815,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1609,  1816,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.77400E-2, 4.99230E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1806,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.76000E-2, 4.96730E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
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4,1.0000
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1809,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1810,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1611,  1811,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
```

```
 2.95800E-2, 5.32510E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1801,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1802,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1803,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
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0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1804,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1612,  1805,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1699,  1703,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 6.69900E-2, 8.37330E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,     8.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1699,  1813,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.72700E-2, 4.90910E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  1699,  1814,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'            ',1,
4,1.0000
 2.77400E-2, 4.99230E-1,   100.00
1.00000,   0.000,   0.000,     0.00,     0.00,    12.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
```

```
  6601,  6600,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'CHF T601    ',1,
1,1.0000
 2.66000E-2, 5.32300E-1,   100.00
1.04550,   0.000,   0.000,    20.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8159,  8615,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF EAST AUX',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8159,  8616,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF EAST ESS',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8160,  8618,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF WEST ESS',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  8160,  8619,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,1,'CHF WEST AUX',1,
1,1.0000
 6.75000E-1, 5.15600E+0,   100.00
1.00000,   0.000,   0.000,     1.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'1 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T1  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
1.00000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000, 999, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'2 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T2  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
1.00000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'3 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T3  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
1.00000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
1.00000,   0.000
  9200,  9300,     0,'4 ',1,1,1, 0.00000E+0, 0.00000E+0,2,'MF F_B3_T4  ',1,
1,1.0000
 1.81880E-3, 6.54769E-2,   100.00
1.00000,   0.000,   0.000,   229.00,     0.00,     0.00, 0,      0, 1.10000,
0.90000, 1.10000, 0.90000,  33, 0, 0.00000, 0.00000,  0.000
```

```
1.00000,   0.000
0 / END OF TRANSFORMER DATA, BEGIN AREA DATA
   1,     0,      0.000,    10.000,'CHURCHILL   '
   2,     0,      0.000,    10.000,'LAB EAST    '
   3,     0,      0.000,    10.000,'LAB WEST    '
   4,     0,      0.000,    10.000,'QUEBEC      '
   5,     0,      0.000,    10.000,'HVDC        '
0 / END OF AREA DATA, BEGIN TWO-TERMINAL DC DATA
0 / END OF TWO-TERMINAL DC DATA, BEGIN VSC DC LINE DATA
0 / END OF VSC DC LINE DATA, BEGIN IMPEDANCE CORRECTION DATA
0 / END OF IMPEDANCE CORRECTION DATA, BEGIN MULTI-TERMINAL DC DATA
0 / END OF MULTI-TERMINAL DC DATA, BEGIN MULTI-SECTION LINE DATA
0 / END OF MULTI-SECTION LINE DATA, BEGIN ZONE DATA
   1,'LABRADOR    '
  10,'CHF TOWN    '
  20,'NLH HVY     '
  30,'IOCC        '
  33,'WABUSH MINES'
  35,'NLH LAB WEST'
  97,'CHF UNIT SER'
  98,'CHF AUX SER '
  99,'TRF NL LOSS '
0 / END OF ZONE DATA, BEGIN INTER-AREA TRANSFER DATA
0 / END OF INTER-AREA TRANSFER DATA, BEGIN OWNER DATA
   1,'CFLCO       '
   2,'NLH         '
   3,'TWINCO      '
   4,'IOCC        '
   5,'WABUSH MINES'
   6,'HYDRO QUEBEC'
0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
0 / END OF FACTS DEVICE DATA, BEGIN SWITCHED SHUNT DATA
   136,0,0,1,1.06520,1.01450,   135,  100.0,'            ',   11.40, 1,
2.40, 1,    2.40, 1,    3.00, 1,    3.60
   221,0,0,1,1.00000,1.00000,     0,  100.0,'            ',   25.20, 1,
25.20
   222,0,0,1,1.00000,1.00000,     0,  100.0,'            ',   25.20, 1,
25.20
   226,0,0,1,1.00000,1.00000,     0,  100.0,'            ',    0.00, 1,  -
27.55
   250,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -495.00, 1, -
165.00, 1, -165.00, 1, -165.00
   251,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -330.00, 1, -
165.00, 1, -330.00
   280,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -495.00, 4, -
165.00, 2, -330.00
   281,0,0,1,1.00000,1.00000,     0,  100.0,'            ', -165.00, 1, -
165.00
  1340,0,0,1,1.00000,1.00000,     0,  100.0,'            ',    9.00, 1,
3.00, 1,    3.00, 1,    3.00, 1,    3.00
0 / END OF SWITCHED SHUNT DATA, BEGIN GNE DATA
0 / END OF GNE DATA
Q
```

NLH: Labrador Dynamics Data file

```
/      Churchill Falls Unit A1
/
 101 'GENSAL'  1     9.2300      0.70000E-01  0.10700       3.8810
        0.0000       0.9800       0.65000      0.29000      0.22000
       0.14000      0.19100      0.46400    /
 101 'IEEEST'  1 4      0         0.00000      0.00000      0.00000
       0.00000      0.00000      0.00000      0.00000      1.00000
       0.10000       1.0000       1.0000      0.08000      3.50000
       0.10000     -0.15000      0.00000      0.00000    /
 101 'EXST1'   1   0.02000      0.02620     -0.0270      0.00000
       0.00000       400.00      0.00000       7.0000      -7.2000
       0.00000      0.00000       1.0000    /
 101 'IEEEG3'  1   0.30000      0.40000E-01  0.10000     -0.10000
        1.0600      0.10000E-01  0.50000E-01  0.29300       5.5000
        1.1000      0.50000       1.0000       1.5000       1.0000    /
/
```

```
/      Churchill Falls Unit A2
/
 102 'GENSAL'  2     8.0000      0.71000E-01  0.25000       3.8070
        0.0000       1.0000       0.62000      0.28000      0.22000
       0.14000      0.19100      0.46400    /
 102 'IEEEST'  2 4      0         0.00000      0.00000      0.00000
       0.00000      0.00000      0.00000      0.00000      1.00000
       0.10000       1.0000       1.0000      0.08000      3.50000
       0.10000     -0.15000      0.00000      0.00000    /
 102 'EXST1'   2   0.02000      0.02620     -0.0270      0.00000
       0.00000       400.00      0.00000       7.0000      -7.2000
       0.00000      0.00000       1.0000    /
 102 'IEEEG3'  2   0.30000      0.40000E-01  0.10000     -0.10000
        1.0600      0.10000E-01  0.50000E-01  0.29300       5.5000
        1.1000      0.50000       1.0000       1.5000       1.0000    /
/
```

```
/      Churchill Falls Unit A3
/
 103 'GENSAL'  3    8.0000       0.71000E-01  0.25000       3.8070
        0.0000       1.0000      0.62000      0.28000      0.22000
       0.14000      0.19100      0.46400    /
 103 'IEEEST'  3 4      0        0.00000      0.00000      0.00000
       0.00000      0.00000      0.00000      0.00000      1.00000
       0.10000       1.0000       1.0000      0.08000      3.50000
       0.10000     -0.15000      0.00000      0.00000    /
 103 'EXST1'   3   0.02000      0.02620      -0.0270      0.00000
       0.00000       400.00      0.00000       7.0000      -7.2000
       0.00000      0.00000       1.0000    /
 103 'IEEEG3'  3   0.30000      0.40000E-01  0.10000     -0.10000
        1.0600      0.10000E-01  0.50000E-01  0.29300       5.5000
        1.1000      0.50000       1.0000       1.5000       1.0000    /
/
/      Churchill Falls Unit A4-A11
/
 9400 'GENSAL'  2    8.0000       0.71000E-01  0.25000       3.8070
        0.0000       1.0000      0.62000      0.28000      0.22000
       0.14000      0.19100      0.46400    /
 9400 'IEEEST'  2 4      0        0.00000      0.00000      0.00000
       0.00000      0.00000      0.00000      0.00000      1.00000
       0.10000       1.0000       1.0000      0.08000      3.50000
       0.10000     -0.15000      0.00000      0.00000    /
 9400 'EXST1'   2   0.02000      0.02620      -0.0270      0.00000
       0.00000       400.00      0.00000       7.0000      -7.2000
       0.00000      0.00000       1.0000    /
 9400 'IEEEG3'  2   0.30000      0.40000E-01  0.10000     -0.10000
        1.0600      0.10000E-01  0.50000E-01  0.29300       5.5000
        1.1000      0.50000       1.0000       1.5000       1.0000    /
/


/     Wabush Synchronous Condenser SC1
/
 223 'GENROU'  1    10.000       0.25000E-01   1.2800       0.64000E-01
        1.8000       0.0000       1.5860       1.1800       0.29000
       1.18000      0.18000      0.14600      0.18000      0.70800    /
 223 'IEEET1'  1   0.00000E+00   200.00      0.10000      5.85000
      -5.85000     -0.17000      0.95000      0.40000E-01   1.0000
       0.00000E+00   5.6250      0.22000       7.5000      0.95000    /
/


/      Wabush Synchronous Condenser SC2
/
 224 'GENROU'  1    10.000       0.25000E-01   1.2800       0.64000E-01
        1.8000       0.0000       1.5860       1.1800       0.29000
       1.18000      0.18000      0.14600      0.18000      0.70800    /
 224 'IEEET1'  1   0.00000E+00   200.00      0.10000      5.85000
      -5.85000     -0.17000      0.95000      0.40000E-01   1.0000
       0.00000E+00   5.6250      0.22000       7.5000      0.95000    /
```

```
/
/     Happy Valley Gas Turbine - Synchronous Condenser Operation
/
 137 'GENROU'  1    10.700      0.50000E-01   3.2000      0.50000E-01
        1.7377       1.0000       1.9300       1.7700       0.21300
       0.3050       0.15800      0.12200      0.18430      0.64710    /
 137 'IEEET2'  1   0.22000E-01  5166.0       0.10000      37.422
       0.00000      1.00000E+00  1.00000      0.13000E-01   0.6000
       1.00000       1.4800      0.10810       1.8500      0.55160    /
/



/     Muskrat Falls G1-G4
/
 9300 'GENSAL'  1     7.4100      0.70000E-01  0.07000       4.1000
        0.0000       1.0270      0.55900      0.34000      0.25400
       0.15000      0.08600      0.29300    /
 9300 'IEEEST'  1 4      0        0.00000      0.00000      0.00000
       0.00000      0.00000      0.00000      0.00000      1.00000
       0.10000       1.0000       1.0000      0.08000      3.50000
       0.10000     -0.15000      0.00000      0.00000    /
 9300 'EXST1'   1   0.02000      0.04710      -0.0476      0.00000
       0.00000       400.00      0.00000      12.3000     -12.7000
       0.00000      0.00000       1.0000    /
 9300 'HYGOV'   1   0.50000E-01  0.44000       4.7600      0.30000E-01
       0.10000      0.10000       1.0000      0.00000       1.1900
        1.0400      0.00000      0.80000E-01/
/


/     Montagnais G1
/
 280 'GENSAL'  1    8.0000      0.71000E-01  0.25000       3.8070
        0.0000       1.0000      0.62000      0.28000      0.20000
       0.14000      0.19100      0.46400    /
 280 'IEEEST'  1 4     0        0.00000      0.00000      0.00000
       0.00000      0.00000      0.00000      0.00000      1.00000
       0.10000       1.0000       1.0000      0.08000      3.50000
       0.10000     -0.15000      0.00000      0.00000    /
 280 'EXST1'   1   0.02000      0.02620      -0.0270      0.00000
       0.00000       400.00      0.00000       7.0000      -7.2000
       0.00000      0.00000       1.0000    /
 280 'IEEEG3'  1   0.30000      0.40000E-01  0.10000     -0.10000
        1.0600      0.10000E-02  0.50000E-01  0.29300       5.5000
        1.1000      0.50000       1.0000       1.5000       1.0000    /
/
```

CONFIDENTIAL (Attachments Only)

Request IR-2:

With respect to Section 3.2.11, please provide the reports summarizing the system planning studies undertaken by Nalcor and NSPML in support of the Maritime Link Project including those for the Newfoundland system and the Nova Scotia system. Specifically those studies that:

(a) identify the need for the proposed transmission system reinforcements in Newfoundland and Nova Scotia to support of the Maritime Link,

(b) evaluate the alternatives for meeting the above need,

(c) defend the selection of the proposed transmission system additions,

(d) confirm that the Newfoundland system is adequate to reliably deliver 500 MW to the Nova Scotia end of the Maritime Link,

(e) confirm that the Nova Scotia system is adequate to reliably absorb 500 MW of incoming power from the Maritime Link and deliver that power for consumption in Nova Scotia or wheel it through to the Nova Scotia - New Brunswick intertie.

Response IR-2:

(a-b) Please refer to McMaster IR-2 Confidential Attachments 1 and 2. The addition of a new 230 KVac transmission line between Bottom Brook and Granite Canal was identified in system studies which contemplate various operating conditions on the island of Newfoundland. The new line is required to alleviate the effects of transfers of 250 MW firm associated with the Maritime Link, without the Maritime Link there is no requirement for the line.

CONFIDENTIAL (Attachments Only)

(c) Please refer to McMaster IR-2 Confidential Attachments 1 and 2, and UARB IR-24 and IR-28.

(d) Please refer to McMaster IR-2 Confidential Attachment 2.

(c) Please refer to McMaster IR-2 Confidential Attachments 1 and 2. Please note that the study was completed on the basis of 170 MW staying in Nova Scotia and 330 MW flowing through, not on the basis of 500 MW being absorbed in Nova Scotia. The study is currently being updated based on updated system status and changes to the Transmission Service Request queue. For modeling purposes of the Maritime Link alternative, only 300 MW of transfers from the Maritime Link were permitted to remain in Nova Scotia at this time.

McMaster IR-2 Attachment 1 has been removed due to confidentiality.

UARB-McMaster IR-2 Attachment 2 has been removed due to confidentiality.

CONFIDENTIAL (Attachment only)

Request IR-3:

With respect to Section 3.2.11 please provide bus level single-line drawings for the Granite Canal, Bottom Brook, and Woodbine Substations for after the Maritime Link is built.

Response IR-3:

Single line drawings for Granite Canal, Bottom Brook, and Woodbine Substations attached.

UARB-McMaster IR-3 Attachment 1 has been removed due to confidentiality.

CONFIDENTIAL (Attachment Only)

Request IR-4:

With respect to Section 6, please provide the twenty year (preferably 35 years if available) generation development/retirement plan for Nova Scotia with and without the Maritime Project. The plan should include all existing generation and planned additions/reinforcements, identifying the year in which the generator was built, the fuel type, heat rates, ramp rates, any significant operating constraints and planned year of retirement.

Response IR-4:

Please refer to CanWEA IR-1 for the complete list of NS Power and Independent Power Producers (IPP) generating units.

Please refer to the Maritime Link Application, Appendix 6.06, pages 1 and 4, for the system resource plans.

Please refer to NSUARB IR-100 for unit retirement forecasts.

Please refer to Confidential Attachment 1 and CA IR-36 Confidential Attachment 2 for unit fuel types, heat rates, ramp rates, and operating restrictions.

Not all of the assumptions presented here were used in the development of the analysis in Section 6.

UARB-McMaster IR-4 Attachment 1 has been removed due to confidentiality.

NON-CONFIDENTIAL

Request IR-5:

With respect to Section 6, please provide a 20 year load forecast (preferably 35 years if available) both peak demand and energy) for Nova Scotia for a baseload, high growth, low growth and the expected impact of planned demand side management programs.

Response IR-5:

The long term load forecast values used in preparation of the Application for energy and capacity including DSM effects values are on page 6 of Appendix 6.03.

NON-CONFIDENTIAL

Request IR-6:

In Section 6.1.4 it is asserted that the Maritime Link proposal provides "enhanced reliability" over other alternatives - please describe how this determination was made and explain the conclusion.

Response IR-6:

The Maritime Link provides enhanced reliability over the other alternatives because it is the only option that provides Nova Scotia with a second interconnection at the opposite end of the province. This diversifies the options for Nova Scotia to acquire energy, capacity, reserve and other system attributes. In addition, the Maritime Link enables the interconnection between NS and NB to be enhanced without any additional capital requirement because the energy flowing from the east out of NS allows for increase energy to flow back into NS from the northeastern connection due to the physical nature of electricity flow. Only the Maritime Link provides this enhanced reliability.

NON-CONFIDENTIAL

Request IR-7:

In Section 6.1.4 it is asserted that the Maritime Link proposal "strengthens Nova Scotia's connection to the North American grid" over other alternatives - please describe how this determination was made and explain the conclusion.

Response IR-7:

Each alternative includes capital investments which alter the interconnectivity of NS, but only the Maritime Link provides a second route to access a new market. Even with a reinforced or second interconnection between NS-NB, there is negligible benefit from a strengthening perspective when compared to a connection to a new market.

Through the Maritime Link, a second connection completes the electrical loop through Newfoundland and Labrador, Quebec and New Brunswick. For Nova Scotia customers, this means NS Power will be able to purchase energy from a variety of markets through either the ML or the NS-NB intertie. Please refer to Liberal IR-29.

NON-CONFIDENTIAL

Request IR-8:

In Section 6.1.4 it is asserted that the Maritime Link proposal "supports the development of additional intermittent energy resources in Nova Scotia" over other alternatives - please describe how this determination was made and explain the conclusion.

Response IR-8:

Please refer to SBA-IR 2.

CONFIDENTIAL (Attachments Only)

Request IR-9:

With respect to Section 6.2.6 please provide geographic maps of the major transmission systems and major generating facilities in New Brunswick, Nova Scotia, Newfoundland (island only), Quebec and Maine.

Response IR-9:

The Major Facility Map for Quebec is posted on-line at: http://www.hydroquebec.com/transenergie/en/pdf/carte_reseau.pdf

The Major Facility Map for New England (including Maine) is posted on-line at: http://www.iso-ne.com/nwsiss/grid_mkts/key_facts/iso-geo-diagram-2012-final-non-ceii.pdf

The Nova Scotia Power Inc. System Operating Map including Generating Stations and Transmission Lines is included as Confidential Attachment 1.

Please refer to Confidential Attachment 2 for the Newfoundland and Labrador Provincial Generation and Transmission Grid map.

Attachment 1 and Attachment 2 are confidential in accordance with NERC Reliability Standard CIP-002 R4:

> R4. Information Protection — The Responsible Entity shall implement and document a program to identify, classify, and protect information associated with Critical Cyber Assets.
>
> R4.1. The Critical Cyber Asset information to be protected shall include, at a minimum and regardless of media type, operational procedures, lists as required in Standard CIP-002-3, network topology or similar diagrams, floor plans of computing centers that contain Critical Cyber Assets, equipment layouts of Critical Cyber Assets, disaster recovery plans, incident response plans, and security configuration information.

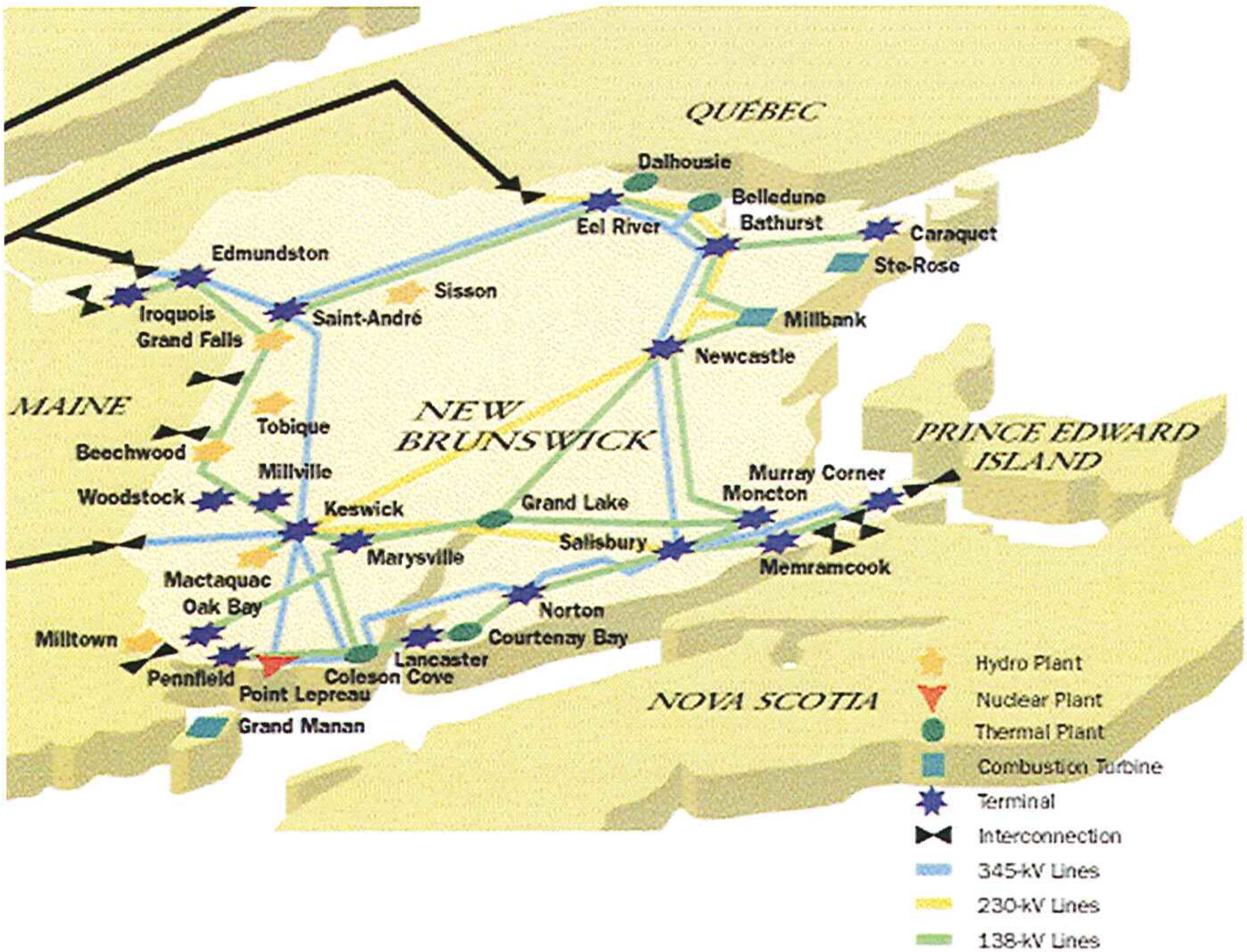
R4.2. The Responsible Entity shall classify information to be protected under this program based on the sensitivity of the Critical Cyber Asset information.

The New Brunswick Power system map is not publicly available. Please refer to Attachment 3 for a public 2001 New Brunswick Power system map, provided by WKM Energy.

UARB-McMaster IR-9 Attachment 1 has been removed due to confidentiality.

UARB-McMaster IR-9 Attachment 2 has been removed due to confidentiality.

NB Power System Map



Énergie NB Power

NON-CONFIDENTIAL

Request IR-10:

With respect to Section 6.2.6 please provide operating limits (Available Transfer Capacity) for the following interties for the interconnected systems after the Maritime Link is in-service:

(a) Nova Scotia and New Brunswick

(b) New Brunswick and Quebec

(c) New Brunswick and Maine.

Response IR-10:

(a) The scope of the SIS for Transmission Service Request 400 (TSR-400) was limited to studying the 330 MW Point to Point services between Nova Scotia and New Brunswick. Work to determine any remaining headroom on the Nova Scotia – New Brunswick interface above 330 MW was outside the scope of this study and was not performed.

(b) Current and historic ATC reports for the interconnection between New Brunswick and Quebec are available on the New Brunswick System Operator website at http://www.nbso.ca/Public/en/op/market/data/reports/default.aspx. Work to determine any remaining headroom on the New Brunswick – Quebec interface was outside the scope of the TSR-400 study and was not performed.

(c) Current and historic ATC reports for the interconnection between New Brunswick and Maine are available on the New Brunswick System Operator website at http://www.nbso.ca/Public/en/op/market/data/reports/default.aspx. Work to determine any remaining headroom on the New Brunswick – Maine interface was outside the scope of the TSR-400 study and was not performed.

NON-CONFIDENTIAL

Request IR-11:

With respect to Appendix 2.06, please provide an electronic copy of the Nova Scotia Power OA TT and, if available, a summary of the key elements of the OATT.

Response IR-11:

The most recent version of the OATT was filed as Appendix 13 of NS Power's 2013 General Rate Application Compliance filing and is available at the Board's public website under matter M04972:

http://www.nsuarb.ca/index.php?option=com_content&task=view&id=73&Itemid=82

NON-CONFIDENTIAL

Request IR-12:

With respect to Appendix 2.07, please provide a summary of them transmission rights held by Bayside Power on the New Brunswick Power electric system.

Response IR-12:

A summary of the transmission rights held by Bayside Power on the New Brunswick Power electric system is set out in Schedule 2 of the NBTUA, as follows:

(a) Description:

(Bayside Power L.P.) has access to firm point-to-point transmission service from the Bayside Generating Station to the NB-Maine border, connecting with the ISO-NE transmission system.

(b) Capacity Levels by Month:

Month	**Capacity (MW)**
April through October, inclusive	A minimum of 220 MW and a maximum of 260 MW

(c) Term:

The initial term of the Bayside Rights expires on March 31, 2021.

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(d) Renewal Rights:

At the end of the initial term of the Bayside Rights, [Bayside Power L.P.] has renewal rights for an additional five years to March 31, 2026. This renewal can be exercised by [Bayside Power L.P.] with no other approvals or consents required.

(e) Applicable Charges:

Per NB Tariff

(f) Procedure for Redirection:

Per NB Tariff

(g) Conditions of the Service to be Provided:

Per NB Tariff

See also SBA IR-130.

NON-CONFIDENTIAL

Request IR-13:

With respect to Appendix 2.08, please provide a summary of the Emera grandfathered transmission rights granted by MEPCO.

Response IR-13:

The MEPCO grandfathered transmission rights arise out of grandfathered transmission service agreements identified as TSA-MEPCO-4-1 and TSA-MEPCO-4-2 at Attachment H to Section II of the ISO-NE OATT (MGTSAs). The ISO-NE OATT provides that the MGTSAs have transmission priority for the purposes of scheduling and curtailment of real-time external transactions between New Brunswick and the New England control area. The MGTSAs may be renewed and may be sold, transferred, or assigned to other "Eligible Customers" (as that term is defined in the ISO-NE OATT). The rights applicable to the MGTSAs are more particularly set forth in Sections II.44 and II.45 of the ISO-NE OATT.