



CONNECTION ASSESSMENT & APPROVAL PROCESS

ASSESSMENT SUMMARY

Applicant: Falconbridge Limited

Project: Nickel Rim Mine Substation

CAA ID No. 2003-EX174

***Long Term Forecasts & Assessments Department
Consistent Information Set Department***

Date: 20th November 2003

ASSESSMENT SUMMARY

FALCONBRIDGE LIMITED

Nickel Rim Mine Substation

1. Introduction

Falconbridge Limited has proposed that the existing idle section of the 115kV circuit, S6F, between Falconbridge Junction and the old INCO Victor Mine, be used to supply their new Nickel Rim Mine Project. This would involve a new tap, approximately 0.3km in length, connected to the existing line at a point approximately 13km from Falconbridge Junction.

The initial load at the mine is expected to be 4MW (at a power factor of 0.90), increasing to an ultimate value of approximately 17MW (at a power factor of 0.95).

The scheduled in-service date for the new substation is September 2004.

2. Existing Facilities Supplied from 115kV Circuit S6F

The 115kV circuit, S6F, presently supplies the following loads from Martindale TS, as shown in Diagram 1:

- Falconbridge No.1 Substation
- Falconbridge Smelter No. 3 Substation, and

The present peak load is approximately 67MW, with an approximate distribution of 25% : 75% between the No. 1 Substation and the Smelter.

3. Alternative Supply

An assessment of an alternative supply arrangement for the existing loads was undertaken earlier this year and a Report issued on 26th May 2003 - CAA Reference No. 2003-EX131. Approval for the proposed temporary connection modification was also given on that date.

Diagram 2 shows the arrangement that was approved for use when the section of circuit S6F between Martindale TS and Falconbridge Junction is unavailable.

This temporary arrangement would involve obtaining a supply via the idle section of the 25Hz circuit T2R from the 115kV circuit S5M. Circuit T2R would then be connected to the idle section of circuit S6F at the point where the two circuits cross. This idle section of circuit S6F was originally used to supply the Victor Mine from Falconbridge Junction.

It is now proposed to use this idle section of circuit S6F to supply the Nickel Rim Mine.

Included within the scope of this assessment is a review of the temporary supply arrangement on to circuit S5M to determine whether the earlier approval would remain valid once the new connection for the Nickel Rim Mine has been completed.

4. Proposed Connection Arrangement for the Nickel Rim Mine Supply

Diagram 3 shows the arrangement that has been proposed for establishing a supply to the new Nickel Rim Mine development.

The principal features are as follows:

- A 115kV disconnect switch, together with a set of surge arresters, at the connection point of the tapped circuit on to the new 115kV busbar at the mine.
- Two 15/20/25MVA step-down transformers, with each transformer equipped with a 600A 115kV circuit-switcher and a 1200A 13.8kV circuit breaker.
- The 13.8kV busbar is to be equipped with a 13.8kV bus-tie circuit breaker that is to be operated normally-closed.
- A total of 14 LV feeders are to be connected to the 13.8kV busbar.

5. Comments on the Proposed Connection Arrangement

Equipment Voltage Ratings:

Appendix 4.1 of the Market Rules details the voltage variation that equipment connected to the 115kV system must be able to accommodate.

For the majority of the system, this range is 127kV to 113kV. However, for northern Ontario, equipment has to be able to accommodate a maximum voltage of 132kV.

Clause 7.1.1 of Section 7 and Clause 1.1.2 of Schedule H in Appendix 1 of the Transmission System Code both state that:

Transformers shall have adequate under-load tap-changers to operate continuously within normal variations of the transmission system, as set out in the Market Rules (i.e. 132kV to 113kV), and to operate with a further transmission voltage variation of $\pm 6\%$ in emergencies.

Diagram 4 shows the voltage variation experienced at Martindale TS for a typical month (in this case August 2002).

Further variations in voltage are expected to occur at the Nickel Rim Mine as a result of operating at different load levels. This is discussed later.

Connection Arrangement

Should Falconbridge want to retain the capability to take a limited emergency supply from circuit S5M via the 'idle' section of the 25Hz circuit T2R then additional mid-span openers would need to be installed in circuit T2R at the junction point of circuits S6F and T2R, as shown in Diagram 5.

It would also seem prudent to include mid-span openers at this junction point in the 13km section of circuit S6F that is to supply the Nickel Rim Mine. This would facilitate the return to service of the sections of circuit S6F that supply the Falconbridge No.1 Substation and the Falconbridge Smelter No. 3 Substation whenever the section of circuit S6F to the Nickel Rim substation has to be removed from service.

6. Thermal Ratings for Circuit S6F

The thermal ratings for the various sections of circuit S6F are given in the following Table:

Thermal Ratings for Circuit S6F				
<i>Section</i>	<i>Conductor</i>	<i>Length</i>	<i>Continuous Rating at 93°C 30°C ambient: 4km/hr wind</i>	
Martindale TS to Falconbridge Junction	1277.5kcmil	8.7km	1060A	220MVA
Falconbridge Junction to Falconbridge No. 1 S/S	211.6kcmil	2.4km	350A	73MVA
Falconbridge Junction to Falconbridge Smelter No. 3 S/S	1192.5kcmil	3.5km	1110A	231MVA
Falconbridge Junction to INCO Victor Mine	336.4kcmil	15.3km	500A	104MVA

7. Assessment

Load flow studies were performed for a limited number of operating conditions and the results have been summarised in the following Table and in the accompanying Diagrams:

<i>Operating Condition</i>	<i>Flow on Circuit S6F from Martindale TS</i>	<i>Voltages</i>		<i>Diagram No.</i>
		<i>Martindale TS</i>	<i>Nickel Rim Substation</i>	
1. Peak Load Condition	95.0MVA	124.5kV	121.9kV	6
2. Light Load Condition (25%)	23.1MVA	126.3kV	125.8kV	7
3. Peak Load Condition, with a reduced 115kV voltage at Martindale TS	95.2MVA	121.3kV	118.6kV	8

Voltage Variation

For the limited range of studies that were performed, the voltage at the Nickel Rim Substation has been shown to vary from 118.6kV to 125.8kV. In practice, this variation is expected to be greater in response not only to the variation in the voltage at Martindale TS, but also to the load at the Falconbridge facilities supplied from circuit S6F.

Circuit Loadings

The maximum loading on the section of circuit S6F between Martindale TS and Falconbridge Junction is shown to be approximately 95MVA. This would well below the 220MVA continuous rating for this section.

Similarly, the loading on the remaining, radial sections would be equivalent to the respective load at the terminal facility including the associated losses:

- Falconbridge Smelter No. 3 Substation \approx 55MVA
- Falconbridge No. 1 Substation \approx 20MVA
- Nickel Rim Mine Substation \approx 20MVA

These transfers would all be within the continuous ratings of the respective sections of circuit S6F.

Emergency Supply

As mentioned in the Assessment Summary for an Alternative Supply to Falconbridge No. 1 Substation: Reference No. 2003-EX131, the ratings for those critical sections of circuits S5M and T2R that would be used to provide the emergency supply are as follows:

<i>Thermal Ratings for Circuits S5M & T2R</i>					
<i>Section</i>		<i>Conductor</i>	<i>Length</i>	<i>Continuous Rating at 93°C 30°C ambient: 4km/hr wind</i>	
<i>S5M</i>	Martindale TS to McCrea Junction	795kcmil	8.7km	850A	177MVA
	McCrea Junction to Onaping Junction	795kcmil	29.6 km	850A	177MVA
<i>T2R</i>	Bleazard Valley Junction to Junction of S6F & T2R	211.6kcmil	21km	260A	54MVA

Diagram 9 shows the results of a load flow study with circuit S5M supplying a load of approximately 50MVA, which corresponds to the present peak loading on this circuit. The loads at the various Falconbridge facilities supplied from circuit S6F have been reduced to approximately half their peak values, as follows:

- Falconbridge No. 1 Substation 8.4MW 4.2MVAr
- Falconbridge No. 1 Substation 25.0MW 11.4MVAr
- Nickel Rim Mine 8.5MW 3.0MVAr

The corresponding flows on circuits S5M and T2R are shown as 107MVA and 48MVA, respectively. These would be within the respective continuous ratings of 177MVA and 54MVA for these two circuits.

The minimum voltages that were recorded were 115.6kV at Falconbridge No. 1 Substation and 117.5kV at Larchwood TS. While these are both above the minimum voltage of 113kV specified in the Market Rules, it should be noted that these voltages correspond to a relatively high voltage of 125.3kV at Martindale TS.

Therefore, should Falconbridge decide to have the temporary connection on to circuit S5M restored for use during planned outages involving the section of circuit S6F between Martindale TS and Falconbridge Junction, *then as long as the voltage at Martindale TS can be maintained above 125kV*, it should be possible to supply a load of approximately 50MVA at the Falconbridge facilities (effectively limited by the continuous rating of circuit T2R). The study has shown that this amount of load could be supplied while still supplying the peak loads on circuit S5M.

However, with lower voltages at Martindale TS it would only be possible to supply a load of approximately 50MVA at the Falconbridge facilities if the loading on circuit S5M were to be reduced, possibly by transferring some of the loads on this circuit to circuit S2B.

Since the temporary connection on to circuit S5M would allow a significant amount of load to be supplied at the Falconbridge facilities under outage conditions, there would therefore appear to be some merit in installing facilities at Falconbridge Junction that would facilitate the restoration of the temporary connection and also limit any disruption of the supply to the Falconbridge loads while the connection is being restored.

The IMO therefore recommends that consideration be given to the installation of new mid-span openers at Falconbridge Junction in the following line sections:

- The section of circuit T2R to Blezard Junction
- The section of circuit S6F to the Nickel Rim Mine Substation

8. Victor Mine

Throughout this assessment it has been assumed that the connection to the original Victor Mine will continue to remain idle.

Should there be any plans to recommence operations at the Victor Mine, then this would need to be the subject of a new connection assessment.

9. IMO Requirements for Connection

The IMO's requirements for the proposed connection are as follows:

1. All equipment installed at the Nickel Rim Mine Substation must be suitable for continuous operation at 132kV. Reference 2 of Appendix 4.1 of the Market Rules
2. The step-down transformers installed at the Nickel Rim Mine Substation must be suitable for operation over a voltage range of 132kV to 113kV, as defined in the Market Rules.
[This is expected to require the use of under-load tap-changers as stipulated in Clause 1.1.2 of Schedule H of the Transmission System Code, which is administered by the Transmitter (in this case, Hydro One).]
3. The new supply point is to be equipped with an automatic under-frequency load-shedding scheme.
This scheme is to have the capability to reject up to 35% of the load supplied from the new facility in response to a declining system frequency. The appropriate settings for the under-frequency load-shedding scheme will be provided by the IMO prior to commissioning of the new facilities.
Reference 2 of Appendix 4.3 of the Market Rules
[Alternatively, an equivalent amount of load at the other Falconbridge facilities supplied from circuit S6F could be included in the scheme.]
4. The load at the Nickel Rim Mine Substation must be maintained at a power factor of at least 0.90 (lagging) when measured at the high voltage side of the step-down transformers.
Reference 1 of Appendix 4.3 of the Market Rules.

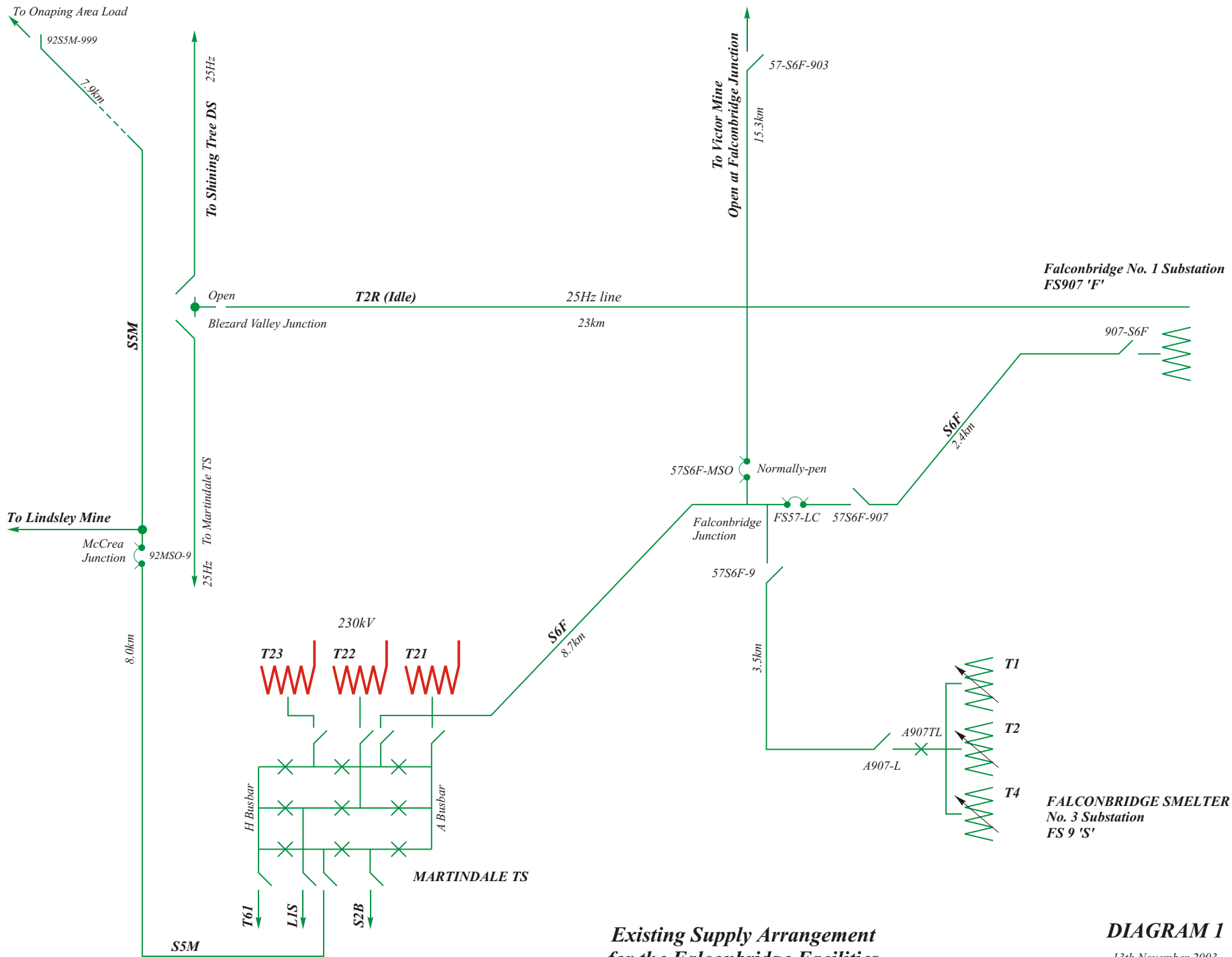
10. Customer Impact Assessment

Hydro One has notified the IMO that since the only customer who would be affected by the new connection would be the proponent, Falconbridge Limited, a Customer Impact Assessment will not be required for this Project.

11. Notification Of Approval

Since it has been determined that the proposed facility will have no adverse impact on the IMO-controlled grid, subject to the implementation of all of the specified IMO requirements, it is therefore recommended that a Notification of Approval of the Connection Proposal be issued.

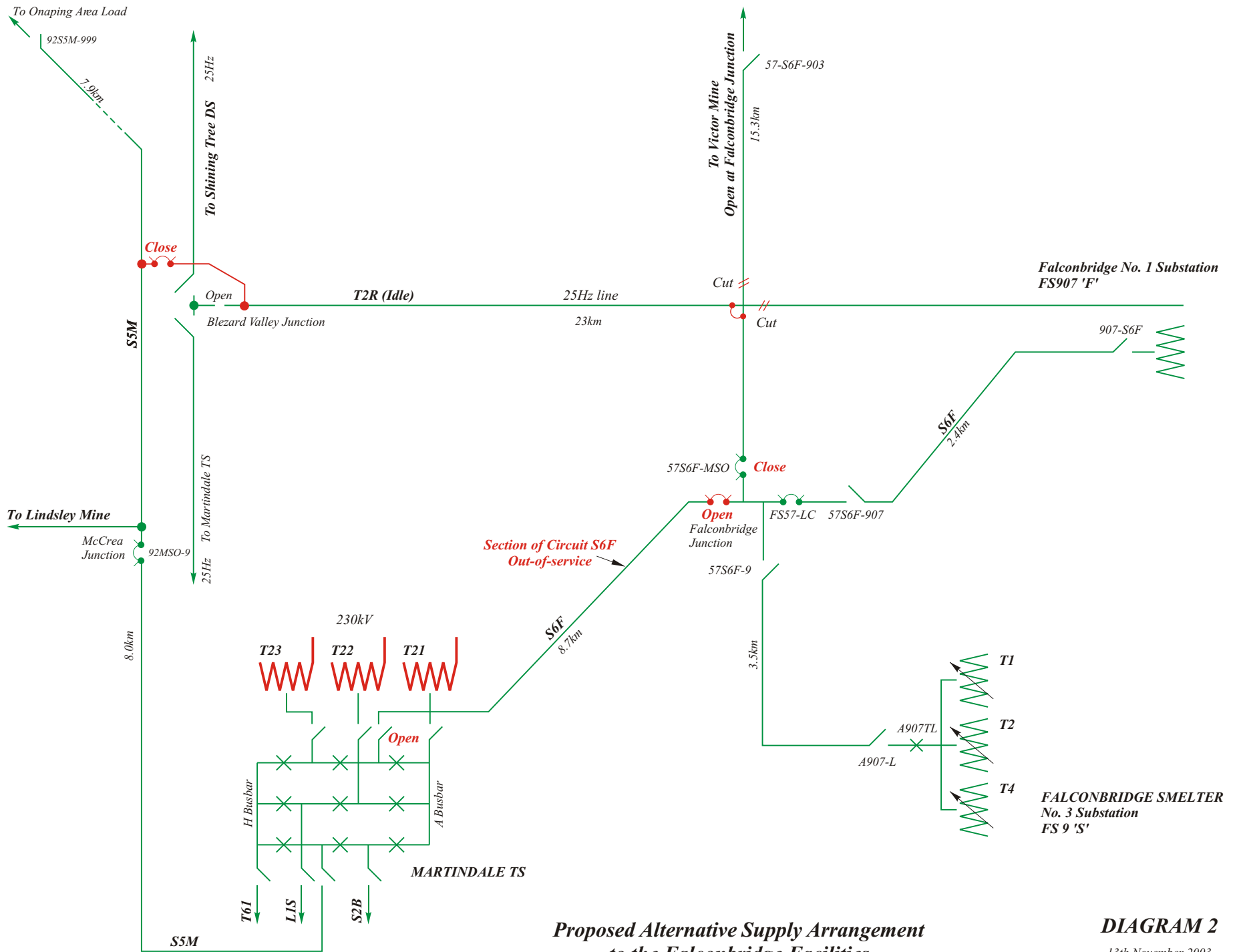
It has also been determined that the work that is now being proposed for the connection of the Nickel Rim Mine would not be invalidate the approval for the temporary connection on to circuit S5M, using the idle section of circuit T2R.



**Existing Supply Arrangement
for the Falconbridge Facilities**

DIAGRAM 1

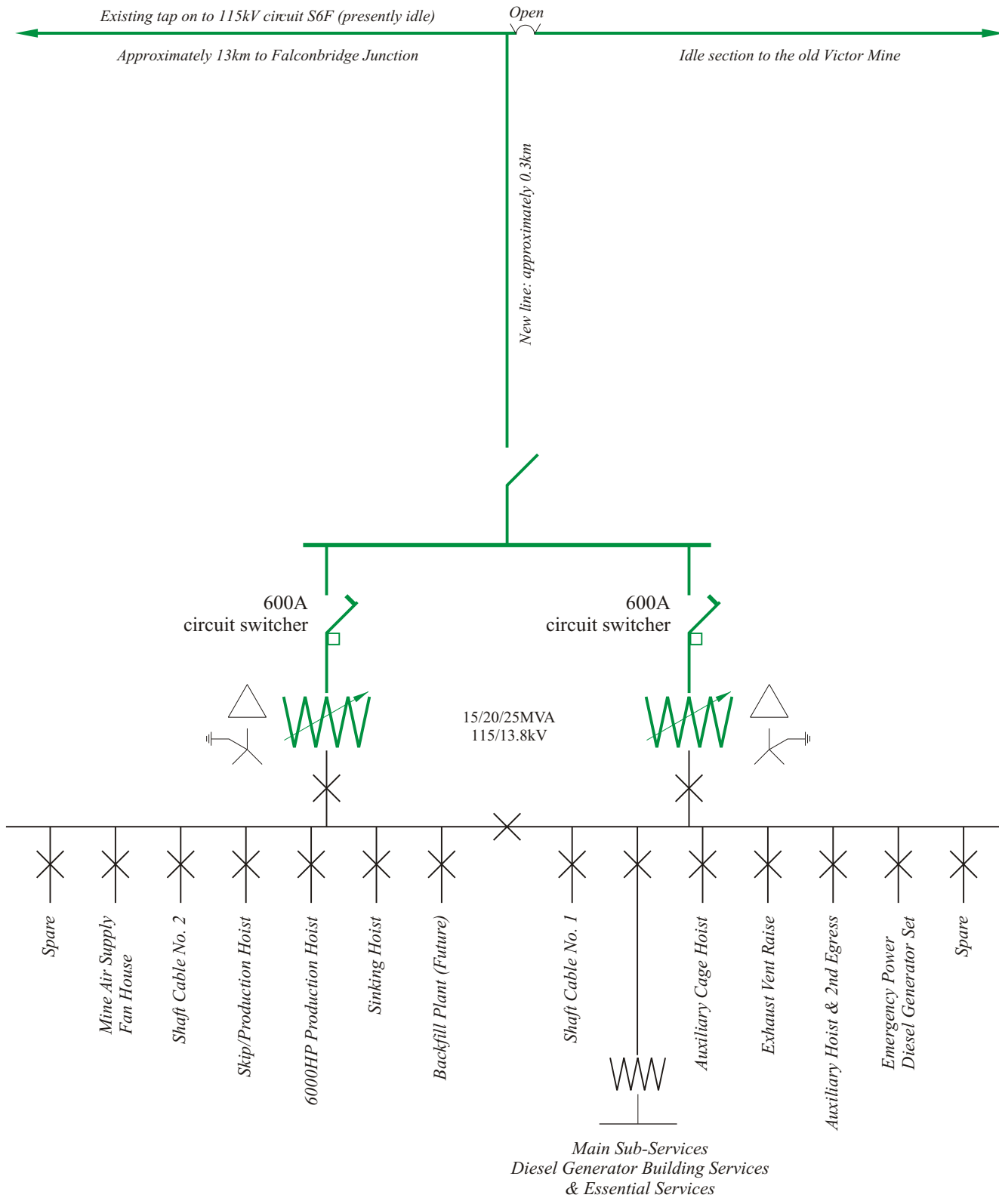
13th November 2003



**Proposed Alternative Supply Arrangement
to the Falconbridge Facilities**

DIAGRAM 2

13th November 2003



Proposed Arrangement for the Nickel Rim Substation

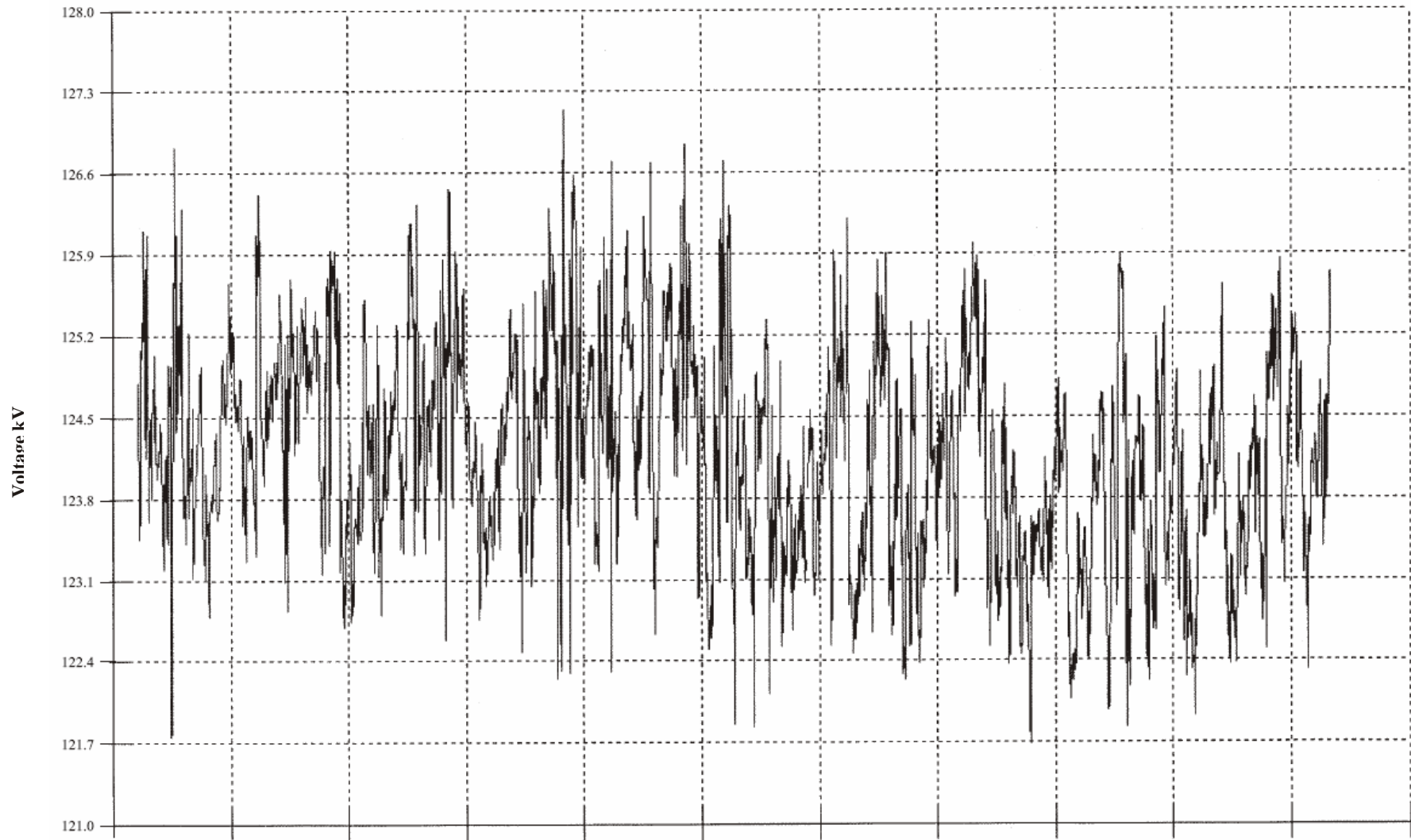
DIAGRAM 3

13th November 2003

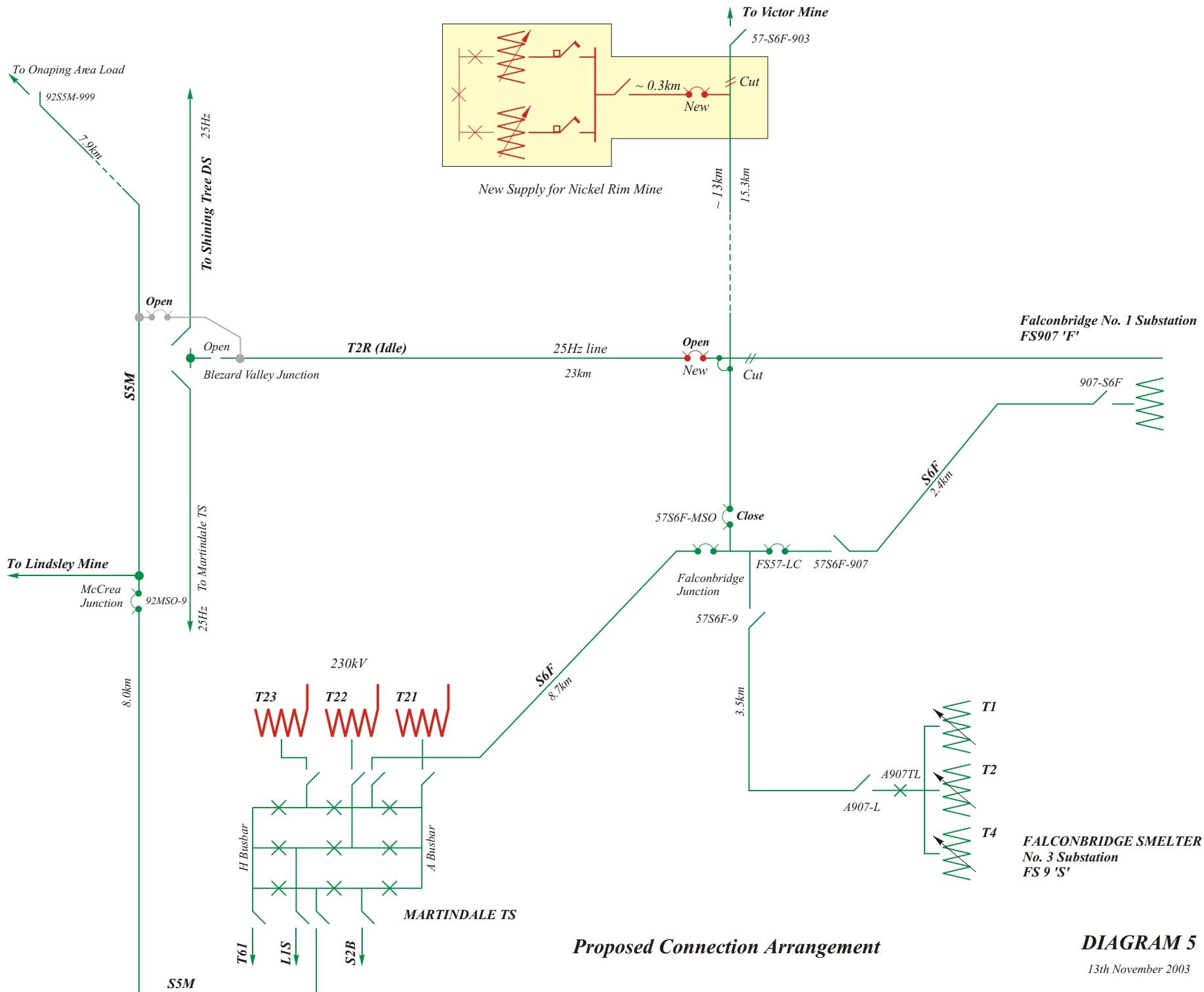
MARTINDALE TS: 115kV BUSBAR VOLTAGE

1st August 2002 00:00 to 31st August 2002 23:59

Max. Value = 127.59kV Min. Value = 121.06kV Mean Value = 124.17kV Standard Deviation = 0.89



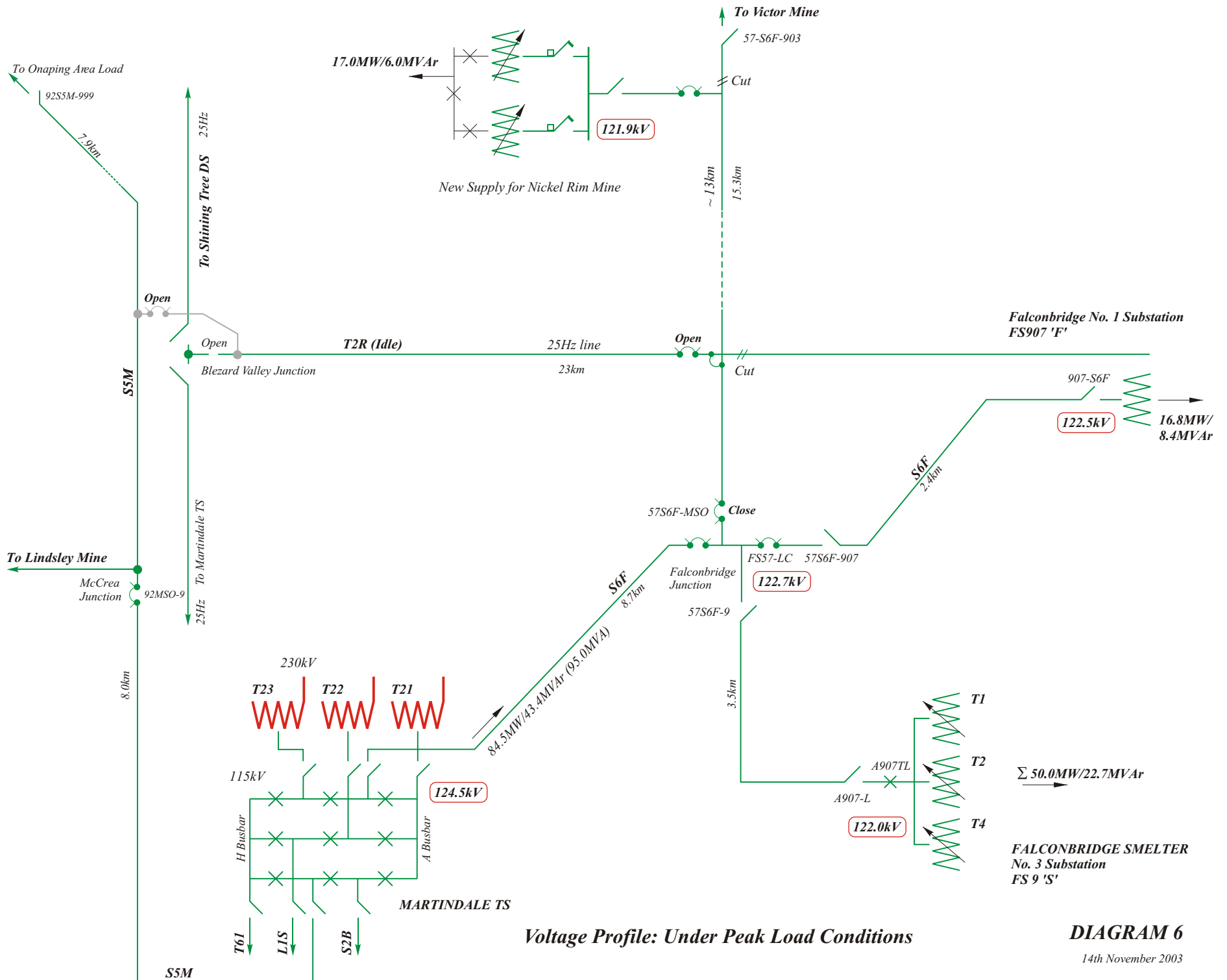
August 2002



Proposed Connection Arrangement

DIAGRAM 5

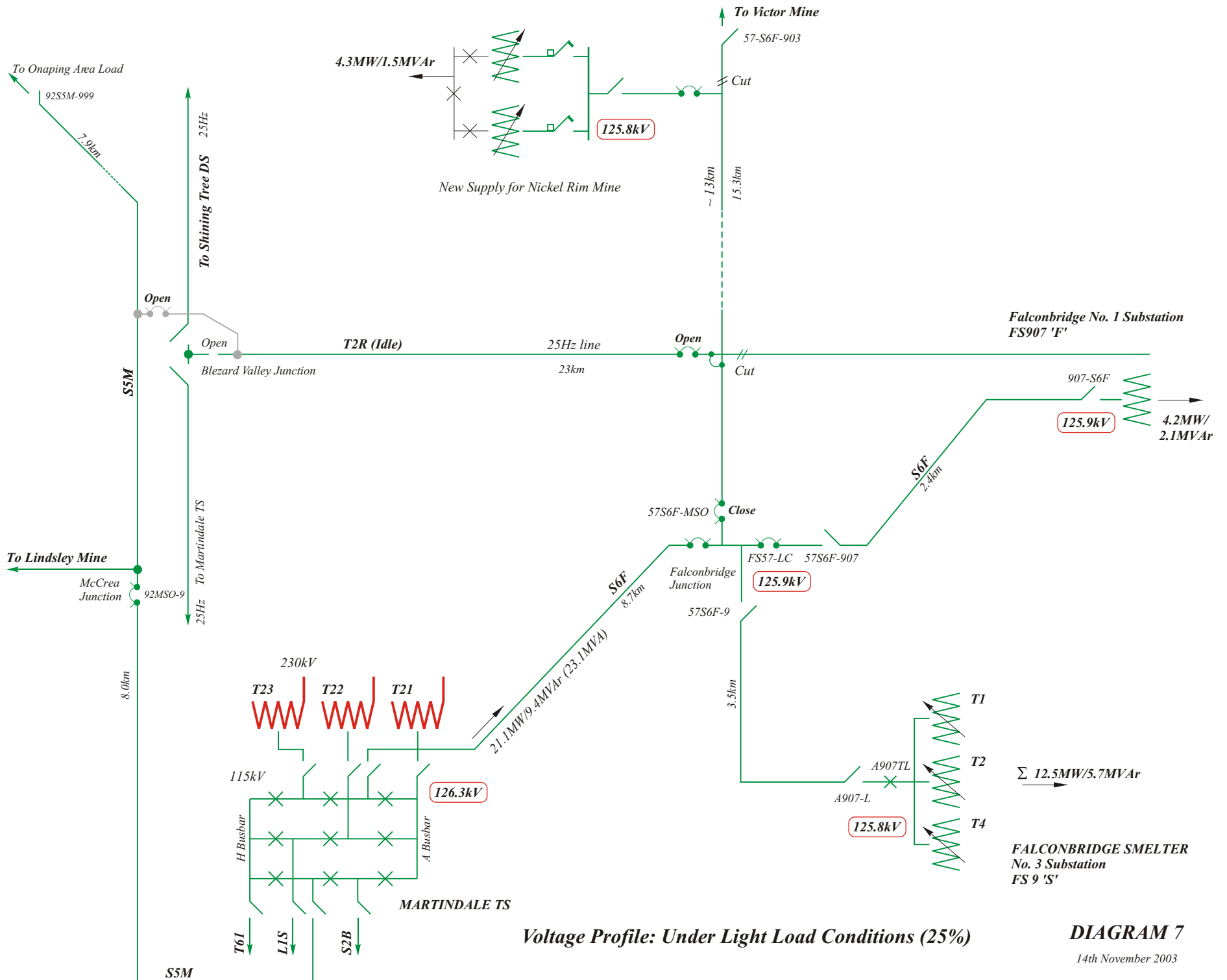
13th November 2003



Voltage Profile: Under Peak Load Conditions

DIAGRAM 6

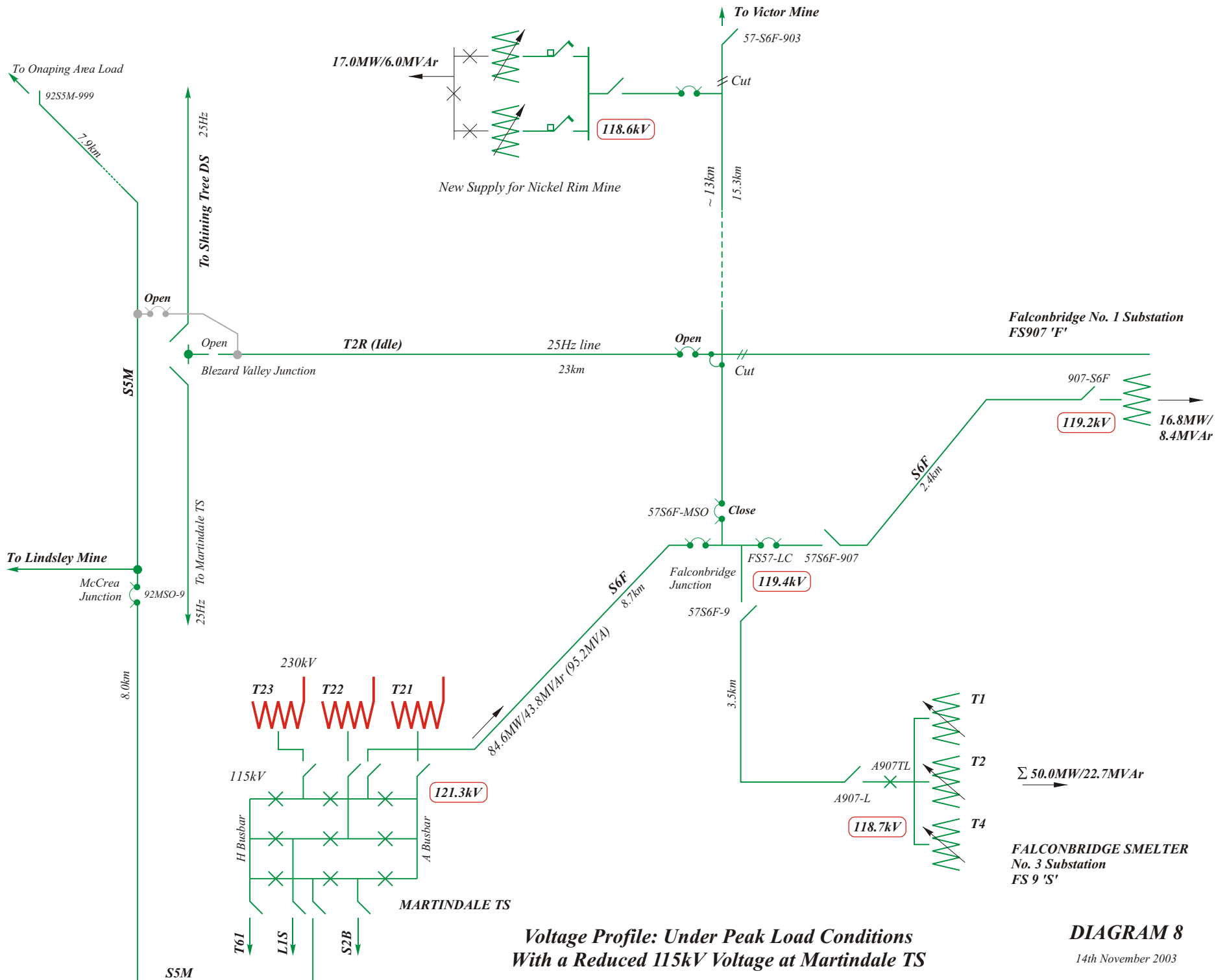
14th November 2003



Voltage Profile: Under Light Load Conditions (25%)

DIAGRAM 7

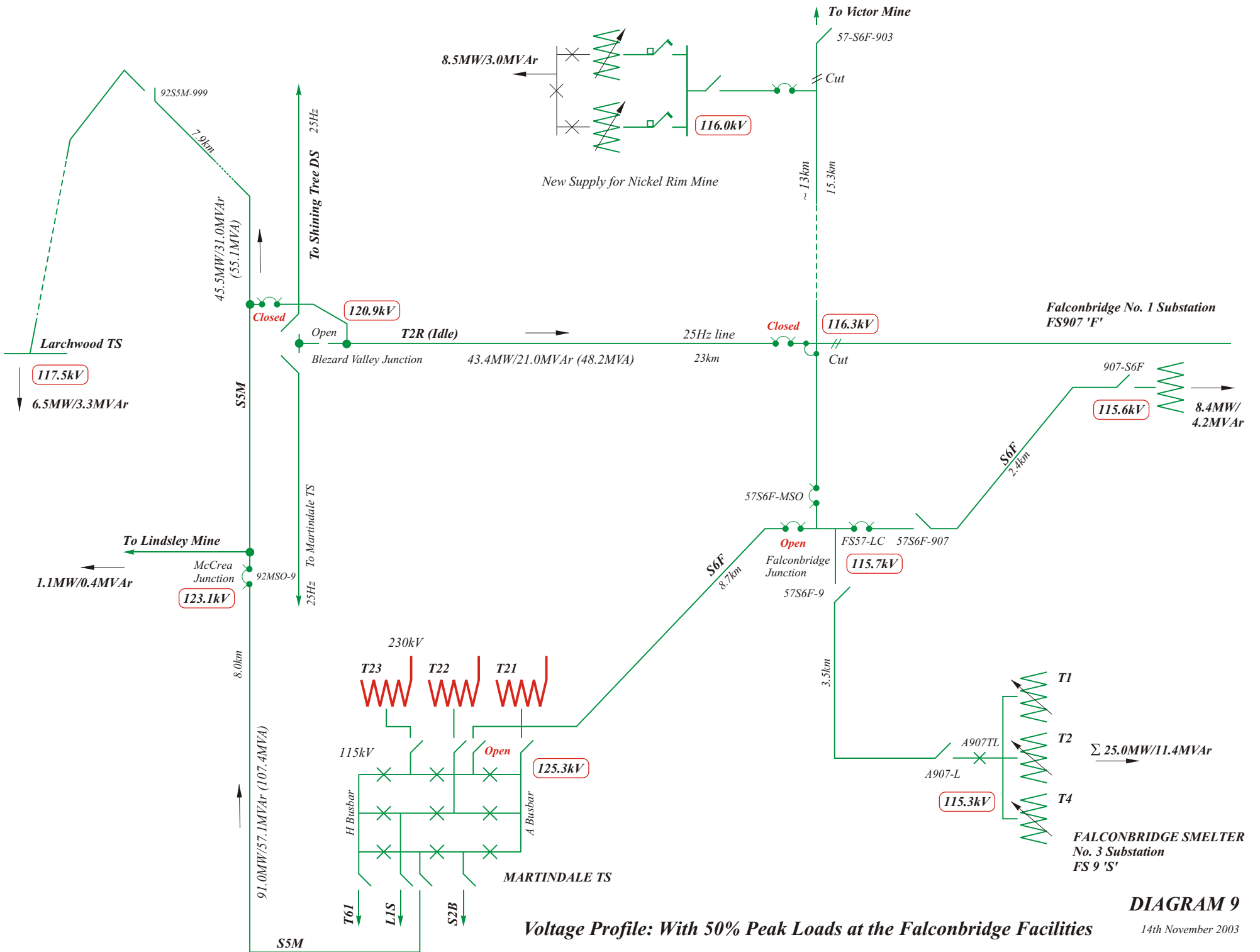
14th November 2003



**Voltage Profile: Under Peak Load Conditions
With a Reduced 115kV Voltage at Martindale TS**

DIAGRAM 8

14th November 2003



Voltage Profile: With 50% Peak Loads at the Falconbridge Facilities

DIAGRAM 9

14th November 2003