

CONNECTION ASSESSMENT & APPROVAL PROCESS

Preliminary Assessment Report For Jim Yarrow MTS

CAA ID 2000-026

Final Report

Long Term Forecasts & Assessments Department
Consistent Information Set Department

April 3, 2002

Preliminary Assessment Report

Jim Yarrow MTS

Acknowledgement

The IMO wished to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IMO

This report has been prepared solely for the purpose of assessing, on a preliminary basis, whether the connection applicant's proposed connection with the IMO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether a System Impact Assessment of the proposed connection should be conducted under Chapter 4, section 6 of the *Market Rules*. This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant, Hydro One and the IMO in accordance with Chapter 4, section 6 of the *Market Rules*. The IMO assumes no responsibility to any third party for any use which it makes of this report. Any liability which the IMO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the *Market Rules*. In the event that the IMO provides a draft of this report to the connection applicant, you must be aware that the IMO may revise drafts of this report at any time in its sole discretion without notice to you. Although the IMO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that it is using the most recent version of this report.

Hydro One

The results reported in this preliminary feasibility study are based on the information available to Hydro One Networks Inc., at the time of the study, suitable for a preliminary assessment of a new generation or load connection proposal.

The short circuit and thermal loading levels have been computed based on the information provided by the connection proponent at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed connection on facilities owned by other load and generation (including OPGI) customers.

In this preliminary feasibility study, short circuit adequacy is assessed only for Hydro One Networks Inc. breakers and does not include other Hydro One Networks Inc. facilities. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One Networks Inc. breakers and identifying upgrades required to incorporate the proposed connection. These results should not be used in the design and engineering of new facilities for the proposed connection. The necessary data will be provided by Hydro One Networks Inc. and discussed with the connection proponent upon request.

The ampacity rating of Hydro One Networks Inc. facilities are established based on assumptions used in Hydro One Networks Inc. for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades which are required to incorporate the proposed connection have been identified to the extent permitted by a preliminary assessment. Additional facility studies may be necessary to confirm constructability and the time required for construction. System impact or further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

Executive Summary

This Preliminary Assessment has examined the impact of a new proposed municipal transformer station, Jim Yarrow MTS, on the reliability of the IMO-controlled grid. This project was subject to an expedited Connection Assessment process and it is not required to undergo a System Impact Assessment.

Proposed Project

Hydro One Brampton Networks Inc. proposes to build a new 230/28/28kV Transformer Station with rated installed transformation of 2 x 75/125MVA. The planned station site is north of Steeles Ave. and west of Chinguacousy Rd. in the city of Brampton, Ontario. The new station will be used to supply 58.5 MW of residential and commercial load in the initial stage. The applicant did not provide an estimate of the ultimate station loading. Unless otherwise specified by the connection applicant, the studies will assume an ultimate station load equivalent to the maximum station capability. The target in-service data for the facility is April 2002.

Impact on System Reliability

This Preliminary Assessment examined the impact of connecting Jim Yarrow MTS to the 230 kV lines R19T and R21T, on the reliability of the IMO-controlled grid. The studies concluded that:

1. The addition of the new supply point does not have a significant effect on the short circuit current at Richview TS or the other transformer stations connected to these circuits.
2. For station loads equivalent to the historical non-coincident peaks and Jim Yarrow MTS loaded at 168 MVA, with all elements in service and under post contingency situations the line power flows are within the continuous ratings of the circuits.
3. For station loads equivalent to the station capabilities the power flow exceeds the continuous rating of one circuit for conditions of permanent outage to the companion circuit.
4. It is recommended that, as the load supplied from Pleasant MTS and Jim Yarrow MTS approaches a peak of 521 MVA, R19T/R21T line taps between Hanlan JCT. and Pleasant station be upgraded to a higher continuous rating. It may be required that other sections of these circuits also be upgraded to accommodate future load growth.
5. In view of guidelines for load supply reliability which state that area loads totaling more than 500 MW shall not be interrupted for a contingency involving a 2-circuit line, it is recommended that Hydro One Networks Inc. investigate plans for improving the availability of supply to this area loads.

IMO Requirements for Connection

This report concluded that Hydro One Brampton Network Inc. must provide the IMO with the following information as soon as it becomes available:

1. A confirmation that an underfrequency load shedding relay, which will have the capability of tripping up to 35% of the station load (12% at 59.3 Hz and additional 23% at 58.8 Hz) is to

be installed. Appropriate settings for the relay will be provided by the IMO prior to commissioning.

2. An estimate of the individual feeder loads for the next five years and any automatic feeder transfer that may be present on the LV side.
3. A confirmation that voltage reduction facilities will be provided, with the capability of reducing the distribution voltage by 3% to 5%.
4. A confirmation that the transfer trip protection scheme is to be installed as required by the Transmission System Code.

It is recommended that approval be granted and Notification of Approval be issued subject to the acceptance by the proponent of the IMO requirements.

1.0 Project Description

Hydro One Brampton Networks Inc. has starting building a new Municipal Transformer Station (MTS) north of Steeles Ave. and west of Chinguacousy Rd. in the city of Brampton Ontario. The name of the new station is Jim Yarrow MTS. The new station will be used to supply 58.5 MW of residential and commercial load in the initial stage. Because an estimate of the ultimate station loading was not specified by the connection applicant, it was assumed that the ultimate station load is equivalent to the station load capability.

The target in-service data for the facility is April 2002.

A schematic representation of the electrical connectivity for the proposed MTS is shown in Figure 1.

The *connection applicant* has indicated that the net new load growth on the 27.6 kV area as 12-15MW annually and that the new station should take at least this much growth. Jim Yarrow MTS will initially have 6-8 feeders integrated. Total initial load in the summer of 2002 is expected to be around 60MW and will constitute largely from load transfers from Pleasant MTS and Bramalea MTS.

2.0 Review of Connection Arrangement

The proposed Jim Yarrow MTS is equipped with two 215.5/28 kV three windings transformers rated at 75/100/125 MVA each, which are supplied from two separate 230 kV transmission circuits (R19T and R21T) that share the same right of way. The transformers are both identical and configured with a solidly grounded wye winding on the high side and double zigzag winding on the low voltage side. Each of the low voltage side windings is grounded via a 1.5 ohms reactor.

The line tap from the station to the 230 kV circuits will be short and thus its impedance was considered negligible in this assessment. The point of connection, the *defined meter point* and the actual meter location are all within meters off the 230 kV circuits.

The applicant has indicated that the station equipment and station control/protection were designed to meet the intent of the Transmission System Code. Based on the single line diagram BH1-100 provided by Elecsar Engineering Limited, each transformer is separated from the transmission system via a motorized disconnection switch. For this particular arrangement the Transmission System Code requires that transfer trip of the Transmitter's breakers at the terminal stations be provided for transformer faults and for a condition of failure to operate of the LT breakers (25T1J, 25T1Q, 25T2J or 25T2Q). In the case of Jim Yarrow MTS, which is connected on a double circuit radial tap off R19T/R21T 230 kV circuits, the transfer trip must be sent to the following HV terminal breakers:

- For fault associated with T1 or failure to operate of breakers 25T1J or 25T1Q, trip A2L19 and L2L19 at Richview 230 kV station and HL38, H2T14 and H1H2 at Trafalgar TS.
- For faults associated with T2 or failure to operate of breakers 25T2J or 25T2Q, trip A2L21 and L20L21 at Richview 230 kV station and HL21 and L21L37 at Trafalgar TS.

It is also required that the protection system initiate simultaneously both signals for the transfer trip, as described above, and the opening of the disconnect switches 25T1-R19T or 25T2-R21T. Full opening of the disconnect switch shall then block the sending of the transfer trip signal.

Power Factor

The *Market Rules* require that wholesale customers and distributors connected to the IMO-controlled grid shall operate at a power factor within the range 90% lagging to 90% leading as measured at the *defined meter point*.

The information received with the connection application indicates that station design provides for installation of 28 kV, 20 MVar shunt capacitors and capacitor breakers to meet that the load power factor requirements of the *Market Rules*. However, Hydro One Brampton Networks Inc. will not install these in the initial stage.

Underfrequency Load Shedding Requirements

The *Market Rules* (Chapter 5 section 10.4) require that each distributor and connected wholesale customer, in conjunction with the relevant transmitter, make arrangements to enable the automatic disconnection of up to 35% of its peak demand for conditions of system under-frequency. To meet this requirement an underfrequency load shedding (UFLS) scheme must be installed at the station. The single line diagram does not show the presence of the UFLS scheme.

Voltage Reduction Facilities Requirements

The *Market Rules* (Chapter 4 Appendix 4.3) requires that distributors connected to the *IMO controlled grid* with directly connected load facilities of aggregated rating of 20 MVA or more and the capability to regulate distribution voltage under load, shall install and maintain facilities to provide *voltage reduction capability*. *Voltage reduction capability* represents the capability of reducing demand by lowering the customer voltage by 3% and 5% and having the controlling authority to be able to effect the voltage reduction within five minutes.

On-line Monitoring

The *Market Rules* (Chapter 4 section 7.5) require that each distributor and connected wholesale customer shall provide the IMO on a continual basis with on-line monitored quantities as specified in Appendix 4.17. It is required that Hydro One Brampton Networks Inc. install all the equipment needed to monitor the information required by the IMO on a continuous basis.

3.0 Data Verification

Information of the projected ultimate station loading was not available at the time of this study. Based on standards for supply of municipal electrical utilities The capability of a DESN station is defined as the maximum load that one transformer can carry for a predefined period of time. This value is usually computed using specific transformer data and daily load curves, and temperature data specific to the transformer location. Information that was provided by the connection applicant indicated that the capability of the new Jim Yarrow MTS is going to be 172 MVA. Assuming a 0.9 load power factor, the maximum MW load that can be supplied from this station is 157.5 MW. If the proponent chooses to connect to the new station loads in excess of the station load capability they may risk damaging their own equipment for situations when one transformer is out of service.

The proposed Jim Yarrow MTS is equipped with two 215.5/28 kV three windings transformers rated at 75/100/125 MVA each. The transformers are both identical and configured with a solidly grounded wye winding on the high side and double zigzag winding on the low voltage side. Each of the low voltage side windings is grounded via a 1.5 ohms reactor. The transformer impedance is 11.5% on 37.5 MVA base. Voltage control will be provided via on-load tap changers located on the high voltage winding of the transformer. The tap changer range for the step-down transformer is 34.5 kV to -34.5 kV (from 250 kV to 181 kV) and it is to be achieved in 33 steps.

It is expected that the proponent will provide when available, the “as built” transformer information.

The rating of the remaining station equipment was found to meet all applicable standards.

4.0 Fault Level Assessment

In general, radial loads do not have a large impact on the system fault levels.

Hydro One has carried out a study to identify the impact of the Jim Yarrow MTS on the short circuit currents in the area. The results indicated that the proposed development does not contribute to the three phase fault currents and augments the line-line-to-ground fault currents at Richview TS by about .18 kA. This contribution to fault levels is considered insignificant, hence the solidly grounded transformer primary configuration is acceptable.

5.0 Impact on System Reliability

The assessment of the impact of incorporating the proposed project has assumed in service all the projects that have already been approved for connection in the electrical vicinity of Claireville TS. Explicitly, the baseline assumptions include Vaughan MTS#3, Richmond Hill MTS#2, Sithe Goreway and Southdown, and all Western Ontario generation developments in service.

5.1 Description of Transmission Facilities

The new Jim Yarrow MTS will have a dual supply from the 230 kV double-circuit line R19T/R21T. Figure 1 shows a schematic representation of the transmission system between Richview TS and Trafalgar TS, all the municipal transformer stations connected to this system, and the location of the new Jim Yarrow MTS. Richview TS is connected to Trafalgar TS via two 230 kV double-circuit lines (R14T/ R17 T and R19T/R21T) which presently supply three transformer stations: Tomken TS, Erindale TS and Pleasant TS. At Richview TS, a shunt capacitor bank rated 412 Mvar at 250 kV is connected, to provide voltage support.

Tomken TS is configured with two dual 230/44 kV supplies, one from R14T/R17T (T1/T2) and the other one from R19T/R21T (T3/T4), and the station is equipped with four low voltage shunt capacitors of 26.35 Mvar each.

Erindale TS is configured with three dual supplies, two from R14T/R17T (T1/T2 & T3/T4) and the other one from R19T/R21T (T5/T6). Transformers T1/T2 have double secondary windings and step down to 27.6 kV. Transformers T3/T4 and T5/T6 step down to 44 kV. There are four low voltage shunt capacitors installed on the 44 kV buses each rated at 26.35 Mvar, and two low voltage shunt capacitors installed on the 27.6 kV bus each rated at 23.14 Mvar.

Pleasant TS is supplied from a 17.5 km line tap off R19T/R21T circuits, as indicated in Figure 1. Pleasant TS is configured with two dual supplies from the double circuit line R19T/R21T, and has four transformers; T1/T2 step down to 44 kV and T5/T6 are equipped with double secondary windings each stepping down to 27.6 kV. The station is also equipped with four low voltage shunt capacitors installed on the 27.6 kV bus each rated at 21.49 Mvar, and two low voltage shunt capacitors installed on the 44 kV bus each rated at 26.35 Mvar.

With the addition of the new proposed Jim Yarrow MTS, two municipal stations with a total of three dual transformers pairs will be supplied via R19T/R21T line tap.

5.2 Area Load Considerations

The impact of the proposed MTS on the local area transmission was studied for three load conditions. These conditions were selected to simulate situations that may maximize the power flowing over the transmission system or create severe system voltages. The loads used in these scenarios are summarized in Table 1 below, and additional explanation pertaining to these scenarios is included in the subsequent sections.

Table 1: Load Scenarios

Station Name	Station Cap. MVA	SCENARIO A Actual 2001 Summer Load (coincident with system peak)			SCENARIO B Summer Load Equivalent to the Station Non-Coincident Peak.			SCENARIO C Summer Light Load Conditions		
	LV Sh. Cap(Mvar)	MW	Mvar	MVA	MW	Mvar	MVA	MW	Mvar	MVA
Tomken T1T2-44 kV (R14/17T)	175	53	14	54.8	155	90	179	70	35	78.3
	2x26.35									
Tomken T3T4-44 kV (R19/21T)	175	144	25	146.2	150	86	173	70	35	78.3
	2x26.35									
Erindale T5T6-44 kV (R19/21T)	175	145	22	146.7	147	77	166	70	35	78.3
	2x26.35									
Erindale T3T4-28 kV (R14/17T)	175	130	17	131.1	143	77	163	70	35	78.3
	2x26.35									
Erindale T1T2-27.6kV (R14/17T)	175	213	37	216.2	213	105	237	100	50	112
	2x23.14									
Pleasant T1T2-44 kV (R19/21T)	175	37	1	37	110	58	124	55	29	62.2
	2x26.35									
Pleasant T5T6-27.6kV (R19/21T)	198	214	6	214.1	190	100	214	100	50	112
	4x21.49									

	Station Cap. MVA									
Jim Yarrow T1T2-27.6kV (R19/21T)	172	-	-	-	150	75	168	76	38	85
	2x19.43									
<i>R19/21T Line Tap</i>		251	7	251.1	400	233	506	231	117	259.2
<i>Load Supplied Off R14/17T</i>		396		402.1			579			268.6
<i>Load Supplied Off R19/21T</i>		540		543			845			415.8

Scenario A was based on coincident summer peak loads obtained from 2001 historical data. The IMO historical information indicated that in August of 2001 an all time new system peak of over 25,000 MW was recorded. It should be pointed out that the records indicate that in 2001 the Erindale TS 230/27.6 kV and Pleasant TS 230/27.6 kV station loads exceeded the station load capabilities. This increases the risk of damaging the station equipment for situations when one transformer is out of service. It is expected that some of the 27.6 kV load at Pleasant TS will be transferred to the new MTS thus alleviating the station equipment overloading problem.

Scenario B assumed that each station is loaded to the non-coincident historical peak MW that was obtained from the 2001 records. This scenario represents most stressed system conditions and was selected in lieu of a set-up that would simulate loads equivalent with the stations’ capability (the 10 day Limited Time Rating). Had the stations been considered to be loaded to their 10 day LTR that is listed in Table 1, the total load in the area would be 1423 MVA which is practically equal to the total MVA load assumed in this scenario.

Scenarios A and B both assumed high power flows into Toronto area. The Flow East To Toronto (FETT) was around 4000 MW which is close to the maximum FETT recorded in 2001.

Scenario C represents light load system conditions and was selected to investigate the system voltage profile.

5.3 Impact on Transmission Thermal Loading

Scenarios A and B were used to identify if the addition of the new MTS has a significant impact on the thermal line loading under conditions of summer peak load with all transmission elements in service, and one critical transmission element out of service. The possible overloading of these circuits represent a concern during the summer months when the load is generally high and the line operating ratings are lower.

The results of these studies were summarized in Table 2 and Table 3 below, and also shown in Figures 2, 3A and 3B.

The summer MVA rating for the double circuit line R19T/R21T was calculated based on circuit current ratings that were provide by Hydro One and an average operating voltage of 241 kV. The

voltage level that was used for the calculation of MVA circuit thermal ratings was selected from the historical records of voltages at Richview 230 kV TS. These records are shown in Figure 4 and indicate that for most of 2001 the voltage was higher than 241 kV.

It should be noted that for dual radial supply of load, the common practice is to use the continuous rating of the conductor in calculating the post contingency acceptable loading of the remaining line, since no operating measures are normally implemented to lower the loading of the remaining single supply.

5.3.1 Study Results

Load Scenario A – Table 2

This assessment was performed for conditions of Flow East To Toronto (FETT) area of about 4000 MW, and was based on actual data obtained from historical records of loads and power flows registered on August 8, 2001. The new Jim Yarrow MTS was not in service. The power flows between Trafalgar TS and Richview TS in this scenario as obtained from historical records are shown in Figure 2 and listed in Table 2. The flow on R19/21T line tap into Pleasant TS was computed based on the station load and assumed 5% line losses.

The results show that with all elements in service circuits R19T and R21T which supply the three existing municipal stations were loaded well below the circuits’ summer continuous capability, at power flow levels corresponding to 57% and 55.4% of the continuous MVA ratings of the lines.

Table 2: Scenario A – All Elements In Service, 2001 Peak Actual

Circuit section	Rating(MVA) ¹		All elements in service					
	Summer Cont.	Summer LTR(15min)	R19T			R21T		
R19/21T			MW	Mvar	MVA, %cont	MW	Mvar	MVA %cont
Trafalgar-Erindale	589	877	336	-19	336.5 57%	325	-32	326.6 55.4%
Hanlan Jct.-Pleasant	521	584			132 25.4%			132 25.4%
Tomken-Richview	521	584	29	-102	106 20.3%	25	-107	110 21.1%

Computed Values are shown in blue. Actual values are shown in black.

Load Scenario B - Table 3

The studies were performed for a condition of Flow East To Toronto (FETT) area of about 4000 MW and Jim Yarrow MTS in service. This condition maximizes the power flowing from Trafalgar TS into the load center resulting in the entire local load being practically supplied from Trafalgar TS. The power flowing from Richview TS on R19T and R21T is minimal. The results of the study are summarized in Table 3 and also shown in Figure 3A and 3B.

¹ MVA rating calculated based on 241 kV voltage. Current ratings were calculated for 30⁰ C ambient temperature and 4km/h wind speed.

Table 3: Scenario B -All Elements in Service & R21T Out of Service

Circuit section	Rating(MVA) ¹		All in Service		R21T O/S	
	Summer Cont.	Summer LTR(15min)	MW, % of Cont. Rating		MW, % of Cont. Rating	
R19/21T			R19T	R21T	R19T	R21T
Trafalgar-Erindale	589	877	372 63%	374 63%	584 99.2%	-
Erindale-Hanlan Jct.	521	584	298 57.2%	297 57.2%	435 83.5%	-
Hanlan Jct.-Pleasant	521	584	228 43.8%	228 43.8%	460 88.3%	-
Hanlan Jct.-Tomken	521	584	70	69	-25 5%	-
Tomken-Richview	521	584	-6	-5	-176 33.8%	-

The studies results concluded that with all elements in service Trafalgar TS to Erindale MTS sections of the 230 kV circuits R19T and R21T are almost equally loaded at 63% of their summer continuous capability.

It was assumed that for R21T out of service the total load will continue to be supplied via the remaining 230 kV circuit (R19T). The study results indicate that about 23% of the power supplying the load, would flow from Richview TS and 77% was supplied from Trafalgar TS. For the outage case, the R19T section between Trafalgar TS and Erindale TS was loaded close to its continuous summer rating and the section between Hanlan Jct. to Pleasant TS was loaded to about 90% of its continuous summer rating.

Study results indicate that for area loads equivalent to non-coincident station peaks and one critical transmission element out of service (R19T or R21T), the remaining circuit becomes loaded close to its continuous rating.

5.4 Voltage Assessment

A preliminary analysis of the IMO-controlled grid voltage at the point of connection of Jim Yarrow MTS indicated that the system voltage is similar in magnitude to the voltages observed at Pleasant MTS

The Preliminary Assessment also examined the effect of a single circuit outage (R19T) and the Richview capacitor (the 420 Mvar capacitor bank which is connected at Richview 230 kV) switching, on the voltage at the new Jim Yarrow MTS station and at Richview TS. The results of the study are shown in Table 4.

Both peak load conditions (scenario B) and light load conditions (scenario C) were used to determine the steady state voltages and the voltage change due to the Richview shunt capacitor switching.

Table 4. Voltage Variations

Monitored Location	Loss of R19T Voltage (kV)			Richview Capacitor Switching Voltage (kV)					
	Peak Load, Post ULTC			Peak Load (Cap On)			Light Load (Cap Off)		
	Pre	Post	%	Pre	Post	%	Pre	Post	%
<i>Jim Yarrow 230 kV</i>	235	226.1	3.8%	235	227.9	3%	241.4	244.8	1.4%
<i>Jim Yarrow 27.6 kV</i>	29.3	29.45	0.5%	29.4	28.3	3.7%	29.1	29.55	1.5%
<i>Richview 230 kV</i>	240.1	239.5	0.25%	240.1	233.1	2.9%	244.3	248.1	1.5%

The results of the voltage variation studies show that:

- the effect of the Richview capacitor switching on the Jim Yarrow MTS voltage is within the 4% margin allowed by the Market Rule, and
- the line switching event creates voltage excursions that are under the 10% margin allowed by the *Market Rules*.

5.5 Discussion - Line Thermal Loading Projections

It is expected that the load in the Brampton area will continue to grow at a rate of about 2% a year. An analysis was performed to establish the adequacy of the R19T and R21T circuits when the loads supplied via Pleasant MTS and Jim Yarrow MTS approach the respective station load capabilities. The calculations also included 5% power losses on the transmission lines.

The power flowing from Hanlan Jct. to Pleasant TS on R19T and R21T was computed based on the formula $P=1.05*(175+172+198)$. Hence, 572 MVA would be flowing on this line tap.

Pre-contingency, Single Element Contingency

It can be concluded that:

- With all elements in service the power flow is well under the continuous rating of the circuits (521 MVA).
- For a fault associated with any one of the six transformers at Pleasant MTS or Jim Yarrow MTS, the remaining Hanlan Jct. to Pleasant circuit will become loaded close to its 15 minute LTR. The clearing of the transformer fault and the restoration to service of the tripped circuit must be carried out in less than 15 minutes.
- For a permanent fault associated with one of the circuits, the entire load would be supplied via the remaining circuit, which would become loaded over its continuous rating.

It is required that Hydro One Networks Inc. upgrade, before the load supplied from Pleasant MTS and Jim Yarrow MTS reaches a peak of 521 MVA, the line taps between Hanlan JCT. and Pleasant station to a continuous rating of about 572 MVA. Based on current load growth projections, this line tap upgrade is required to be in service before 2011.

It may be required that other sections of the double circuit line R19T/R21T also be upgraded to accommodate future load growth.

Double Circuit Contingency

For the purpose of this assessment the supply availability levels have been evaluated in accordance with the following guidelines:

- For affected loads totalling between 250 MW and 500 MW, restoration is to be possible by switching within 30 minutes,
- For affected loads totalling more than 500 MW no interruption in supply is to occur.

Year 2001 records indicated that under peak load conditions, the load supplied via R19T/R21T was over 500 MW. A contingency involving both circuits would result in the loss of supply to all the connected loads - Erindale 44 kV, Pleasant MTS and Tomken 44 kV (T3/T4) – and hence does not meet the guidelines for supply availability.

In view of the guidelines used to assess the load supply reliability, it is recommended that Hydro One Networks Inc. investigate plans for improving the availability of supply to the loads connected to the double circuit line R19/21T.

These plans could include building a 230 kV switchyard at Hanlan Jct., thus allowing the isolation of the faulted section without affecting the loads connected to the unfaulted lines.

Year 2001 records indicated that under peak load conditions, the load supplied via R14T/R17T was between 250 and 500 MW. A contingency involving both circuits would result in the loss of supply to all the Erindale 27.6 kV and Tomken 44 kV (T1/T2). Under this condition, the Tomken 44 kV load could be transferred to T3/T4 granted that the station load capability is not exceeded, but it is not clear if an alternative supply for the Erindale 27.6 kV load exists.

6.0 Conclusions and Recommendations

This Preliminary Assessment has examined the impact of connecting Jim Yarrow MTS to the 230 kV lines R19T and R21T, on the reliability of the IMO-controlled grid. The studies concluded:

1. The addition of the new supply point does not have a significant effect on the short circuit current at Richview TS or the other transformer stations connected to these circuits.
2. For station loads equivalent to the historical non-coincident peaks and Jim Yarrow MTS loaded at 168 MVA, with all elements in service and under post contingency situations the line power flows are within the continuous ratings of the circuits.
3. For station loads equivalent to the station capabilities the power flow exceeds the continuous rating of one circuit for conditions of permanent outage to the companion circuit.
4. It is recommended that before 2011, the R19T/R21T line taps between Hanlan JCT. and Pleasant station be upgraded to a higher continuous rating which is when the load supplied off Pleasant MTS and Jim Yarrow MTS is expected to reach a peak of 521 MVA. It may be required that other sections of the R19T/R21T circuits also be upgraded to accommodate future load growth.
5. In view of guidelines for load supply reliability which state that area loads totaling more than 500 MW shall not be interrupted for a contingency involving a 2-circuit line , it is recommended that Hydro One Networks Inc. investigate plans for improving the availability of supply to this area loads.

If in the near future the supply of the area load would require an additional transformer station then, the connection of the new station could become contingent on the recommendations made in 4 and 5 above.

7.0 IMO Requirements

It is required that Hydro One Brampton Network Inc. provide the IMO with the following information as soon as it becomes available:

1. A confirmation that an underfrequency load shedding relay, which will have the capability of tripping up to 35% of the station load (12% at 59.3 Hz and additional 23% at 58.8 Hz) is to be installed. Appropriate settings for the relay will be provided by the IMO prior to commissioning.
2. An estimate of the individual feeder loads for the next five years and any automatic feeder transfer that may be present on the LV side.
3. A confirmation that voltage reduction facilities will be provided, with the capability of reducing the distribution voltage by 3% to 5%.
4. A confirmation that the transfer trip protection scheme was installed as required by the Transmission System Code.

8.0 Notification of Approval

Section 8.0 of the Preliminary Assessment Report lists all the requirements identified by the IMO CAA process for the incorporation of the proposed Jim Yarrow Municipal Transformer Station. It

is recommended that approval be granted and Notification of Approval be issued subject to the acceptance by the proponent of the IMO requirements.

In addition to the Connection Assessment and Approval process any new connection to the IMO controlled grid has to fulfill, before coming into service, the following:

1. It is required that Hydro One Brampton Networks Inc. meet all the requirements of the IMO Facility Registration process.
2. It is required that Hydro One Brampton Networks Inc. install all the equipment needed to monitor the system operating information required by the IMO on a continuous basis as described in Chapter 4 section 7.5 and Appendix 4.17 of the *Market Rules*.
3. It is required that Hydro One Brampton Networks Inc. follow the IMO Meter Registration process.

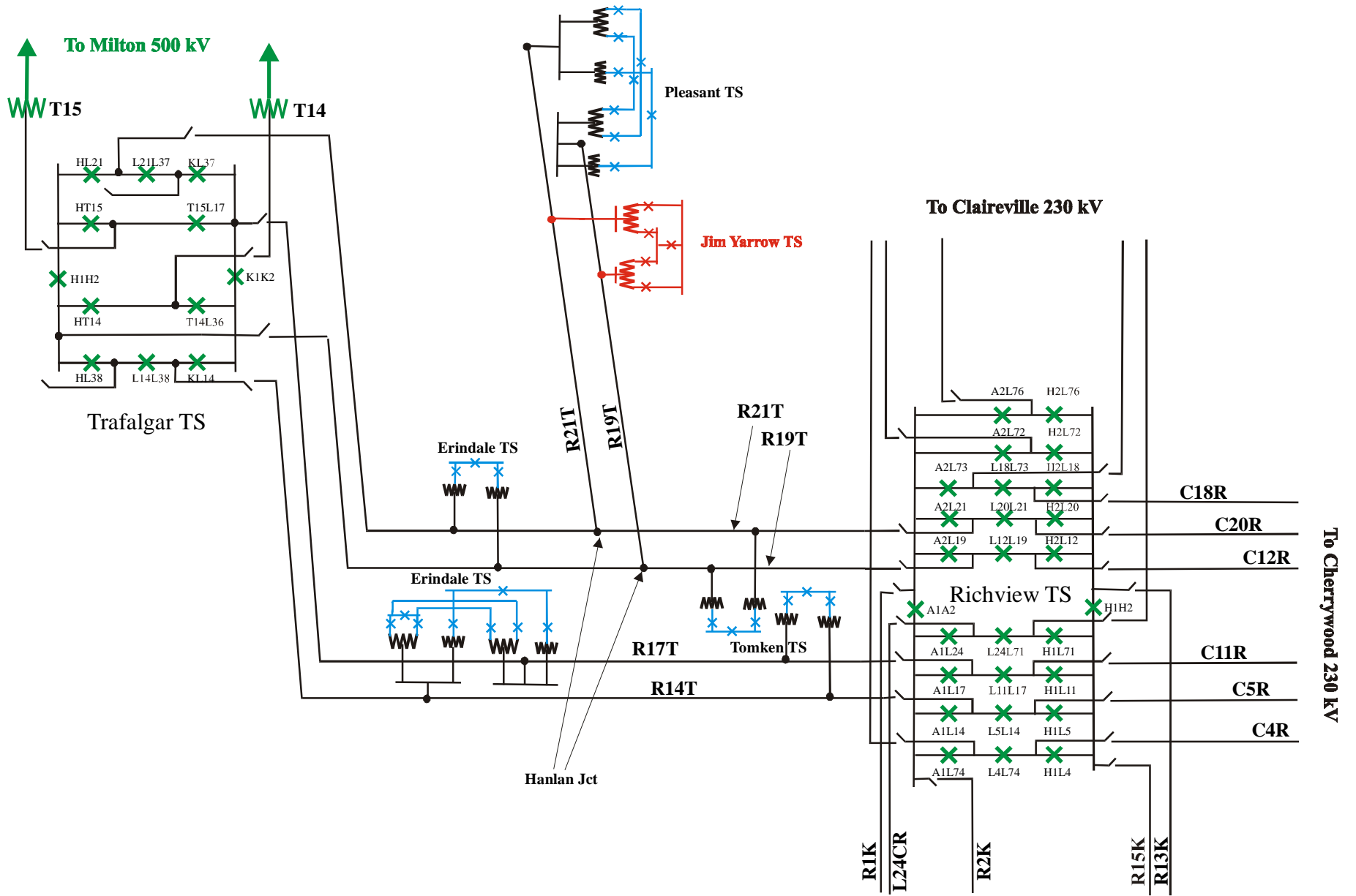


Figure 1. Transmission System Representation - Richview to Trafalgar

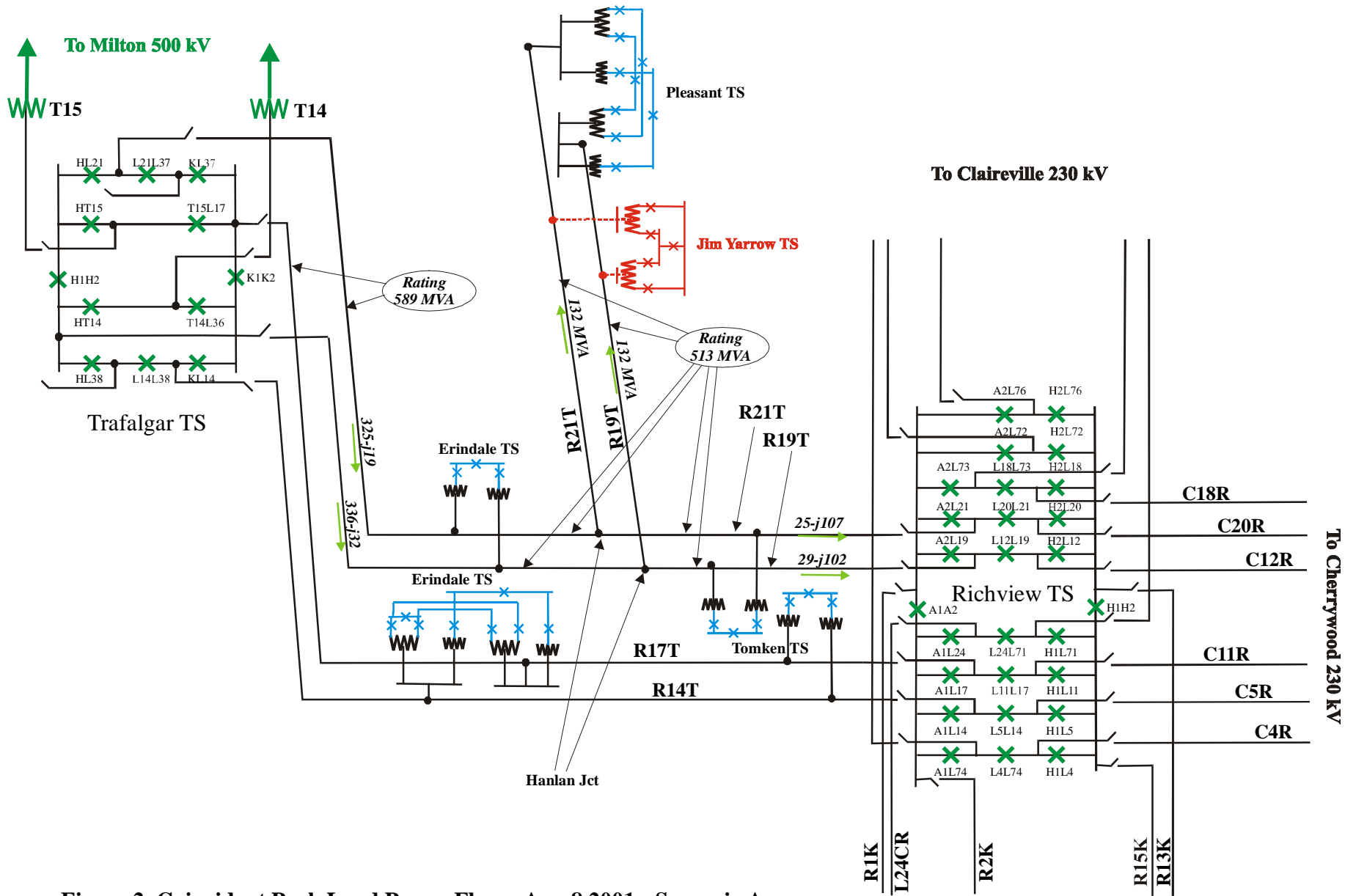


Figure 2. Coincident Peak Load Power Flows, Aug 8 2001 - Scenario A

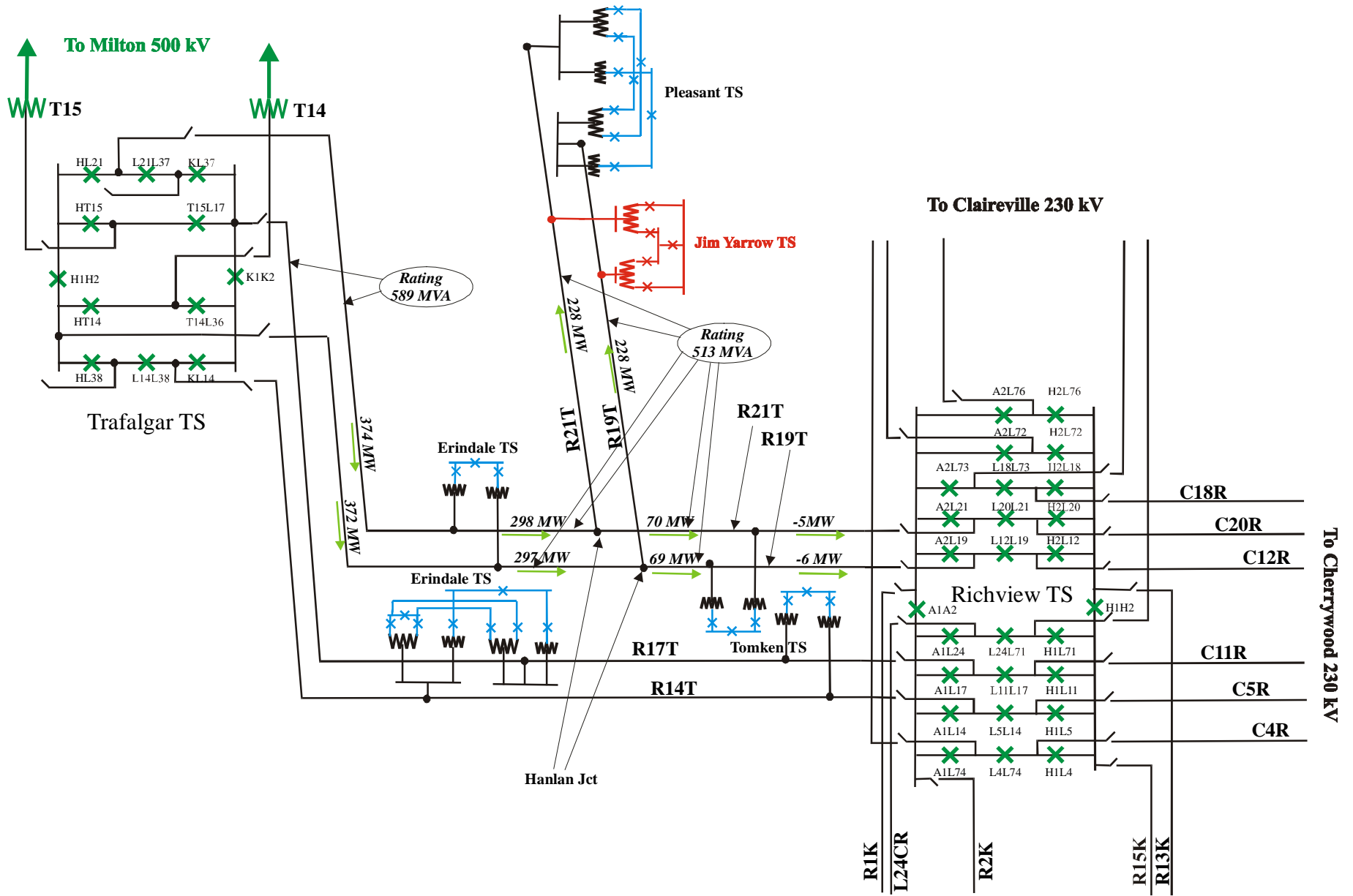


Figure 3A. Non-coincident Peal Load Power Flows - Scenario B

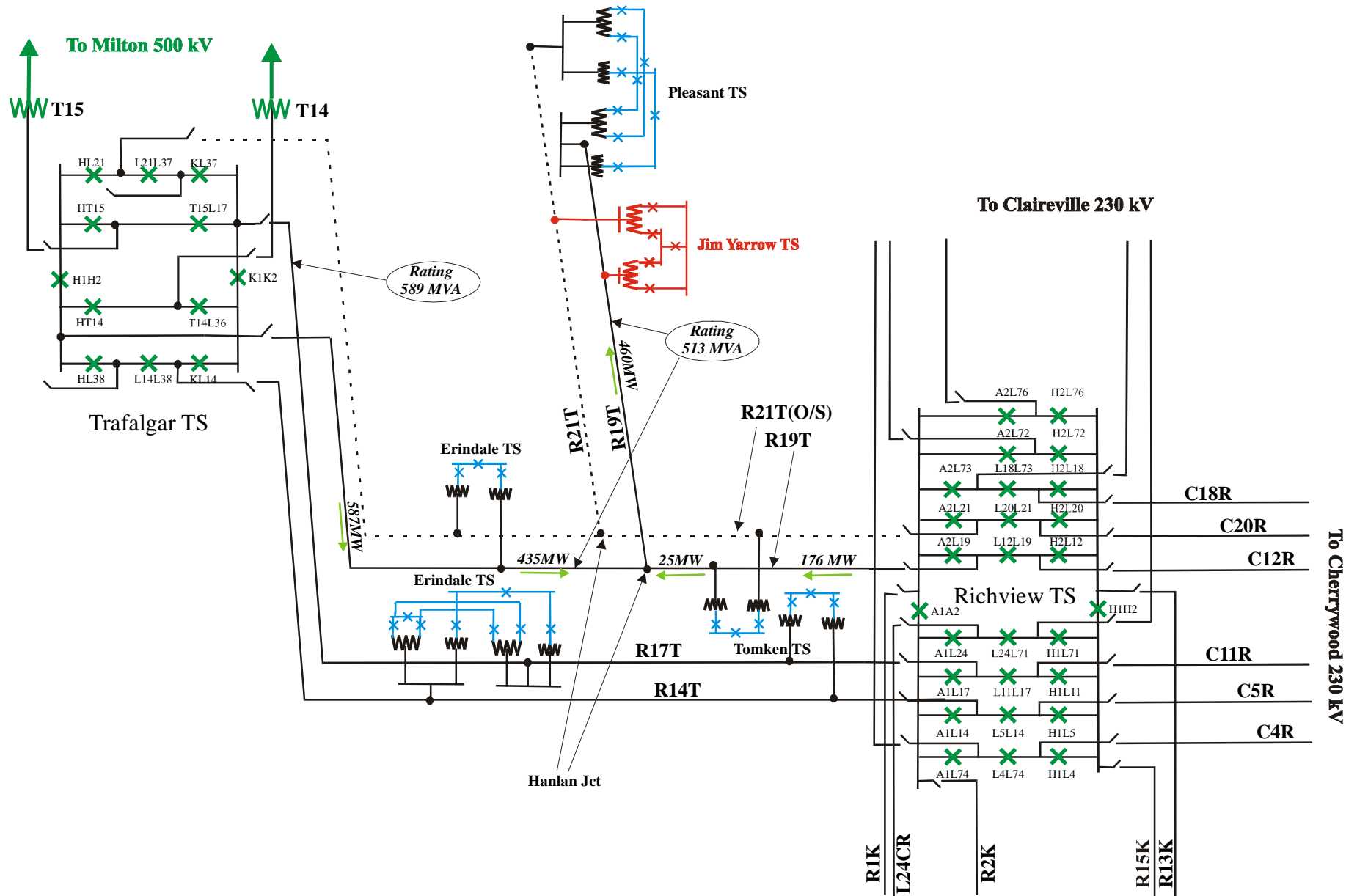


Figure 3B. Non-coincident Peal Load Power Flows - R21T O/S Scenario B

