SPARKPOWER

Project Sites:
Rideau St. Lawrence Distribution
9 Substations in Prescott, ON; Morrisburg, ON;
Iroquois, ON and Cardinal, ON

D-001 Rev. 1
Substation Condition Assessment

CONFIDENTIAL

March 18, 2020

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Project Information

Project Name:	Substation Condition Assessment
Project #:	30934
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Project Sites:	Cardinal MS1
	Cardinal MS2
	Iroquois MS
	Morrisburg MS1
	Morrisburg MS2
	Prescott MS1
	Prescott MS2
	Prescott MS3
	Prescott MS4

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Revision Log

Revision	Date	Prepared by:	Reviewed by:	Approved by:	Description
00	2019-12-20	RSG	HH	RSG	Draft for Customer Review
01	2020-03-05	RSG	HH	RSG	Customer Comments

SECTION B: PREAMBLE

1. EXECUTIVE SUMMARY

Spark Power, as Tal Trees Power Services, was engaged by Rideau St. Lawrence Distribution to perform a data-driven condition assessment of their nine (9) municipal substation, located in four (4) operating areas, that would be used to plan future station projects or service activities. This information will be used to develop capital and, operations & maintenance budgets that can be incorporated in subsequent rate filing applications.

The findings of the assessment revealed a number of small modification and larger capital projects which would maintain system reliability and ensure long-term operations for Rideau St. Lawrence. The projects were provided with priority levels based on criticality and scoring of the component, available redundancy in the event of an emergency and benefit to the station's scoring after the change is made. A detailed list is provided in Section E.

A summary of the most impactful upgrade for each station, priority level and change in station scoring after the project is completed is provided below.

Station	Total Station Score	Top Project	Priority	Score After Top Project
Cardinal MS1	2.6	New T1	Medium	3.7
Cardinal MS2	2.7	New T1	Medium	3.9
Iroquois MS	3.6	New T1	Low	4.2
Morrisburg MS1	3	New T1	High	3.8
Morrisburg MS2	2.7	New T1	Severe	3.6
Prescott MS1	3.8	N/A	N/A	N/A
Prescott MS2	3.3	N/A	N/A	N/A
Prescott MS3	2.8	40F1 & 40F2 Repair	Medium	3.5
Prescott MS4	3.0	New T1	Low	3.9

2. INTRODUCTION

The data-driven condition assessment differs from the typical industry practice which relies on visual inspections and operational feedback during a site visit. The typical practice generally finds that equipment beyond manufacturer defined end-of-life should be planned for replacement. A data-driven assessment utilizes established industry maintenance practices to assess the condition of each component so that even components after manufacturer end-of-life can be considered for long-term reliability. For context, a liquid-filled transformer which rarely carries over 50% load can be expected to last well beyond its design lifespan, in many cases over 40 years.

3. METHODOLOGY

The preparation of this report consisted of the following steps:

1. Data Gathering

a. Available maintenance reports from 2017 & 2018 were received from Tal Trees
b. Tal Trees performed maintenance services on five (5) substations in 2019 and provided reports to the engineering team.
c. Site visits were performed at each substation to gather visual data on station infrastructure and accompanied by Rideau St. Lawrence personnel to establish an understanding of the station operating procedures.

2. Data Analysis
    a. Each substation was evaluated as follows:
        i. Each major component was assessed based on the maintenance data.
            1. Assessments were broken up into several key categories based on NETA ATS equipment criteria.
            2. A cumulative score was established for each component based on a weighting of the component scores.
            3. A scoring matrix is provided below. Note that a zero (0) score is not shown but would be indicative of a failed component requiring replacement before re-energization.

Equipment Scoring							Weighting
Equipment ID	Description	1	2	3	4	5	
Transformer	Mechanical Assessment	Visible evidence of oil pooling indicating significant leak and/or rust visible on tank, radiator or conservator.	Trace amounts of oil around the transformer. Some rusting of base or structural supports of the transformer.	Transformer accessory(ies) no longer functioning (i.e. liquid level, temperature gauge, etc.)	Transformer < 10 years old, no mechanical issues.	Appears brand new.	0.5
	TTR	Turns Ratio Rest results differ from tap changer. Investigate results.	Not applicable.	Not applicable.	Not applicable.	Turns Ratio Test Results match tap charger configuration.	0.5
	Winding Resistance	More than 1% deviation from average phase reading.	Not applicable.	Within 1% of average phase reading.	Not applicable.	Within 0.5% of average phase reading.	0.5
	Dielectric Absorption Test (DAT)	DAT indicates reduced dielectric capacity, supported by DGA	Indicates reduced dielectric capacity, DGA still within specification.	DAT is lower than previous past results but still acceptable.	DAT is within satisfactory specification.	All data within specification, near initial factory test data.	1
	Dissipation Factor	Greater than 1%.	Less than 1% corrected.	Less than 0.75% corrected.	Less than 0.5% corrected.	Less than 0.25% corrected.	0.5
	Dissolved Gas Analysis (DGA)	DGA results continue to trend in negative direction, or results indicate contamination.	DGA results exhibit levels indicative of overheating or reduced dielectric capacity, either trend data not	Results exhibit levels of overheating or reduced dielectric capacity in the past, but trend	Results within satisfactory specification.	All data well within specification, near initial factory test data.	5

			available or change in data.	data is available and level.			
	Spare	No spare available.	Not applicable.	Spare transformer on-site.	Not applicable.	Spare transformer off-site.	2
Switching Equipment	Mechanical	Mechanical operation unreliable; Enclosure exhibiting significant rust	Slow or difficult operation; small amounts of rust	< 20 years old, no mechanical issues; trace or limited amounts of rust.	< 10 years old, no mechanical issues; no signs of enclosure degradation	Appears brand new.	2
	Contact Resistance	High resistance, visible heat damage	Phase difference > 50%	Low resistance, phase difference > 25%	Low resistance, minor phase differences	Low resistance, all phases similar	2
	Fuse resistance	Phase difference > 50%	Phase difference > 25%	Low resistance, phase difference > 10%	Low resistance, minor phase differences	Low resistance, all phases similar	2
	Fuse spares	No longer available new	Spares > 1 week lead time, or refurbished units only	Spares > 1 day lead time	Spares available off-shelf	Spares on-site / in storage	1

ii. The substation was then evaluated based on the findings of the site visit and discussion with Rideau St. Lawrence staff:

1. An assessment was performed on individual categories based on industry best practices as identified in the scoring matrix provided below:

Infrastructure Scores					
Item	1	2	3	4	5
Building	Significant structural or mechanical issues.	Structural or mechanical concerns are visually evident.	Some signs of deterioration, moisture infiltration, etc.	No signs of deterioration.	Installation condition consistent with brand new.
Fencing	Significant problems with structural integrity of fencing.	Signs of deterioration of posts or open areas in wire mesh.	Some rusting of posts or minor damage to mesh.	No signs of deterioration.	Installation condition consistent with brand new.
Ground Grid	Exposed grounding conductor, areas bare of granular; major safety concern	Areas lacking granular, weeds over 2' in length; visibly would not satisfy design resistance	Weeds growing through granular, granular mostly in tact, not recently tested to design resistance	Granular less than 6" deep, tested recently to design resistance	Granular at 6" depth, test ground rod visibly marked or accessible
Structures	Significant rusting and structural defects in steel lattice or structure.	Some rusting or defects in structures. Clearances or heights no longer meet code.	Some rusting or defects in structures, no design flaws.	No signs of deterioration or design flaws.	Installation condition consistent with brand new.
Foundations	Exposed rebar with visible signs of rust	Foundations exhibit signs of deterioration	Foundations exhibit some cracking due to	No signs of stress or wear, < 10 years old	No signs of wear or tear, less than 10 years old

	and deterioration.	around edges and in need of patching	age but otherwise in good condition		
Security	No security measures in place. Station readily accessible by unauthorized personnel.	Physical security in place, no yard lighting or extended security system	Both physical security measures and yard lighting in place. Visible from major roadways.	Some remote security in place, with physical measures and yard lighting.	Physical, and remote security features in place with yard lighting.
Conductors	Conductors installed or condition causing potential hazard.	Conductors or terminations appear to be deuterating due to age or installation practices.	Some signs of deterioration of conductor or terminations.	No signs of deterioration.	Installation condition consistent with brand new.
Safety	Code compliancy concerns require major renovation. (> $100k)	Code compliancy concerns require restoration immediately (< $50k)	Minor code compliancy concerns require immediate restoration (< $10k).	Grandfathered code issues which can be readily corrected at next renovation.	No code compliancy concerns.

2. A cumulative score was established for the station based on the lowest score of the individual categories. The minimum score was selected as any infrastructure component was deemed equally important and substantial enough to necessitate the markings.

iii. The cumulative substation score was established based on the weighting of component and substation infrastructure.

b. Each substation was also scored based on its impact on system reliability. The system reliability score is used to prioritize recommended substation projects based on their impact to system availability.

Reliability Score					
Description	**1**	**2**	**3**	**4**	**5**
Redundancy	No redundancy or critical spares available.	Some redundancy is provided through manual switching but not at peak loading.	Redundancy provided through spare equipment which must be relocated.	Station is redundant at the station & feeder level via manual operation.	Station is redundant at the station & feeder level via automatic operation.

3. Recommendations
   a. Based on the findings of the Data Analysis, project recommendations are made for each substation with an outlook over the next 1-5 years.
   b. Recommendations range from equipment replacement, spare capacity or infrastructure modifications. Projects are ranked based on impact, and recommended timeframe.

4. Summary and Conclusions
   a. Overall recommendations are provided along with a prioritization amongst the substations based on community size and potential impact to system reliability.

b. Some recommendations for the design of future modifications are also provided which can improve system reliability.

SECTION C: TERMS AND DEFINITIONS

Throughout this document, several technical terms, acronyms and initializations shall be used:

Term	Definition	Description
MS	Municipal Substation	LDC-owned substation for transformation and distribution of rural system voltages (44 kV delta) to municipal voltages (generally 4160V or 13.8 kV four-wire systems)
DS	Disconnect Switch	An electrical isolation device
DG	Distributed Generation	Generation facility connected to distribution system
TX	Transformer	An electrical device which converts voltage levels
LBS	Load Break Switch	Isolation device that can operate during full load
LDC	Local Distribution Company	Utility that owns connecting distribution system
HONI	Hydro One Networks Inc.	Utility that owns distribution and transmission assets
OESC	Ontario Electrical Safety Code	Rules & requirements that govern electrical installations in Ontario
OGCC	Ontario Grid Control Center	Operations centre for Ontario Transmission Assets
TS	Transmission Station	Substation for transformation of transmission voltages (>= 69 KV) to distribution voltages (13.8 kV)
SEL	Schweitzer Engineering Laboratories	Manufacturer of utility-grade protection relays, communication processors and technologies.
SLD	Single Line Diagram	Schematic depicting facility electrical infrastructure
SCADA	Supervisory Communications and Data Acquisition	System of relays, controllers and network devices used to monitor, control electrical system

SECTION D: CONDITION ASSESSMENT

1. CARDINAL MS1

Cardinal MS1 is a 44 kV to 4160V municipal substation located at 715 County Rd. 2 in the village of Cardinal, Ontario. It is one of two substations in the Cardinal area, with the other being Cardinal MS2. The transformer is a 3/4 MVA Oil Filled Transformer that dates to 1953. It has been maintained but never refurbished. The 4160V system runs from the transformer secondaries down a riser to a three-bay S&C Metal-Enclosed Switchgear lineup that includes a metering bay and two outgoing fused switch bays. The switchgear was installed new in 2013. One feeder is normally closed at the station while the other is normally open. There is redundancy within the 4160V distribution system in Cardinal.

The station infrastructure consists of a small steel lattice structure for the overhead incoming dead-end, a small single column secondary riser support structure and a shed. The station has a large surface area, sufficient for future expansion or side-by-side station replacement. It is surrounded by an eight-foot chain-link fence topped with barbed wire.

Hourly load data was provided for Cardinal MS2. The load ranges from under 300 kW to approximately 1100 kW during the year. It appears that Cardinal MS1 was taken offline for a period, resulting in complete load shifting to Cardinal MS2, yielding a peak cumulative capacity of approximately 1800 kW. This data indicates that one transformer could effectively carry the Cardinal area load, providing a level of redundancy to the Cardinal distribution system. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed on August 24, 2017:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The maintenance activities undertaken at the substation determined that most of the core components are in good working order, particularly the switching equipment. The cumulative scoring for the high voltage and secondary switching equipment scored an average of 4.2 out of 5, with low scores

effectively resulting from concern over the age of the main switch, however, this component could be replaced with used or refurbished equipment relatively quickly in the event of a failure. The main switch does not exhibit any mechanical signs of failure.

The power transformer on the other hand exhibits evidence of overheating and insulation degradation based on the oil analysis & dielectric testing. Due to the age of the transformer, it's possible that it may be nearing end-of-life rather than having experienced high loading or other usage-based degradation. As such, we have assessed the transformer a score of 1.55 out of 5.

c) Station Infrastructure Assessment

The station is in relatively good condition for the age of the construction. The fencing, structures, foundations and ground grid all appear in good condition. The station would score a 3 out of 5, due to the lack of remote security equipment, if not for the condition of the secondary conductors (flexible bus) directly off the transformer secondary bushings. Due to the visible fraying, these conductors should be replaced (at relatively low cost) and result in a station infrastructure a score of 2.

As some redundancy exists between Cardinal MS1 & Cardinal MS2, we established a redundancy score of 3 out 5.

d) Summary & Recommendations

Based on the substation assessment, we have developed a total score of 1 out of 5. The score is based on the findings that the transformer is potentially nearing end-of-life. Due the age of the unit and the status of the oil sample, we recommend that a spare or replacement transformer be considered in the near future.

The following minor recommendations are made to improve the reliability of the substation:

- Replace flexible bus at the transformer secondaries.
- Consider a motion-based camera system with SCADA reporting
- Until the transformer is replaced, we recommend performing oil analysis on an annual basis to develop trended DGA data

During the site visit, we identified the following procedural items which should be considered:

- The main switch is not load break rated. While kirk keying is not required for utility personnel, we do recommend providing signage or written procedures locally to ensure staff operate the low voltage disconnects prior to opening the main switch.
- While a simple configuration, we also recommend a single line diagram be placed within the station. A lamacoid on Bay 1 of the secondary switchgear would be an appropriate location.

2. CARDINAL MS2

Cardinal MS2 is a 44 kV to 4160V municipal substation located at 3039 John St in the village of Cardinal, Ontario. It is the second of two substations in the Cardinal area, with the other being Cardinal MS1. The transformer is a 3/4 MVA Oil Filled Transformer that dates to 1953. It was refurbished in 1996 by Reliance Transformers. The 4160V system runs from the transformer secondaries down a riser to a three-bay S&C Metal-Enclosed Switchgear lineup that includes a metering bay and two outgoing fused switch bays. The switchgear was installed new in 1996. The switchgear pad was constructed to allow for a third fused switch bay. There is redundancy within the 4160V distribution system in Cardinal.

The station infrastructure consists of a concrete pole for the overhead incoming structure with underground cables connecting directly to the secondary bushings. The station has ample working space and located near industrial parking & residential properties.

Hourly load data was provided for Cardinal MS2. The load ranges from under 300 kW to approximately 1000 kW during the year. It appears that Cardinal MS1 was taken offline for a period, resulting in complete load shifting to Cardinal MS2, yielding a peak cumulative capacity of approximately 1800 kW. This data indicates that one transformer could effectively carry the Cardinal area load. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed on August 23, 2017:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The equipment assessment results of Cardinal MS2 are very similar to Cardinal MS1. The switching equipment, except for the Phase A HV Fuses, are in great condition and appear to have several years of useful life remaining. We recommend investigating the Phase A HV Fuses at the next available maintenance activity to determine if the fuseholders require adjustment or repair to improve resistivity measurement. We scored the switching equipment an average of 3.6 out of 5 mainly due to lack of spare fuses.

The power transformer though does exhibit signs of deterioration in both the oil analysis and insulation resistance testing results, like the transformer for Cardinal MS1. We have assessed the transformer a score of 1.55 out of 5.

c) Station Infrastructure Assessment

The substation infrastructure appears in good condition, with no concerns visible or noted through operations. The station infrastructure scores a 3 out of 5 based on the lack of remote security features.

As some redundancy exists between Cardinal MS1 & Cardinal MS2, we established a redundancy score of 4 out 5.

d) Summary & Recommendations

Based on the assessment performed for Cardinal MS2, we have developed a total score of 2.7 out of 5. The score is primarily based on the findings that the transformer is exhibiting conditions associated with end-of-life. Due to the age of the unit and the status of the oil sample, we recommend that a spare transformer or replacement transformer be considered soon.

The following other recommendations are made to improve station reliability:

- Revisit Phase A HV Fuses & Fuseholder to determine cause of high resistance
- Consider a motion-based camera system with SCADA reporting
- Continue to monitor health of the transformer until replacement: perform oil analysis on an annual basis to develop trended DGA data

During the site visit, we identified the following procedural items which should be considered:

- The main switch is not load break rated. While kirk keying is not required for utility personnel, we do recommend providing signage or written procedures locally to ensure staff operate the low voltage disconnects prior to opening the main switch.
- While a simple configuration, we also recommend a single line diagram be placed within the station. A lamacoid on Bay 1 of the secondary switchgear would be an appropriate location.

3. IROQUOIS MS

Iroquois MS is a 44 kV to 8320V municipal substation located at 5799 Carman Rd in the village of Iroquois, Ontario. It is the only substation in this area, serving the small industrial and residential customers in the vicinity. The station is equipped with two transformer, two outgoing feeders. Transformer T1 is a 3 MVA Oil-Filled transformer built in 1953 by Brown Boveri. Transformer T1 is fed from an overhead lattice structure that is equipped with a manual air break switch, and vertical cut-out fuseholders. Transformer T1 has top-mounted HV and LV bushings, with the secondaries connecting to an open-air steel framed structure. An underground riser from the structure connects the transformer secondaries to an S&C Padmount Switchgear unit.

Transformer T2 is a 3 MVA Oil filled transformer built in 2015 by Northern Transformer. The 44 kV main overhead structure is a dead-end framed wood pole with a vertical, double break S&C Load Break switch & fuse holders. Bare conductors connect from the base of the switch to the primary bushings of the transformer. The secondary bushings on Transformer T2 are enclosed, live-front, side mounted terminations which are connected by underground cable to an S&C Padmount Switchgear unit.

With the two transformers connecting through the S&C Padmount Switchgear unit, Rideau St Lawrence can entirely switch the station load from one transformer to the other. Interlocking can be modified to allow the transformers to operate in parallel for added redundancy and flexibility. No remote-control capability exists either, meaning a failure would require a truck roll and manual operation of the switching equipment.

Underground cables are then run over to the overhead secondary structure where two outgoing feeders are setup. One feeder (11F1) is fused, while the other (11F2) uses single phase, oil filled reclosers. The recloser is not controlled or monitored by any external device.

We have been provided with load data from the secondary side of Iroquois MS. Based on the data, it appears that the station is loaded between approximately 600 kW & 2300 kW; averaging 1280 kW. An additional 500 kVA of load is expected to be added in 2020.

a) Maintenance Data

The following maintenance activities were performed on October 18, 2097:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
  - Recloser testing for 11F2
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

DGA Analysis data from February 2017 was also made available for comparison.

b) Equipment Assessment

Based on assessment of the Maintenance reports, the high voltage switching equipment appears to be in good working order. The 44 kV Switch feeding T1-L is also equipped with a set of lightning arresters of which Phase C appears to require immediate replacement. While T1-L itself would score a 3 out of 5, it has been assessed a 1 out of 5 pending replacement. Transformer T2's switch T2-L is in good condition, scoring 4 out of 5, with point reduction due to not having spare fuses on site.

Power Transformer T1 appears to be deteriorating at it nears end of life. Maintenance data from the oil analysis yielded levels of Interfacial Tension and Neutralization Number outside of manufacturer and industry standard ranges. These results are indicative of oxidization and contamination of the insulating fluid. These results are bolstered by the findings of an oil leak & rust during the site visit. These results are very different from the 2017 DGA results which indicated that the transformer was in good working order. It is recommended that oil analysis continue more frequently (every year, at minimum), with removal from service dictated based on the trend & results of the analysis. At this time, the transformer is scored 2.3 out of 5. While the transformer should not be relied upon for an extended duration, it can remain in operation.

Power Transformer T2 is in great condition, which is predictable considering its age and loading conditions. Based on the site visit findings and the maintenance, it was assigned a score of 4.8 out of 5.

Secondary switching equipment is separated into two categories at this station, with manual switches for the bus tie & feeder 11F1, and a recloser for feeder 11F2. The S&C Padmount Switchgear is a PMH-13 unit that was installed in 2016. Maintenance documentation indicates that the unit is in near-brand new condition, resulting in a score of 5.

Feeder 11F1's overhead switch is an S&C Alduti-Rupter that appears to be in good condition from it's test results. Unfortunately, the Phase B lighting arrester associated with the outgoing feeder tests low, which results in a score of 2.

Feeder 11F2's recloser is a McGraw Edison Type L hydraulically controlled recloser. Although it is outside of its design life, its test results are reasonable in addition to the visual inspection which did not yield any indications of any concerns, resulting in a condition score of 4 out of 5.

c) Station Infrastructure Assessment

The substation's infrastructure exhibits some concerns which should be monitored. The concrete footings supporting the secondary overhead structure appear to be deteriorated with edges one of the footings approaching the base plate & the anchor bolts, although no rebar reinforcement or infringement of the anchor's required clearance indicates that the damage has not yet impacted structural integrity. It may be prudent to patch or seal the exterior of the concrete to prevent cracks or other structural damage from occurring.

Further, the metallic shed & storage space both exhibit oxidization on the exterior cladding although the structures are not critical to the operation of the station currently, and not concerning from a reliability perspective.

It was also noted that no remote monitoring or security measures at present at the substation. The cumulative station infrastructure score is 2 out of 5.

As there is no feeder redundancy available within town but there is a spare transformer for switching purposes, we have assessed the station a Redundancy Score of 4.

d) Summary & Recommendations

Based on the above assessments of the infrastructure and equipment at Iroquois MS, we have scored the station 3.3 out of 5.

The following recommendations are made to improve the reliability of the station:

- Replace lightning arrester on T1 and 11F1
- Consider a motion-based camera system with SCADA reporting
- Perform oil analysis on T1 annually; proactively remove transformer from service to avoid failure based on oil data trends
- Replace Transformer T1 to maintain redundancy.
- Perform preventative maintenance on concrete footings.

During the site visit, we identified the following procedural items which should be considered:

- The main switch T1-L is not load break rated. While kirk keying is not required for utility personnel, we do recommend providing signage or written procedures locally to ensure staff operate the low voltage disconnects prior to opening the main switch.
- While a simple configuration, we also recommend a single line diagram be placed within the station.

It should be noted that the load data indicates that Transformer T2 will experience loading generally in the area of 50% capacity, which can predict a longer than expected lifespan, however Transformer T1 will eventually need to be removed from service resulting in a high degree of risk for service in the Iroquois area.

4. MORRISBURG MS1

Morrisburg MS1 is a 44 kV to 4160V municipal substation located at 11 Fifth St. E. in the village of Morrisburg, Ontario. It is the first of two substations in Morrisburg, with the other being Morrisburg MS2. The transformer is a 5 MVA Oil Filled Transformer that dates to 1976. It has been maintained but never refurbished. Both incoming & outgoing structures are open-air, steel lattice with concrete footings. The 44 kV incoming structure is equipped with an air-break switch, cutout fuseholders and lightning arresters. The 4160V structure supports four (4) outgoing feeders, all equipped with load break switches & fuses. One of the feeders exits via underground cables while the remainder are overhead.

Load data for Morrisburg MS1 is provided via average load readings performed during the summer and winter months. No real-time or trended data is available as Hydro One data includes 44 kV customers in addition to the MS. The average load readings indicate loading of the station is approximately 2500 kW. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed on November 15, 2019:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The equipment at Morrisburg MS1 can be separated into two categories, the switching equipment and the transformer. The power transformer T1's test results indicate that it's dielectric breakdown has decreased below satisfactory levels since 2017. Due to this result, we score the transformer a 2.4 out of 5 and recommend continuing to perform oil sampling to monitor.

The switching equipment is in good condition based on the maintenance data. Certain elements appear to require monitoring or small component replacement, such an arc contact on 46F1 which should be replaced and a set of porcelain lightning arresters which are recommended for replacement to avoid porcelain fragments during a failure. Cumulatively the switching equipment would score 4 out of 5.

c) Station Infrastructure Assessment

The station infrastructure is also in fair condition. There are no visible code or structure concerns. The ground grid does exhibit some visible weeds which should be sprayed from time-to-time to avoid impact to the top layer of crushed stone. Otherwise, we would recommend remote station security of some type. The substation shed is also in poor condition, however it is not critical to the operation of the station. At this time, we would score the station infrastructure would score a 3 out 5.

As the station can only be temporarily fed from Morrisburg MS1, we have assessed the station a reliability score of 3 out of 5.

d) Summary & Recommendations

The Morrisburg MS1 station is in relatively good condition, with an assessed total station score of 3 out of 5. As with several other stations in this system, we have identified some concerns with the transformer which need to be monitored very closely; especially considering the lack of redundancy in the Morrisburg system.

The following recommendations are made to improve the reliability of the station:

- Replace lightning arresters on 46T1-L
- Consider a motion-based camera system with SCADA reporting
- Perform oil analysis on T1 annually;

During the site visit, we identified the following procedural items which should be considered:

- The main switch T1-L is not load break rated. While kirk keying is not required for utility personnel, we do recommend providing signage or written procedures locally to ensure staff operate the low voltage disconnects prior to opening the main switch.
- The station structure is not labelled for 46F4 nor is a single line provided onsite. We recommend preparing both as lamacoids and mounting during subsequent maintenance activities.

5. MORRISBURG MS2

Morrisburg MS2 is a 44 kV to 4160V municipal substation located on Village Rd in Morrisburg, Ontario. It is the second of two substations in Morrisburg. The transformer is a 5 MVA ONAN Oil Filled Transformer that was

manufactured in 1988. It has been maintained but never refurbished. The incoming structure is open-air, steel lattice with concrete footings. The 44 kV incoming structure is equipped with an air-break switch, cutout fuseholders and lightning arresters. The 4160V system consists of a three-bay S&C Metal Enclosed Switchgear lineup, with metering cell as Bay 1 and two fused load break switches in Bay 2 & Bay 3 respectively. The outgoing feeder conductors are underground cables from the S&C switchgear to riser poles just outside the station.

Load data for Morrisburg MS2 is provided via average load readings performed during the summer and winter months. No real-time or trended data is available as Hydro One data includes 44 kV customers in addition to the MS. The average load readings indicate loading of the station is approximately 1400 kW. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed on October 16, 2019:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The equipment at Morrisburg MS2 can be separated into two categories, the switching equipment and the transformer. The power transformer T1's test results indicate that it's experiencing elevated levels of Carbon Monoxide and Total Dissolved Combustible Gas, however the results are consistent with results produced during maintenance activities in 2017. The elevated level of these gases is indicative of overheating or secondary feeder faults, with the load data consistent with a transformer which may have been overloaded in the past, but which now carries relatively low load levels. We scored the transformer a 2.35 out of 5.

The switching equipment at Morrisburg MS2 requires some attention. The switch MS2F2-L has a broken arc compressor which is required for full load operation. This is a concern as the station does not have a load break switch on the 44 KV system, which means that the station relies on 4160V load break operation. Further, the metal-enclosed switchgear cells which house both MS2F1-L and MS2F2-L are exhibiting concerns of internal rusting. A more thorough analysis of the rust, as well as documenting it's progress should be undertaken at future maintenance activities.

Although some minor concerns exist, these are readily rectified, we have assessed the station switching equipment an average score of 3.9 out of 5. The scoring can be increased to 4.3 once MS2F2-L is repaired.

c) Station Infrastructure Assessment

The station's infrastructure is in good to great condition. The lattice structure was replaced or refurbished very recently, with ground grid, foundations and fencing all appearing to be in great condition as well. Based on a visual inspection and from maintenance notes, there does not appear to be any code concerns. As with all stations in the system, there is no security measures beyond the physical station fencing.

We have assessed the station infrastructure a score of 3 out of 5.

In discussion with Operations personnel, the station has no redundancy in coordination with MS1 due to feeder conductor limitations. As such, we score the station a reliability score of 3.

d) Summary & Recommendations

Morrisburg MS2's condition is very similar to MS1 with the exception that it's incoming structure and associated station infrastructure is in slightly better condition. The transformer T1 needs to be monitored closely and a plan should be put in place for its eventually replacement; especially considering the lack of redundancy in the Morrisburg system. A transformer replacement would lift the station from a score of 3.5 out of 5, to 4 out of 5.

In addition to the replacement of T1, we would recommend the following:

- Replace arc contacts on MS2F2-L;
- Consider a motion-based camera system with SCADA reporting;
- Perform oil analysis on T1 annually;

During the site visit, we identified the following procedural items which should be considered:

- The main switch is not load break rated. While kirk keying is not required for utility personnel, we do recommend providing signage or written procedures locally to ensure staff operate the low voltage disconnects prior to opening the main switch.
- While a simple configuration, we also recommend a single line diagram be placed within the station.

6. PRESCOTT MS1

Prescott MS1 is a 44 kV to 4160V substation consisting of open-air steel lattice substation structure on the primary, a 5000 kVA transformer and S&C Metal-Enclosed Switchgear installed inside of a brick & mortar substation building. The lattice structure supports an air break switch, fuse holders directly above the transformer, with IPS rigid bus running through the brick wall supported by insulators on either side & connecting to underground cable into the S&C Switchgear. The station is located at 675 Corrine St, Prescott, ON.

Load data for Prescott MS1 from three days in July & three days in January suggest that the station carries approximately 1900 kW of load. Operationally, the station has some redundancy within the town of Prescott as feeders can be manually switched between the four stations in the area. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed at Prescott MS1 on November 13, 2017:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The equipment at Prescott MS1 can be separated into two categories, the switching equipment and the transformer. The power transformer T1's test results indicate that the transformer is in good condition resulting in a score of 3.6 out of 5, although it does have elevated PCB content which we recommend performing an oil replacement proactively.

Overall switching equipment is in good condition. The 4160V Switchgear was installed recently, in 2017 and is in near brand-new condition. The primary switch is older however can still be considered in good condition based on the maintenance results. We scored the switching equipment an average of 4.8 out of 5.

c) Station Infrastructure Assessment

The station infrastructure at Prescott MS1 is in relatively good condition, although the routing of uninsulated IPS is generally not performed any longer (usually cable, cable bus or open bus-duct now). The lattice structure & foundations outside do not exhibit any cause for concern.

While the building itself is utilitarian in nature, it encloses outdoor rated metal enclosed switchgear which does not require climate control

Considering the design, functionality and visual inspection results, we have assessed the station a score of 3 out of 5; which would be considered a 5 out of 5, if not for lack of remote security.

As mentioned previously, the station has redundancy in its feeder distribution system, albeit manually, and there receives a redundancy score of 4 out of 5.

d) Summary & Recommendations

Based on the substation assessment, we have developed a total score of 3.8 out of 5. The score is nearly the highest achievable score for the stations in the Rideau St. Lawrence distribution system due to the lack of remote security, and our scoring matrix. There are no recommendations for improving the reliability of this station.

During the site visit, we identified the following procedural items which should be considered:

- While a simple configuration, we also recommend a single line diagram be placed within the station. A lamacoid inside the switchgear building would be an appropriate location.
- Repair the metering devices on the 4160V system and consider a SCADA interface.

7. PRESCOTT MS2

Prescott MS2 is a 44 kV to 4160V substation consisting of a single open-air steel substation structure supporting both primary and secondary switching equipment, and a 5000 kVA ONAN transformer. The primary switch is an air break switch with separate fuseholders directly over the transformer. The secondary switch and fusing are two (2) outgoing feeders mounted vertically on the far side of the structure, away from the transformer. The station is located at 101 Churchill Rd. E, Prescott.

Load data for Prescott MS2 was provided for feeder 2 only from three days in July & three days in January which suggests the station carries 500-700 kW of load. Operationally, the station has some redundancy within the town of Prescott as feeders can be manually switched between the four stations in the area. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed at Prescott MS2 on July 28, 2017:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

Unfortunately test data is not available for the switching equipment on-site however anecdotal evidence, operational experience and the visual inspection estimates a score of 3.5 out of 5 for the switching equipment with no immediate concerns.

The transformer was recently replaced with a refurbished transformer in 2017. In accordance with the maintenance test results from the commissioning activities, the transformer is in good condition, scoring a 3.6 out of 5.

c) Station Infrastructure Assessment

The station's infrastructure is in good condition. The lattice structure and footings, and transformer pad all appear in good condition. The station also does exhibit some code-related grounding defects which should be rectified. The shed/building exhibits signs of rust but is not critical to the operation of the station at this time. As a result, the station has been graded a 3 out of 5.

As mentioned previously, the station has redundancy in its feeder distribution system, albeit manually, and there receives a redundancy score of 4 out of 5.

d) Summary & Recommendations

Based on the substation assessment, we have developed a total score of 3.3 out of 5. There are no recommendations for improving the reliability of this station.

During the site visit, we identified the following procedural items which should be considered:

- While a simple configuration, we also recommend a single line diagram be placed within the station. A lamacoid at the metering enclosure would be an appropriate location.

8. PRESCOTT MS3

Prescott MS3 is a 44 kV to 4160V substation consisting of open-air substation structures on the primary & secondary sides of a 5000 KVA ONAN transformer. The primary side is a steel lattice riser structure with a Dominion Air Break Switch, fuseholders to the top mounted bushings of the transformer. The secondary feeds a steel lattice structure supporting rigid IPS bus that is outfitted with four (4) switch & fuse outgoing feeders. The station is located at 101 Churchill Rd. E, Prescott and is located within the same fenced perimeter as Prescott MS2.

Load data for Prescott MS3 from three days in July & three days in January suggest that the station carries approximately 2960 kW of load. Operationally, the station has some redundancy within the town of Prescott as feeders can be manually switched between the four stations in the area. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed on October 23, 2019:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear

  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The equipment at Prescott MS3 can be separated into two categories, the switching equipment and the transformer. The power transformer T1's test results indicate that the insulating oil is in good condition, however the TTR, Dissipation Testing both yielded abnormal results indicating degradation. From a mechanical perspective, the transformer's temperature gauge no longer functions, which is a concern. We scored the transformer a 3.1 out of 5.

Overall switching equipment is in good condition. Each of 40F1, 40F2 and 40F3 exhibit minor issues which should be repaired or investigated. We scored the switching equipment an average of 3.5 out of 5.

c) Station Infrastructure Assessment

Prescott MS3's station infrastructure does have areas requiring renovation or consideration. The primary pole & secondary lattice structure both appear in good condition, while concrete footings of the lattice structure present some cracking & degradation. The station also does exhibit some code-related grounding defects which should be rectified. Refer to the maintenance report for more information. As a result, the station has been graded a 2 out of 5.

As mentioned previously, the station has redundancy in its feeder distribution system, albeit manually, and there receives a redundancy score of 4 out of 5.

d) Summary & Recommendations

Based on the substation assessment, we have developed a total score of 2.8 out of 5. The score is based on the findings that the switching equipment requires some repairs and that some grounding modifications are required to bring the station up to current code requirements.

The primary issue with the station is it's switching equipment, with repairs required particularly on 40F1 & 40F2, as well as procuring spare fuses for the HV switch and fixing the grounding issues. We recommend pursuing those repairs, which would improve the station condition from 2.8 to 3.5.

The following minor recommendations are made to improve the reliability of the substation:

- Consider a motion-based camera system with SCADA reporting

- We recommend performing all transformer testing on an annual basis to develop trended data and monitor for future failure
- Add a second ground connection from the gang operated switch handle to the ground mat & ground grid per OESC requirements.

During the site visit, we identified the following procedural items which should be considered:

- While a simple configuration, we also recommend a single line diagram be placed within the station. A lamacoid at the metering enclosure would be an appropriate location.

9. PRESCOTT MS4

Prescott MS4 is a 44 kV to 4160V substation consisting of open-air substation structures on the primary & secondary sides of a 5000 KVA ONAN transformer. The primary side is a wood pole riser structure through an S&C Air Break Switch, fuseholders to the top mounted bushings of the transformer. The secondary feeds a steel lattice structure supporting rigid IPS bus that is outfitted with two (2) Cooper Kyle Type W reclosers and space for a future third. The station is located at 800 Boundary Rd, Prescott, ON.

Load data for Prescott MS4 from three days in July & three days in January suggest that the station experiences between 1350 to 1700 kW of load. Operationally, the station has some redundancy within the town of Prescott as feeders can be manually switched between the four stations in the area. No significant load growth is expected.

a) Maintenance Data

The following maintenance activities were performed on May 24, 2018:

- High Voltage Switch Testing:
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Secondary Switchgear
  - Mechanical/Operational Verification
  - Contact Visual Inspection & Resistance Testing
  - Fuses & Fuseholder visual inspection & resistance testing
  - All components cleaned and fasteners verified
- Power Transformer:
  - Bushing & Connection Verification
  - Turn Ratio Test
  - Primary & Secondary Winding Resistance
  - Capacitance Test
  - Insulation Resistance Testing
  - Oil Sampling & Testing

b) Equipment Assessment

The equipment at Prescott MS4 can be separated into two categories, the switching equipment and the transformer. The power transformer T1's test results indicate that the dielectric strength of it's oil is being reduced, while it's dissipation factor is low. Given the condition of its exterior tank & radiator

which is exhibiting rust due to a degrading paint cover, the transformer is considered in poor condition, requiring replacement or refurbishment. We scored the transformer a 2.2 out of 5.

Overall switching equipment is in good condition. The insulation test results for the recloser on 30F1 appears low, we suggest this be investigated on future maintenance activities; potentially sooner than every three (3) years to monitor for possible failure. We scored the switching equipment an average of 3.8 out of 5.

c) Station Infrastructure Assessment

The station's infrastructure is in good to great condition. The primary pole & secondary lattice structure both appear in good condition, while concrete footings & pads do not appear to exhibit any degradation. As with the other stations in the system, security is provided only by a station fence, resulting in an infrastructure score of 3 out of 5.

As mentioned previously, the station has redundancy in its feeder distribution system, albeit manually, and there receives a redundancy score of 4 out of 5.

d) Summary & Recommendations

Based on the substation assessment, we have developed a total score of 3 out of 5. The score is based on the findings that the transformer is a cause for concern, although provided with some redundancy through nearby stations. Due the age of the unit and the status of the oil sample, we recommend that a spare, replacement or refurbishment be considered.

The substation is otherwise in good condition and could be re-assessed at 4.3 out of 5 following rectification of transformer concerns.

The following minor recommendations are made to improve the reliability of the substation:

- Monitor 30F1 insulation resistance results
- Consider a motion-based camera system with SCADA reporting
- Until the transformer is replaced, we recommend performing all testing on an annual basis to develop trended data

During the site visit, we identified the following procedural items which should be considered:

- While a simple configuration, we also recommend a single line diagram be placed within the station. A lamacoid at the metering enclosure would be an appropriate location.

SECTION E: CONCLUSIONS

a) Substation Scoring Summary & Priorities

While each station was scored individually and summarized below with the top project and a priority rating given the concern presented by the data, local loading (i.e. if any redundancy within the area) and level of concern presented by the top project. For context, a station with a score under 3 likely requires capital planning soon, while a station above 3 is in good condition and may need only small modifications or preventative maintenance activities.

Station	Total Station Score	Top Project	Priority	Comments
Cardinal MS1	2.6	New T1	Medium	MS2 could bear load
Cardinal MS2	3.1	New T1	Medium	MS1 could bear load
Iroquois MS	3.3	New T1	Low	T2 on-site & good condition
Morrisburg MS1	3.1	New T1	High	MS2 may be able to bear load, but feeder conductor may be impacted.
Morrisburg MS2	2.7	New T1	Severe	MS1 may be able to bear load, but feeder conductor may be impacted.
Prescott MS1	3.8	N/A	N/A	No project recommendations.
Prescott MS2	3.3	N/A	N/A	No project recommendations
Prescott MS3	2.8	40F1 & 40F2 Repair	Medium	Some redundancy within Prescott area
Prescott MS4	3.0	New T1	Low	Some redundancy within Prescott area

The following chart illustrates the presented severity levels:

Severity Level	Comment
Very low	No bearing on reliability.
Low	Would impact reliability but requires N-1 failure which is low risk.
Medium	Would impact reliability but requires N-1 failure but more likely to occur.
High	Would impact reliability. Could be dealt with for short-term duration.
Severe	Failure impacts reliability.

For context, a score under 3 likely requires capital planning over the next 1-5 years, while a score above 3 implies that longer term planning can be considered.

From the above, a significant quantity of transformers is nearing end-of-life, as ascertained by the maintenance results. In order to better accommodate the replacement of these transformers in the capital budget (or maintenance budget depending on the payment terms), we recommend a staggered approach to the replacements. Since the substations (except for Iroquois MS) are 44 kV to 4160V stations, a single spare transformer can be used to replace any station transformer. Whether procured through capital expenditure or leased, a transformer can be held initially as a spare, acting as an emergency replacement for all stations. Subsequent purchases can then either be installed directly on-site or used to re-stock the spare if it has already been depleted.

The following table has been developed to map potential projects and their impact to the station scoring based on our established ranking.

Station	Beginning Station Score	Recommended Projects	Priority	Change in Station Score	Comments
Cardinal MS1	2.6	Replace T1 Replace Flex Bus	Medium Low	+1.1 +0.3	MS2 could bear load. Recommend replacement at next maintenance
Cardinal MS2	3.1	Replace T1 Add Spare Fusing	Medium Medium	+1.2 +0.3	MS1 could bear load Recommend best practice
Iroquois MS	3.3	Replace T1 Replace Lightning Arresters Concrete Footing Preventative Maintenance	Low Low Medium	+0.6 +0.1 +0.3	T2 is primary unit. Recommend replacement at next maintenance. Perform initial assessment in near future.
Morrisburg MS1	3.1	Replace T1 Replace Porcelain Lightning Arresters Replace LV Fuse	Severe Low Low	+0.9 +0.1 +0.1	High due to redundancy concerns Recommend replacement at next maintenance. Recommend replacement at next maintenance.
Morrisburg MS2	2.7	Replace T1 Replace Porcelain Lightning Arresters Replace Arc Contact + Spare HV Fuses	Severe Low Low	+0.9 +0.1 +0.4	High due to redundancy concerns Recommend replacement at next maintenance. Recommend replacement at next maintenance.
Prescott MS1	3.8	N/A	N/A	N/A	N/A
Prescott MS2	3.3	N/A	N/A	N/A	N/A

Prescott MS3	2.8	Replace T1	Low	+0.7	Relatively good condition, not immediate concern.
		40F1 & 40F2 Repair + Spare HV Fuses	Low	+0.4	Recommend replacement at next maintenance.
		Grounding Repairs	Medium	+0.4	Recommended as soon as possible.
		Footing Patches	Low	+0.4	Perform initial assessment in near future.
Prescott MS4	3.0	Replace T1	High	+0.9	Some redundancy on feeder.

b) Additional Topics

Through the development of this condition assessment, it was apparent that the stations are well maintained and operated to this point in their lifecycle. Based on the analysis, there are minimal projects which need to be undertaken in order to extend the lifetime of the stations another 10 years or more, apart from the implementation of a universal program for transformer replacement.

We do want to note that some devices did pass the condition assessment with fair maintenance results, however some actions are recommended to preserve the reliability and operation of the stations:

- HV Disconnect Switches
  - As with the Power Transformers, the HV Disconnects are approaching end-of-life and may be difficult to find spare parts for. Stations such as Iroquois (T1-L), Cardinal MS1, Cardinal MS2, Morrisburg MS1, Morrisburg MS2 are all equipped with HV Disconnects which were procured from manufacturer's which no longer exist and for which spare part capacities will deplete overtime. A program from replacement with new S&C devices may be prudent, however is not predicated on the analysis of any maintenance data. A stocked spare 44 kV disconnect is recommended as well.

- Oil Analysis
  - If a staggered spare transformer & replacement program is selected, it will be necessary to increase the frequency of oil sampling. We recommend that any transformer identified as necessitating a replacement project be sampled at a minimum of once per year. The data should be built into a tracking sheet to establish a deterioration trend.

c) Design Recommendations

While this report was focused on the assessment of the substations and recommendations associated with maintaining the station reliability & infrastructure, the following topics could be considered in order to improve the capabilities and reliability of the station:

- For substations such as Cardinal MS1 and Cardinal MS2 where fuses are used for circuit protection, it is recommended that future component replacements include the use of reclosers for feeder protection. Reclosers can be pole mounted or built into metal-enclosed switchgear, and provide substantial capabilities:

    - An obvious advantage of reclosers is that they can be configured, with protective relaying, to automatically reclose during fault scenarios in the event only momentary fault conditions (i.e. tree contact) occurs. In discussion with Rideau St. Lawrence personnel, currently field staff will perform an inspection prior to replacing the fuses and re-closing the switch but uncertainty exists when the inspection yields no root cause.
    - Reclosers can be further configured with remote operating apparatus (an HMI, or simple pushbuttons) to allow operators distance from the electrical device during operation.

- SCADA & Metering has been a topic of discussion amongst most utilities as part of the smart metering & grid modernization efforts that have been pursued over the past 10-15 years. In discussion with operators, there is currently no operators center overseeing the status or control of the distribution system. Considering the configuration of the system and the devices available (mostly fused disconnects), there is not significant impetus to developing a system at this time, however steps can also be taken to allow for this if design steps such as a transition to reclosers is considered:

    - Installation of metering devices on all feeders
    - Development of SCADA screens for each station (view device status, load flows, etc.)
    - Development of alarm emailing & text messaging for operations staff
    - Remote control of feeder devices (reclosers if available) to avoid truck rolls during inclement weather by re-engaging reclosers.

  It should also be noted that Rideau St. Lawrence is considered to have very low cyber security risk in its infrastructure as the stations require physical access to perform switching or affect system performance.

- As part of the telecommunications infrastructure of a SCADA (or eventual SCADA system), some security infrastructure should be added. A relatively simple, single camera setup with on-site storage would be suitable for the nine (9) stations. With a SCADA system, an alarm and/or photo can be delivered during motion sensor activation, but otherwise just locally stored for future review or remote viewing on demand.

- We recommend reviewing the ground grid design for 44 kV utility stations on a 10-year basis due to the age of some of the stations, and the typically rising fault currents experienced in the Ontario transmission & distribution systems. The fault levels have been rising due to increasing renewables penetration, as well as increasing propensity for parallel system operation.

APPENDIX A: CONDITION ASSESSMENT SUMMARIES

Summary

Substation	**IROQUOIS DS**
Address	**5799 Carman Rd., Iroquois, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
T1	BROWN BOVERI	44 kV	Delta	8320/4160 V	Wye Ground	3000	66	N/A
T2	NORTHERN TRANSFORMER	44 kV	Delta	8320/4160 V	Wye Ground	3000	4	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
T1	2	4	4	3	4	4	1	2.3
T2	5	5	5	5	5	4	5	4.8

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
T1-L	EASTERN POWER DEVICES	44 kV	46 kV	1957 (assumed)	N/A	600A	N/A	No	S&C PF	SMD	100E	4
T2-L	S&C ALDUTI RUPTER	44 kV	46 kV		N/A	600A		Yes	S&C PF	POWER FUSE	100E	0
11-F1	S&C ALDUTI RUPTER	7.2 kV	8.3 kV		N/A	600A		Yes	S&C	SM-5	200A	2
PADMOUNT	S&C	13.8 kV	15 kV	3	N/A	600A		Yes	S&C		200A	3

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
T1-L	4	4	2	2	3.1
T2-L	5	5	5	2	4.6
11-F1	4	4	4	4	4.0
PADMOUNT	5	4	5	5	4.7
Comments: -T1-L Lightning Arrester Phase C needs replacement.. -11-F1 Phase B Lightning Arrester needs replacement					

	Recloser(s)						
	Switching Equipment Data						
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**
11F2	MCGRAW EDISON	4800 V	8320 V	N/A	N/A	100A	5 KA

	Condition Assessment				
Device #	**Ops. Counter**	**Mech. Op.**	**Contact Res. (Closed)**	**Contact Res. (Open)**	**Overall**
11F2	N/A	4	4	4	4

Station Infrastructure Score		
	Condition	**Comments**
Building	3	
Fencing	4	
Ground Grid	4	
Structures	3	
Foundations	2	
Security	3	
Safety	3	
Conductors	4	
Redundancy	4	T1 is on potential but not loaded. Switching can't be performed under load. No feeder redundancy.
Total Score	3.3	

Summary

Substation	**CARDINAL DS1**
Address	**715 County Rd. #2, Cardinal, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
T1	Brown Boveri	44 kV	Delta	4160/8320 V	Wye Ground	3000	66	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
T1	4	4	4	2	1	1	1	1.55

Comments:
-Transformer oil exhibits high Carbon Dioxide content (3307 ppm), lower than required Dielectric Breakdown and lower than expected Interfacial Tension which requires close monitoring. May be exhibition of overloading/overheating or simply degradation over time.
-Recommend transformer replacement or spare stock in the future.

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
23TIL-X	Delta Star	46 kV	48 kV	Unknown	N/A	600A	N/A	No	Dominion Cutout Tower Mount 2834-C2	Tower Mont	65E	6
23F1	S&C	4.2 kV	4.8 kV	6	N/A	600A	180	Yes	S&C SM 86641R2	SM	400E	6
23F2	S&C	4.2 kV	4.8 kV	6	N/A	600A	180	Yes	S&C SM 86641R2	SM	400E	6

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
23TIL-X	4	5	4	2	4.0
23F1	5	4	3	4	4.0
23F2	5	5	4	4	4.6

Comments:
-23F1 Contact Resistance of Fuseholder passes although differs from 23F2. Likely related to loading. No immediate concerns but recommend trending in future maintenance reports.
-Recommend Interlocks for switch or clear demarcation of operating procedures for operating primary switch. A lamacoid could be created and installed on-site. Air break switch should not be operated under load.
-23T1-L is aging hardware but exhibits no discernable issues. Recommend keeping 48 kV fuses in stock on site or in shop.

Station Infrastructure Score		
	Condition	**Comment**
Building	5	No building.
Fencing	5	N/A
Ground Grid	4	Recommend backfilling around S&C Switc
Structures	5	N/A
Foundations	5	N/A
Security	3	No cameras.
Safety	3	
Conductors	2	Transformer Flexible Secondaries visibly fr
Redundancy	4	N/A
Total Score	2.6	

Recommendations
'- Transformer requires monitoring or prioritization.
- Substation otherwise in good condition, with exception of transformer, score would be 4.
- No test data on substation bus or conductors. Recommend replacing transformer secondary connections at next maintenance shutdown due to visible fraying. Assessing secondaries based on IR scanning or other techniques would not be worth the cost of replacement.

Summary

Substation	**CARDINAL DS2**
Address	**3039 John St., Cardinal, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
T2	Moloney Electric Co.	44 kV	Delta	4160/2400 V	Wye Ground	3000	67	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
T2	4	4	4	2	1	1	1	1.55

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
CSST2-L	Kearny	46 kV	48.3 kV	N/A	N/A	N/A		Yes	S&C SMD-2C 186925R1-T4	SMD-2C	65E	0
33F4	S&C	4.2 kV	4.8 kV	23	N/A	600A		Yes	S&C SM5S 86641R2	SM5S	300E	0
33F5	S&C	4.2 kV	4.8 kV	23	N/A	600A		Yes	S&C SM5S 86641R2	SM5S	300E	0

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
CSST2-L	4	4	3	2	3.4
33F4	4	4	4	2	3.7
33F5	4	4	4	2	3.7

Comments:
-Elevated fuse resistance readings for Phase C, posible fuse holder refurbishment or fuse replacement required in near future.
-Recommend Interlocks for switch or clear demarcation of operating procedures for opening. Air break switch should not be operated under load.
-Recommend switch replacement ?

	Condition	
Building	5	No building.
Fencing	5	
Ground Grid	3	
Structures	4	
Foundations	5	
Security	3	
Safety	5	
Conductors	4	
Redundancy	4	
Total score	3.1	

Summary

Substation:	**MORRISBURG MS1**
Address	**11 Fifth Street East, Morrisburg, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
MS1 - 11 FIFTH ST	HK PORTER COMPANY CANANA LTD	44 kV	Delta	4160/2400 V	Wye Ground	5000	43	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
MS1 - 11 FIFTH ST	4	4	4	4	4	1	2	2.4

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
46T1-L	EASTERN POWER DEVICES	46 kV	48.3 kV	N/A	N/A	600 A	N/A	No	S&C SMD 5249872	SMD	150 A	3
46F1	S&C	7.2 kV	8.3 kV	N/A	N/A	600 A	N/A	Yes	S&C POWER FUSE SM5 86151R2	SM5	400 A	4
46F2	S&C	7.2 kV	8.3 kV	N/A	N/A	600 A	N/A	Yes	S&C POWER FUSE SM5 87511	SM5	400 A	4
46F3	S&C	7.2 kV	8.3 kV	N/A	N/A	600 A	N/A	Yes	S&C POWER FUSE SM5 86151	SM5	400 A	4
46F4	S&C	14.4 kV	17 kV	N/A	N/A	600 A	N/A	Yes	S&C POWER FUSE SM5 86152R2	SM5	400 A	4

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
46T1-L	4	4	4	5	4.1
46F1	4	4	4	5	4.1
46F2	4	4	4	5	4.1
46F3	4	4	2	5	3.6
46F4	4	4	4	5	4.1

Comments:
-46F1 arc contact is damaged, should be replaced.
-46F3 Phase A fuse hairline crack
-46T1-L is equipped with porcelain arresters; polymer are recommended as porcelain explode during failures.

	Condition	**Comments**
Building	3	
Fencing	4	
Ground Grid	4	
Structures	3	
Foundations	3	
Conductor	4	
Security	3	
Safety	5	
Redundancy	3.5	Can be fed from MS1
		Can feed MS1 but only temp
		Concern : feeder conductor and total load
Total Station	3.1	

Summary

Substation:	**MORRISBURG MS2**
Address	**Village Rd, Morrisburg, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
MS2 - VILLAGE RD	Transelectrix	44 kV	Delta	4160/2400 V	Wye Ground	5000	31	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
MS2 - VILLAGE RD	4	4	4	3	5	1	2	2.35

	Switching Equipment										
	Switching Equipment Data								Fuse Equipment Data		
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
W20T1-L	KEARNEY NATIONAL CANADA	46 kV	47.5 kV	31	N/A	600 A		No	DOMINION CUTOUT BPD46100		125 A	0
MS2F1-L	S&C	14.4 kV	17 kV	30	N/A	600A	40 kA	Yes	S&C SM-5S 86642R2	SM-5S	400 A	3
MS2F2-L	S&C	14.4 kV	17 kV	30	N/A	600A	40 kA	Yes	S&C SM-5S 86642R2	SM-5S	400 A	3

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
W20T1-L	2	5	5	1	3.6
MS2F1-L	4	5	4	5	4.4
MS2F2-L	1	5	4	5	3.6
Comments: -Replace					

	Condition	**Comments**
Building	N/A	No building.
Fencing	4	None.
Ground Grid	3	Some weeds.
Structures	4	No comment.
Foundations	4	
Conductor	2	
Security	3	No cameras. Previous copper theft.
Safety	5	
Redundancy	3.5	Can be fed from MS1 temporarily
Total Station	2.7	

Summary

Substation:	**PRESCOTT MS1**
Address	**103 Churchill East, Prescott, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
B20IT1-X	Ferranti Packard	44 kV	Delta	4800 V	Wye	5000	54	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
B20IT1-X	4	4	4	4	3	2	4	3.55

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
Tower Switch	Dominion Cutout	44 kV	48.3 kV	N/A	N/A	600A	40 kA	Yes	S&C SMD-50	SMD-50	100E	2
Tower Switch	S&C	4.2 kV	4.8 kV	N/A	N/A	600 A	25 kA	Yes	N/A	N/A	N/A	N/A
46F2	S&C	4.2 kV	4.8 kV	N/A	N/A	600 A	25 kA	Yes	S&C SMD-40	SMU-40	250E	9
46F3	S&C	4.2 kV	4.8 kV	N/A	N/A	600 A	25 kA	Yes	S&C SMD-40	SMU-40	250E	9
46F4	S&C	4.2 kV	4.8 kV	N/A	N/A	600 A	25 kA	Yes	S&C SMD-40	SMU-40	250E	9

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
Tower Switch	4	4	4	5	4.1
Tower Switch	5	5	5	5	5.0
46F2	5	5	5	5	5.0
46F3	5	5	5	5	5.0
46F4	5	5	5	5	5
Comments:					

	Condition
Building	5
Fencing	5
Ground Grid	5
Structures	5
Foundations	5
Conductor	5
Security	5
Safety	5
Redundancy	4
Total score	3.8

Summary

Substation:	**PRESCOTT MS2**
Address	**103 Churchill East, Prescott, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
T1	Reliance Power	44 kV	Delta	4800 V	Wye	5000	29	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
T1	4	4	4	4	4	2	4	3.6

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
					0.0
Comments:					

	Condition
Building	5
Fencing	4
Ground Grid	4
Structures	4
Foundations	4
Conductor	4
Security	3
Safety	4
Redundancy	4
Total score	3.3

Summary

Substation:	**PESCOTT MS3**
Address	**103 Churchill East, Prescott, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
T1	ARCHER	44 kV	Delta	4160/2400V	Wye Ground	5000	56	

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
T1	3	1	4	4	1	1	4	3.05

-Transformer Temperature gauge not working
-Transmformer nameplate missing
-Turns Ratio reading lower than expected.
-Dissipation Test yields higher than expected results.

	Switching Equipment										
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
E201T1-L	DOMINION	46 kV	48.3 kV		N/A	600A	N/A	NO	S&C SMD-1A 118925R1	SMD-1A	100 A	6
40F1	S&C ALDUTI RUPTER	7.5 kV	7.5 kV		N/A	400 A		Yes	S&C SMP-W 86151	SM-5	400 A	6
40F2	S&C ALDUTI RUPTER	7.5 kV	7.5 kV		N/A	400 A		Yes	S&C SMP-W 86151	SM-5	400 A	6
40F3	S&C ALDUTI RUPTER	7.2 kV	8.2 kV	58	N/A	600 A		Yes	S&C SMP-W 86151	SM-5	400 A	6
40F4	S&C ALDUTI RUPTER	7.5 kV	7.5 kV		N/A	400 A		Yes	S&C SM-5 86151R2	SM-5	400 A	6

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
E201T1-L	4	4	4	1	3.6
40F1	1	4	4	5	3.3
40F2	1	3	3	5	2.7
40F3	4	4	2	5	3.6
40F4	4	4	4	5	4.1

Comments:
-40F3 exhibits fuse resistance differences greater than expectations, recommend monitoring fuses & fuseholders during futrue maintenance.
-40F2 exhibits contact & fuse resistance differences greater than expectations, recommend monitoring fuses & fuseholders during future maintenance.
-No spare primary fuses on-site; located at Industrial Rd. shop.
-40F1 & 40F2 both have arc contacts in poor condition. This should be rectified due to lack of load break switch on primary.

	Condition
Infrastructure	
Building	N/A
Fencing	4
Ground Grid	4
Structures	4
Foundations	2
Conductor	4
Security	3
Safety	3
Redundancy	4
Total score	2.8

Summary

Substation:	**PRESCOTT MS4**
Address	**800 Boundary Rd., Prescott, ON**

	Transformers							
	Transformer Data							
Device #	**Manufacturer**	**Primary Voltage**	**Primary Config.**	**Secondary Voltage**	**Secondary Config.**	**Size (kVA)**	**Age**	**Refurb.**
T1	Reliance Power Equipment	44 kV	Delta	4160/2400 V	Wye Ground	5000	28	N/A

	Condition Assessment							
Device #	**Mechanical**	**TTR**	**Winding Resistance**	**DAT**	**Cap.**	**Spare**	**DGA**	**Overall**
T1	2	4	4	4	2	1	2	2.2

Comments:
-Transformer T1 extgerior paint in poor condition; exhibiting rust.
-Dielectric breakdown is low per DGA analysis
-Dissipation is higher than normal; although could be result of age.

	Switching Equipment											
	Switching Equipment Data								Fuse Equipment Data			
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**	**Load Break (Y/N)**	**Fuseholder**	**Fuse Type**	**Fuse Size**	**Spare Qty**
H201T-L	S&C	44 kV	46 kV	33	N/A	600A	40 KA	Yes	Dominion	N/A	N/A	X2 65A X2 125A

	Condition Assessment				
Device #	**Mech. Op.**	**Contact Res.**	**Fuse Res.**	**Spares**	**Overall**
H201T-L	4	5	4	4	4.3

Comments:
- None

	Recloser(s)						
	Switching Equipment Data						
Device #	**Manufacturer**	**Nom. Voltage**	**Max. Voltage**	**Age**	**Refurb.**	**Rating (A)**	**Rating (MVA,sym)**
30F1	Cooper Power Systems	14.4 kV	15.5 kV	28	N/A	400	12 kA
30F2	Cooper Power Systems	14.4 kV	15.5 kV	28	N/A	400	12 kA

	Condition Assessment					
Device #	**Ops. Counter**	**Mech. Op.**	**Contact Resistance**	**Insulation Resistance**	**Spares**	**Overall**
30F1	97	4	4	2.0	3.0	3.3
30F2	91	4	4	4.0	3.0	3.9

Comments:
-Lower than expected insulation resistance results on 30F1 Phase A & Phase B, review on future maintenance activities.

	Condition
Building	N/A
Fencing	5
Ground Grid	5
Structures	5
Foundations	5
Conductor	5
Security	3
Safety	5
Redundancy	4
Total score	3.0

APPENDIX B: MAINTENANCE RECORDS

September 27th, 2017

Rideau St. Lawrence
985 Industrial Rd.
Prescott, ON.
K0E 1T0

Attention: John Biccum

Re: Maintenance Inspection Report - Our Ref: 15769
Site: Cardinal D.S. #1 – 715 County Rd. #2, Cardinal, ON.

To whom it may concern,

Please find the attached report for the maintenance work and inspections completed August 24th, 2017.

Tal Trees cleaned, serviced and tested as required the main power system. A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC).

Load Break Switch & Secondary Switch gear:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.

- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.

- All insulators were inspected and cleaned, As well tightness and condition of pole ground including the switch matt checked.

- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.

- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.

- Primary connections were inspected for tightness and indications of overheating and reinstalled with anti–oxidant grease.

- Primary bushings inspected for damage and cleaned.

- Full transformer test was completed on the transformer.

Findings/Repairs:

- ***Power transformer currently only has one connection to ground, it requires a second connection on opposite corner to comply with OESC.***

- ***There are braided bus connections between the secondary bus on transformer and cables on dip pole. These braided connections are fraying and deteriorated and should be replaced. (Connections are approx.. 4" in length)***

- ***All transformer test results were satisfactory with the exception of the capacitance dissipation factor and dielectric absorption test (insulation resistance). These test results might be an indication that the transformer has low oil levels. This is further supported by the oil results and should be followed up with Tal Trees for further recommendations.***

Recommendations:

- Please install another ground connection to transformer enclosure on opposite side of existing ground connection.

- Replace braided bus connection on secondary bus.

- Check transformer oil levels.

- Continue with regular yearly maintenance.

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all of the recommended repairs listed in this report.

If you have any questions/concerns please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence.

Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr.
Belleville ON. K8N 4Z5

TALTREES
POWER SERVICES
A SPARKPOWER COMPANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID Incoming 44KV **Device ID** 23TIL-X

Customer	Rideau St. Lawrence	Date	August 24th, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15769
Site	DS#1 Cardinal	System Neutral Present	
Site Address	715 County Rd #2		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break		Air Break	X			Other

Manufacturer	DELTA STAR	BIL Rating	N/A kV
Date Of Manufacture	N/A	Feeder ID	23T1L-X
Serial #	N/A	Feeds To	T1
Catalog #	115452H	Interrupting Rating	N/A A
Nom. / Max. Voltage	46.0 48.3 kV	Continuous Ampacity	600 A
Comments	TYPE # PMB236		

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate	X	Station		
Composition	Ceramic		Polymer	X			

Manufacturer	OHIO BRASS	Max. / MCOV Rating	48.0 / 39.0 kV
Catalog #	303039		
Comments			

Protective Device Data

Primary Fuse Holder Data

Manufacturer	DOMINION CUTOUT
Type	TOWER MOUNT
Nom. / Max. Voltage	46.0 / 48.3 kV
Holder Max. Fuse Link	200A
Holder Catalog #	2834-C2

Primary Fuse Link Data

Manufacturer	S&C
Type	SMD1A
Link Size	65E A
TCC #	153-1
Link Catalog #	445065R1

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No	X	# of Spares
Spare Location					
Comments					

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	

Manufacturer		Key Interlock #	
Comments			

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	2/O SOLID	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	2/O SOLID	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	1	
Insulation Voltage	BARE				# of Neutral Conductors	N/A	
Insulation Type	BARE CU				Neutral Size / Dim.	N/A	
Comments							

Recorded By: C. SULLIVAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID Incoming 44KV **Device ID** 23TIL-X

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	1256 µΩ	1284 µΩ	1241 µΩ
Fuse	1065 µΩ	1071 µΩ	1122 µΩ
Overall	N/A µΩ	N/A µΩ	N/A µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	330000 MΩ
Phase B to Ground	279000 MΩ
Phase C to Ground	249000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	121000 MΩ
Phase B to Ground	126000 MΩ
Phase C to Ground	127000 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: **C. SULLIVAN, R. MELVIN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID INCOMING 4160 **Device ID** 23F1

Customer	Rideau St. Lawrence	Date	August 24th, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15769
Site	DS#1 Cardinal	System Neutral Present	
Site Address	715 County Rd #2		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other

Manufacturer	S&C	BIL Rating	60 kV
Date Of Manufacture	10/2013	Feeder ID	23F1
Serial #	N/A	Feeds To	LS204
Catalog #	CTD-594553	Interrupting Rating	40000 A
Nom. / Max. Voltage	4.2 / 4.8 kV	Continuous Ampacity	600 A
Comments			

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				

Manufacturer		Max. / MCOV Rating	/ kV
Catalog #			
Comments			

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86641R2

Primary Fuse Link Data

Manufacturer	S&C
Type	55
Link Size	400E A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 6
Spare Location	SHED BEHIND SWITCHGEAR				
Comments					

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	

Manufacturer		Key Interlock #	
Comments			

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	N/A	
Conductor Material	Aluminum		Copper		Conductors per Phase	N/A	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	N/A	
Insulation Voltage	N/A				# of Neutral Conductors	N/A	
Insulation Type	N/A				Neutral Size / Dim.	N/A	

Comments

NOT LEGIBLE.

Recorded By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID INCOMING 4160 **Device ID** 23F1

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	540 µΩ	596 µΩ	612 µΩ
Fuse	547.8 µΩ	670 µΩ	766 µΩ
Overall	584 µΩ	655 µΩ	677 µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ _____ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ _____ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: **D. MACLEAN, R. MELVIN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID INCOMING 4160 **Device ID** 23F2

Customer	Rideau St. Lawrence	Date	August 24th, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15769
Site	DS#1 Cardinal	System Neutral Present	
Site Address	715 County Rd #2		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating	60	kV
Date Of Manufacture	10/2013				Feeder ID	23F2	
Serial #	N/A				Feeds To	LS204	
Catalog #	CTD-594553				Interrupting Rating	40000	A
Nom. / Max. Voltage	4.2 / 4.8	kV			Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86641R2

Primary Fuse Link Data

Manufacturer	S&C
Type	55
Link Size	400E A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 6
Spare Location	SHED BEHIND SWITCHGEAR				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	220 MILS	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	4/O	
Concentric Neutral	Aluminum		Copper	X	# of Bond Coductors	3	
Insulation Voltage	15KV				# of Neutral Conductors	N/A	
Insulation Type	XLPE				Neutral Size / Dim.	N/A	
Comments							

Recorded By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID: INCOMING 4160 Device ID: 23F2

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	482 µΩ	570 µΩ	606 µΩ
Fuse	613 µΩ	637 µΩ	581 µΩ
Overall	668 µΩ	691 µΩ	697 µΩ

Line Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	>500000 MΩ
Phase B to Ground	>500000 MΩ
Phase C to Ground	>500000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID | Device ID: T1

Customer: Rideau St. Lawrence
Customer Address: 985 Industrial Rd., Prescott
Site: DS#1 Cardinal
Site Address: 715 County Rd #2

Date: August 24th, 2017
Job #: 15769

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side		Other

Manufacturer	BROWN BOVERI		Core & Windings	12150	kg		lb X
Date of Manufacture	1953		Tanks & Fittings	6450	kg		lb X
Serial #	C197		Coolant Volume	N/A	L		Gal
KVA / Prov. KVA Rating	3000	KVA	Coolant Weight	8500	kg		lb X
Primary Voltage	44000	V	Total Weight	27100	kg		lb X
Primary Ampacity	39.3	A	Temperature Rise	55	°C X		°F
Secondary Voltage	4160/8320	V	HV BIL Rating	N/A	kV		
Secondary Ampacity	208	A	LV BIL Rating	N/A	kV		
HV Winding Material	N/A		Percent Impedance	5.50 %	ONAN X		ONAF
LV Winding Material	N/A		Tamper Resistant		YES		NO X
CSA Specification(s)	N/A		Transformer Colour	GRAY			
Comments							

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Ground Connections	Satisfactory		Not Satisfactory	X	N/A		Comments: ONLY 1 GROUND CONN.
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Temp. Gauge Operation	Satisfactory		Not Satisfactory		N/A	X	Comments: NO TEMP GAUGE

Coolant Temperature: 20 °C X °F | Max. Coolant Temperature: 20 °C X °F
Comments:

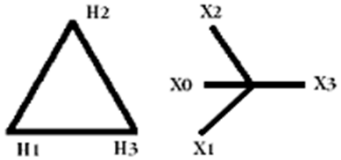
Oil Conservator

Oil Conservator	Yes	X	No		Conservator Volume		L		Gal
Silica Gel Breather	Yes		No	X	Breather Volume		L		Gal
Silica Gel Colour	Good		Bad		Replaced		N/A	X	
Comments									

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	44000		
2 / B	102.50%	42900	X	X
3 / C	100.00%	41800		
4 / D	97.50%	40700		
5 / E	95.00%	39600		

Vector Diagram: DeltaWye2__15.Dyn11



Primary Vector: X | Secondary Vector: X

Comments:

Recorded By: D. MACLEAN, C. IVANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID | Device ID: T1

Neutral Grounding Resistor (NGR)

NGR Present	Yes [ ]	No [X]		
Manufacturer			NGR Serial #	
NGR Voltage	V		Maximum Current	A
NGR Resistance	Ω		NGR Location	
Comments				

Transformer Lightning Arrestors

Lightning Arrestors	Yes [ ]	No [X]		
Class	Distribution [ ]	Intermediate [ ]	Station [ ]	
Composition	Ceramic [ ]	Polymer [ ]		
Manufacturer			Max. / MCOV Rating	/ kV
Catalog #				
Comments				

Interlock

Key Interlock	Yes [ ]	No [X]				
Interlock Type	Elec. [ ]	Mech. [ ]	Utility Lock [ ]			
Devices Interlocked	H.V. Switch [ ]	Breaker [ ]	Trans. Encl. [ ]	Other [ ]		
Manufacturer				Key Interlock #		
Comments						

Fans

Fans	Yes [ ]	No [X]		
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable [X]	Bus Bar [ ]	Conductor Size / Dim.	250 KCMIL	
Conductor Material	Aluminum [ ]	Copper [X]	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum [ ]	Copper [ ]	Bond Size / Dim.	2/O	
Concentric Neutral	Aluminum [ ]	Copper [ ]	# of Bond Conductors	1	
Insulation Voltage	28KV		# of Neutral Conductors	0	
Insulation Type	TR-XLPE		Neutral Size / Dim.	N/A	

Comments:

Recorded By: D. MACLEAN, C. IVANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID | Device ID: T1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 1 To X 0	H 2 To H 3 / X 2 To X 0	H 3 To H 1 / X 3 To X 0
1 / A	105.00%	44000				
2 / B	102.50%	42900	17.862	17.874	17.881	17.862
3 / C	100.00%	41800				
4 / D	97.50%	40700				
5 / E	95.00%	39600				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	2	0.450 mA	0.007 %	0.420 mA	0.110 %	0.340 mA	0.000 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	3.470 Ω
H0 - H2	N/A Ω	H2 - H3	3.470 Ω
H0 - H3	N/A Ω	H3 - H1	3.460 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	16.900 mΩ	X1 - X2	31.800 mΩ
X0 - X2	16.900 mΩ	X2 - X3	32.200 mΩ
X0 - X3	16.800 mΩ	X3 - X1	32.100 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	7167 pF	1870 pF	5294 pF	5085 pF	10377 pF
Uncorrected D.F. (%)	2.040 %	2.360 %	1.900 %	2.020 %	1.960 %
Corrected to 20 °C (%)	2.040 %	2.360 %	1.900 %	2.020 %	1.960 %

Temp. Correction Factor 1

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	N/A MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	N/A MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

SECONDARY CONDUCTOR INSULATION RESISTANCE RESULTS ARE ON H.V. SWITCH TEST PAGE.
DISSIPATION FACTOR RESULTS ARE HIGHER THAN NORMAL LIMITS.

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	0311	51091	5563	7776

Tested By: D. MACLEAN, C. IVANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID: | Device ID: T1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	**116.2 MΩ**	**116 MΩ**	**59 MΩ**	**59 MΩ**	**49 MΩ**	**49 MΩ**
30 sec	**126.9 MΩ**	**127 MΩ**	**65 MΩ**	**65 MΩ**	**54 MΩ**	**54 MΩ**
45 sec	**130.2 MΩ**	**130 MΩ**	**69 MΩ**	**69 MΩ**	**55 MΩ**	**55 MΩ**
1 min	**133.4 MΩ**	**133 MΩ**	**72 MΩ**	**72 MΩ**	**56 MΩ**	**56 MΩ**
2 min	**138.2 MΩ**	**138 MΩ**	**76 MΩ**	**76 MΩ**	**57 MΩ**	**57 MΩ**
3 min	**140 MΩ**	**140 MΩ**	**78 MΩ**	**78 MΩ**	**58 MΩ**	**58 MΩ**
4 min	**141.1 MΩ**	**141 MΩ**	**80 MΩ**	**80 MΩ**	**58 MΩ**	**58 MΩ**
5 min	**141.8 MΩ**	**142 MΩ**	**82 MΩ**	**82 MΩ**	**59 MΩ**	**59 MΩ**
Test Voltage	10000	**V**	1000	**V**	1000	**V**
Multiplier	1		1		1	
Polarization Index	**1.00**		**1.00**		**1.00**	
TCC **1.00**	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	**133**	**MΩ @**	**10000**	**V**
Low to High & Ground	**72**	**MΩ @**	**1000**	**V**
High & Low to Ground	**56**	**MΩ @**	**1000**	**V**

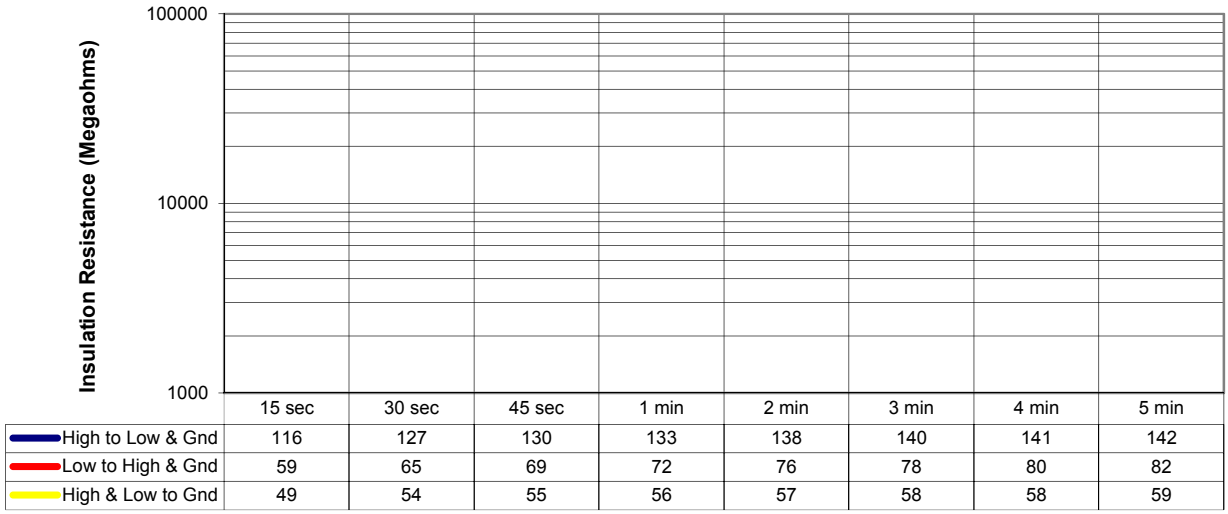
Core Ground Insulation Resistance

Resistance in meg-ohms after 1 minute.

Core Ground Accessible: Yes [ ] No [X]

Test Voltage: _____ **V**

Core Ground Resistance: _____ **MΩ**



Test Instrument(s) Manufacturer / Model: **Megger**

Serial #: **7776**

Comments: **TRANSFORMER INSULATION RESISTANCE RESULTS ARE VERY LOW. THIS MAY BE DUE TO WEATHER CONDITIONS (RAIN/HUMIDITY) WHEN TESTED.**

Tested By: D. MACLEAN, C. IVANY

September 27th, 2017

Rideau St. Lawrence
985 Industrial Rd.
Prescott, ON.
K0E 1T0

Attention: John Biccum

Re: Oil Analysis Report - Our Ref: 15769
Site: Cardinal D.S. #1 – 715 County Rd. #2, Cardinal, ON.

To whom it may concern,

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer – Asea Brown Boveri, Serial no. C197 (T1)**
  - ***Dissolved Gas Analysis (DGA)***
    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. With the exception of Carbon Dioxide (CO2), all of the other dissolved gases remained stable and within IEEE recommended limits. **Carbon Dioxide (3307 ppm) exceeds the IEEE recommended Condition 2 limit (2501-4000 *ppm*).** Elevated levels of these gases indicate that the windings paper insulation is being stressed due overheating. Possible causes can be attributed to loading issues or problems with oil circulation. Please contact us to perform a FURAN analysis with remaining sample. **We recommend resampling in 6 months for DGA to monitor these gases**.
  - ***Chemical Analysis (ASTM/Water)***
    The chemistry (ASTM) tests show the insulating fluid to be in satisfactory condition, remaining clear with zero amounts of sediment detected, and having a slight amount of water content (*24 ppm*). All of the parameters **with the exception of *Interfacial Tension and Dielectric Breakdown*** were found within manufacturer recommended limits. ***Interfacial Tension* (*22 dynes/cm*) remains below current recommended manufacturer guideline minimum limit (*25 dynes/cm*).** ***Interfacial Tension (IFT)*** *measures the tension at the interface between two liquids which do not mix (oil and water) and is expressed in dynes/cm. This test is used to detect the presence of oil decay products (sludge), polar contaminants from solid insulating materials and oxidation products in the oil.* Please contact Tal Trees if you wish to perform an inhibitor analysis on remaining sample. The Dielectric Breakdown **(32KV)** is lower than recommend limit (40KV). ***Dielectric Breakdown*** *of an insulating oil is a measure of the oils ability to withstand electrical stress without failure. Contaminants such as particles, contaminants and water can reduce the dielectric strength of an insulating liquid.* All of the other measured parameters remained within IEEE recommended limits for acceptable in-service operation. **We recommend resampling at your earliest convenience to verify Dielectric Breakdown.**

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence in the future.

Yours Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr.
Belleville ON. K8N 4Z5

OIL SAMPLE ANALYSIS RESULTS Y

IN SERVICE - OIL

Cust PO : RSL-CARDINAL MS1

Lab No . . . : T 2017-1767
File No . . . : 13888
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : AUG 31 2017
Analysis Date : SEP 12 2017

BELLEVILLE ON
K8N 4Z5

Analyzed By : TM
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : T1

Rating : 3 MVA
HV_Rating : 44 kV
Manuf. / Date: ASEA BROWN BOVERI 1953
Serial No : C197

Volume : 8500 GALLONS
Sample Port : BOTTOM - MAIN TANK
Sampled By : CI
Sample Date : AUG 24 2017

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min) 1816 -	32
	D877	KV (Min) 877 -	
Neutralization Number	D974	0.2 Max (0.5 - Scrap) Milligrams KOH/gram	0.06
Interfacial Tension	D971	25 Dynes/cm (Minimum)	22
Specific Gravity	D1298	(60/60°F)	0.888
API Gravity			27.8
Colour	D1500	0.5 — 8.0	2.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	24
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

DIELECTRIC BREAKDOWN IS LOW FOR HV RATING
IFT INDICATES POLAR CONTAMINANTS AND OXIDATION PRODUCTS IN THE OIL
NEUTRALIZATION NUMBER IS GOOD
WATER CONTENT IS GOOD

RECOMMENDATIONS: RE-SAMPLE TO VERIFY THE DIELECTRIC BREAKDOWN
CONTACT LAB TO PERFORM INHIBITOR ANALYSIS ON REMAINING OIL

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : RSL-CARDINAL MS1

Lab No : D 2017-1720
File No : 13888
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : AUG 31 2017
Analysis Date : SEP 05 2017

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SJ

SAMPLE IDENTIFICATION

Description : T1

Rating	: 3 MVA	Fluid Temp.	: (°C)
HV Rating	: 44 kV	Volume	: 8500 GALLONS
Manuf. / Date	: ASEA BROWN BOVERI 1953	Preservation	: SEALED
Serial No	: C197	Syringe Serial	: AA560
Sample Port	: BOTTOM - MAIN TANK	Sampled By	: C.I
		Sample Date	: AUG 24 2017

COMPONENT	MEASURED PPM	% COMBUSTIBLES
Hydrogen (H2)	9	3.1
Oxygen + Argon (O2 + A)	24572	-----
Nitrogen (N2)	52626	-----
Methane (CH4)	9	3.1
Carbon Monoxide (CO)	226	76.6
Carbon Dioxide (CO2)	3307	-----
Ethylene (C2H4)	4	1.4
Ethane (C2H6)	4	1.4
Acetylene (C2H2)	<1	.0
Propane (C3H8)	43	14.6
Total Gas Content	8.08 %	
Combustible Gas Content	295 ppm	.365 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: CARBON DIOXIDE IS ABOVE NORMAL LIMIT INDICATING HIGHER THAN NORMAL TEMPERATURE WITHIN THE PAPER INSULATION. REST OF FAULT GASES ARE WITHIN NORMAL RANGE.

Recommendations : SAMPLE IN 6 MONTHS FOR DISSOLVED GASES
CONTACT LAB TO PERFORM FURAN ANALYSIS FROM REMAINING SAMPLE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

September 27th, 2017

Rideau St. Lawrence
985 Industrial Rd.
Prescott, ON.
K0E 1T0

Attention: John Biccum

Re: Maintenance Inspection Report - Our Ref: 15857
Site: Cardinal D.S. #2 – 3039 John St., Cardinal, ON.

To whom it may concern,

Please find the attached report for the maintenance work and inspections completed August 23rd, 2017.

Tal Trees cleaned, serviced and tested as required the main power system. A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC).

Load Break Switch & Secondary Switch gear:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.

- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.

- All insulators were inspected and cleaned, As well tightness and condition of pole ground including the switch matt checked.

- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.

- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.

- Primary connections were inspected for tightness and indications of overheating and reinstalled with anti–oxidant grease.

- Primary bushings inspected for damage and cleaned.

- Full transformer test was completed on the transformer.

Findings/Repairs:

- ***Temperature gauge on transformer is not functioning.***
- ***Substation requires more gravel along east side. There are some areas that the station fence is 6" above gravel, this is a large opening that animals could potentially enter the station.***
- ***The bottom tension wire is broken on east side of substation fence and should be repaired.***

Recommendations:

- Repair transformer temperature gauge.
- Add gravel to substation to comply with OESC and prevent animals from entering station.
- Repair tension wire on fence.
- Continue with regular yearly maintenance.

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all of the recommended repairs listed in this report.

If you have any questions/concerns please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence.

Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr.
Belleville ON. K8N 4Z5

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID INCOMING 44KV **Device ID** CSST2-L

Customer	Rideau St. Lawrence	Date	August 23rd, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15857
Site	Caridnal D.S. #2	System Neutral Present	
Site Address	3039 John St., Cardinal, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole	X	Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	KEARNY				BIL Rating	N/A	kV
Date Of Manufacture					Feeder ID	CSST2-L	
Serial #	N/A				Feeds To	T2	
Catalog #	N/A				Interrupting Rating		A
Nom. / Max. Voltage	46.0 / 48.3 kV				Continuous Ampacity		A
Comments	NAMEPLATE FADED / NOT LEGIBLE						

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate	X	Station		
Composition	Ceramic		Polymer	X			
Manufacturer	HUBLE				Max. / MCOV Rating	39.0 / 48.0	kV
Catalog #	30003996						
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMD-2C
Nom. / Max. Voltage	46.0 / 48.0 kV
Holder Max. Fuse Link	300E
Holder Catalog #	186925R1-T4

Primary Fuse Link Data

Manufacturer	S&C
Type	SMD 1A
Link Size	65E A
TCC #	153-1
Link Catalog #	445065R1

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No	X	# of Spares
Spare Location					
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	3/O	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	1	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE				Neutral Size / Dim.	2/O	
Comments							

Recorded By: C. SULLIVAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID: INCOMING 44KV Device ID: CSST2-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition		X		FADED
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	2029 µΩ	1524 µΩ	1447 µΩ
Fuse	1903 µΩ	1187 µΩ	1219 µΩ
Overall	3577 µΩ	2466 µΩ	2460 µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ 10000 V DC after 1 minute

Phase A to Ground	247000 MΩ
Phase B to Ground	284000 MΩ
Phase C to Ground	258000 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: C. SULLIVAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID INCOMING 4160 **Device ID** 33F4

Customer	Rideau St. Lawrence	Date	August 23rd, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15857
Site	Caridnal D.S. #2	System Neutral Present	
Site Address	3039 John St., Cardinal, ON		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating	60	kV
Date Of Manufacture	09/1996				Feeder ID	33F4	
Serial #	GTB-2929R20				Feeds To	LS218	
Catalog #	CTS-59184				Interrupting Rating	40000	A
Nom. / Max. Voltage	4.2 / 4.8	kV			Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM5S
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86641R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	300E A
TCC #	
Link Catalog #	N/A

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No	X	# of Spares
Spare Location					
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	500KCMIL	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	2/O	
Concentric Neutral	Aluminum	X	Copper		# of Bond Coductors	1	
Insulation Voltage	28KV				# of Neutral Conductors	0	
Insulation Type	N/A				Neutral Size / Dim.	N/A	
Comments							

Recorded By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID: INCOMING 4160 Device ID: 33F4

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	N/A µΩ	N/A µΩ	N/A µΩ
Fuse	357.9 µΩ	364 µΩ	339.4 µΩ
Overall	653.1 µΩ	631.6 µΩ	584.5 µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Comments / Observations

COULD NOT TEST LOAD SIDE CONDUCTORS DUE TO GROUNDING FOR WORK PROTECTION.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID INCOMING 4160 **Device ID** 33F5

Customer	Rideau St. Lawrence	Date	August 23rd, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15857
Site	Caridnal D.S. #2	System Neutral Present	
Site Address	3039 John St., Cardinal, ON		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating	60	kV
Date Of Manufacture	09/1996				Feeder ID	33F5	
Serial #	GTB-2929R20				Feeds To	LS218	
Catalog #	CTS-59184				Interrupting Rating	40000	A
Nom. / Max. Voltage	4.2 / 4.8	kV			Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM5S
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86641R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	300E A
TCC #	
Link Catalog #	N/A

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No	X	# of Spares
Spare Location					
Comments					

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	500KCMIL	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	2/O	
Concentric Neutral	Aluminum	X	Copper		# of Bond Coductors	1	
Insulation Voltage	28KV				# of Neutral Conductors	0	
Insulation Type	N/A				Neutral Size / Dim.	N/A	
Comments							

Recorded By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID: INCOMING 4160 Device ID: 33F5

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	N/A µΩ	N/A µΩ	N/A µΩ
Fuse	360 µΩ	274 µΩ	365 µΩ
Overall	645.9 µΩ	539.6 µΩ	658.3 µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ _____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Comments / Observations

COULD NOT TEST LOAD SIDE CONDUCTORS DUE TO GROUNDING FOR WORK PROTECTION.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: D. MACLEAN, R. MELVIN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: INCOMING 44KV | Device ID: T2

Customer	Rideau St. Lawrence	Date	August 23rd, 2017
Customer Address	985 Industrial Rd., Prescott	Job #	15857
Site	Caridnal D.S. #2		
Site Address	3039 John St., Cardinal, ON		

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other	
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other	
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side		Other	

Manufacturer	MOLONEY ELECTRIC CO.		Core & Windings	13950	kg		lb	X
Date of Manufacture	8/1952		Tanks & Fittings	12030	kg		lb	X
Serial #	149836		Coolant Volume	1453	L		Gal	X
KVA / Prov. KVA Rating	3000	KVA	Coolant Weight	13080	kg		lb	X
Primary Voltage	44000	V	Total Weight	39060	kg		lb	X
Primary Ampacity	N/A	A	Temperature Rise	55	°C	X	°F	
Secondary Voltage	4160/2400Y	V	HV BIL Rating	N/A	kV			
Secondary Ampacity	N/A	A	LV BIL Rating	N/A	kV			
HV Winding Material	N/A		Percent Impedance	5.57 %	ONAN	X	ONAF	
LV Winding Material	N/A		Tamper Resistant		YES		NO	X
CSA Specification(s)	N/A		Transformer Colour	GRAY				
Comments								

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments: BARELY LEGIBLE
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments:
Ground Connections	Satisfactory	X	Not Satisfactory		N/A		Comments:
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments:
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments:
Temp. Gauge Operation	Satisfactory		Not Satisfactory	X	N/A		Comments: NOT WORKING

Coolant Temperature	20	°C	X	°F		Max. Coolant Temperature	20	°C	X	°F	
Comments											

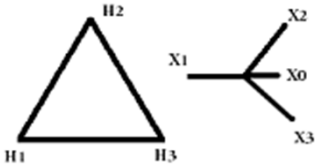
Oil Conservator

Oil Conservator	Yes		No	X		Conservator Volume		L		Gal	
Silica Gel Breather	Yes		No	X		Breather Volume		L		Gal	
Silica Gel Colour	Good		Bad		Replaced		N/A	X			
Comments											

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	44000		
2 / B	102.50%	42900		
3 / C	100.00%	41800	X	X
4 / D	97.50%	40700		
5 / E	95.00%	39600		

Vector Diagram: DeltaWye1__5.Dyn1



Primary Vector: X | Secondary Vector: X

Comments:

Recorded By: D. MALCEAN, C. IVANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: INCOMING 44KV Device ID: T2

Neutral Grounding Resistor (NGR)

NGR Present: Yes [ ] No [X]
Manufacturer: _____ NGR Serial #: _____
NGR Voltage: _____ V Maximum Current: _____ A
NGR Resistance: _____ Ω NGR Location: _____
Comments: _____

Transformer Lightning Arrestors

Lightning Arrestors: Yes [ ] No [X]
Class: Distribution [ ] Intermediate [ ] Station [ ]
Composition: Ceramic [ ] Polymer [ ]
Manufacturer: _____ Max. / MCOV Rating: _____ / _____ kV
Catalog #: _____
Comments: _____

Interlock

Key Interlock: Yes [ ] No [X]
Interlock Type: Elec. [ ] Mech. [ ] Utility Lock [ ]
Devices Interlocked: H.V. Switch [ ] Breaker [ ] Trans. Encl. [ ] Other [ ] _____
Manufacturer: _____ Key Interlock #: _____
Comments: _____

Fans

Fans: Yes [ ] No [X]
# of Fans: _____ Fan Voltage: _____
Fan Size: _____ Frame Size: _____
Horsepower: _____
Comments: _____

Transformer Load Side Conductor Data

Conductor Type	Cable [X]	Bus Bar [ ]	Conductor Size / Dim.	500MCM	
Conductor Material	Aluminum [ ]	Copper [X]	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum [ ]	Copper [ ]	Bond Size / Dim.	4/O	
Concentric Neutral	Aluminum [ ]	Copper [ ]	# of Bond Conductors	1	
Insulation Voltage	15KV		# of Neutral Conductors	0	
Insulation Type	N.A		Neutral Size / Dim.	N/A	

Comments:

Recorded By: D. MALCEAN, C. IVANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID INCOMING 44KV **Device ID** T2

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 0 To X 2	H 2 To H 3 / X 0 To X 3	H 3 To H 1 / X 0 To X 1
1 / A	105.00%	44000				
2 / B	102.50%	42900				
3 / C	100.00%	41800	17.404	17.467	17.468	17.466
4 / D	97.50%	40700				
5 / E	95.00%	39600				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	3	0.740 mA	0.370 %	0.760 mA	0.370 %	0.600 mA	0.360 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	3.070 Ω
H0 - H2	N/A Ω	H2 - H3	3.080 Ω
H0 - H3	N/A Ω	H3 - H1	3.060 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	17.100 mΩ	X1 - X2	29.400 mΩ
X0 - X2	19.300 mΩ	X2 - X3	28.700 mΩ
X0 - X3	18.600 mΩ	X3 - X1	30.000 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	4991 pF	1636 pF	3358 pF	8223 pF	11572 pF
Uncorrected D.F. (%)	1.270 %	1.380 %	1.090 %	1.490 %	1.390 %
Corrected to 20 °C (%)	1.270 %	1.380 %	1.090 %	1.490 %	1.390 %

Temp. Correction Factor 1

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ 5000 V DC after 1 minute

Phase A to Ground	>500000 MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	>500000 MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	>500000 MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	0311	51091	5563	7776

Tested By: D. MALCEAN, C. IVANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID INCOMING 44KV **Device ID** T2

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd		Low to High & Gnd		High & Low to Gnd	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
15 sec	**147.2 MΩ**	**147 MΩ**	**79 MΩ**	**79 MΩ**	**113 MΩ**	**113 MΩ**
30 sec	**180.1 MΩ**	**180 MΩ**	**112 MΩ**	**112 MΩ**	**140 MΩ**	**140 MΩ**
45 sec	**194.9 MΩ**	**195 MΩ**	**133 MΩ**	**133 MΩ**	**155 MΩ**	**155 MΩ**
1 min	**218 MΩ**	**218 MΩ**	**149 MΩ**	**149 MΩ**	**166 MΩ**	**166 MΩ**
2 min	**218 MΩ**	**218 MΩ**	**200 MΩ**	**200 MΩ**	**182 MΩ**	**182 MΩ**
3 min	**233 MΩ**	**233 MΩ**	**231 MΩ**	**231 MΩ**	**189 MΩ**	**189 MΩ**
4 min	**235 MΩ**	**235 MΩ**	**253 MΩ**	**253 MΩ**	**193 MΩ**	**193 MΩ**
5 min	**237 MΩ**	**237 MΩ**	**268 MΩ**	**268 MΩ**	**196 MΩ**	**196 MΩ**
Test Voltage	10000	**V**	1000	**V**	1000	**V**
Multiplier	1		1		1	
Polarization Index	**1.00**		**1.00**		**1.00**	
TCC **1.00**	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	**218**	**MΩ @**	**10000**	**V**
Low to High & Ground	**149**	**MΩ @**	**1000**	**V**
High & Low to Ground	**166**	**MΩ @**	**1000**	**V**

Core Ground Insulation Resistance

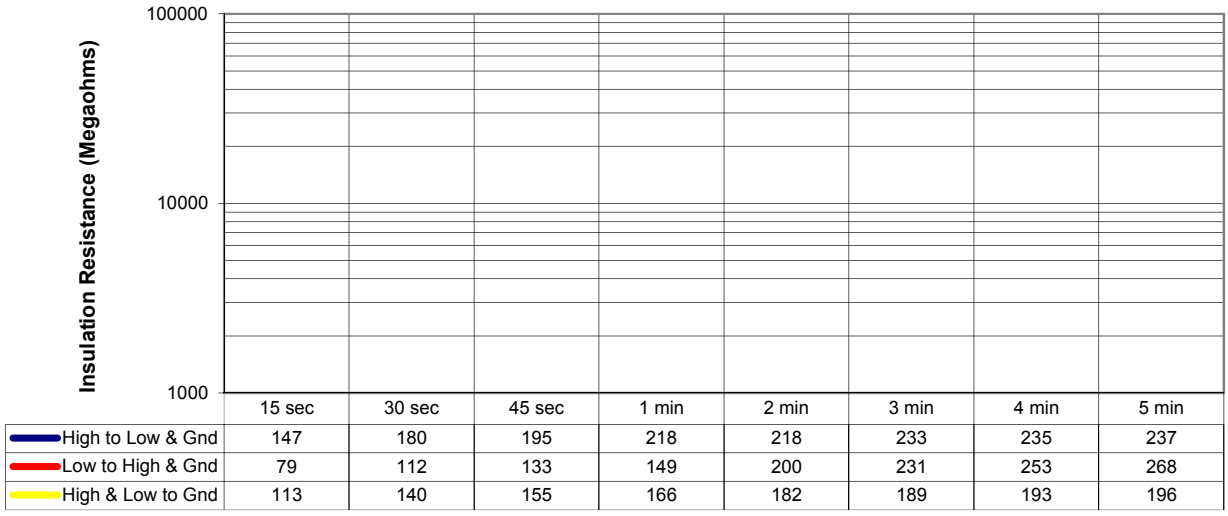
Resistance in meg-ohms after 1 minute.

Core Ground Accessible Yes [ ] No [X]

Test Voltage _____ **V**

Core Ground Resistance _____ **MΩ**

Dielectric Absorption Test



	15 sec	30 sec	45 sec	1 min	2 min	3 min	4 min	5 min
High to Low & Gnd	147	180	195	218	218	233	235	237
Low to High & Gnd	79	112	133	149	200	231	253	268
High & Low to Gnd	113	140	155	166	182	189	193	196

Test Instrument(s) Manufacturer / Model **Megger**

Serial # **7776**

Comments: INSULATION RESISTANCE RESULTS ARE LOW. PLEASE SEE OIL RESULTS TO CONFIRM

Tested By: D. MALCEAN, C. IVANY

September 27th, 2017

Rideau St. Lawrence
985 Industrial Rd.
Prescott, ON.
K0E 1T0

Attention: John Biccum

Re: Oil Analysis Report - Our Ref: 15857
Site: Cardinal D.S. #2 – 3039 John St., Cardinal, ON.

To whom it may concern,

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer – Moloney, Serial no. 149836 (T2)**
  - ***Dissolved Gas Analysis (DGA)***

    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. With the exception of Carbon Dioxide (CO2), all of the other dissolved gases remained stable and within IEEE recommended limits. **Carbon Dioxide (2789 ppm) exceeds the IEEE recommended Condition 2 limit (2501-4000 *ppm*).** Elevated levels of these gases indicate that the windings paper insulation is being stressed due overheating. Possible causes can be attributed to loading issues or problems with oil circulation. Please contact us to perform a FURAN analysis with remaining sample. **We recommend resampling in 6 months for DGA to monitor these gases**.

  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the insulating fluid to be in satisfactory condition, remaining clear with zero amounts of sediment detected, and having a slight amount of water content (*24 ppm*). All of the parameters **with the exception of *Interfacial Tension and Dielectric Breakdown*** were found within manufacturer recommended limits. ***Interfacial Tension (22 dynes/cm) remains below current recommended manufacturer guideline minimum limit (25 dynes/cm).*** ***Interfacial Tension (IFT)*** *measures the tension at the interface between two liquids which do not mix (oil and water) and is expressed in dynes/cm. This test is used to detect the presence of oil decay products (sludge), polar contaminants from solid insulating materials and oxidation products in the oil.* Please contact Tal Trees if you wish to perform an inhibitor analysis on remaining sample. The ***Dielectric Breakdown (36KV) is lower than recommend limit (40KV).*** ***Dielectric Breakdown*** *of an insulating oil is a measure of the oils ability to withstand electrical stress without failure. Contaminants such as particles, contaminants and water can reduce the dielectric strength of an insulating liquid.* All of the other measured parameters remained within IEEE recommended limits for acceptable in-service operation. **We recommend resampling at your earliest convenience to verify Dielectric Breakdown.**

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence in the future.

Yours Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr.
Belleville ON. K8N 4Z5

TALTREES
POWER SERVICES
A SPARKPOWER COMPANY

OIL SAMPLE ANALYSIS RESULTS Y

IN SERVICE - OIL

Cust PO : MSL-CARDINAL MS2

Lab No . . . : T 2017-1768
File No . . . : 13888
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : AUG 31 2017
Analysis Date : SEP 12 2017

BELLEVILLE ON
K8N 4Z5

Analyzed By : TM
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : T1

Rating :	3 MVA	Volume :	1453 IMP. GALLONS
HV_Rating :	44 kV	Sample Port :	BOTTOM - MAIN TANK
Manuf. / Date:	MOLONEY 1952	Sampled By :	CI
Serial No :	149836	Sample Date :	AUG 24 2017

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min) 1816 -	36
	D877	KV (Min) 877 -	
Neutralization Number	D974	0.2 Max (0.5 - Scrap) Milligrams KOH/gram	0.05
Interfacial Tension	D971	25 Dynes/cm (Minimum)	22
Specific Gravity	D1298	(60/60°F)	0.882
API Gravity			28.9
Colour	D1500	0.5 — 8.0	1.5
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	28
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

DIELECTRIC BREAKDOWN IS LOW FOR HV RATING
IFT INDICATES POLAR CONTAMINANTS AND OXIDATION PRODUCTS IN THE OIL
NEUTRALIZATION NUMBER IS GOOD
WATER CONTENT IS GOOD

RECOMMENDATIONS: RE-SAMPLE TO VERIFY THE DIELECTRIC BREAKDOWN
CONTACT LAB TO PERFORM INHIBITOR ANALYSIS ON REMAINING OIL

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : RSL-CARDINAL MS2

Lab No : D 2017-1721
File No : 13888
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : AUG 31 2017
Analysis Date : SEP 05 2017

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SD

SAMPLE IDENTIFICATION

Description : T1

Rating : 3 MVA
HV Rating : 44 kV
Manuf. / Date: MOLONEY 1952
Serial No : 149836
Sample Port : BOTTOM - MAIN TANK

Fluid Temp. : 20 (°C)
Volume : 1453 IMP. GALLONS
Preservation : SEALED
Syringe Serial: CG862
Sampled By : C.I
Sample Date : AUG 24 2017

COMPONENT	MEASURED PPM		% COMBUSTIBLES
Hydrogen (H2)	20		7.9
Oxygen + Argon (O2 + A)	21873		-----
Nitrogen (N2)	52867		-----
Methane (CH4)	6		2.4
Carbon Monoxide (CO)	194		76.7
Carbon Dioxide (CO2)	2789		-----
Ethylene (C2H4)	3		1.2
Ethane (C2H6)	3		1.2
Acetylene (C2H2)	<1		.0
Propane (C3H8)	27		10.7
Total Gas Content	7.78	%	
Combustible Gas Content	253	ppm	.325 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: CARBON DIOXIDE HAS INCREASED SINCE DEC/16 INDICATING HIGHER THAN NORMAL TEMPERATURE WITHIN THE PAPER INSULATION. REST OF FAULT GASES HAVE REMAINED WITHIN NROAML RANGE.

Recommendations : SAMPLE IN 6 MONTHS FOR DISSOLVED GASES
CONTACT LAB TO PERFORM FURAN ANALYSIS FROM REMAINING SAMPLE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

November 18th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Maintenance Inspection Report - Our Ref: 29995
Site: Iroquois MS #1 – 5549 Carman Rd., Iroquois, ON

Please find the attached report for the maintenance work and inspections completed October 18th, 2019.

Tal Trees cleaned, serviced, tested & inspected, the main power system. All testing and inspections were performed in accordance to NETA Maintenance Testing Specifications.

Items tested/inspected include:

- 44KV Air Break Switches
- Lightning Arrestors
- Main Transformers
- Secondary Cables
- Transformer Oil Analysis
- 4.16KV Load Break Switches
- Automatic Recloser
- S&C pad mount switch

A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC) and NETA MTS.

Air Break / Load Break Switches:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.

- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.

- All insulators were inspected and cleaned, as well tightness and condition of pole ground including the switch matt checked.

- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.

- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.
- Primary connections were inspected for tightness and indications of overheating and reinstalled with antioxidant grease.
- Primary bushings inspected for damage and cleaned.
- Full transformer tests were completed on the transformer including turn ratio test, winding resistance, capacitance test and dielectric absorption test (insulation resistance).
- An oil sample was obtained for fluid analysis and DGA.

Findings/Repairs:

- ***Order spare S&C SMD-2C 100 Amp fuses (TCC# 153-1) for T2-L. It is recommended to stock spare fuses on site.***
- ***Transformer T1 is leaking insulating fluid from the top of the main tank. The leak is considered significant at this time as oil was observed pooling on the concrete pad. Rust has formed on the exterior of the conservator tank and radiators; these findings are confirmed by the oil analysis that indicates oxidation has contaminated the insulating fluid.***
- ***Pad mount switch is currently interlocked to prevent the secondary connections of transformer T1&T2 from being placed in parallel. Meaning each time, the source is transferred there will be a power interruption on the secondary feeders.***
- ***Transformer T1 does not have any ground connection to the grid.***
- ***Primary connection on transformer T1 was replaced as one of the U-bolts was broken and the bracket was cracked.***

Recommendations:

- ***Given the current age physical condition and oil analysis results of transformer T1 it is recommended to consider replacement. This unit has already had all bushings re-gasketed has reached the end of its life expectancy. .***
- ***Consult with engineering regarding the switching & loading capabilities of the pad mount switchgear.***
- ***Continue with annual substation maintenance.***

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all the recommended repairs listed in this report.

If you have any questions/concerns, please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence Utility.

Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID IROQUOIS MS#1 **Device ID** T1-L

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1	System Neutral Present	
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break		Air Break	X			Other	
Manufacturer	EASTERN POWER				BIL Rating			kV
Date Of Manufacture	1957				Feeder ID	BROCKVILLE M26		
Serial #	60986				Feeds To	T1		
Catalog #					Interrupting Rating	600		A
Nom. / Max. Voltage	44.0 / 46.0	kV			Continuous Ampacity			A
Comments								

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate		Station	X	
Composition	Ceramic		Polymer	X			
Manufacturer	OHIO BRASS				Max. / MCOV Rating	48.3 / 39.0	kV
Catalog #	300039						
Comments	YEAR: 1995						

Protective Device Data

Primary Fuse Holder Data

Manufacturer	SMD PF
Type	BMP
Nom. / Max. Voltage	44.0 / 46.0 kV
Holder Max. Fuse Link	200E
Holder Catalog #	86705R1

Primary Fuse Link Data

Manufacturer	S&C
Type	SMD-1A
Link Size	100 A
TCC #	119-1
Link Catalog #	455100

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 4
Spare Location	SUBSTATION SHED.				
Comments					

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	2/O	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	N/A	
Comments							

Recorded By: T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID: IROQUOIS MS#1 Device ID: T1-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance: N/A Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage: 1 kV [ ] 2 kV [ ] 5 kV [ ] 10 kV [X]

	Phase A	Phase B	Phase C
Phase to GND	118400 MΩ	110300 MΩ	147300 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	71 µΩ	68 µΩ	71 µΩ
Fuse	884 µΩ	853 µΩ	791 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ 10000 V DC after 1 minute

Phase A to Ground	97300 MΩ
Phase B to Ground	103000 MΩ
Phase C to Ground	126000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ 10000 V DC after 1 minute

Phase A to Ground	173000 MΩ
Phase B to Ground	163300 MΩ
Phase C to Ground	2880 MΩ

Comments / Observations

C PHASE LIGHTNING ARRESTOR TESTED POORLY COMPARED TO OTHERS.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	3678	8B04

Tested By: T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID IROQUOIS MS#1 **Device ID** T2-L

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1	System Neutral Present	
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole	X	Tower		Other	
Switch Type	Load Break	X	Air Break				Other	
Manufacturer	S&C ALDUTI RUPTER				BIL Rating		kV
Date Of Manufacture					Feeder ID	IROQUOIS MS#1	
Serial #					Feeds To	T2	
Catalog #	145825R10-E				Interrupting Rating	40000	A
Nom. / Max. Voltage	44.0 / 46.0 kV				Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments	ARRESTORS ON TX PRIMARY						

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	POWER FUSE
Nom. / Max. Voltage	46.0 / 48.3 kV
Holder Max. Fuse Link	300E
Holder Catalog #	

Primary Fuse Link Data

Manufacturer	S&C	
Type	SMD-2C	
Link Size	100	A
TCC #	153-1	
Link Catalog #		

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No	X	# of Spares
Spare Location					
Comments	RECOMMEND KEEPING SPARE FUSES ON SITE.				

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	2/O	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	N/A	
Comments							

Recorded By: J. TLAMSA

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID IROQUOIS MS#1 **Device ID** T2-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	**N/A** Ω
Phase B	**N/A** Ω
Phase C	**N/A** Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [ ] 10 kV [X]

	Phase A	Phase B	Phase C
Phase to GND	**1709000 MΩ**	**1320000 MΩ**	**1117000 MΩ**

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	**118 µΩ**	**240 µΩ**	**348 µΩ**
Fuse	**765 µΩ**	**651 µΩ**	**734 µΩ**
Overall	**800 µΩ**	**720 µΩ**	**749 µΩ**

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **5000 V DC** after 1 minute

Phase A to Ground	**N/A MΩ**
Phase B to Ground	**N/A MΩ**
Phase C to Ground	**N/A MΩ**

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **1000 V DC** after 1 minute

Phase A to Ground	**N/A MΩ**
Phase B to Ground	**N/A MΩ**
Phase C to Ground	**N/A MΩ**

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	8B04

Tested By: **J. TLAMSA**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 11-F1

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1	System Neutral Present	
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break	X	Air Break				Other	
Manufacturer	S&C ALDUTI RUPTER				BIL Rating			kV
Date Of Manufacture					Feeder ID	11-F1		
Serial #					Feeds To	FEEDER #1		
Catalog #	36011				Interrupting Rating			A
Nom. / Max. Voltage	7.2 / 8.3		kV		Continuous Ampacity	600		A
Comments								

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution	X	Intermediate		Station		
Composition	Ceramic	X	Polymer				
Manufacturer	UNICAP				Max. / MCOV Rating	3.0 /	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM-5
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400A
Holder Catalog #	86151R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	200 A
TCC #	119-4
Link Catalog #	261300R3

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	2
Spare Location	SUBSTATION HUT				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O OVERHEAD	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	3/O OVERHEAD	
Comments							

Recorded By: D. MACLEAN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 11-F1

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV 2 kV 5 kV 10 kV

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	34 µΩ	35 µΩ	36 µΩ
Fuse	336 µΩ	313 µΩ	312 µΩ
Overall	354 µΩ	353 µΩ	323 µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **1000** V DC after 1 minute

Phase A to Ground	197000 MΩ
Phase B to Ground	2700 MΩ
Phase C to Ground	176900 MΩ

Comments / Observations

B PHASE LIGHTNING ARRESTOR TESTED POORLY COMPARED TO OTHERS.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	6400	8B04

Tested By: **S. MULLALLY**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

RECLOSER
DATA SHEET (Pg. 1 of 1)

System ID 4160 FEEDER **Device ID** 11F2

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1		
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Manufacturer	MCGRAW EDISON		Catalog #	GL145624	
Serial #	GLI4561		Max Voltage	8320	V
Ampacity	100	A	Inter. Capacity	5	KA
Year			Operating Voltage	4800	V
Oil Type			Oil Volume		
Total Weight of Unit					
Comments	AUTOMATIC RECLOSER TYPE "L"				

Visual Inspection

						Comments
Compare Nameplate with Drawings	Satisfactory		Not Satisfactory		N/A	X	
Inspect Anchorage, Alignment, Grounding	Satisfactory	X	Not Satisfactory		N/A		
Inspect Physical and Mechanical Condition	Satisfactory	X	Not Satisfactory		N/A		
Inspect for Correct Insulation Liquid Level	Satisfactory	X	Not Satisfactory		N/A		

Comments

Electrical Tests

Insulation Resistance

Resistance in meg-ohms after 1 minute.

Test Voltage: 1 kV [ ] 2.5 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A (A to B)	Phase B (B to C)	Phase C (C to A)
Open - Pole to Pole	MΩ	MΩ	MΩ
Closed - Pole to Frame	15960 MΩ	12250 MΩ	16620 MΩ

Contact Resistance

Resistance in meg-ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
As Found	562 µΩ	547 µΩ	423 µΩ
As Left	µΩ	µΩ	µΩ

Contact Measurement

	Phase A	Phase B	Phase C
Contact Gap	N/A	N/A	N/A
Contact Erosion			

Counter Reading

Counter as Found	
Counter as Left	

Operational Tests

						Comments
Trip and Close Recloser with Control Switch	Satisfactory	X	Not Satisfactory		N/A		
Trip Recloser by Operating each Protect Relay	Satisfactory		Not Satisfactory		N/A	X	
Trip and Close Recloser with Control Switch	Satisfactory	X	Not Satisfactory		N/A		
Trip Recloser by Operating each Protect Relay	Satisfactory		Not Satisfactory		N/A	X	

Comments

Comments / Observations

LA'S TESTED @ 1KV FOR 1 MIN - AØ - 59200MΩ, B Ø - 37300MΩ, CØ, 38700MΩ

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	8B04

Tested By: S. MULLALLY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID | **Device ID** PADMOUNT

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1	System Neutral Present	
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating	95	kV
Date Of Manufacture	2016				Feeder ID	MS#1 (F1 &F2)	
Serial #	161132				Feeds To	T1-T2 FEEDER	
Catalog #	LL-12794 (8377)				Interrupting Rating	14000	A
Nom. / Max. Voltage	13.8 / 15.0	kV			Continuous Ampacity	600	A
Comments	PMH-13						

Lightning Arrestors

Lightning Arrestors	Yes	X	No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C		
Type			
Nom. / Max. Voltage	/	kV	
Holder Max. Fuse Link			
Holder Catalog #			

Primary Fuse Link Data

Manufacturer	S&C		
Type	SMU-20		
Link Size	200	A	
TCC #	153-2		
Link Catalog #	612200		

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares	3	
Spare Location	SUBSTATION HUT						
Comments							

Interlock

Key Interlock	Yes	X	No					
Interlock Type	Electrical		Mechanical	X	Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	X	PADMOUNT ENCLO
Manufacturer	SUPERIOR				Key Interlock #	110214		
Comments	REQUIRES INTERLOCKS ON T1-L & T2-I TO ISOLATE PADMOUNT							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.		
Conductor Material	Aluminum		Copper		Conductors per Phase	/ Phase	
Tape Shield	Aluminum		Copper		Bond Size / Dim.		
Concentric Neutral	Aluminum		Copper		# of Bond Coductors		
Insulation Voltage					# of Neutral Conductors		
Insulation Type					Neutral Size / Dim.		
Comments							

Recorded By: B. DOUGLAS, K. BRANT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID | Device ID: PADMOUNT

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X		X	

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance: **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	**N/A** Ω
Phase B	**N/A** Ω
Phase C	**N/A** Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage: 1 kV | 2 kV | 5 kV | 10 kV

	Phase A	Phase B	Phase C
Phase to GND	**N/A** MΩ	**N/A** MΩ	**N/A** MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: **10 A**

	Phase A	Phase B	Phase C
Contacts	**109** µΩ	**99** µΩ	**108** µΩ
Fuse	**107** µΩ	**109** µΩ	**108** µΩ
Overall	**104** µΩ	**107** µΩ	**105** µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	**N/A** MΩ
Phase B to Ground	**N/A** MΩ
Phase C to Ground	**N/A** MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	**N/A** MΩ
Phase B to Ground	**N/A** MΩ
Phase C to Ground	**N/A** MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	3678	8B04

Tested By: **B. DOUGLAS., K. BRANT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: IROQUOIS MS#1 Device ID: T1

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1		
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other	
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other	ONS
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side		Other	

Manufacturer	BROWN BOVERI		Core & Windings	12150	kg		lb	X
Date of Manufacture	1953		Tanks & Fittings	6450	kg		lb	X
Serial #	C199		Coolant Volume		L		Gal	
KVA / Prov. KVA Rating	3000	KVA	Coolant Weight	8500	kg		lb	X
Primary Voltage	44000	V	Total Weight	27100	kg		lb	X
Primary Ampacity	39.3	A	Temperature Rise	55	°C	X	°F	
Secondary Voltage	8320/4160	V	HV BIL Rating		kV			
Secondary Ampacity	208/416	A	LV BIL Rating		kV			
HV Winding Material			Percent Impedance	5.40 %	ONAN	X	ONAF	
LV Winding Material			Tamper Resistant		YES		NO	X
CSA Specification(s)			Transformer Colour	GREY				
Comments								

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Ground Connections	Satisfactory		Not Satisfactory	X	N/A		Comments NO GROUND CONNECTION
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A		Comments

Coolant Temperature	25	°C	X	°F		Max. Coolant Temperature	40	°C	X	°F	
Comments											

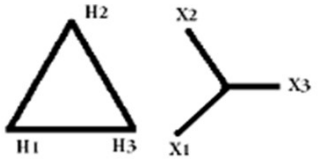
Oil Conservator

Oil Conservator	Yes	X	No			Conservator Volume		L		Gal
Silica Gel Breather	Yes		No	X		Breather Volume		L		Gal
Silica Gel Colour	Good		Bad		Replaced	N/A	X			
Comments										

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	44000	X	X
2 / B	102.50%	42900		
3 / C	100.00%	41800		
4 / D	97.50%	40700		
5 / E	95.00%	39600		

Vector Diagram: DeltaWyeNoXo2b__16.Dy11



Primary Vector: X Secondary Vector: X

Comments: TRANSFORMER LEAKING FROM TOP OF MAIN TANK.

Recorded By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: IROQUOIS MS#1 Device ID: T1

Neutral Grounding Resistor (NGR)

NGR Present	Yes		No	X
Manufacturer			NGR Serial #	
NGR Voltage	V		Maximum Current	A
NGR Resistance	Ω		NGR Location	
Comments				

Transformer Lightning Arrestors

Lightning Arrestors	Yes		No	X		
Class	Distribution		Intermediate		Station	
Composition	Ceramic		Polymer			
Manufacturer					Max. / MCOV Rating	/ kV
Catalog #						
Comments						

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Elec.		Mech.		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Fans

Fans	Yes		No	X
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	1" IPS
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1 / Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A
Concentric Neutral	Aluminum		Copper		# of Bond Conductors	0
Insulation Voltage	N/A				# of Neutral Conductors	0
Insulation Type	BARE BUS				Neutral Size / Dim.	N/A

Comments:

Recorded By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: IROQUOIS MS#1 Device ID: T1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 1 To X 2	H 2 To H 3 / X 2 To X 3	H 3 To H 1 / X 3 To X 1
1 / A	102.50%	44000	9.160	9.150	9.151	9.151
2 / B	100.00%	42900				
3 / C	97.30%	41800				
4 / D	94.50%	40700				
5 / E	91.80%	39600				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	1	2.200 mA	-0.110 %	2.300 mA	-0.100 %	1.700 mA	-0.100 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	3.370 Ω
H0 - H2	N/A Ω	H2 - H3	3.390 Ω
H0 - H3	N/A Ω	H3 - H1	3.370 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	62.000 mΩ	X1 - X2	124.700 mΩ
X0 - X2	61.900 mΩ	X2 - X3	124.500 mΩ
X0 - X3	62.200 mΩ	X3 - X1	125.300 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	7271 pF	1904 pF	5365 pF	4672 pF	10040 pF
Uncorrected D.F. (%)	0.468 %	0.552 %	0.403 %	0.413 %	0.434 %
Corrected to 20 °C (%)	0.370 %	0.436 %	0.318 %	0.326 %	0.343 %

Temp. Correction Factor 0.79

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	N/A MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	N/A MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

TEMPORARY GROUNDS APPLIED ON SECONDARY CABLES FOR WORK PROTECTION.

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	184	51006	0319	7776

Tested By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID: IROQUOIS MS#1 Device ID: T1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	1059 MΩ	318 MΩ	775 MΩ	233 MΩ	93 MΩ	28 MΩ
30 sec	1300 MΩ	390 MΩ	889 MΩ	267 MΩ	1020 MΩ	306 MΩ
45 sec	1460 MΩ	438 MΩ	980 MΩ	294 MΩ	1060 MΩ	318 MΩ
1 min	1570 MΩ	471 MΩ	1040 MΩ	312 MΩ	1080 MΩ	324 MΩ
2 min	1820 MΩ	546 MΩ	1200 MΩ	360 MΩ	1140 MΩ	342 MΩ
3 min	1940 MΩ	582 MΩ	1320 MΩ	396 MΩ	1170 MΩ	351 MΩ
4 min	2030 MΩ	609 MΩ	1420 MΩ	426 MΩ	1180 MΩ	354 MΩ
5 min	2090 MΩ	627 MΩ	1500 MΩ	450 MΩ	1190 MΩ	357 MΩ
6 min	2140 MΩ	642 MΩ	1580 MΩ	474 MΩ	1210 MΩ	363 MΩ
7 min	2180 MΩ	654 MΩ	1640 MΩ	492 MΩ	1220 MΩ	366 MΩ
8 min	2210 MΩ	663 MΩ	1690 MΩ	507 MΩ	1220 MΩ	366 MΩ
9 min	2240 MΩ	672 MΩ	1740 MΩ	522 MΩ	1230 MΩ	369 MΩ
10 min	2260 MΩ	678 MΩ	1780 MΩ	534 MΩ	1240 MΩ	372 MΩ
Test Voltage	10000 V		1000 V		1000 V	
Multiplier	1		1		1	
Polarization Index	1.44		1.71		1.15	
TCC 0.30	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	471	MΩ @	10000	V
Low to High & Ground	312	MΩ @	1000	V
High & Low to Ground	324	MΩ @	1000	V

Core Ground Insulation Resistance

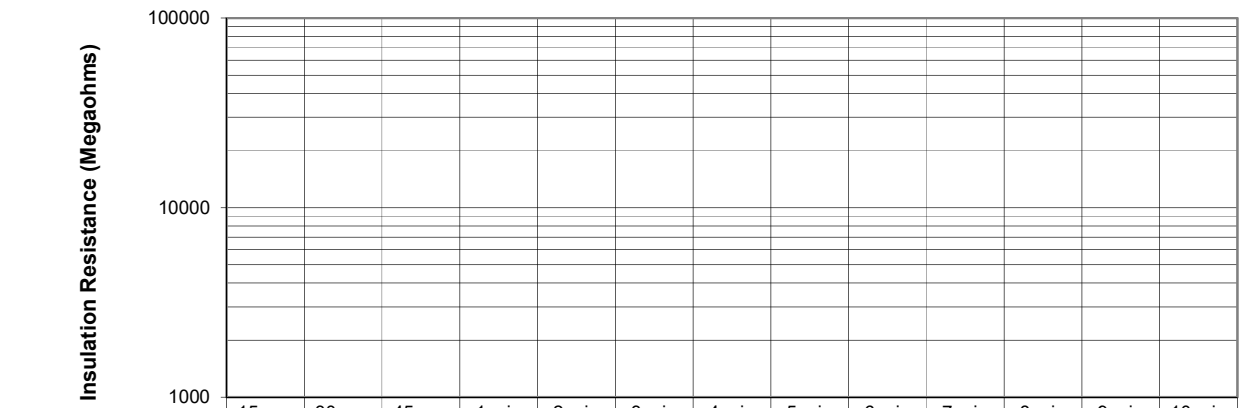
Resistance in meg-ohms after 1 minute.

Core Ground Accessible: Yes [ ] No [X]

Test Voltage: V

Core Ground Resistance: MΩ

Dielectric Absorption Test



	15 sec	30 sec	45 sec	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min	9 min	10 min
High to Low & Gnd	318	390	438	471	546	582	609	627	642	654	663	672	678
Low to High & Gnd	233	267	294	312	360	396	426	450	474	492	507	522	534
High & Low to Gnd	28	306	318	324	342	351	354	357	363	366	366	369	372

Test Instrument(s) Manufacturer / Model: Megger

Serial #: 7776

Comments:

Tested By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: IROQUOIS MS#1 Device ID: T2

Customer	Rideau St. Lawrence Utility	Date	October 18th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Iroquois MS#1		
Site Address	5549 Carman Rd., Iroquois, ON		

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other		
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other		
Bushing Configuration	Dead Front		Top - Top		Top - Side	X	Side - Side		Other		

Manufacturer	NORTHERN TRANSFORMER		Core & Windings	4838	kg	X	lb		
Date of Manufacture	2015		Tanks & Fittings	2677	kg	X	lb		
Serial #	15-2707		Coolant Volume	3273	L	X	Gal		
KVA / Prov. KVA Rating	3000	KVA	Coolant Weight	2810	kg	X	lb		
Primary Voltage	44000	V	Total Weight	10325	kg	X	lb		
Primary Ampacity	39.4	A	Temperature Rise	55	°C	X	°F		
Secondary Voltage	8320-4160	V	HV BIL Rating	250	kV				
Secondary Ampacity	208	A	LV BIL Rating	75	kV				
HV Winding Material	CU		Percent Impedance	5.54 %	ONAN	X	ONAF		
LV Winding Material	CU		Tamper Resistant	PENTA	YES	X	NO		
CSA Specification(s)	C88-M90		Transformer Colour	GREY					
Comments									

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Ground Connections	Satisfactory	X	Not Satisfactory		N/A		Comments
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A		Comments

Coolant Temperature	25	°C	X	°F		Max. Coolant Temperature	62	°C	X	°F	
Comments											

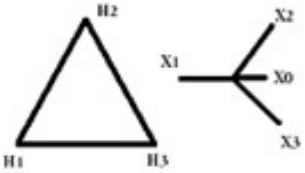
Oil Conservator

Oil Conservator	Yes		No	X		Conservator Volume		L		Gal	
Silica Gel Breather	Yes		No	X		Breather Volume		L		Gal	
Silica Gel Colour	Good		Bad		Replaced		N/A	X			
Comments											

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	46200		
2 / B	102.50%	45100		
3 / C	100.00%	44000	X	X
4 / D	97.50%	42900		
5 / E	95.00%	41800		

Vector Diagram: DeltaWye1__5.Dyn1



Primary Vector: X Secondary Vector: X

Comments:

Recorded By: B. DOUGLAS, K. BRANT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: IROQUOIS MS#1 Device ID: T2

Neutral Grounding Resistor (NGR)

NGR Present	Yes		No	X	
Manufacturer				NGR Serial #	
NGR Voltage		V		Maximum Current	A
NGR Resistance		Ω		NGR Location	
Comments					

Transformer Lightning Arrestors

Lightning Arrestors	Yes	X	No			
Class	Distribution		Intermediate		Station	
Composition	Ceramic		Polymer			
Manufacturer	OHIO BRASS			Max. / MCOV Rating	48.0 / 39.0	kV
Catalog #	300039					
Comments						

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Elec.		Mech.		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.	Other	
Manufacturer				Key Interlock #			
Comments							

Fans

Fans	Yes		No	X
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	
Conductor Material	Aluminum		Copper		Conductors per Phase	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	
Concentric Neutral	Aluminum		Copper		# of Bond Conductors	
Insulation Voltage					# of Neutral Conductors	
Insulation Type					Neutral Size / Dim.	

Comments:

Recorded By: B. DOUGLAS, K. BRANT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: IROQUOIS MS#1 Device ID: T2

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 0 To X 2	H 2 To H 3 / X 0 To X 3	H 3 To H 1 / X 0 To X 1
1 / A	102.50%	46200				
2 / B	100.00%	45100				
3 / C	97.30%	44000	9.159	9.162	9.167	9.166
4 / D	94.50%	42900				
5 / E	91.80%	41800				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	3	2.200 mA	0.020 %	2.200 mA	0.070 %	2.700 mA	0.070 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	2.950 Ω
H0 - H2	N/A Ω	H2 - H3	2.940 Ω
H0 - H3	N/A Ω	H3 - H1	2.970 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	43.400 mΩ	X1 - X2	85.800 mΩ
X0 - X2	42.800 mΩ	X2 - X3	85.500 mΩ
X0 - X3	43.100 mΩ	X3 - X1	86.100 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	3821 pF	1448 pF	2378 pF	13232 pF	15606 pF
Uncorrected D.F. (%)	0.312 %	0.390 %	0.190 %	0.165 %	0.182 %
Corrected to 20 °C (%)	0.246 %	0.308 %	0.150 %	0.130 %	0.144 %

Temp. Correction Factor 0.79

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ 10000 V DC after 1 minute

Phase A to Ground	131700 MΩ
Phase B to Ground	800000 MΩ
Phase C to Ground	708000 MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ 5000 V DC after 1 minute

Phase A to Ground	77400 MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	58600 MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	67800 MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

TEMPORARY GROUNDS APPLIED ON SECONDARY CABLES FOR WORK PROTECTION.

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	184	51006	0319	3678

Tested By: B. DOUGLAS, K. BRANT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID IROQUOIS MS#1 **Device ID** T2

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	19700 MΩ	5910 MΩ	22100 MΩ	6630 MΩ	15200 MΩ	4560 MΩ
30 sec	39100 MΩ	11730 MΩ	36000 MΩ	10800 MΩ	26800 MΩ	8040 MΩ
45 sec	47300 MΩ	14190 MΩ	47000 MΩ	14100 MΩ	32100 MΩ	9630 MΩ
1 min	53600 MΩ	16080 MΩ	54700 MΩ	16410 MΩ	36100 MΩ	10830 MΩ
2 min	68200 MΩ	20460 MΩ	74300 MΩ	22290 MΩ	46800 MΩ	14040 MΩ
3 min	78400 MΩ	23520 MΩ	87000 MΩ	26100 MΩ	53600 MΩ	16080 MΩ
4 min	88000 MΩ	26400 MΩ	98400 MΩ	29520 MΩ	58900 MΩ	17670 MΩ
5 min	96500 MΩ	28950 MΩ	108400 MΩ	32520 MΩ	64300 MΩ	19290 MΩ
Test Voltage	10000 V		1000 V		1000 V	
Multiplier	1		1		1	
TCC 0.30	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	16080	MΩ @	10000	V
Low to High & Ground	16410	MΩ @	1000	V
High & Low to Ground	10830	MΩ @	1000	V

Core Ground Insulation Resistance

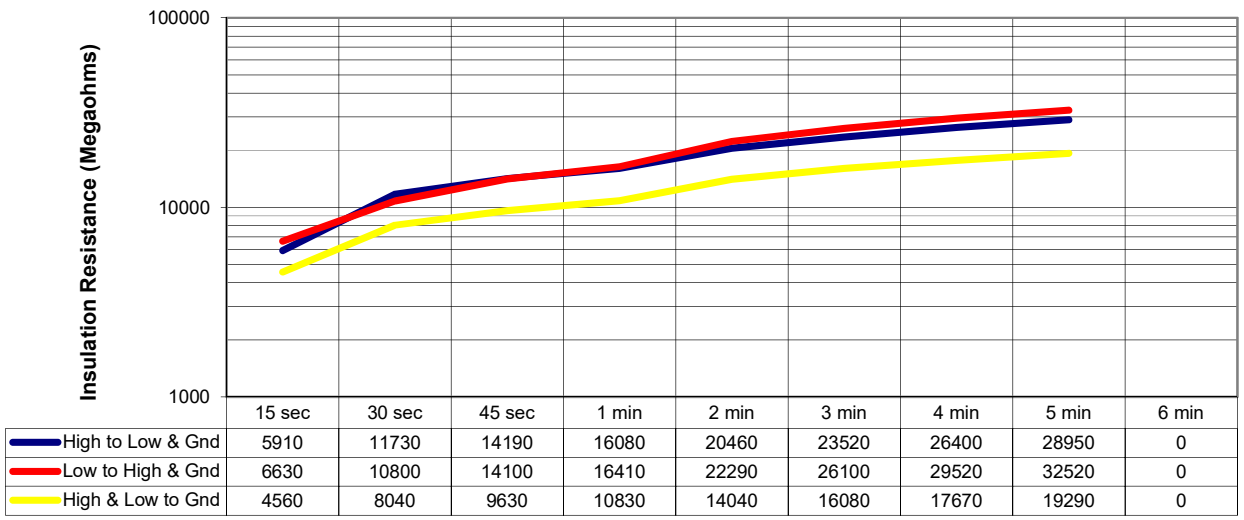
Resistance in meg-ohms after 1 minute.

Core Ground Accessible Yes [ ] No [X]

Test Voltage V

Core Ground Resistance MΩ

Dielectric Absorption Test



Test Instrument(s) Manufacturer / Model **Megger**

Serial # **3678**

Comments:

Tested By: **B. DOUGLAS, K. BRANT**

November 18th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Oil Analysis Report - Our Ref: 29995
Site: Iroquois MS #1 – 5549 Carman Rd., Iroquois, ON

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer – Asea Brown Boveri, Serial no. C199 (T1)**

  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the insulating fluid is clear with zero amounts of sediment detected and having a slight amount of water content (*10 ppm*). All the parameters **except for *Interfacial Tension & Neutralization Number*** were found within manufacturer recommended limits. ***Interfacial Tension* (*20 dynes/cm*) is below current recommended manufacturer guideline minimum limit (*25 dynes/cm*). Neutralization Number (0.24 Milligrams KOH/gram) is above recommended manufacturer guideline maximum limit (0.2 Milligrams KOH/gram).** ***Interfacial Tension (IFT)*** *measures the tension at the interface between two liquids which do not mix (oil and water) and is expressed in dynes/cm. This test is used to detect the presence of oil decay products (sludge), polar contaminants from solid insulating materials and oxidation products in the oil.* ***Neutralization Number (Acidity)*** *is a measure of acids in the oil which originate from decomposition/oxidation products. High values of acidity increase the rate of deterioration and can induce corrosion inside the transformer when water is present.* Please contact Tal Trees if you wish to perform an inhibitor analysis on remaining sample.

  - ***Dissolved Gas Analysis (DGA)***

    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. All the dissolved gases remained within IEEE recommended limits. **We recommend resampling annually (every 12 months), to monitor gases.**

- **<u>Transformer – Northern Transformer, Serial no. 152707 (T2)</u>**
  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the oil to be in satisfactory condition, remaining clear with zero amount of sediment detected, and having a slight amount of water content (*<1 ppm*). All the measured parameters remained within IEEE recommended limits for acceptable in-service operation.

  - ***Dissolved Gas Analysis (DGA)***

    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. All the dissolved gases remained within IEEE recommended limits. **We recommend resampling annually (every 12 months), to monitor gases.**

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence Utility in the future.

Yours Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

OIL SAMPLE ANALYSIS RESULTS

IN SERVICE - OIL

Y

Cust PO : 29995-RSLU IROQUOIS

Lab No . . . : T 2019-1590
File No . . . : 20042
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 25 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : VN
Reviewed By : SWD

SAMPLE IDENTIFICATION

Description : MS1 TX1

Rating : 3 MVA
HV_Rating : 44 kV
Manuf. / Date: ASEA BROWN BOVERI 1953
Serial No : C199

Volume : 8500 LITRES
Sample Port : BOTTOM - MAIN TANK
Sampled By : EC
Sample Date : OCT 18 2019

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min)	1816 - 64
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max Milligrams KOH/gram	0.24
Interfacial Tension	D971	25 Dynes/cm (Minimum)	20
Specific Gravity	D1298	(60/60°F)	0.889
API Gravity			27.6
Colour	D1500	0.5 — 8.0	3.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	10
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

DIELECTRIC BREAKDOWN IS GOOD
WATER CONTENT IS GOOD
NEUTRALIZATION NUMBER IS POOR INDICATING EXCESSIVE OXIDATION
IFT INDICATES POLAR CONTAMINANTS AND OXIDATION PRODUCTS IN THE OIL

RECOMMENDATIONS: SAMPLE AS PER SCHEDULE
CONTACT LAB TO PERFORM INHIBITOR ANALYSIS ON REMAINING OIL

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 29995-RSLU IROQUOIS

Lab No : D 2019-1581
File No : 20042
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 24 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : MS1 TX1

Rating	: 3 MVA	Fluid Temp.	: 25 (°C)
HV Rating	: 44 kV	Volume	: 8500 LITRES
Manuf. / Date	: ASEA BROWN BOVERI 1953	Preservation	: CONSERVATOR
Serial No	: C199	Syringe Serial	: CJ825
Sample Port	: BOTTOM - MAIN TANK	Sampled By	: EC
		Sample Date	: OCT 18 2019

COMPONENT	MEASURED PPM	% COMBUSTIBLES
Hydrogen (H2)	15	4.6
Oxygen + Argon (O2 + A)	22201	-----
Nitrogen (N2)	42953	-----
Methane (CH4)	5	1.5
Carbon Monoxide (CO)	255	78.2
Carbon Dioxide (CO2)	2417	-----
Ethylene (C2H4)	4	1.2
Ethane (C2H6)	<1	.0
Acetylene (C2H2)	1	.3
Propane (C3H8)	46	14.1
Total Gas Content	6.79 %	
Combustible Gas Content	326 ppm	.480 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: FAULT GAS CONCENTRATIONS HAVE REMAINED WITHIN NORMAL RANGE SINCE DEC/16.

Recommendations : SAMPLE AS PER SCHEDULE FOR DISSOLVED GASES

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : 29995-RSLU IROQUOIS

Lab No . . . : T 2019-1591
File No . . . : 20042
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 25 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : VN
Reviewed By : SWD

SAMPLE IDENTIFICATION

Description : MS1-TX2

Rating :	3 MVA	Volume :	3273 LITRES
HV_Rating :	44 kV	Sample Port :	BOTTOM - MAIN TANK
Manuf. / Date:	NORTHERN 2015	Sampled By :	KB/BD
Serial No :	152707	Sample Date :	OCT 18 2019

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min)	1816 - 66
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max Milligrams KOH/gram	<0.01
Interfacial Tension	D971	25 Dynes/cm (Minimum)	43
Specific Gravity	D1298	(60/60°F)	0.876
API Gravity			30.0
Colour	D1500	0.5 — 8.0	<0.5
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	<1
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

OIL IS IN SATISFACTORY CONDITION FOR CONTINUED USE

RECOMMENDATIONS: SAMPLE AS PER SCHEDULE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 29995-RSLU IROQUOIS

Lab No : D 2019-1582
File No : 20042
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 24 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : MS1-TX2

Rating : 3 MVA
HV Rating : 44 kV
Manuf. / Date: NORTHERN 2015
Serial No : 152707
Sample Port : BOTTOM - MAIN TANK

Fluid Temp. : 25 (°C)
Volume : 3273 LITRES
Preservation : SEALED
Syringe Serial: 8498
Sampled By : KB/BD
Sample Date : OCT 18 2019

COMPONENT	MEASURED PPM	% COMBUSTIBLES
Hydrogen (H2)	10	3.2
Oxygen + Argon (O2 + A)	18716	-----
Nitrogen (N2)	60147	-----
Methane (CH4)	5	1.6
Carbon Monoxide (CO)	293	94.8
Carbon Dioxide (CO2)	1074	-----
Ethylene (C2H4)	1	.3
Ethane (C2H6)	<1	.0
Acetylene (C2H2)	<1	.0
Propane (C3H8)	<2	.0
Total Gas Content	8.02 %	
Combustible Gas Content	309 ppm	.385 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: FAULT GAS CONCENTRATIONS HAVE REMAINED WITHIN NORMAL RANGE SINCE DEC/16.

Recommendations : SAMPLE AS PER SCHEDULE FOR DISSOLVED GASES

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

November 15th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Maintenance Inspection Report - Our Ref: 29995
Site: Morrisburg MS#1 – 11 Fifth St. E., Morrisburg, ON

Please find the attached report for the maintenance work and inspections completed October 17th, 2019.

Tal Trees cleaned, serviced, tested & inspected, the main power system. All testing and inspections were performed in accordance to NETA Maintenance Testing Specifications.

Items tested/inspected include:

- 44KV Air Break Switch
- Lightning Arrestors
- Main Transformer
- Secondary Cables
- Transformer Oil Analysis
- 4.16KV Load Break Switches

A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC) and NETA MTS.

Air Break / Load Break Switches:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.
- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.
- All insulators were inspected and cleaned, as well tightness and condition of pole ground including the switch matt checked.
- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.
- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.
- Primary connections were inspected for tightness and indications of overheating and reinstalled with antioxidant grease.
- Primary bushings inspected for damage and cleaned.
- Full transformer tests were completed on the transformer including turn ratio test, winding resistance, capacitance test and dielectric absorption test (insulation resistance).
- An oil sample was obtained for fluid analysis and DGA.

Findings/Repairs:

- ***44KV Lightning arrestors on substation tower are porcelain composition and should be replaced at earliest convenience with polymer style. If this type of arrestor fails, it can explode, causing damage to surrounding components including transformer bushings & tower insulators.***
- ***Transformer tank currently has one ground connection to the grid.***
- ***Feeder 46F3 fuse (AØ) was found to be in poor condition (cracked) and was replaced with a spare link from the substation hut.***
- ***Three porcelain insulators were replaced on the secondary (4160V) structure. The insulators required replacement due to their age, the epoxy that holds the metal cap separates.***
- ***Secondary structure is missing warning signs "Do not operate fuses under load" sign as required by OESC Rule #: 36-006.***
- ***Feeder 46F4 does not have a nomenclature to designate device ID.***

Recommendations:

- ***Replace 44KV lightning arrestors with polymer style.***
- ***Install second ground connection on transformer to comply with current trade grounding practice.***
- ***Consider replacing porcelain insulators with cypoxy insulators for increased longevity.***
- ***Install warning/nomenclature signs on secondary tower to comply with OESC requirements for all feeders.***
- ***Continue with annual substation maintenance.***

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all the recommended repairs listed in this report.

If you have any questions/concerns, please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence Utility.

Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
TALTREES POWER SERVICES
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(613) 403 7804
dgalbraith@taltrees.ca

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID MORRISBURG MS#1 **Device ID** 46T1-L

Customer	Rideau St. Lawrence Utility	Date	October 17th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#1	System Neutral Present	
Site Address	11 Fifth St E., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break		Air Break	X			Other	
Manufacturer	EASTERN POWER DEVICES				BIL Rating			kV
Date Of Manufacture					Feeder ID			
Serial #	65807				Feeds To	T1		
Catalog #					Interrupting Rating			A
Nom. / Max. Voltage	46.0 / 48.3	kV			Continuous Ampacity	600		A
Comments	VERY RUSTY							

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate		Station	X	
Composition	Ceramic	X	Polymer				
Manufacturer	ASEA				Max. / MCOV Rating	46.0 / 39.0	kV
Catalog #	5249872						
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C		
Type	SMD		
Nom. / Max. Voltage	46.0 / 48.3	kV	
Holder Max. Fuse Link	200E		
Holder Catalog #	86705-R1		

Primary Fuse Link Data

Manufacturer	S&C		
Type	SMD-1A		
Link Size	150	A	
TCC #	153-1		
Link Catalog #	445150R1-46		

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	X	# of Spares	3	
Spare Location	SUBSTATION HUT.						
Comments	1977						

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	1/2" IPS	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	N/A	
Comments							

Recorded By: T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID MORRISBURG MS#1 **Device ID** 46T1-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors		X		PORCELAIN
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [ ] 10 kV [X]

	Phase A	Phase B	Phase C
Phase to GND	1400000 MΩ	1650000 MΩ	2100000 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	18 µΩ	16 µΩ	16 µΩ
Fuse	620 µΩ	880 µΩ	609 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	1400000 MΩ
Phase B to Ground	1600000 MΩ
Phase C to Ground	1500000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	10320 MΩ
Phase B to Ground	10240 MΩ
Phase C to Ground	9680 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	3678	7293

Tested By: **T. GILBERT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 46F1

Customer	Rideau St. Lawrence Utility	Date	October 17th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#1	System Neutral Present	
Site Address	11 Fifth St E., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating		kV
Date Of Manufacture					Feeder ID	46F1	
Serial #					Feeds To	FEEDER #1	
Catalog #	36011				Interrupting Rating	600	A
Nom. / Max. Voltage	7.2 / 8.3 kV				Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution	X	Intermediate		Station		
Composition	Ceramic	X	Polymer				
Manufacturer	UNICAP				Max. / MCOV Rating	3.0 /	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C POWER FUSE
Type	SM5
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400A
Holder Catalog #	86151R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	4
Spare Location	SUBSTATION HUT				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	3/O	
Comments							

Recorded By: T. GILBERT, D. MACLEAN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 46F1

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	157600 MΩ	52100 MΩ	185400 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	80 µΩ	65 µΩ	60 µΩ
Fuse	256 µΩ	259 µΩ	226 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **1000 V DC** after 1 minute

Phase A to Ground	130000 MΩ
Phase B to Ground	110000 MΩ
Phase C to Ground	6040 MΩ

Comments / Observations

AØ ARC CONTACT ON SWITCH IS DAMAGED (HOLE) - RECOMMEND REPLACING.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	7293

Tested By: **D. MACLEAN,T. GILBERT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 46F2

Customer	Rideau St. Lawrence Utility	Date	October 17th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#1	System Neutral Present	
Site Address	11 Fifth St E., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating		kV
Date Of Manufacture					Feeder ID	46F2	
Serial #					Feeds To	FEEDER #2	
Catalog #	36011				Interrupting Rating	600	A
Nom. / Max. Voltage	7.2 / 8.3	kV			Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution	X	Intermediate		Station		
Composition	Ceramic	X	Polymer				
Manufacturer	UNICAP				Max. / MCOV Rating	3.0 /	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C POWER FUSE
Type	SM5
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400A
Holder Catalog #	87511

Primary Fuse Link Data

Manufacturer	S&C
Type	SM5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	4
Spare Location	SUBSTATION HUT				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	3/O	
Comments							

Recorded By: D. MACLEAN, E. COURTNEY, T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 46F2

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	157600 MΩ	52100 MΩ	185400 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	180 µΩ	205 µΩ	189 µΩ
Fuse	342 µΩ	323 µΩ	322 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **1000 V DC** after 1 minute

Phase A to Ground	814 MΩ
Phase B to Ground	928 MΩ
Phase C to Ground	744 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	7293

Tested By: **D. MACLEAN, E. COURTNEY, T. GILBERT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 46F3

Customer	Rideau St. Lawrence Utility	Date	October 17th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#1	System Neutral Present	
Site Address	11 Fifth St E., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating		kV
Date Of Manufacture					Feeder ID	46F3	
Serial #					Feeds To	FEEDER #3	
Catalog #	36011				Interrupting Rating	600	A
Nom. / Max. Voltage	7.2 / 8.3 kV				Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution	X	Intermediate		Station		
Composition	Ceramic	X	Polymer				
Manufacturer	UNICAP				Max. / MCOV Rating	3.0 /	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C POWER FUSE
Type	SM5
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400A
Holder Catalog #	86151

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	4
Spare Location	SUBSTATION HUT				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	3/O	
Comments							

Recorded By: D. MACLEAN, E. COURTNEY, T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 46F3

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	157600 MΩ	52100 MΩ	185400 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	204 µΩ	107 µΩ	146 µΩ
Fuse	301 µΩ	271 µΩ	212 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **1000 V DC** after 1 minute

Phase A to Ground	>200000 MΩ
Phase B to Ground	>200000 MΩ
Phase C to Ground	166000 MΩ

Comments / Observations

AØ FUSE HAS A HAIRLINE CRACK.
REPLACED INSULATOR ON BOTTOM SWITCH BLADE (BØ).
REPLACED TWO INSULATORS ON CØ FUSE HOLDER.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	7293

Tested By: **D. MACLEAN, E. COURTNEY, T. GILBERT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 46F4

Customer	Rideau St. Lawrence Utility	Date	October 17th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#1	System Neutral Present	
Site Address	11 Fifth St E., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break	X	Air Break				Other	
Manufacturer	S&C				BIL Rating	110		kV
Date Of Manufacture					Feeder ID	46F4		
Serial #					Feeds To	FEEDER #4		
Catalog #	136332R2				Interrupting Rating	600		A
Nom. / Max. Voltage	14.4 / 17.0			kV	Continuous Ampacity	400		A
Comments								

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C POWER FUSE
Type	SM5
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86152R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 4
Spare Location	SUBSTATION HUT				
Comments					

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	350MCM	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper	X	# of Bond Coductors	0	
Insulation Voltage	15KV				# of Neutral Conductors	1	
Insulation Type	XLPE				Neutral Size / Dim.	2/O	
Comments							

Recorded By: D. MACLEAN, E. COURTNEY, T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 46F4

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	157600 MΩ	52100 MΩ	183400 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	81 µΩ	98 µΩ	83 µΩ
Fuse	311 µΩ	311 µΩ	380 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	7293

Tested By: **D. MACLEAN, E. COURTNEY, T. GILBERT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: 46T1-L Device ID: T1

Customer	Rideau St. Lawrence Utility	Date	October 17th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#1		
Site Address	11 Fifth St E., Morrisburg, ON		

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side		Other

Manufacturer	HK PORTER COMPANY CANADA LTD		Core & Windings	16023	kg		lb X
Date of Manufacture	1976		Tanks & Fittings	12095	kg		lb X
Serial #	2201-1		Coolant Volume	1184	L		Gal X
KVA / Prov. KVA Rating	5000	KVA	Coolant Weight	10182	kg		lb X
Primary Voltage	44000	V	Total Weight	38300	kg		lb X
Primary Ampacity	65.6	A	Temperature Rise	55	°C	X	°F
Secondary Voltage	4160/2400	V	HV BIL Rating	250	kV		
Secondary Ampacity	694	A	LV BIL Rating	95	kV		
HV Winding Material			Percent Impedance	5.87 %	ONAN	X	ONAF
LV Winding Material			Tamper Resistant		YES		NO X
CSA Specification(s)			Transformer Colour	GREY			
Comments							

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments	
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A		Comments	
Ground Connections	Satisfactory		Not Satisfactory	X	N/A		Comments	ONLY 1 GND CONNECTION
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments	
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments	
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A		Comments	

Coolant Temperature	28	°C X	°F	Max. Coolant Temperature	50	°C X	°F
Comments							

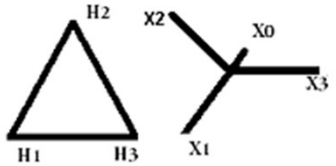
Oil Conservator

Oil Conservator	Yes		No	X		Conservator Volume		L	Gal
Silica Gel Breather	Yes		No	X		Breather Volume		L	Gal
Silica Gel Colour	Good		Bad		Replaced		N/A	X	
Comments									

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	44000		
2 / B	102.50%	42900	X	X
3 / C	100.00%	41800		
4 / D	97.50%	40700		
5 / E	95.00%	39600		

Vector Diagram: DeltaWye3



Primary Vector X Secondary Vector X

Comments: VECTOR DIAGRAM 11

Tested By: D. MACLEAN, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: 46T1-L Device ID: T1

Neutral Grounding Resistor (NGR)

NGR Present	Yes		No	X	
Manufacturer				NGR Serial #	
NGR Voltage		V		Maximum Current	A
NGR Resistance		Ω		NGR Location	
Comments					

Transformer Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Interlock

Key Interlock	Yes		No	X					
Interlock Type	Elec.		Mech.		Utility Lock				
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other		
Manufacturer							Key Interlock #		
Comments									

Fans

Fans	Yes		No	X		
# of Fans					Fan Voltage	
Fan Size					Frame Size	
Horsepower						
Comments						

Transformer Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	1" ROUND IPS
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1 / Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A
Concentric Neutral	Aluminum		Copper		# of Bond Conductors	0
Insulation Voltage	N/A				# of Neutral Conductors	1
Insulation Type	BARE BUS				Neutral Size / Dim.	1" ROUND IPS
Comments						

Tested By: D. MACLEAN, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: 46T1-L Device ID: T1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 1 To X 0	H 2 To H 3 / X 2 To X 0	H 3 To H 1 / X 3 To X 0
1 / A	105.00%	44000				
2 / B	102.50%	42900	42900.000	17.862	17.889	17.889
3 / C	100.00%	41800				
4 / D	97.50%	40700				
5 / E	95.00%	39600				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	2	2.800 mA	0.150 %	3.100 mA	0.150 %	2.300 mA	0.150 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	1.650 Ω
H0 - H2	N/A Ω	H2 - H3	1.640 Ω
H0 - H3	N/A Ω	H3 - H1	1.660 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	7.210 mΩ	X1 - X2	14.320 mΩ
X0 - X2	7.250 mΩ	X2 - X3	14.310 mΩ
X0 - X3	7.260 mΩ	X3 - X1	14.280 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	7450 pF	2685 pF	4769 pF	10381 pF	15142 pF
Uncorrected D.F. (%)	0.323 %	0.208 %	0.342 %	0.444 %	0.412 %
Corrected to 20 °C (%)	0.226 %	0.146 %	0.239 %	0.311 %	0.288 %

Temp. Correction Factor: 0.7

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ 5000 V DC after 1 minute

Phase A to Ground	157600 MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	52100 MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	185400 MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	184	51006	7123	3678

Tested By: D. MACLEAN, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID 46T1-L **Device ID** T1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	15710 MΩ	25136 MΩ	6650 MΩ	10640 MΩ	11740 MΩ	18784 MΩ
30 sec	25200 MΩ	40320 MΩ	13140 MΩ	21024 MΩ	18380 MΩ	29408 MΩ
45 sec	28600 MΩ	45760 MΩ	14940 MΩ	23904 MΩ	21000 MΩ	33600 MΩ
1 min	31200 MΩ	49920 MΩ	16480 MΩ	26368 MΩ	22600 MΩ	36160 MΩ
2 min	36200 MΩ	57920 MΩ	20200 MΩ	32320 MΩ	26500 MΩ	42400 MΩ
3 min	39200 MΩ	62720 MΩ	22700 MΩ	36320 MΩ	28700 MΩ	45920 MΩ
4 min	41400 MΩ	66240 MΩ	24800 MΩ	39680 MΩ	30400 MΩ	48640 MΩ
5 min	43200 MΩ	69120 MΩ	26700 MΩ	42720 MΩ	31600 MΩ	50560 MΩ
6 min	44600 MΩ	71360 MΩ	28300 MΩ	45280 MΩ	32400 MΩ	51840 MΩ
7 min	45800 MΩ	73280 MΩ	29700 MΩ	47520 MΩ	33500 MΩ	53600 MΩ
8 min	47200 MΩ	75520 MΩ	31000 MΩ	49600 MΩ	34300 MΩ	54880 MΩ
9 min	48500 MΩ	77600 MΩ	32200 MΩ	51520 MΩ	35100 MΩ	56160 MΩ
10 min	49000 MΩ	78400 MΩ	33300 MΩ	53280 MΩ	35700 MΩ	57120 MΩ
Test Voltage	10000 V		1000 V		1000 V	
Multiplier	1		1		1	
Polarization Index	1.57		2.02		1.58	
TCC 1.60	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	49920	MΩ @	10000	V
Low to High & Ground	26368	MΩ @	1000	V
High & Low to Ground	36160	MΩ @	1000	V

Core Ground Insulation Resistance

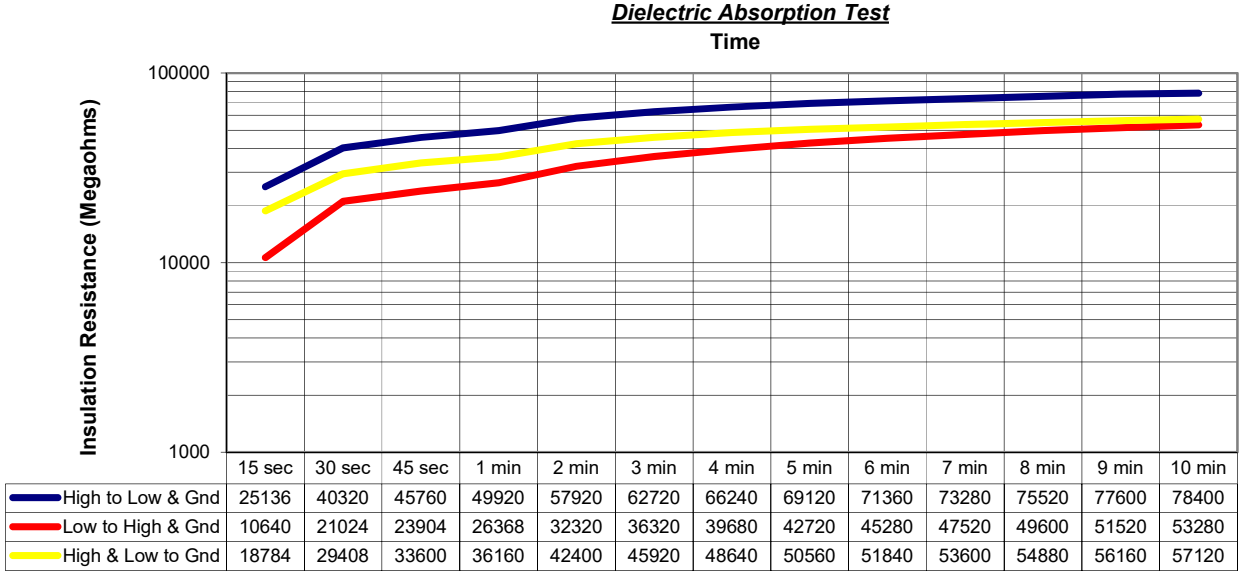
Resistance in meg-ohms after 1 minute.

Core Ground Accessible Yes [ ] No [X]

Test Voltage V

Core Ground Resistance MΩ

Dielectric Absorption Test



Test Instrument(s) Manufacturer / Model **Megger**

Serial # **3678**

Comments:

Tested By: **D. MACLEAN, M. GRAHAM**

November 15th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Oil Analysis Report - Our Ref: 29995
Site: Morrisburg MS#1 – 11 Fifth St. E., Morrisburg, ON

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer - Porter, Serial no. 22011 (T1)**

  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the oil to be in satisfactory condition, remaining clear with zero amount of sediment detected, and having a slight amount of water content (*17 ppm*). All the measured parameters remained within IEEE recommended limits for acceptable in-service operation.

  - ***Dissolved Gas Analysis (DGA)***

    The chemistry (ASTM) tests show the oil to be in satisfactory condition, except for ***Dielectric Breakdown.*** *The transformer oil has* remained clear with zero amount of sediment detected and having a slight amount of water content (11 *ppm*). The Dielectric Breakdown **(33KV)** is lower than recommend limit (40KV). ***Dielectric Breakdown*** *of an insulating oil is a measure of the oils ability to withstand electrical stress without failure. Contaminants such as particles, contaminants and water can reduce the dielectric strength of an insulating liquid.* All the other measured parameters remained within IEEE recommended limits for acceptable in-service operation. **We recommend resampling at your earliest convenience to verify Dielectric Breakdown.**

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence Utility in the future.

Yours Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : 29995-MORRISBURG

Lab No . . . : T 2019-1592
File No . . . : 20042
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 25 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : VN
Reviewed By : SWD

SAMPLE IDENTIFICATION

Description : MS1 - T1

Rating :	5 MVA	Volume :	1984 IMP. GALLONS
HV_Rating :	44 kV	Sample Port :	BOTTOM - MAIN TANK
Manuf. / Date:	PORTER 1976	Sampled By :	DM
Serial No :	22011	Sample Date :	OCT 15 2019

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min)	1816 - 33
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max Milligrams KOH/gram	0.01
Interfacial Tension	D971	25 Dynes/cm (Minimum)	37
Specific Gravity	D1298	(60/60°F)	0.860
API Gravity			33.0
Colour	D1500	0.5 — 8.0	1.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	1
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

NEUTRALIZATION NUMBER IS GOOD
INTERFACIAL TENSION IS GOOD
WATER CONTENT IS GOOD
DIELECTRIC BREAKDOWN IS LOW FOR HV RATING

RECOMMENDATIONS: RE-SAMPLE TO VERIFY THE DIELECTRIC BREAKDOWN

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 29995-RSLU MORRISBURG

Lab No : D 2019-1583
File No : 20042
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 24 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : MS1 - T1

Rating : 5 MVA
HV Rating : 44 kV
Manuf. / Date: PORTER 1976
Serial No : 22011
Sample Port : BOTTOM - MAIN TANK

Fluid Temp. : 25 (°C)
Volume : 1984 IMP. GALLONS
Preservation : SEALED
Syringe Serial: CW219
Sampled By : DM
Sample Date : OCT 15 2019

COMPONENT	MEASURED PPM		% COMBUSTIBLES
Hydrogen (H2)	3		12.5
Oxygen + Argon (O2 + A)	32167		-----
Nitrogen (N2)	50686		-----
Methane (CH4)	1		4.2
Carbon Monoxide (CO)	18		75.0
Carbon Dioxide (CO2)	635		-----
Ethylene (C2H4)	2		8.3
Ethane (C2H6)	<1		.0
Acetylene (C2H2)	<1		.0
Propane (C3H8)	<2		.0
Total Gas Content	8.35	%	
Combustible Gas Content	24	ppm	.029 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: FAULT GAS CONCENTRATIONS ARE WITHIN NORMAL RANGE.

Recommendations : SAMPLE AS PER SCHEDULE FOR DISSOLVED GASES

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

November 12th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Maintenance Inspection Report - Our Ref: 29995
Site: Morrisburg MS#2 – Village Rd, Morrisburg, ON

Please find the attached report for the maintenance work and inspections completed October 16th, 2019.

Tal Trees cleaned, serviced, tested & inspected, the main power system. All testing and inspections were performed in accordance to NETA Maintenance Testing Specifications.

Items tested/inspected include:

- 44KV Air Break Switch
- Lightning Arrestors
- Main Transformer
- Secondary Cables
- Transformer Oil Analysis
- 4.16KV Load Break Switches

A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC) and NETA MTS.

Air Break / Load Break Switches:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.

- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.

- All insulators were inspected and cleaned, as well tightness and condition of pole ground including the switch matt checked.

- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.

- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.
- Primary connections were inspected for tightness and indications of overheating and reinstalled with antioxidant grease.
- Primary bushings inspected for damage and cleaned.
- Full transformer tests were completed on the transformer including turn ratio test, winding resistance, capacitance test and dielectric absorption test (insulation resistance).
- An oil sample was obtained for fluid analysis and DGA.

Findings/Repairs:

- ***44KV dead end insulators on tower structure were found to be in unsatisfactory condition.***
- ***Minor rust/corrosion was observed inside the metal clad switchgear enclosure. The secondary feeder conduits entering the concrete pad were sealed with duct seal compound to prevent moisture from entering.***
- ***Arc compressor on feeder MS2F2-L mini-rupter switch is broken on phase 'A'. This component allows the switching duty of the device to open/close under load up to 600A.***
- ***Cable termination in MS2F2-L (phase 'C') was found to be in poor condition. The terminator has been taped over the compression lug and tested very poorly (<10kΩ after 1min @ 5000V). Results are highlighted in yellow in the attached test report. There is evidence on the adjacent fiber board that this connection has been producing excessive heat.***
- ***Transformer tank currently has one ground connection to the grid.***
- ***Tower is missing warning signs "Do not operate fuses under load" sign as required by OESC Rule #: 36-006.***
- ***Potential transformer fuse inside metering cabinet is blown, causing ground fault lights to indicate a fault.***
- ***Dominion fuses on 44KV tower structure are not making a secure connection.***

Recommendations:

- ***Replace 44KV dead end insulators on tower at your convenience.***
- ***Replace arc compressor on feeder MS2F2-L mini-rupter switch to ensure proper load breaking capability of the device and personnel safety.***
- ***Re-terminate cable in MS2F2-L on phase 'c' and replace adjacent fiberboard divider to ensure power reliability.***
- ***Install second ground connection on transformer to comply with current trade grounding practice.***
- ***Install warning sign on tower to comply with OESC requirements.***
- ***Replace Westinghouse 0.5amp type CLE-PTI fuse for PT inside metering cabinet. (Style No.: 758C433A19, S.C. No.: T1215)***
- ***Replace 44KV dominion fuses and holders to S&C style for a more secure fit.***
- ***Continue with annual substation maintenance.***

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all the recommended repairs listed in this report.

If you have any questions/concerns, please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence Utility.

Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID Morrisbug MS#2 **Device ID** W20T1-L

Customer	Rideau St. Lawrence Utility	Date	October 16th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#2	System Neutral Present	
Site Address	Village Rd., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break		Air Break	X			Other	
Manufacturer	KEARNEY NATIONAL CANADA				BIL Rating	250		kV
Date Of Manufacture	1988				Feeder ID	BROCKVILLE M26		
Serial #					Feeds To	T1		
Catalog #	3149501				Interrupting Rating	600		A
Nom. / Max. Voltage	46.0 / 47.5			kV	Continuous Ampacity	600		A
Comments								

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate		Station	X	
Composition	Ceramic		Polymer	X			
Manufacturer	OHIO BRASS				Max. / MCOV Rating	48.3 / 39.0	kV
Catalog #	300039						
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	DOMINION CUTOUT		
Type			
Nom. / Max. Voltage	46.0 / 48.3	kV	
Holder Max. Fuse Link			
Holder Catalog #	BPD46100		

Primary Fuse Link Data

Manufacturer	DOMINION		
Type			
Link Size	125	A	
TCC #	STANDARD		
Link Catalog #	6789		

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	X	# of Spares		
Spare Location	METERING CABINET						
Comments							

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	1 1/4" ROUND	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	N/A	
Comments							

Recorded By: T. GILBERT

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID Morrisbug MS#2 **Device ID** W20T1-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition		X		44KV DEAD ENDS
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [ ] 10 kV [X]

	Phase A	Phase B	Phase C
Phase to GND	594000 MΩ	621000 MΩ	557000 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	90 µΩ	94 µΩ	98 µΩ
Fuse	1077 µΩ	1131 µΩ	1066 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	2860000 MΩ
Phase B to Ground	3450000 MΩ
Phase C to Ground	2100000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	613000 MΩ
Phase B to Ground	866000 MΩ
Phase C to Ground	791000 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	8B04

Tested By: **T. GILBERT**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** MS2F1-L

Customer	Rideau St. Lawrence Utility	Date	October 16th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#2	System Neutral Present	
Site Address	Village Rd., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating	95	kV
Date Of Manufacture	1989				Feeder ID	F1	
Serial #					Feeds To	MS2F1	
Catalog #	2554R22R2				Interrupting Rating	40000	A
Nom. / Max. Voltage	14.4 / 17.0	kV			Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM-5S
Nom. / Max. Voltage	14.4 / 17.0 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86642R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5S
Link Size	400 A
TCC #	153-4
Link Catalog #	132600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 3
Spare Location	ENCLOSURE DOOR				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	350MCM	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	4/O	
Concentric Neutral	Aluminum		Copper	X	# of Bond Coductors	1	
Insulation Voltage	28KV				# of Neutral Conductors	0	
Insulation Type	XLPE				Neutral Size / Dim.	N/A	
Comments							

Recorded By: D. MACLEAN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** MS2F1-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X		X	

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	**N/A** Ω
Phase B	**N/A** Ω
Phase C	**N/A** Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	**562000 MΩ**	**640000 MΩ**	**650000 MΩ**

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	**35 µΩ**	**32 µΩ**	**30 µΩ**
Fuse	**310 µΩ**	**290 µΩ**	**273 µΩ**
Overall	**440 µΩ**	**382 µΩ**	**356 µΩ**

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **5000 V DC** after 1 minute

Phase A to Ground	**51200 MΩ**
Phase B to Ground	**51600 MΩ**
Phase C to Ground	**180200 MΩ**

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	**N/A MΩ**
Phase B to Ground	**N/A MΩ**
Phase C to Ground	**N/A MΩ**

Comments / Observations

INSTALLED DUCT SEAL IN ALL CONDUITS TO PREVENT MOISTURE INSIDE ENCLOSURE.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	3678	7293

Tested By: **D. MACLEAN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** MS2F2-L

Customer	Rideau St. Lawrence Utility	Date	October 16th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#2	System Neutral Present	
Site Address	Village Rd., Morrisburg, ON		

Nameplate Data

Switch Mounting	Metal Enclosed	X	Pole		Tower		Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C				BIL Rating	95	kV
Date Of Manufacture	1989				Feeder ID	F2	
Serial #					Feeds To	MS2F2	
Catalog #	2554R22R2				Interrupting Rating	40000	A
Nom. / Max. Voltage	14.4 / 17.0	kV			Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM-5S
Nom. / Max. Voltage	14.4 / 17.0 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86642R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5S
Link Size	400 A
TCC #	153-4
Link Catalog #	132600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 3
Spare Location	ENCLOSURE DOOR				
Comments					

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	350MCM	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	4/O	
Concentric Neutral	Aluminum		Copper	X	# of Bond Coductors	1	
Insulation Voltage	28KV				# of Neutral Conductors	0	
Insulation Type	XLPE				Neutral Size / Dim.	N/A	
Comments							

Recorded By: D. MACLEAN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** MS2F2-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X		X	

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	**N/A** Ω
Phase B	**N/A** Ω
Phase C	**N/A** Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	**399000** MΩ	**755000** MΩ	**505000** MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	**30** µΩ	**29** µΩ	**31** µΩ
Fuse	**308** µΩ	**333** µΩ	**297** µΩ
Overall	**416** µΩ	**391** µΩ	**381** µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **5000 V DC** after 1 minute

Phase A to Ground	**123400** MΩ
Phase B to Ground	**55400** MΩ
Phase C to Ground	**0.01** MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	**N/A** MΩ
Phase B to Ground	**N/A** MΩ
Phase C to Ground	**N/A** MΩ

Comments / Observations

PLASTIC PIECE IS BROKEN ON AØ SWITCH ASSEMBLY.
CABLE TERMINATION ON CØ IS IN POOR CONDITION AND TESTED POORLY.
INSTALLED DUCT SEAL IN ALL CONDUITS TO PREVENT MOISTURE INSIDE ENCLOSURE.

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	**3678**	**7293**

Tested By: **D. MACLEAN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: MS#2 Device ID: T1

Customer	Rideau St. Lawrence Utility	Date	October 16th, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Morrisburg MS#2		
Site Address	Village Rd., Morrisburg, ON		

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other
Transformer Cooling	ONAN		ONAF	X	LNAN		DRY		Other
Bushing Configuration	Dead Front		Top - Top		Top - Side	X	Side - Side		Other

Manufacturer	TRANSELECTRIX TECHNOLOGY INC		Core & Windings	6091	kg	X	lb	
Date of Manufacture	1988		Tanks & Fittings	3545	kg	X	lb	
Serial #	A32S0020		Coolant Volume	3673	L	X	Gal	
KVA / Prov. KVA Rating	5000/6667	KVA	Coolant Weight	3205	kg	X	lb	
Primary Voltage	44000	V	Total Weight	12841	kg	X	lb	
Primary Ampacity	87.5	A	Temperature Rise	65	°C	X	°F	
Secondary Voltage	4160	V	HV BIL Rating	250	kV			
Secondary Ampacity	925.2	A	LV BIL Rating	50	kV			
HV Winding Material	AL		Percent Impedance	7.39 %	ONAN		ONAF	X
LV Winding Material	AL		Tamper Resistant		YES		NO	X
CSA Specification(s)			Transformer Colour	GREEN				
Comments								

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments
Fan / Pump Operation	Satisfactory	X	Not Satisfactory		N/A		Comments
Ground Connections	Satisfactory		Not Satisfactory	X	N/A		Comments ONLY 1 GND CONNECTION
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A		Comments

Coolant Temperature	32	°C	X	°F		Max. Coolant Temperature	55	°C	X	°F	
Comments											

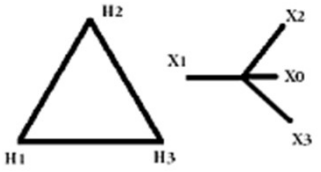
Oil Conservator

Oil Conservator	Yes		No	X		Conservator Volume		L	Gal
Silica Gel Breather	Yes		No	X		Breather Volume		L	Gal
Silica Gel Colour	Good		Bad		Replaced	N/A	X		
Comments									

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	46200		
2 / B	102.50%	45100		
3 / C	100.00%	44000		
4 / D	97.50%	42900		
5 / E	95.00%	41800		

Vector Diagram: DeltaWye1__5.Dyn1



Primary Vector X Secondary Vector X

Comments:

Tested By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: MS#2 Device ID: T1

Neutral Grounding Resistor (NGR)

NGR Present	Yes		No	X	
Manufacturer				NGR Serial #	
NGR Voltage		V		Maximum Current	A
NGR Resistance		Ω		NGR Location	
Comments					

Transformer Lightning Arrestors

Lightning Arrestors	Yes		No	X		
Class	Distribution		Intermediate		Station	
Composition	Ceramic		Polymer			
Manufacturer				Max. / MCOV Rating	/	kV
Catalog #						
Comments						

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Elec.		Mech.		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Fans

Fans	Yes	X	No		
# of Fans	4			Fan Voltage	230
Fan Size	24"			Frame Size	
Horsepower					
Comments					

Transformer Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	4" X 1/2"	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Conductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE BUS				Neutral Size / Dim.	N/A	
Comments							

Tested By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: MS#2 Device ID: T1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 0 To X 2	H 2 To H 3 / X 0 To X 3	H 3 To H 1 / X 0 To X 1
1 / A	105.00%	46200				
2 / B	102.50%	45100				
3 / C	100.00%	44000				
4 / D	97.50%	42900	17.862	17.872	17.873	17.873
5 / E	95.00%	41800				

		H 1 To H 2 / X 0 To X 2		H 2 To H 3 / X 0 To X 3		H 3 To H 1 / X 0 To X 1	
		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	4	1.000 mA	0.060 %	0.700 mA	0.060 %	1.000 mA	0.060 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	1.620 Ω
H0 - H2	N/A Ω	H2 - H3	1.630 Ω
H0 - H3	N/A Ω	H3 - H1	1.600 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	6.430 mΩ	X1 - X2	12.440 mΩ
X0 - X2	6.400 mΩ	X2 - X3	12.530 mΩ
X0 - X3	6.440 mΩ	X3 - X1	12.480 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	6893 pF	2355 pF	4541 pF	8500 pF	13038 pF
Uncorrected D.F. (%)	0.277 %	0.131 %	0.285 %	0.357 %	0.333 %
Corrected to 20 °C (%)	0.161 %	0.076 %	0.165 %	0.207 %	0.193 %

Temp. Correction Factor 0.58

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	N/A MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	N/A MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	184	51006	0319	3678

Tested By: E. COURTNEY, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID: MS#2 Device ID: T1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	13900 MΩ	28912 MΩ	6700 MΩ	13936 MΩ	5800 MΩ	12064 MΩ
30 sec	26200 MΩ	54496 MΩ	11700 MΩ	24336 MΩ	10400 MΩ	21632 MΩ
45 sec	31300 MΩ	65104 MΩ	13970 MΩ	29058 MΩ	12300 MΩ	25584 MΩ
1 min	33900 MΩ	70512 MΩ	15600 MΩ	32448 MΩ	13300 MΩ	27664 MΩ
2 min	41400 MΩ	86112 MΩ	20300 MΩ	42224 MΩ	15500 MΩ	32240 MΩ
3 min	46300 MΩ	96304 MΩ	24200 MΩ	50336 MΩ	16700 MΩ	34736 MΩ
4 min	50400 MΩ	104832 MΩ	26500 MΩ	55120 MΩ	17500 MΩ	36400 MΩ
5 min	53900 MΩ	112112 MΩ	29100 MΩ	60528 MΩ	17800 MΩ	37024 MΩ
6 min	57200 MΩ	118976 MΩ	29400 MΩ	61152 MΩ	18900 MΩ	39312 MΩ
7 min	59900 MΩ	124592 MΩ	33100 MΩ	68848 MΩ	19200 MΩ	39936 MΩ
8 min	62500 MΩ	130000 MΩ	34800 MΩ	72384 MΩ	18900 MΩ	39312 MΩ
9 min	65200 MΩ	135616 MΩ	36300 MΩ	75504 MΩ	18500 MΩ	38480 MΩ
10 min	67500 MΩ	140400 MΩ	38200 MΩ	79456 MΩ	19100 MΩ	39728 MΩ
Test Voltage	10000 V		1000 V		1000 V	
Multiplier	1		1		1	
Polarization Index	1.99		2.45		1.44	
TCC 2.08	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	70512	MΩ @	10000	V
Low to High & Ground	32448	MΩ @	1000	V
High & Low to Ground	27664	MΩ @	1000	V

Core Ground Insulation Resistance

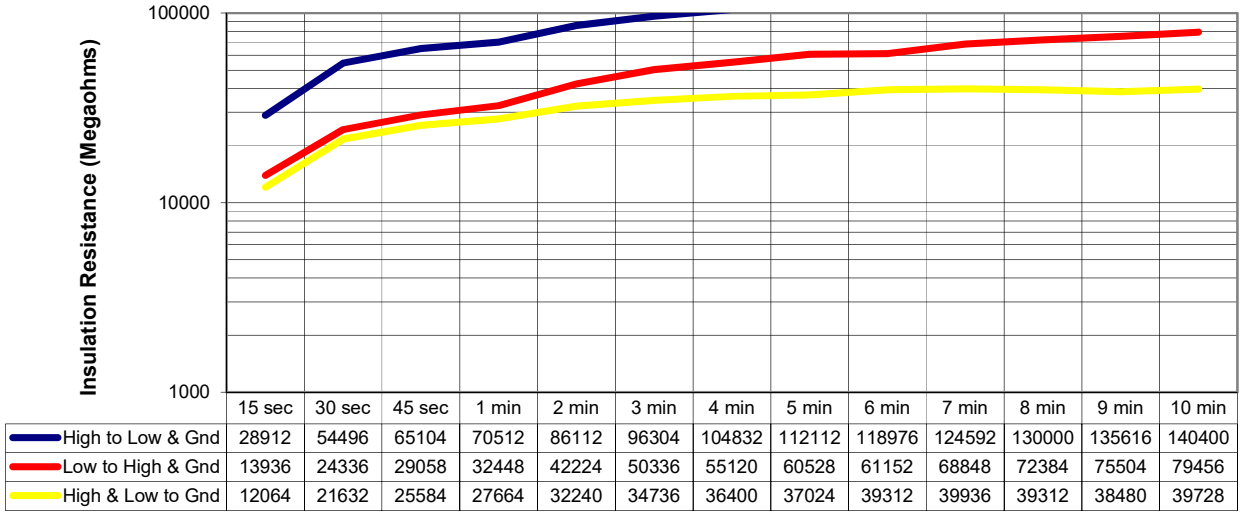
Resistance in meg-ohms after 1 minute.

Core Ground Accessible: Yes [ ] No [X]

Test Voltage: V

Core Ground Resistance: MΩ

Dielectric Absorption Test



Test Instrument(s) Manufacturer / Model: Megger

Serial #: 3678

Comments:

Tested By: E. COURTNEY, M. GRAHAM

November 14th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Oil Analysis Report - Our Ref: 29995
Site: Morrisburg MS#2 – Village Rd, Morrisburg, ON

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer – Transelectrix Technology, Serial no. A32S0020 (T1)**

  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the oil to be in satisfactory condition, remaining clear with zero amount of sediment detected, and having a slight amount of water content (2 *ppm*). All the measured parameters remained within IEEE recommended limits for acceptable in-service operation.

  - ***Dissolved Gas Analysis (DGA)***

    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. Except for Carbon Monoxide (CO), Carbon Dioxide (CO2) and Total Dissolved Combustible Gas (TDCG), all the other dissolved gases remained stable and within IEEE recommended limits. **Carbon Monoxide (*1210 ppm)* is within the IEEE recommended Condition 3 limit (5*71-1400 ppm*), Carbon Dioxide (3661 ppm) is within the IEEE recommended Condition 2 limit (2501-*4000 ppm*)** while **Total Dissolved Combustible Gas (1304 *ppm*) is within the IEEE recommended Condition 2 limit (721-1920 ppm).** Elevated levels of these gases indicate that the windings paper insulation is being stressed due overheating, accelerating the decomposition process. Possible causes can be attributed to loading issues or problems with oil circulation. Please contact us to perform a FURAN analysis with remaining sample. **We recommend resampling in 3 months to monitor these gases**.

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence Utility in the future.

Yours Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : 29995-RSLU MORRISBURG

Lab No . . . : T 2019-1593
File No . . . : 20042
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 25 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : VN
Reviewed By : SWD

SAMPLE IDENTIFICATION

Description : MS2 - MAIN TX

Rating : 5 MVA
HV_Rating : 44 kV
Manuf. / Date: TRANSELECTRIX TEC 1989
Serial No : A32S0020

Volume : 3673 LITRES
Sample Port : BOTTOM - MAIN TANK
Sampled By : EC
Sample Date : OCT 16 2019

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min) 1816 -	64
	D877	KV (Min) 877 -	
Neutralization Number	D974	0.2 Max Milligrams KOH/gram	0.01
Interfacial Tension	D971	25 Dynes/cm (Minimum)	40
Specific Gravity	D1298	(60/60°F)	0.866
API Gravity			31.8
Colour	D1500	0.5 — 8.0	2.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	2
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

OIL IS IN SATISFACTORY CONDITION FOR CONTINUED USE

RECOMMENDATIONS: SAMPLE AS PER SCHEDULE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 29995-RSLU MORRISBURG

Lab No : D 2019-1584
File No : 20042
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 23 2019
Analysis Date : OCT 24 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SW

SAMPLE IDENTIFICATION

Description : MS2 - MAIN TX

Rating	: 5 MVA	Fluid Temp.	: 32 (°C)
HV Rating	: 44 kV	Volume	: 3673 LITRES
Manuf. / Date	: TRANSELECTRIX TEC 1989	Preservation	: SEALED
Serial No	: A32S0020	Syringe Serial	: 5423
Sample Port	: BOTTOM - MAIN TANK	Sampled By	: EC
		Sample Date	: OCT 16 2019

COMPONENT	MEASURED PPM	% COMBUSTIBLES
Hydrogen (H2)	16	1.2
Oxygen + Argon (O2 + A)	821	-----
Nitrogen (N2)	61484	-----
Methane (CH4)	27	2.1
Carbon Monoxide (CO)	1210	92.8
Carbon Dioxide (CO2)	3661	-----
Ethylene (C2H4)	38	2.9
Ethane (C2H6)	<1	.0
Acetylene (C2H2)	<1	.0
Propane (C3H8)	13	1.0
Total Gas Content	6.73 %	
Combustible Gas Content	1304 ppm	1.938 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: CARBON MONOXIDE IS ABOVE NORMAL LIMIT INDICATING HIGHER THAN NORMAL TEMPERATURE WITHIN THE PAPER INSULATION. REST OF FAULT GASES ARE WITHIN NORMAL RANGE.

Recommendations : SAMPLE IN 3 MONTHS FOR DISSOLVED GASES
CONTACT LAB TO PERFORM FURAN ANALYSIS FROM REMAINING SAMPLE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

November 14th, 2017

Rideau St. Lawrence Utility
985 Industrial Rd
Prescott, ON
K0E 1T0

Attention: John Biccum

Re: Maintenance Inspection Report - Our Ref: 15374
Site: Prescott MS #1 – 675 Corrine St., Prescott, ON

To whom it may concern,

Please find the attached report for the installation and inspections completed November 13th 2017.

Tal Trees removed existing 5KV switchgear from within the brick electrical building on Corrine St, Prescott. Concrete was removed around existing underground cables to accommodate the installation of new feeder conductors. New concrete was poured and finished prior to installation of new switchgear units. S&C switchgear was supplied and installed in compliance with OESC regulations. The switchgear is complete including one main load break switch with CT's & PT's as well as three feeder fused load break switches complete with Amp Meters for each feeder. Tal Trees crew also installed 28KV XLPE conductors from existing transformer secondary to main load break switch in switchgear.

The new S&C switchgear and cables were commissioned and deemed in satisfactory condition to be energized by Tal Trees Power Services. As well, the existing power transformer & tower were overhauled, tested and inspected. A single line diagram was posted to substation fence and limacodid nomenclature for feeder's and switch gear were installed. A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC).

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.
- Primary & secondary connections were inspected for tightness and indications of overheating and reinstalled with anti–oxidant grease.
- Primary & secondary bushings inspected for damage and cleaned.
- Transformers was tested electrically (Turn ratio test, winding resistance, capacitance bridge & dielectric absorption test).

Air Break Switch:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.

- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.

- All insulators were inspected and cleaned, As well tightness and condition of pole ground including the switch matt checked.

- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.

- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

S&C Switchgear:

- S&C Switchgear was installed and while contact alignment, toggles, stops, linkage and general ease of operation were inspected.

- The contacts were inspected for contact pressure, and simultaneous closure. Fusing contacts were checked for contact pressure as well as lubricated with electrical grease.

- Bus bar was bolted and torqued to manufacturers recommended specifications.

- Switchgear & fuses were tested electrically for insulation resistance and with a micro ohm meter for contact resistance.

- All 28KV cables were installed in compliance with OESC regulations, terminated and tested for insulation resistance.

Findings/Repairs:

- Tal Trees installed a second ground connection with 2/O copper to station transformer to comply with OESC requirements.
- Oil level in transformer conservator is getting low as shown by liquid level gauge.
- Porcelain standoff insulator on transformer secondary was found to be broken & was replaced.
- All transformer & H.V. test results were satisfactory.

Recommendations:

- The installation of cables and switchgear was found to be in satisfactory condition for energization.
- Continue with regular maintenance on all transformers and high voltage switches.

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all of the recommended repairs listed in this report.

If you have any questions/concerns please do not hesitate to contact us. We look forward to being of continued service to Calabogie Peaks Resort.

Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr.
Belleville ON. K8N 4Z5

TALTREES
POWER SERVICES
A SPARKPOWER COMPANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID MS#1 **Device ID** Tower Switch

Customer	Rideau St. Lawrence	Date	October 25 2017
Customer Address	985 Industrial Rd. Prescott	Job #	15374
Site	MS #1	System Neutral Present	
Site Address	675 Corrine St.		

Nameplate Data

Switch Mounting	Metal Enclosed	x	Pole		Tower		Other
Switch Type	Load Break	x	Air Break				Other

Manufacturer	DOMINION CUTOUT LTD.	BIL Rating	250 kV
Date Of Manufacture	N/A	Feeder ID	B201T1-L
Serial #	N/A	Feeds To	T1
Catalog #	57-K46600	Interrupting Rating	40000 A
Nom. / Max. Voltage	44.0 / 48.3 kV	Continuous Ampacity	600 A
Comments	CSA C22.2 NO.31 Series		

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate		Station	X	
Composition	Ceramic		Polymer	X			

Manufacturer	OHIO BRASS	Max. / MCOV Rating	48.0 / 39.0 kV
Catalog #	3100039		
Comments	YEAR: 2009		

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMD-50
Nom. / Max. Voltage	46.0 / 48.3 kV
Holder Max. Fuse Link	100E
Holder Catalog #	86535

Primary Fuse Link Data

Manufacturer	N/A
Type	SMD-50
Link Size	100E A
TCC #	
Link Catalog #	

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 2
Spare Location	INSIDE BUILDING				
Comments					

Interlock

Key Interlock	Yes		No	x				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	

Manufacturer		Key Interlock #	
Comments			

Load Side Conductor Data

Conductor Type	Cable		Bus Bar	x	Conductor Size / Dim.	1" ROUND	
Conductor Material	Aluminum		Copper	x	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	2/0	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	2	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE BUS				Neutral Size / Dim.	N/A	

Comments

Recorded By: D. MACLEAN

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID MS#1 **Device ID** Tower Switch

Visual Inspection / Mechanical Tests

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments	
Insulator Condition	Satisfactory	X	Not Satisfactory		N/A		Comments	
Ground Connections	Satisfactory	X	Not Satisfactory		N/A		Comments	
Lightning Arrestors	Satisfactory	X	Not Satisfactory		N/A		Comments	
Arc Suppressors	Satisfactory		Not Satisfactory		N/A	X	Comments	
Key Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments	
Ground Straps & Materials	Satisfactory	X	Not Satisfactory		N/A		Comments	

Switch Condition / Operation

Switch Operation As Left	Satisfactory	x	Not Satisfactory		N/A		Comments	
Contact Surface Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Simultaneous Closure	Satisfactory	x	Not Satisfactory		N/A		Comments	

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** **Ω**

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	**Ω**
Phase B	**Ω**
Phase C	**Ω**

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	**N/A MΩ**	**N/A MΩ**	**N/A MΩ**

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
SW. Contacts	**39 µΩ**	**36 µΩ**	**42 µΩ**
Fuse	**1484 µΩ**	**1463 µΩ**	**1583 µΩ**
Overall	**N/A µΩ**	**N/A µΩ**	**N/A µΩ**

Load Side Conductor Insulation Resistance (Switchgear Bus)

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	**N/A MΩ**
Phase B to Ground	**N/A MΩ**
Phase C to Ground	**N/A MΩ**

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	**944000 MΩ**
Phase B to Ground	**949000 MΩ**
Phase C to Ground	**982000 MΩ**

Comments / Observations

Test Instrument(s)

Manufacturer / Model	Megger	Ductor
Serial #	7776	6839

Tested By: **D. MACLEAN, T. LANTHIER**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID MS#1 **Device ID** H.V Switch #1

Customer	Rideau St. Lawrence	Date	October 25 2017
Customer Address	985 Industrial Rd. Prescott	Job #	15374
Site	MS #1	System Neutral Present	
Site Address	675 Corrine St.		

Nameplate Data

Switch Mounting	Metal Enclosed	x	Pole		Tower		Other
Switch Type	Load Break	x	Air Break				Other

Manufacturer	S & C	BIL Rating	60 kV
Date Of Manufacture	10/17	Feeder ID	QL2
Serial #	9301	Feeds To	H.V Switch #2,3,4
Catalog #	CDT- 595041	Interrupting Rating	25000 A
Nom. / Max. Voltage	4.2 / 4.8 kV	Continuous Ampacity	600 A
Comments	CSA C22.2 NO.31 Series		

Lightning Arrestors

Lightning Arrestors	Yes		No	x			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				

Manufacturer		Max. / MCOV Rating	/ kV
Catalog #			
Comments	Located on primary side at tower switch, on load side at dip switch		

Protective Device Data

Primary Fuse Holder Data

Manufacturer	N/A
Type	
Nom. / Max. Voltage	/ kV
Holder Max. Fuse Link	
Holder Catalog #	

Primary Fuse Link Data

Manufacturer	N/A
Type	
Link Size	A
TCC #	
Link Catalog #	

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares
Spare Location	INSIDE BUILDING				
Comments					

Interlock

Key Interlock	Yes		No	x				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	

Manufacturer		Key Interlock #	
Comments			

Load Side Conductor Data

Conductor Type	Cable		Bus Bar	x	Conductor Size / Dim.	2 X 1/4"	
Conductor Material	Aluminum		Copper	x	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	2/0	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	3	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE BUS				Neutral Size / Dim.	N/A	

Comments

Recorded By: TL

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID MS#1 **Device ID** H.V Switch #1

Visual Inspection / Mechanical Tests

Nameplate Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Insulator Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Ground Connections	Satisfactory	x	Not Satisfactory		N/A		Comments	
Lightning Arrestors	Satisfactory		Not Satisfactory		N/A	x	Comments	
Arc Suppressors	Satisfactory	x	Not Satisfactory		N/A		Comments	
Key Interlock Operation	Satisfactory		Not Satisfactory		N/A	x	Comments	
Ground Straps & Materials	Satisfactory	x	Not Satisfactory		N/A		Comments	

Switch Condition / Operation

Switch Operation As Left	Satisfactory	x	Not Satisfactory		N/A		Comments	
Contact Surface Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Simultaneous Closure	Satisfactory	x	Not Satisfactory		N/A		Comments	

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	Ω
Phase B	Ω
Phase C	Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	MΩ	MΩ	MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	105.4 µΩ	103 µΩ	95.7 µΩ
Fuse	N/A µΩ	N/A µΩ	N/A µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance (Switchgear Bus)

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	2140000 MΩ
Phase B to Ground	3680000 MΩ
Phase C to Ground	4650000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	MΩ
Phase B to Ground	MΩ
Phase C to Ground	MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: **D. MACLEAN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID MS#1 **Device ID** H.V Switch #2

Customer	Rideau St. Lawrence	Date	October 25 2017
Customer Address	985 Industrial Rd. Prescott	Job #	
Site	MS #1	System Neutral Present	
Site Address	675 Corrine St.		

Nameplate Data

Switch Mounting	Metal Enclosed	x	Pole		Tower		Other	
Switch Type	Load Break	x	Air Break				Other	
Manufacturer	S & C				BIL Rating	60	kV
Date Of Manufacture	10/17				Feeder ID	QL2	
Serial #	9301				Feeds To	H.V Switch #2,3,4	
Catalog #	CDT- 595041				Interrupting Rating	25000	A
Nom. / Max. Voltage	4.2 / 4.8	kV			Continuous Ampacity	600	A
Comments	CSA C22.2 NO.31 Series						

Lightning Arrestors

Lightning Arrestors	Yes		No	x			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMD-40
Nom. / Max. Voltage	4.8 / 5.5 kV
Holder Max. Fuse Link	
Holder Catalog #	

Primary Fuse Link Data

Manufacturer	S&C
Type	SMU-40
Link Size	250E A
TCC #	153-1
Link Catalog #	

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 9
Spare Location	INSIDE BUILDING				
Comments					

Interlock

Key Interlock	Yes		No	x				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	x	Bus Bar		Conductor Size / Dim.	2/O	
Conductor Material	Aluminum		Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	N/A	
Insulation Voltage	N/A				# of Neutral Conductors	N/A	
Insulation Type	N/A				Neutral Size / Dim.	N/A	
Comments							

Recorded By: TL

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID MS#1 **Device ID** H.V Switch #2

Visual Inspection / Mechanical Tests

Nameplate Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Insulator Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Ground Connections	Satisfactory	x	Not Satisfactory		N/A		Comments	
Lightning Arrestors	Satisfactory		Not Satisfactory		N/A	x	Comments	
Arc Suppressors	Satisfactory	x	Not Satisfactory		N/A		Comments	
Key Interlock Operation	Satisfactory		Not Satisfactory		N/A	x	Comments	
Ground Straps & Materials	Satisfactory	x	Not Satisfactory		N/A		Comments	

Switch Condition / Operation

Switch Operation As Left	Satisfactory	x	Not Satisfactory		N/A		Comments	
Contact Surface Condition	Satisfactory	x	Not Satisfactory		N/A		Comments	
Simultaneous Closure	Satisfactory	x	Not Satisfactory		N/A		Comments	

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	Ω
Phase B	Ω
Phase C	Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	MΩ	MΩ	MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	86.8 µΩ	79.3 µΩ	75.6 µΩ
Fuse	306.2 µΩ	334.3 µΩ	314.1 µΩ
Overall	N/A µΩ	N/A µΩ	N/A µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	MΩ
Phase B to Ground	MΩ
Phase C to Ground	MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: **D. MACLEAN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID MS#1 **Device ID** H.V Switch #3

Customer	Rideau St. Lawrence	Date	October 25 2017
Customer Address	985 Industrial Rd. Prescott	Job #	
Site	MS #1	System Neutral Present	
Site Address	675 Corrine St.		

Nameplate Data

Switch Mounting	Metal Enclosed	x	Pole		Tower		Other
Switch Type	Load Break	x	Air Break				Other

Manufacturer	S & C	BIL Rating	60 kV
Date Of Manufacture	10/17	Feeder ID	QL2
Serial #	9301	Feeds To	H.V Switch #2,3,4
Catalog #	CDT- 595041	Interrupting Rating	25000 A
Nom. / Max. Voltage	4.2 / 4.8 kV	Continuous Ampacity	600 A
Comments	CSA C22.2 NO.31 Series		

Lightning Arrestors

Lightning Arrestors	Yes		No	x			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				

Manufacturer		Max. / MCOV Rating	/ kV
Catalog #			
Comments	Located on primary side at tower switch, on load side at dip switch		

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMD-40
Nom. / Max. Voltage	4.8 / 5.5 kV
Holder Max. Fuse Link	
Holder Catalog #	

Primary Fuse Link Data

Manufacturer	S&C
Type	SMU-40
Link Size	250E A
TCC #	153-2
Link Catalog #	N/A

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 9
Spare Location	INSIDE BUILDING				
Comments					

Interlock

Key Interlock	Yes		No	x				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	

Manufacturer		Key Interlock #	
Comments			

Load Side Conductor Data

Conductor Type	Cable	x	Bus Bar		Conductor Size / Dim.	2/0	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	N/A	
Insulation Voltage	N/A				# of Neutral Conductors	N/A	
Insulation Type	BARE BUS				Neutral Size / Dim.	N/A	
Comments							

Recorded By: TL

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID MS#1 **Device ID** H.V Switch # 3

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	x			
Insulator Condition	x			
Ground Connections	x			
Lightning Arrestors			x	
Arc Suppressors	x			
Key Interlock Operation			x	
Ground Straps & Materials	x			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	x			
Contact Surface Condition	x			
Simultaneous Closure	x			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	Ω
Phase B	Ω
Phase C	Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	MΩ	MΩ	MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	98.3 µΩ	85.6 µΩ	87.8 µΩ
Fuse	319.4 µΩ	333.9 µΩ	322.4 µΩ
Overall	N/A µΩ	N/A µΩ	N/A µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	MΩ
Phase B to Ground	MΩ
Phase C to Ground	MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: **D. MACLEAN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID MS#1 **Device ID** H.V Switch #4

Customer	Rideau St. Lawrence	Date	October 25 2017
Customer Address	985 Industrial Rd. Prescott	Job #	
Site	MS #1	System Neutral Present	
Site Address	675 Corrine St.		

Nameplate Data

Switch Mounting	Metal Enclosed	x	Pole		Tower		Other	
Switch Type	Load Break	x	Air Break				Other	
Manufacturer	S & C				BIL Rating	60	kV
Date Of Manufacture	10/17				Feeder ID	QL2	
Serial #	9301				Feeds To	H.V Switch #2,3,4	
Catalog #	CDT- 595041				Interrupting Rating	25000	A
Nom. / Max. Voltage	4.2 / 4.8	kV			Continuous Ampacity	600	A
Comments	CSA C22.2 NO.31 Series						

Lightning Arrestors

Lightning Arrestors	Yes		No	x			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments	Located on primary side at tower switch, on load side at dip switch						

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMD-40
Nom. / Max. Voltage	4.8 / 5.5 kV
Holder Max. Fuse Link	N/A
Holder Catalog #	N/A

Primary Fuse Link Data

Manufacturer	S&C
Type	SMU-40
Link Size	250E A
TCC #	153-2
Link Catalog #	N/A

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No		# of Spares 9
Spare Location	INSIDE BUILDING				
Comments					

Interlock

Key Interlock	Yes		No	x			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	x	Bus Bar		Conductor Size / Dim.	2/O	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	N/A	
Insulation Voltage	N/A				# of Neutral Conductors	N/A	
Insulation Type	N/A				Neutral Size / Dim.	N/A	
Comments							

Recorded By: TL

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID MS#1 **Device ID** H.V Switch # 4

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	x			
Insulator Condition	x			
Ground Connections	x			
Lightning Arrestors			x	
Arc Suppressors	x			
Key Interlock Operation			x	
Ground Straps & Materials	x			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	x			
Contact Surface Condition	x			
Simultaneous Closure	x			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	Ω
Phase B	Ω
Phase C	Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	MΩ	MΩ	MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	73.2 µΩ	81.4 µΩ	76.8 µΩ
Fuse	313.7 µΩ	322.9 µΩ	360 µΩ
Overall	N/A µΩ	N/A µΩ	N/A µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	MΩ
Phase B to Ground	MΩ
Phase C to Ground	MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	6839

Tested By: **D. MACLEAN**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: MS#1 | Device ID: B20ITI - X

Customer: Rideau St. Lawrence | Date: October 25 2017
Customer Address: 985 Industrial Rd. Prescott | Job #:
Site: MS #1
Site Address: 675 Corrine St.

Nameplate Data

Transformer Class	Unit Padmount		Padmount	X	Station				Other	
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other	
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side		Other	

Manufacturer	FERRANTI PACKARD ELECTRIC LTD.		Core & Windings	9950	kg		lb	X
Date of Manufacture	1965		Tanks & Fittings	5350	kg		lb	X
Serial #	1-2445		Coolant Volume	915	L		Gal	X
KVA / Prov. KVA Rating	5000	KVA	Coolant Weight	7850	kg		lb	X
Primary Voltage	44000	V	Total Weight	23150	kg		lb	X
Primary Ampacity	40.4	A	Temperature Rise	55	°C	X	°F	
Secondary Voltage	4160/2400	V	HV BIL Rating	250	kV			
Secondary Ampacity	417	A	LV BIL Rating	75	kV			
HV Winding Material	N/A		Percent Impedance	5.41 %	ONAN	X	ONAF	
LV Winding Material	N/A		Tamper Resistant		YES		NO	X
CSA Specification(s)	N/A		Transformer Colour	GREEN				
Comments								

Visual Inspection

Nameplate Condition	Satisfactory		Not Satisfactory	X	N/A		Comments: FADED
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments:
Ground Connections	Satisfactory	X	Not Satisfactory		N/A		Comments:
Liquid Levels In Tanks	Satisfactory		Not Satisfactory	X	N/A		Comments: OIL LEVEL IS GETTING LOW
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments:
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A		Comments:

Coolant Temperature: 25 °C X °F | Max. Coolant Temperature: 60 °C X °F
Comments:

Oil Conservator

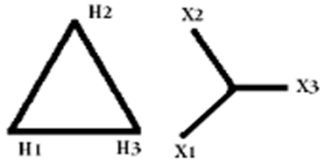
Oil Conservator	Yes	X	No		Conservator Volume		L	Gal
Silica Gel Breather	Yes	X	No		Breather Volume		L	Gal
Silica Gel Colour	Good	X	Bad		Replaced		N/A	

Comments:

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	45100		
2 / B	102.50%	44000		
3 / C	100.00%	42900	X	X
4 / D	97.50%	41800		
5 / E	95.00%	40700		

Vector Diagram: DeltaWyeNoXo2b__16.Dy11



Primary Vector: X | Secondary Vector: X

Comments:

Recorded By: E. COURTNEY, T. LANTHIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: MS#1 Device ID: B20ITI - X

Neutral Grounding Resistor (NGR)

NGR Present	Yes [ ]	No [X]		
Manufacturer			NGR Serial #	
NGR Voltage	V		Maximum Current	A
NGR Resistance	Ω		NGR Location	
Comments				

Transformer Lightning Arrestors

Lightning Arrestors	Yes [ ]	No [X]		
Class	Distribution [ ]	Intermediate [ ]	Station [ ]	
Composition	Ceramic [ ]	Polymer [ ]		
Manufacturer			Max. / MCOV Rating	/ kV
Catalog #				
Comments				

Interlock

Key Interlock	Yes [ ]	No [X]				
Interlock Type	Elec. [ ]	Mech. [ ]	Utility Lock [ ]			
Devices Interlocked	H.V. Switch [ ]	Breaker [ ]	Trans. Encl. [ ]	Other [ ]		
Manufacturer				Key Interlock #		
Comments						

Fans

Fans	Yes [ ]	No [X]		
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable [ ]	Bus Bar [X]	Conductor Size / Dim.	1 1/2" ROUND BUS
Conductor Material	Aluminum [ ]	Copper [X]	Conductors per Phase	1 / Phase
Tape Shield	Aluminum [ ]	Copper [ ]	Bond Size / Dim.	N/A
Concentric Neutral	Aluminum [ ]	Copper [ ]	# of Bond Conductors	0
Insulation Voltage	N/A		# of Neutral Conductors	1
Insulation Type	BARE BUS		Neutral Size / Dim.	1 1/2" ROUND BUS

Comments:

Recorded By: E. COURTNEY, T. LANTHIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: MS#1 Device ID: B20ITI - X

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 1 To X 2	H 2 To H 3 / X 2 To X 3	H 3 To H 1 / X 3 To X 1
1 / A	105.00%	45100				
2 / B	102.50%	44000				
3 / C	100.00%	42900	17.862	17.903	17.906	17.902
4 / D	97.50%	41800				
5 / E	95.00%	40700				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	3	0.310 mA	0.230 %	0.300 mA	0.250 %	0.220 mA	0.230 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	3.500 Ω
H0 - H2	N/A Ω	H2 - H3	3.450 Ω
H0 - H3	N/A Ω	H3 - H1	3.450 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	11.070 mΩ	X1 - X2	21.500 mΩ
X0 - X2	10.650 mΩ	X2 - X3	21.300 mΩ
X0 - X3	10.700 mΩ	X3 - X1	21.500 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	5165 pF	1800 pF	3362 pF	4752 pF	8123 pF
Uncorrected D.F. (%)	0.502 %	0.292 %	0.526 %	1.070 %	0.895 %
Corrected to 20 °C (%)	0.397 %	0.231 %	0.416 %	0.845 %	0.707 %

Temp. Correction Factor 0.79

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ 10000 V DC after 1 minute

Phase A to Ground	315000 MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	557000 MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	647000 MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	0311	51006	5563	7776

Tested By: E. COURTNEY, T. LANTHIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID MS#1 **Device ID** B20ITI - X

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	**7950 MΩ**	**10335 MΩ**	**495 MΩ**	**644 MΩ**	**565 MΩ**	**735 MΩ**
30 sec	**12920 MΩ**	**16796 MΩ**	**522 MΩ**	**679 MΩ**	**607 MΩ**	**789 MΩ**
45 sec	**14850 MΩ**	**19305 MΩ**	**537 MΩ**	**698 MΩ**	**622 MΩ**	**809 MΩ**
1 min	**16330 MΩ**	**21229 MΩ**	**549 MΩ**	**714 MΩ**	**632 MΩ**	**822 MΩ**
2 min	**19450 MΩ**	**25285 MΩ**	**590 MΩ**	**767 MΩ**	**656 MΩ**	**853 MΩ**
3 min	**21300 MΩ**	**27690 MΩ**	**605 MΩ**	**787 MΩ**	**680 MΩ**	**884 MΩ**
4 min	**22600 MΩ**	**29380 MΩ**	**616 MΩ**	**801 MΩ**	**690 MΩ**	**897 MΩ**
5 min	**23600 MΩ**	**30680 MΩ**	**632 MΩ**	**822 MΩ**	**689 MΩ**	**896 MΩ**
Test Voltage	10000	**V**	1000	**V**	1000	**V**
Multiplier	1		1		1	
Polarization Index	**1.00**		**1.00**		**1.00**	
TCC **1.30**	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	**21229**	**MΩ @**	**10000**	**V**
Low to High & Ground	**714**	**MΩ @**	**1000**	**V**
High & Low to Ground	**822**	**MΩ @**	**1000**	**V**

Core Ground Insulation Resistance

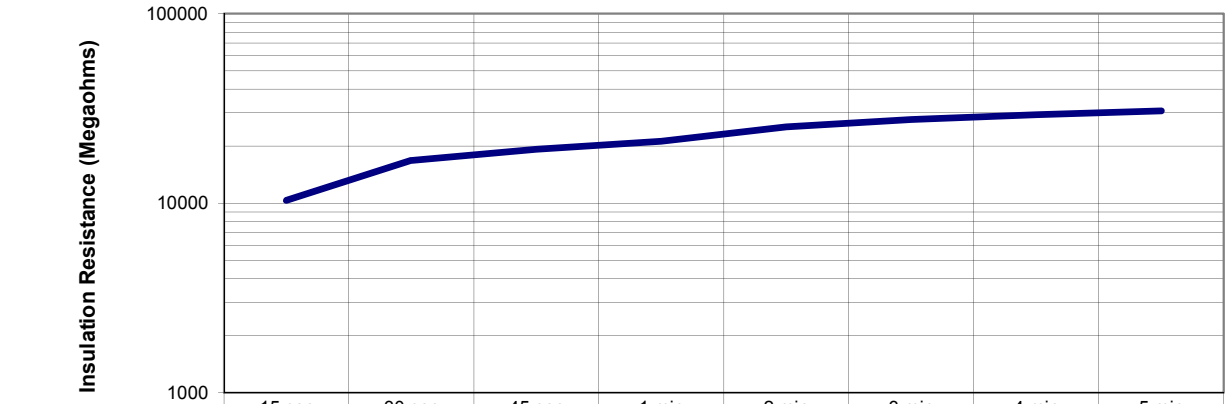
Resistance in meg-ohms after 1 minute.

Core Ground Accessible Yes [ ] No [X]

Test Voltage _____ **V**

Core Ground Resistance _____ **MΩ**

Dielectric Absorption Test



	15 sec	30 sec	45 sec	1 min	2 min	3 min	4 min	5 min
High to Low & Gnd	10335	16796	19305	21229	25285	27690	29380	30680
Low to High & Gnd	644	679	698	714	767	787	801	822
High & Low to Gnd	735	789	809	822	853	884	897	896

Test Instrument(s) Manufacturer / Model **Megger**

Serial # **7776**

Comments: _____

Tested By: E. COURTNEY, T. LANTHIER

July 17, 2017

Rideau St. Lawrence
985 Industrial Rd.
Prescott, ON
K0E 1T0

Attention: John

Re: Maintenance Inspection Report - Our Ref: 15374
Site: Rideau St. Lawrence – MS#2 – 101 Churchill Rd E., Prescott (T1)

To whom it may concern,

Please find the attached report for the installation and inspections completed July 28, 2017.

Tal Trees installed and commissioned a 5000 KVA power transformer. Oil sealing gaskets were replaced for on secondary bushings to repair leaks. A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC).

Power Transformer:

- Transformers were inspected for oil leaks, and visual damage from transportation.
- All grounding of transformers was performed according to OESC standards.
- Primary conductors were replaced to accommodate positioning and dimensions of new transformer.
- Transformers were tested electrically (Turn ratio test, winding resistance, capacitance bridge & dielectric absorption test).

Findings/Repairs:

- Gaskets were replaced on all secondary bushings (4) to repair leaks.
- All transformer test results were satisfactory.

Recommendations:

- Equipment was found to be in satisfactory condition and suitable to be energized.
- Continue with regular scheduled maintenance.

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all of the recommended repairs listed in this report.

If you have any questions/concerns please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence.

Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr.
Belleville ON. K8N 4Z5

TALTREES
POWER SERVICES
A SPARKPOWER COMPANY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: MS2 Device ID: TX1

Customer: Rideau St. Lawrence
Customer Address: 985 Industrial Rd., Prescott, ON
Site: M.S. #2 (Giant Tiger)
Site Address: 101 Churchill Rd. East., Prescott

Date: June 28, 2017
Job #: 15374

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	x			Other
Transformer Cooling	ONAN	x	ONAF		LNAN		DRY		Other
Bushing Configuration	Dead Front		Top - Top	x	Top - Side		Side - Side		Other

Manufacturer	Reliance Power		Core & Windings		kg		lb
Date of Manufacture	1990		Tanks & Fittings		kg		lb
Serial #	C-5201		Coolant Volume	1080	L		Gal X
KVA / Prov. KVA Rating	5000	KVA	Coolant Weight		kg		lb
Primary Voltage	44000	V	Total Weight	35000	kg		lb X
Primary Ampacity	65.6	A	Temperature Rise	55	°C X		°F
Secondary Voltage	4160	V	HV BIL Rating		kV		
Secondary Ampacity	695	A	LV BIL Rating		kV		
HV Winding Material			Percent Impedance	7.75 %	ONAN		ONAF
LV Winding Material			Tamper Resistant		YES		NO
CSA Specification(s)			Transformer Colour	GRAY			
Comments							

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A		Comments
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Ground Connections	Satisfactory	X	Not Satisfactory		N/A		Comments
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A		Comments

Coolant Temperature: 32 °C X °F — Max. Coolant Temperature: 59 °C X °F
Comments:

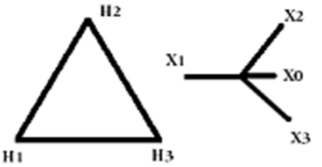
Oil Conservator

Oil Conservator	Yes	X	No			Conservator Volume		L	Gal
Silica Gel Breather	Yes		No	X		Breather Volume		L	Gal
Silica Gel Colour	Good		Bad		Replaced	N/A	X		
Comments									

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	46200		
2 / B	102.50%	45100		
3 / C	100.00%	44000		
4 / D	97.50%	42900	X	X
5 / E	95.00%	41800		

Vector Diagram: DeltaWye1__5.Dyn1



Primary Vector: X — Secondary Vector: X

Comments:

Recorded By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
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TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: MS2 Device ID: TX1

Neutral Grounding Resistor (NGR)

NGR Present	Yes [ ]	No [X]		
Manufacturer			NGR Serial #	
NGR Voltage	V		Maximum Current	A
NGR Resistance	Ω		NGR Location	
Comments				

Transformer Lightning Arrestors

Lightning Arrestors	Yes [ ]	No [X]		
Class	Distribution [ ]	Intermediate [ ]	Station [ ]	
Composition	Ceramic [ ]	Polymer [ ]		
Manufacturer			Max. / MCOV Rating	/ kV
Catalog #				
Comments				

Interlock

Key Interlock	Yes [ ]	No [X]				
Interlock Type	Elec. [ ]	Mech. [ ]	Utility Lock [ ]			
Devices Interlocked	H.V. Switch [ ]	Breaker [ ]	Trans. Encl. [ ]	Other [ ]		
Manufacturer				Key Interlock #		
Comments						

Fans

Fans	Yes [ ]	No [X]		
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable [ ]	Bus Bar [X]	Conductor Size / Dim.	1/2"
Conductor Material	Aluminum [ ]	Copper [X]	Conductors per Phase	1 / Phase
Tape Shield	Aluminum [ ]	Copper [ ]	Bond Size / Dim.	N/A
Concentric Neutral	Aluminum [ ]	Copper [ ]	# of Bond Conductors	0
Insulation Voltage	N/A		# of Neutral Conductors	1
Insulation Type	BARE		Neutral Size / Dim.	1/2"

Comments:

Recorded By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: MS2 Device ID: TX1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 0 To X 2	H 2 To H 3 / X 0 To X 3	H 3 To H 1 / X 0 To X 1
1 / A	105.00%	46200				
2 / B	102.50%	45100				
3 / C	100.00%	44000				
4 / D	97.50%	42900	17.862	17.877	17.879	17.882
5 / E	95.00%	41800				

		H 1 To H 2 / X 0 To X 2 Excitation Currrent	Percent Deviation	H 2 To H 3 / X 0 To X 3 Excitation Currrent	Percent Deviation	H 3 To H 1 / X 0 To X 1 Excitation Currrent	Percent Deviation
Tap Position As Found	4	2.100 mA	0.080 %	1.700 mA	0.090 %	2.300 mA	0.110 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	1.994 Ω
H0 - H2	N/A Ω	H2 - H3	1.998 Ω
H0 - H3	N/A Ω	H3 - H1	1.996 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	7.630 mΩ	X1 - X2	14.890 mΩ
X0 - X2	7.610 mΩ	X2 - X3	14.860 mΩ
X0 - X3	7.630 mΩ	X3 - X1	14.910 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	7685 pF	2.49 pF	5541 pF	4915 pF	10457 pF
Uncorrected D.F. (%)	1.620 %	1.520 %	1.650 %	1.190 %	1.430 %
Corrected to 20 °C (%)	0.940 %	0.882 %	0.957 %	0.690 %	0.829 %

Temp. Correction Factor 0.58

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ N/A V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ N/A V DC after 1 minute

Phase A to Ground	N/A MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	N/A MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	N/A MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	0412	51006	5563	1261

Tested By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
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TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID MS2 **Device ID** TX1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd		Low to High & Gnd		High & Low to Gnd	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
15 sec	**1480 MΩ**	**3078 MΩ**	**1010 MΩ**	**2101 MΩ**	**1570 MΩ**	**3266 MΩ**
30 sec	**1730 MΩ**	**3598 MΩ**	**1290 MΩ**	**2683 MΩ**	**1990 MΩ**	**4139 MΩ**
45 sec	**1890 MΩ**	**3931 MΩ**	**1490 MΩ**	**3099 MΩ**	**2170 MΩ**	**4514 MΩ**
1 min	**1980 MΩ**	**4118 MΩ**	**1670 MΩ**	**3474 MΩ**	**2280 MΩ**	**4742 MΩ**
2 min	**2150 MΩ**	**4472 MΩ**	**2030 MΩ**	**4222 MΩ**	**2470 MΩ**	**5138 MΩ**
3 min	**2210 MΩ**	**4597 MΩ**	**2310 MΩ**	**4805 MΩ**	**2550 MΩ**	**5304 MΩ**
4 min	**2230 MΩ**	**4638 MΩ**	**2520 MΩ**	**5242 MΩ**	**2590 MΩ**	**5387 MΩ**
5 min	**2260 MΩ**	**4701 MΩ**	**2680 MΩ**	**5574 MΩ**	**2610 MΩ**	**5429 MΩ**
Test Voltage	10000	**V**	1000	**V**	1000	**V**
Multiplier	1		1		1	
Polarization Index	**1.00**		**1.00**		**1.00**	
TCC **2.08**	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	**4118**	**MΩ @**	**10000**	**V**
Low to High & Ground	**3474**	**MΩ @**	**1000**	**V**
High & Low to Ground	**4742**	**MΩ @**	**1000**	**V**

Core Ground Insulation Resistance

Resistance in meg-ohms after 1 minute.

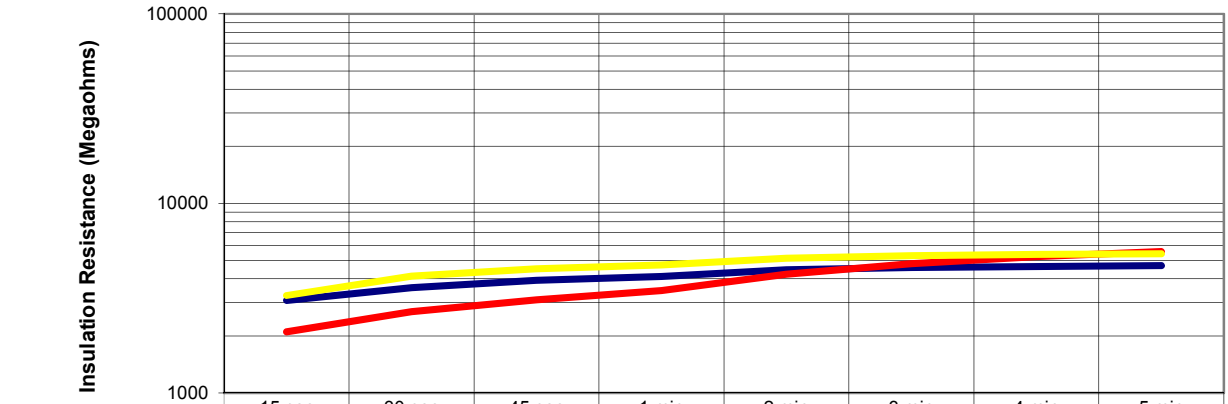
Core Ground Accessible Yes [ ] No [X]

Test Voltage _____ **V**

Core Ground Resistance _____ **MΩ**

Dielectric Absorption Test

Time



	15 sec	30 sec	45 sec	1 min	2 min	3 min	4 min	5 min
High to Low & Gnd	3078	3598	3931	4118	4472	4597	4638	4701
Low to High & Gnd	2101	2683	3099	3474	4222	4805	5242	5574
High & Low to Gnd	3266	4139	4514	4742	5138	5304	5387	5429

Test Instrument(s) Manufacturer / Model **Megger**

Serial # **1261**

Comments: _____

Tested By: D. MACLEAN, C. MERCIER

July 17, 2017

Rideau St. Lawrence
985 Industrial Rd.
Prescott, ON

Attention: John

Re: Oil Analysis Report - Our Ref: 15374
Site: Rideau St. Lawrence – MS#2 – 101 Churchill Rd E., Prescott (T1)

To whom it may concern,

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer – Reliance Power, Serial no. C-5201 (Main TX)**
  - ***Dissolved Gas Analysis (DGA)***
    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. All of the dissolved gases remained within IEEE recommended limits. **We recommend resampling annually (every 12 months).**
  - ***Chemical Analysis (ASTM/Water)***
    The chemistry (ASTM) tests show the oil to be in satisfactory condition, remaining clear with zero amount of sediment detected, and having a slight amount of water content (27 *ppm*). All of the measured parameters remained within IEEE recommended limits for acceptable in-service operation.

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence in the future.

Yours Sincerely,

John Portt, CET, PME
Vice President, Operations

Phone: (613) 968-9648 Ext: 6202
Mobile: (613) 968-0548
102 Parks Dr. Belleville, ON. K8N 4Z5

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : 15374 RIDEAU ST. LAWRENCE

Lab No . . . : T 2017-1108
File No . . . : 13888
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUL 07 2017
Analysis Date : JUL 07 2017
Analyzed By : MJ
Reviewed By : SW

BELLEVILLE ON
K8N 4Z5

SAMPLE IDENTIFICATION

Description : T1

Rating : 0.5 MVA
HV_Rating : 44 kV
Manuf. / Date: RELIANCE POWER 1990
Serial No : C5201

Volume : 1080 US GALLONS
Sample Port : BOTTOM - MAIN TANK
Sampled By : D.L
Sample Date : JUN 28 2017

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	1mm Gap 23 KV (Min)	1816 - 24
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max (0.5 - Scrap) Milligrams KOH/gram	0.01
Interfacial Tension	D971	25 Dynes/cm (Minimum)	34
Specific Gravity	D1298	(60/60°F)	0.869
API Gravity			31.3
Colour	D1500	0.5 — 8.0	1.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	27
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

OIL IS IN SATISFACTORY CONDITION FOR CONTINUED USE

RECOMMENDATIONS: SAMPLE AS PER SCHEDULE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 15374-RIDEAU ST. LAWRENCE

Lab No : D 2017-1108
File No : 13888
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUL 07 2017
Analysis Date : JUL 10 2017

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : T1

Rating :	0.5 MVA	Fluid Temp. :	(°C)
HV Rating :	44 kV	Volume :	1080 US GALLONS
Manuf. / Date:	RELIANCE POWER 1990	Preservation :	CONSERVATOR
Serial No :	C5201	Syringe Serial:	32
Sample Port :	BOTTOM - MAIN TANK	Sampled By :	D.L
		Sample Date :	JUN 28 2017

COMPONENT	MEASURED PPM	% COMBUSTIBLES
Hydrogen (H2)	3	2.6
Oxygen + Argon (O2 + A)	31510	-----
Nitrogen (N2)	47104	-----
Methane (CH4)	3	2.6
Carbon Monoxide (CO)	97	82.9
Carbon Dioxide (CO2)	1924	-----
Ethylene (C2H4)	<1	.0
Ethane (C2H6)	<1	.0
Acetylene (C2H2)	<1	.0
Propane (C3H8)	14	12.0
Total Gas Content	8.07 %	
Combustible Gas Content	117 ppm	.145 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: FAULT GAS CONCENTRATIONS ARE WITHIN NORMAL RANGE.

Recommendations : SAMPLE AS PER SCHEDULE FOR DISSOLVED GASES

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

November 12th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Maintenance Inspection Report - Our Ref: 29995
Site: Prescott MS#3 – 103 Churchill Rd. E, Prescott, ON

Please find the attached report for the maintenance work and inspections completed October 23rd, 2019.

Tal Trees cleaned, serviced, tested & inspected, the main power system. All testing and inspections were performed in accordance to NETA Maintenance Testing Specifications.

Items tested/inspected include:

- 44KV Air Break Switch
- Lightning Arrestors
- Main Transformer
- Secondary Cables
- Transformer Oil Analysis
- 4.16KV Load Break Switches

A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC) and NETA MTS.

Air Break / Load Break Switches:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.
- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.
- All insulators were inspected and cleaned, as well tightness and condition of pole ground including the switch matt checked.
- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.
- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.
- Primary connections were inspected for tightness and indications of overheating and reinstalled with antioxidant grease.
- Primary bushings inspected for damage and cleaned.
- Full transformer tests were completed on the transformer including turn ratio test, winding resistance, capacitance test and dielectric absorption test (insulation resistance).
- An oil sample was obtained for fluid analysis and DGA.

Findings/Repairs:

- ***Ground mat installed at 44KV air break switch is currently a temporary mat (chain-link fence) with only one corner connected to ground. Ontario Electrical Safety Code (OESC) rule #36-310 (2) requires the metallic gradient control mat to be connected to the switch handle by two separate conductors not less than 2/O copper and have dimensions approximately 1.2M x 1.8M.***
- ***Arc contacts on feeder switched 40F1 & 40F2 are in poor condition. At least two of these contacts have been damaged during switch operation.***
- ***Feeder 40F3 fuse was found to be in poor condition and was replaced with a spare link from the substation hut.***
- ***Two fused cutouts were replaced that feed metering on 4.16KV structure.***
- ***Transformer test results were satisfactory except for those highlighted in yellow in the results report. Further investigation may be required to determine the irregularities in these results.***

Recommendations:

- ***Install a proper gradient control mat for the purpose of operating the gang operated air break switch. This mat should be installed in compliance with OESC regulations to ensure safe operation of the switch.***
- ***Replace arc contacts on feeder switches at your convenience to ensure proper load breaking capability of the device.***
- ***Continue with annual substation maintenance.***

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all the recommended repairs listed in this report.

If you have any questions/concerns, please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence Utility.

Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID PRESCOTT MS#3 **Device ID** E201T1-L

Customer	Rideau St. Lawrence Utility	Date	October 23rd, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Prescott MS #3	System Neutral Present	
Site Address	103 Churchill Rd. E., Prescott, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break		Air Break	X			Other	
Manufacturer	DOMINION				BIL Rating			kV
Date Of Manufacture					Feeder ID	BROCKVILLE		
Serial #	820-1				Feeds To	T1		
Catalog #					Interrupting Rating			A
Nom. / Max. Voltage	46.0 / 48.3 kV				Continuous Ampacity			A
Comments								

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution		Intermediate		Station	X	
Composition	Ceramic		Polymer	X			
Manufacturer	OHIO BRASS				Max. / MCOV Rating	48.3 / 39.0 kV	
Catalog #	300039						
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMD-1A
Nom. / Max. Voltage	46.0 / 48.3 kV
Holder Max. Fuse Link	300E
Holder Catalog #	118925R1

Primary Fuse Link Data

Manufacturer	S&C
Type	SMD-2C
Link Size	100 A
TCC #	153-1
Link Catalog #	465100R3

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No	X	# of Spares
Spare Location					
Comments	RECOMMEND KEEPING SPARES ON SITE.				

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	1/2" SOLID ROUND BUS
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1 / Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0
Insulation Voltage	N/A				# of Neutral Conductors	0
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	N/A

Comments: CHAINLINK FENCE INSTALLED AS TEMPORARY GROUND MAT - RECOMMEND INSTALLING STANDARD 4FTX6FT GRADIENT GROUND MAT.

Recorded By: J. ROGERS

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID PRESCOTT MS#3 **Device ID** E201T1-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [ ] 10 kV [X]

	Phase A	Phase B	Phase C
Phase to GND	6840 MΩ	511000 MΩ	45900 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	176 μΩ	158 μΩ	317 μΩ
Fuse	738 μΩ	732 μΩ	718 μΩ
Overall	1030 μΩ	1150 μΩ	1010 μΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	6840 MΩ
Phase B to Ground	511000 MΩ
Phase C to Ground	459000 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **10000 V DC** after 1 minute

Phase A to Ground	165500 MΩ
Phase B to Ground	159700 MΩ
Phase C to Ground	139000 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7776	8B04

Tested By: **J. ROGERS**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 40F1

Customer	Rideau St. Lawrence Utility	Date	October 23rd, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Prescott MS #3	System Neutral Present	
Site Address	103 Churchill Rd. E., Prescott, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C ALDUTI RUPTER				BIL Rating	95	kV
Date Of Manufacture					Feeder ID	40F2	
Serial #					Feeds To	FEEDER #1	
Catalog #	36001				Interrupting Rating	400	A
Nom. / Max. Voltage	7.5 / 7.5 kV				Continuous Ampacity	400	A
Comments	TYPE RS						

Lightning Arrestors

Lightning Arrestors	Yes	X	No			
Class	Distribution	X	Intermediate		Station	
Composition	Ceramic	X	Polymer			
Manufacturer				Max. / MCOV Rating	/	kV
Catalog #						
Comments						

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMP-W
Nom. / Max. Voltage	7.2 / 7.5 kV
Holder Max. Fuse Link	400A
Holder Catalog #	86151

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	6
Spare Location					
Comments	SUBSTATION HUT				

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	1/O OVERHEAD
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1 / Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0
Insulation Voltage	N/A				# of Neutral Conductors	1
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	1/O OVERHEAD
Comments						

Recorded By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID: 4160 FEEDER Device ID: 40F1

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance: N/A Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage: 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	3760 MΩ	3840 MΩ	3310 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	110 µΩ	72 µΩ	70 µΩ
Fuse	450 µΩ	353 µΩ	380 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ 5000 V DC after 1 minute

Phase A to Ground	3760 MΩ
Phase B to Ground	3840 MΩ
Phase C to Ground	3310 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ 1000 V DC after 1 minute

Phase A to Ground	2000 MΩ
Phase B to Ground	847 MΩ
Phase C to Ground	2000 MΩ

Comments / Observations

BØ ARC CONTACT ON SWITCH IS DAMAGED (HOLE)

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	6400	8B04

Tested By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 40F2

Customer	Rideau St. Lawrence Utility	Date	October 23rd, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Prescott MS #3	System Neutral Present	
Site Address	103 Churchill Rd. E., Prescott, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other	
Switch Type	Load Break	X	Air Break				Other	
Manufacturer	S&C ALDUTI RUPTER				BIL Rating	95		kV
Date Of Manufacture					Feeder ID	40F2		
Serial #					Feeds To	FEEDER #2		
Catalog #	36001				Interrupting Rating	400		A
Nom. / Max. Voltage	7.5 / 7.5	kV			Continuous Ampacity	400		A
Comments	TYPE RS							

Lightning Arrestors

Lightning Arrestors	Yes	X	No				
Class	Distribution	X	Intermediate		Station		
Composition	Ceramic	X	Polymer				
Manufacturer					Max. / MCOV Rating	/	kV
Catalog #							
Comments							

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMP-W
Nom. / Max. Voltage	7.2 / 7.5 kV
Holder Max. Fuse Link	400A
Holder Catalog #	86151

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	6
Spare Location					
Comments	SUBSTATION HUT				

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	1/O OVERHEAD	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	1/O OVERHEAD	
Comments							

Recorded By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 40F2

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance: N/A Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage: 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	3760 MΩ	3840 MΩ	3310 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	148 µΩ	103 µΩ	88 µΩ
Fuse	297 µΩ	546 µΩ	566 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ 5000 V DC after 1 minute

Phase A to Ground	3760 MΩ
Phase B to Ground	3840 MΩ
Phase C to Ground	3310 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ 1000 V DC after 1 minute

Phase A to Ground	1150000 MΩ
Phase B to Ground	668000 MΩ
Phase C to Ground	1578000 MΩ

Comments / Observations

AØ ARC CONTACT ON SWITCH IS DAMAGED (HOLE)

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	6400	8B04

Tested By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 40F3

Customer	Rideau St. Lawrence Utility	Date	October 23rd, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Prescott MS #3	System Neutral Present	
Site Address	103 Churchill Rd. E., Prescott, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C ALDUTI RUPTER				BIL Rating	95	kV
Date Of Manufacture	1961				Feeder ID	40F3	
Serial #					Feeds To	FEEDER #3	
Catalog #	36011R4				Interrupting Rating	600	A
Nom. / Max. Voltage	7.2 / 8.3 kV				Continuous Ampacity	600	A
Comments							

Lightning Arrestors

Lightning Arrestors	Yes	X	No			
Class	Distribution	X	Intermediate		Station	
Composition	Ceramic	X	Polymer			
Manufacturer				Max. / MCOV Rating	/	kV
Catalog #						
Comments						

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SMP-W
Nom. / Max. Voltage	7.2 / 7.5 kV
Holder Max. Fuse Link	400A
Holder Catalog #	86151

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	6
Spare Location					
Comments	SUBSTATION HUT				

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O OVERHEAD	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	1/O OVERHEAD	
Comments							

Recorded By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 40F3

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance: N/A Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage: 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	3760 MΩ	3840 MΩ	3310 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current: 10 A

	Phase A	Phase B	Phase C
Contacts	45 µΩ	74 µΩ	66 µΩ
Fuse	826 µΩ	1090 µΩ	257 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ 5000 V DC after 1 minute

Phase A to Ground	3760 MΩ
Phase B to Ground	3840 MΩ
Phase C to Ground	3310 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ 1000 V DC after 1 minute

Phase A to Ground	86300 MΩ
Phase B to Ground	2600 MΩ
Phase C to Ground	4800 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	6400	8B04

Tested By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID 4160 FEEDER **Device ID** 40F4

Customer	Rideau St. Lawrence Utility	Date	October 23rd, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Prescott MS #3	System Neutral Present	
Site Address	103 Churchill Rd. E., Prescott, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole		Tower	X	Other
Switch Type	Load Break	X	Air Break				Other
Manufacturer	S&C ALDUTI RUPTER				BIL Rating	95	kV
Date Of Manufacture					Feeder ID	40F4	
Serial #					Feeds To	FEEDER #4	
Catalog #	36001				Interrupting Rating	400	A
Nom. / Max. Voltage	7.5 / 7.5 kV				Continuous Ampacity	400	A
Comments	TYPE RS						

Lightning Arrestors

Lightning Arrestors	Yes	X	No			
Class	Distribution	X	Intermediate		Station	
Composition	Ceramic	X	Polymer			
Manufacturer				Max. / MCOV Rating	/	kV
Catalog #						
Comments						

Protective Device Data

Primary Fuse Holder Data

Manufacturer	S&C
Type	SM-5
Nom. / Max. Voltage	7.2 / 8.3 kV
Holder Max. Fuse Link	400E
Holder Catalog #	86151R2

Primary Fuse Link Data

Manufacturer	S&C
Type	SM-5
Link Size	400 A
TCC #	119-4
Link Catalog #	261600R4

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes	X	No	# of Spares	6
Spare Location					
Comments	SUBSTATION HUT				

Interlock

Key Interlock	Yes		No	X			
Interlock Type	Electrical		Mechanical		Utility Lock		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other
Manufacturer					Key Interlock #		
Comments							

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	3/O OVERHEAD	
Conductor Material	Aluminum	X	Copper		Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	1	
Insulation Type	BARE CONDUCTOR				Neutral Size / Dim.	1/O OVERHEAD	
Comments							

Recorded By: D. MACLEAN, E. COURTNEY

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID 4160 FEEDER **Device ID** 40F4

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors	X			
Arc Suppressors	X			
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure			X	INDIVIDUAL SW'S

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance **N/A** Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A Ω
Phase B	N/A Ω
Phase C	N/A Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV [ ] 2 kV [ ] 5 kV [X] 10 kV [ ]

	Phase A	Phase B	Phase C
Phase to GND	3760 MΩ	3840 MΩ	3310 MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	61 µΩ	57 µΩ	57 µΩ
Fuse	226 µΩ	250 µΩ	290 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **5000 V DC** after 1 minute

Phase A to Ground	3760 MΩ
Phase B to Ground	3840 MΩ
Phase C to Ground	3310 MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **1000 V DC** after 1 minute

Phase A to Ground	3560 MΩ
Phase B to Ground	3830 MΩ
Phase C to Ground	10000 MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	7739	8B04

Tested By: **D. MACLEAN, E. COURTNEY**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: PRESCOTT MS#3 Device ID: T1

Customer	Rideau St. Lawrence Utility	Date	October 23rd, 2019
Customer Address	985 Industrial Rd., Prescott, ON	Job #	29995
Site	Prescott MS #3		
Site Address	103 Churchill Rd. E., Prescott, ON		

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X		Other
Transformer Cooling	ONAN		ONAF		LNAN		DRY	Other ONS
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side	Other

Manufacturer	ARCHER		Core & Windings	14300	kg		lb X
Date of Manufacture	1963		Tanks & Fittings	6400	kg		lb X
Serial #	NO SERIAL NUMBER		Coolant Volume	870	L		Gal X
KVA / Prov. KVA Rating	5000	KVA	Coolant Weight	7400	kg		lb X
Primary Voltage	44000	V	Total Weight	28100	kg		lb X
Primary Ampacity	65.7	A	Temperature Rise	65	°C X	°F	
Secondary Voltage	4160/2400	V	HV BIL Rating	250	kV		
Secondary Ampacity	694	A	LV BIL Rating	75	kV		
HV Winding Material	CU		Percent Impedance	6.30 %	ONAN X	ONAF	
LV Winding Material	CU		Tamper Resistant		YES	NO X	
CSA Specification(s)			Transformer Colour	GREY			
Comments							

Visual Inspection

Nameplate Condition	Satisfactory		Not Satisfactory	X	N/A		Comments NOT LEGIBLE
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Ground Connections	Satisfactory		Not Satisfactory	X	N/A		Comments 1 GROUND CONNECTION
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A		Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A	X	Comments
Temp. Gauge Operation	Satisfactory		Not Satisfactory	X	N/A		Comments NOT WORKING

Coolant Temperature	20	°C X	°F	Max. Coolant Temperature	60	°C X	°F
Comments							

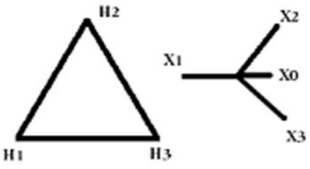
Oil Conservator

Oil Conservator	Yes	X	No		Conservator Volume		L	Gal
Silica Gel Breather	Yes		No	X	Breather Volume		L	Gal
Silica Gel Colour	Good		Bad		Replaced		N/A X	
Comments								

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	45200		
2 / B	102.50%	44000		
3 / C	100.00%	42800	X	X
4 / D	97.50%	41600		
5 / E	95.00%	40400		

Vector Diagram: DeltaWye1__5.Dyn1



Primary Vector X Secondary Vector X

Comments:

Recorded By: D. MACLEAN, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: PRESCOTT MS#3 Device ID: T1

Neutral Grounding Resistor (NGR)

NGR Present	Yes		No	X
Manufacturer			NGR Serial #	
NGR Voltage	V		Maximum Current	A
NGR Resistance	Ω		NGR Location	
Comments				

Transformer Lightning Arrestors

Lightning Arrestors	Yes		No	X		
Class	Distribution		Intermediate		Station	
Composition	Ceramic		Polymer			
Manufacturer					Max. / MCOV Rating	/ kV
Catalog #						
Comments						

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Elec.		Mech.		Utility Lock			
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	
Manufacturer					Key Interlock #			
Comments								

Fans

Fans	Yes		No	X
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable		Bus Bar	X	Conductor Size / Dim.	1" ROUND BAR
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1 / Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A
Concentric Neutral	Aluminum		Copper		# of Bond Conductors	0
Insulation Voltage	N/A				# of Neutral Conductors	0
Insulation Type	BARE BUS				Neutral Size / Dim.	N/A

Comments:

Recorded By: D. MACLEAN, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: PRESCOTT MS#3 Device ID: T1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 0 To X 2	H 2 To H 3 / X 0 To X 3	H 3 To H 1 / X 0 To X 1
1 / A	102.50%	45200				
2 / B	100.00%	44000				
3 / C	97.30%	42800	17.820	17.631	17.630	17.614
4 / D	94.50%	41600				
5 / E	91.80%	40400				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	3	2.200 mA	-1.060 %	1.500 mA	-1.070 %	1.600 mA	-1.160 %
Tap Position As Left	3	mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	1.910 Ω
H0 - H2	N/A Ω	H2 - H3	1.910 Ω
H0 - H3	N/A Ω	H3 - H1	1.920 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	6.800 mΩ	X1 - X2	13.400 mΩ
X0 - X2	6.900 mΩ	X2 - X3	13.400 mΩ
X0 - X3	6.900 mΩ	X3 - X1	13.500 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	7267 pF	1743 pF	5524 pF	8372 pF	13872 pF
Uncorrected D.F. (%)	0.413 %	1.040 %	0.160 %	4.730 %	3.280 %
Corrected to 20 °C (%)	0.413 %	1.040 %	0.160 %	4.730 %	3.280 %

Temp. Correction Factor 1

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ ____ V DC after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ 5000 V DC after 1 minute

Phase A to Ground	3760 MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	3840 MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	3310 MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	184	51006	7123	7776

Tested By: D. MACLEAN, M. GRAHAM

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID: PRESCOTT MS#3 Device ID: T1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd Uncorrected	High to Low & Gnd Corrected	Low to High & Gnd Uncorrected	Low to High & Gnd Corrected	High & Low to Gnd Uncorrected	High & Low to Gnd Corrected
15 sec	2900 MΩ	870 MΩ	1960 MΩ	588 MΩ	1760 MΩ	528 MΩ
30 sec	3810 MΩ	1143 MΩ	2470 MΩ	741 MΩ	2300 MΩ	690 MΩ
45 sec	4440 MΩ	1332 MΩ	2790 MΩ	837 MΩ	2550 MΩ	765 MΩ
1 min	4830 MΩ	1449 MΩ	3040 MΩ	912 MΩ	2750 MΩ	825 MΩ
2 min	5820 MΩ	1746 MΩ	3810 MΩ	1143 MΩ	3220 MΩ	966 MΩ
3 min	6430 MΩ	1929 MΩ	4400 MΩ	1320 MΩ	3500 MΩ	1050 MΩ
4 min	6850 MΩ	2055 MΩ	4880 MΩ	1464 MΩ	3690 MΩ	1107 MΩ
5 min	7140 MΩ	2142 MΩ	5290 MΩ	1587 MΩ	3870 MΩ	1161 MΩ
6 min	7390 MΩ	2217 MΩ	5580 MΩ	1674 MΩ	4000 MΩ	1200 MΩ
7 min	7570 MΩ	2271 MΩ	5870 MΩ	1761 MΩ	4120 MΩ	1236 MΩ
8 min	7770 MΩ	2331 MΩ	6110 MΩ	1833 MΩ	4240 MΩ	1272 MΩ
9 min	7910 MΩ	2373 MΩ	6340 MΩ	1902 MΩ	4330 MΩ	1299 MΩ
10 min	8030 MΩ	2409 MΩ	6550 MΩ	1965 MΩ	4430 MΩ	1329 MΩ
Test Voltage	10000 V		1000 V		1000 V	
Multiplier	1		1		1	
Polarization Index	1.66		2.15		1.61	
TCC 0.30	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	1449	MΩ @	10000	V
Low to High & Ground	912	MΩ @	1000	V
High & Low to Ground	825	MΩ @	1000	V

Core Ground Insulation Resistance

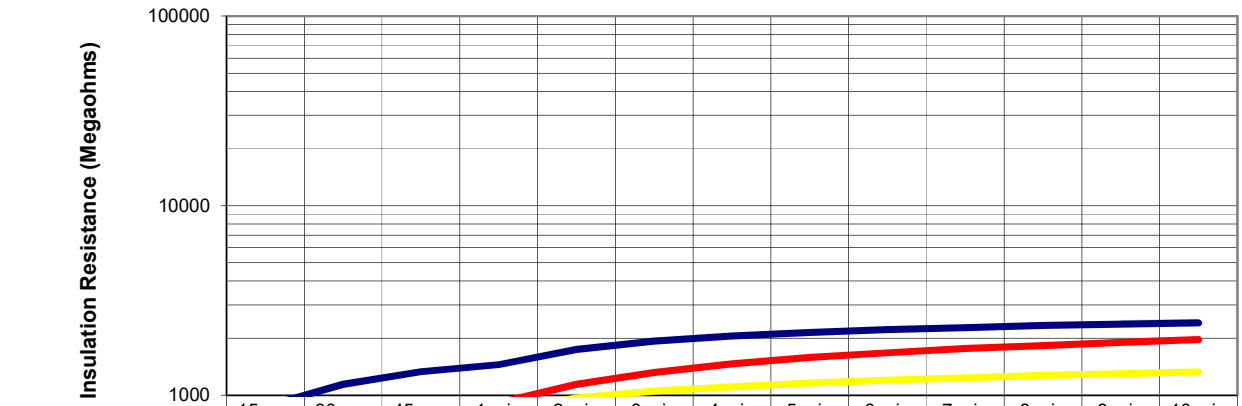
Resistance in meg-ohms after 1 minute.

Core Ground Accessible: Yes [ ] No [X]

Test Voltage: V

Core Ground Resistance: MΩ

Dielectric Absorption Test



	15 sec	30 sec	45 sec	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min	9 min	10 min
High to Low & Gnd	870	1143	1332	1449	1746	1929	2055	2142	2217	2271	2331	2373	2409
Low to High & Gnd	588	741	837	912	1143	1320	1464	1587	1674	1761	1833	1902	1965
High & Low to Gnd	528	690	765	825	966	1050	1107	1161	1200	1236	1272	1299	1329

Test Instrument(s) Manufacturer / Model: Megger

Serial #: 7776

Comments:

Tested By: D. MACLEAN, M. GRAHAM

November 14th, 2019

Rideau St. Lawrence Utility
985 Industrial Rd.,
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Oil Analysis Report - Our Ref: 29995
Site: Prescott MS#3 – 103 Churchill Rd. E, Prescott, ON

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer - Archer, Serial no. N/A (T1)**

  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the oil to be in satisfactory condition, remaining clear with zero amount of sediment detected, and having a slight amount of water content (*17 ppm*). All the measured parameters remained within IEEE recommended limits for acceptable in-service operation.

  - ***Dissolved Gas Analysis (DGA)***

    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. All the dissolved gases remained within IEEE recommended limits. **We recommend resampling annually (every 12 months), to monitor gases.**

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence Utility in the future.

Yours Sincerely,

Dave MacLean,
(309A) Construction & Maintenance Electrician
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 849-9666
dmaclean@taltrees.ca

Darren Galbraith, P. Eng.
Project Manager
102 Parks Dr., Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : 29995-PRESCOTT MS#3

Lab No . . . : T 2019-1624
File No . . . : 20042
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 29 2019
Analysis Date : OCT 30 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : VN
Reviewed By : SWD

SAMPLE IDENTIFICATION

Description : T1

Rating :	5 MVA	Volume :	870 IMP. GALLONS
HV_Rating :	44 kV	Sample Port :	BOTTOM - MAIN TANK
Manuf. / Date:	ARCHER 1963	Sampled By :	MG
Serial No :	PRESCOTT	Sample Date :	OCT 23 2019

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min)	1816 - 62
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max Milligrams KOH/gram	0.07
Interfacial Tension	D971	25 Dynes/cm (Minimum)	28
Specific Gravity	D1298	(60/60°F)	0.860
API Gravity			33.0
Colour	D1500	0.5 — 8.0	2.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	17
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

OIL IS IN SATISFACTORY CONDITION FOR CONTINUED USE

RECOMMENDATIONS: SAMPLE AS PER SCHEDULE

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 29995 - PRESCOTT MS #3

Lab No : D 2019-1632
File No : 20042
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : OCT 29 2019
Analysis Date : OCT 30 2019

BELLEVILLE ON
K8N 4Z5

Analyzed By : SK
Reviewed By :

SAMPLE IDENTIFICATION

Description : T1

Rating : 5 MVA
HV Rating : 44 kV
Manuf. / Date: ARCHER 1963
Serial No : PRESCOTT
Sample Port : BOTTOM - MAIN TANK

Fluid Temp. : (°C)
Volume : 870 IMP. GALLONS
Preservation : CONSERVATOR
Syringe Serial: 7132
Sampled By : MG
Sample Date : OCT 23 2019

COMPONENT	MEASURED PPM	% COMBUSTIBLES
Hydrogen (H2)	10	4.6
Oxygen + Argon (O2 + A)	34025	-----
Nitrogen (N2)	57621	-----
Methane (CH4)	2	.9
Carbon Monoxide (CO)	192	88.5
Carbon Dioxide (CO2)	1875	-----
Ethylene (C2H4)	13	6.0
Ethane (C2H6)	<1	.0
Acetylene (C2H2)	<1	.0
Propane (C3H8)	<2	.0
Total Gas Content	9.37 %	
Combustible Gas Content	217 ppm	.231 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: FAULT GAS CONCENTRATIONS ARE WITHIN NORMAL RANGE.

Recommendations : SAMPLE AS PER SCHEDULE FOR DISSOLVED GASES

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

May 30th, 2018

Rideau St. Lawrence Distribution Inc
985 Industrial Rd.
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Maintenance Inspection Report - Our Ref: 18001
Site: Prescott M4 – 800 Boundary Rd., Prescott, ON.

Please find the attached report for the maintenance work and inspections completed May 24th, 2018.

Tal Trees cleaned, serviced and tested as required the main power system. A summary of the site findings is listed below for your review. All findings are referenced to the Ontario Electrical Safety Code (OESC).

Load Break Switch:

- Switch Contact alignment, toggles, stops, linkage and general ease of operation were inspected and serviced.
- The contacts were closely inspected for burning, wear contact pressure, and simultaneous closure. The integrity of the silver plating was inspected, cleaned and lubricated with electrical grease.
- All insulators were inspected and cleaned, as well tightness and condition of pole ground including the switch matt checked.
- Fusing contacts were checked for burning, wear, and contact pressure as well cleaned and lubricated with electrical grease.
- Fuse holders were cleaned and inspected for excessive wear, fatigue and alignment, as well all insulators were inspected and cleaned.

Power Transformer:

- Transformer tank was inspected for oil leaks, rust and visual damage.
- Primary connections were inspected for tightness and indications of overheating and reinstalled with anti–oxidant grease.
- Primary bushings inspected for damage and cleaned.
- Full transformer tests were completed on the transformer including: turn ratio test, winding resistance, capacitance test and dielectric absorption test (insulation resistance).
- An oil sample was obtained for fluid analysis and DGA.

Findings/Repairs:

- ***Recloser 30F1 has lower insulation resistance results on Phase "A" & "B" from pole to ground. These results are considerably lower than results on phase "C" and in comparison to other unit.***

- ***Gradient ground mat is not installed to current OESC requirements. Currently the mat is smaller than required (1.2m X 1.8m). Rule OESC #: 36-310 (2)(b)(iii).***

- ***Gang operated switch handle does not comply with OESC grounding requirements as it only has one point of attachment to ground. A second connection to ground is required by OESC Rule #: 36-310(2)(a).***

- ***Upper fence extension is not currently bonded to ground. The fence that was extended vertically has no grounding installed. This is a violation of OESC Rule #: 36-312(2),(4).***

- ***Substation gate does not currently have flexible copper grounding conductor installed. This is a violation of OESC Rule #:36-312(3).***

- ***Paint on transformer T1 is in unsatisfactory condition and there is visible rust on the bottom of radiators.***

- ***West side of substation had heavy pine needle build up which was removed at the time of maintenance to maintain step and touch voltage hazards and reduce probability of fire spread.***

- ***Pine trees located on West side of substation are growing close to incoming 44KV overhead conductors creating a fire hazard.***

Recommendations:

- **Please see dielectric breakdown results from oil sample taken from 30F1 and continue to monitor insulation resistance of recloser in future maintenance work.**

- **Complete all substation grounding in accordance to OESC requirements.**

- **Trim pine trees away from incoming 44KV overhead conductors.**

- ***Continue with regular yearly maintenance.***

All other equipment that we tested appears in satisfactory condition, suitable for continued service.

Please give us a call should you wish us to provide you pricing and services for any or all the recommended repairs listed in this report.

If you have any questions/concerns, please do not hesitate to contact us. We look forward to being of continued service to Rideau St. Lawrence.

Sincerely,

Darren Galbraith, P. Eng.
Project Manager
102 Parks Drive
Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca
www.sparkpower.ca

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH DATA SHEET (Pg. 1 of 2)

System ID QL30 **Device ID** H201T-L

Customer	Rideau St. Lawrence Distrtibution Inc.	Date	May 24th, 2018
Customer Address	985 Industrial Rd., Prescott, ON	Job #	18001
Site	MS#4	System Neutral Present	
Site Address	Boundary Rd., Prescott, ON		

Nameplate Data

Switch Mounting	Metal Enclosed		Pole	X	Tower		Other
Switch Type	Load Break		Air Break	X			Other

Manufacturer	S&C SWITCH	BIL Rating	kV
Date Of Manufacture	1986	Feeder ID	
Serial #	N/A	Feeds To	T1
Catalog #	320305R9	Interrupting Rating	40000 A
Nom. / Max. Voltage	44.0 / 46.0 kV	Continuous Ampacity	600 A
Comments			

Lightning Arrestors

Lightning Arrestors	Yes		No	X			
Class	Distribution		Intermediate		Station		
Composition	Ceramic		Polymer				

Manufacturer		Max. / MCOV Rating	/ kV
Catalog #			
Comments			

Protective Device Data

Primary Fuse Holder Data

Manufacturer	DOMINION
Type	
Nom. / Max. Voltage	/ kV
Holder Max. Fuse Link	
Holder Catalog #	

Primary Fuse Link Data

Manufacturer	
Type	
Link Size	A
TCC #	
Link Catalog #	

Primary Fuse Link Spares / Location

Spare Primary Fuses	Yes		No		# of Spares X2 65A X2 125A
Spare Location	METERING CABINET				
Comments	H201T1-X				

Interlock

Key Interlock	Yes		No	X				
Interlock Type	Electrical		Mechanical		Utility Lock	X		
Devices Interlocked	H.V. Switch		Breaker		Trans. Encl.		Other	

Manufacturer		Key Interlock #	
Comments			

Load Side Conductor Data

Conductor Type	Cable	X	Bus Bar		Conductor Size / Dim.	1/O	
Conductor Material	Aluminum		Copper	X	Conductors per Phase	1	/ Phase
Tape Shield	Aluminum		Copper		Bond Size / Dim.	N/A	
Concentric Neutral	Aluminum		Copper		# of Bond Coductors	0	
Insulation Voltage	N/A				# of Neutral Conductors	0	
Insulation Type	BARE CU				Neutral Size / Dim.	N/A	

Comments

Recorded By: J. HARDER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

HIGH VOLTAGE SWITCH TEST SHEET (Pg. 2 of 2)

System ID QL30 **Device ID** H201T-L

Visual Inspection / Mechanical Tests

	Satisfactory	Not Satisfactory	N/A	Comments
Nameplate Condition	X			
Insulator Condition	X			
Ground Connections	X			
Lightning Arrestors			X	
Arc Suppressors			X	
Key Interlock Operation			X	
Ground Straps & Materials	X			

Switch Condition / Operation

	Satisfactory	Not Satisfactory	N/A	Comments
Switch Operation As Left	X			
Contact Surface Condition	X			
Simultaneous Closure	X			

Electrical Tests

Earth Resistance (3-Point Test)

Earth Resistance in Ohms.

Earth Resistance _____ Ω

Arc Suppressor Contact Resistance

Arc Suppressor Contact Resistance in Ohms.

Phase A	N/A	Ω
Phase B	N/A	Ω
Phase C	N/A	Ω

Switch Insulation Resistance

Resistance in Meg-Ohms after 1 minute.

Test Voltage 1 kV ☐ 2 kV ☐ 5 kV ☐ 10 kV ☐

	Phase A	Phase B	Phase C
Phase to GND	N/A MΩ	N/A MΩ	N/A MΩ

Switch / Fuse Contact Resistance

Resistance in micro-Ohms after 1 minute.

Test Current **10 A**

	Phase A	Phase B	Phase C
Contacts	20 µΩ	40 µΩ	32 µΩ
Fuse	1651 µΩ	1450 µΩ	1630 µΩ
Overall	µΩ	µΩ	µΩ

Load Side Conductor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Lightning Arrestor Insulation Resistance

Resistance in Meg-Ohms @ **V DC** after 1 minute

Phase A to Ground	N/A MΩ
Phase B to Ground	N/A MΩ
Phase C to Ground	N/A MΩ

Comments / Observations

	Manufacturer / Model	Megger	Ductor
Test Instrument(s)	Serial #	N/A	7293

Tested By: **J. HARDER**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 1 of 4)

System ID: PRESCOTT M4 Device ID: T1

Customer: Rideau St. Lawrence Distrtibution Inc.
Customer Address: 985 Industrial Rd., Prescott, ON
Site: MS#4
Site Address: Boundary Rd., Prescott, ON

Date: May 24th, 2018
Job #: 18001

Nameplate Data

Transformer Class	Unit Padmount		Padmount		Station	X			Other
Transformer Cooling	ONAN	X	ONAF		LNAN		DRY		Other
Bushing Configuration	Dead Front		Top - Top	X	Top - Side		Side - Side		Other

Manufacturer	RELIANCE POWER EQUIPMENT		Core & Windings		kg		lb
Date of Manufacture	10/1991		Tanks & Fittings		kg		lb
Serial #	292867		Coolant Volume	1100	L		Gal X
KVA / Prov. KVA Rating	5000	KVA	Coolant Weight		kg		lb
Primary Voltage	44000	V	Total Weight	33650	kg		lb X
Primary Ampacity	65.6	A	Temperature Rise	55	°C X		°F
Secondary Voltage	4160/2400	V	HV BIL Rating		kV		
Secondary Ampacity	694	A	LV BIL Rating		kV		
HV Winding Material	N/A		Percent Impedance	8.31 %	ONAN X		ONAF
LV Winding Material	N/A		Tamper Resistant		YES		NO X
CSA Specification(s)			Transformer Colour	GRAY			
Comments							

Visual Inspection

Nameplate Condition	Satisfactory	X	Not Satisfactory		N/A	Comments
Fan / Pump Operation	Satisfactory		Not Satisfactory		N/A X	Comments
Ground Connections	Satisfactory	X	Not Satisfactory		N/A	Comments
Liquid Levels In Tanks	Satisfactory	X	Not Satisfactory		N/A	Comments
Interlock Operation	Satisfactory		Not Satisfactory		N/A X	Comments
Temp. Gauge Operation	Satisfactory	X	Not Satisfactory		N/A	Comments

Coolant Temperature: 25 °C X °F — Max. Coolant Temperature: 35 °C X °F
Comments:

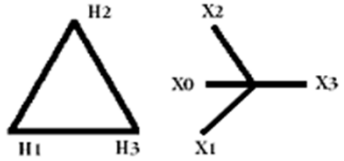
Oil Conservator

Oil Conservator	Yes	X	No		Conservator Volume		L	Gal
Silica Gel Breather	Yes		No	X	Breather Volume		L	Gal
Silica Gel Colour	Good		Bad		Replaced		N/A X	
Comments								

Tap Changer Data

Position / Designation		Tap Voltages (V)	As Found	As Left
1 / A	105.00%	45048		
2 / B	102.50%	44000		
3 / C	100.00%	42952		
4 / D	97.50%	41904		
5 / E	95.00%	40857		

Vector Diagram: DeltaWye2__15.Dyn11



Primary Vector X — Secondary Vector X

Comments:

Recorded By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER DATA SHEET (Pg. 2 of 4)

System ID: PRESCOTT M4 Device ID: T1

Neutral Grounding Resistor (NGR)

NGR Present	Yes [ ]	No [X]		
Manufacturer			NGR Serial #	
NGR Voltage	V		Maximum Current	A
NGR Resistance	Ω		NGR Location	
Comments				

Transformer Lightning Arrestors

Lightning Arrestors	Yes [X]	No [ ]		
Class	Distribution [ ]	Intermediate [ ]	Station [X]	
Composition	Ceramic [ ]	Polymer [X]		
Manufacturer	OHIO BRASS		Max. / MCOV Rating	48.0 / 39.0 kV
Catalog #	300039			
Comments				

Interlock

Key Interlock	Yes [ ]	No [X]				
Interlock Type	Elec. [ ]	Mech. [ ]	Utility Lock [ ]			
Devices Interlocked	H.V. Switch [ ]	Breaker [ ]	Trans. Encl. [ ]	Other [ ]		
Manufacturer			Key Interlock #			
Comments						

Fans

Fans	Yes [ ]	No [X]		
# of Fans			Fan Voltage	
Fan Size			Frame Size	
Horsepower				
Comments				

Transformer Load Side Conductor Data

Conductor Type	Cable [X]	Bus Bar [ ]	Conductor Size / Dim.	350 KCMIL
Conductor Material	Aluminum [ ]	Copper [X]	Conductors per Phase	1 / Phase
Tape Shield	Aluminum [ ]	Copper [ ]	Bond Size / Dim.	4/O
Concentric Neutral	Aluminum [ ]	Copper [ ]	# of Bond Conductors	1
Insulation Voltage			# of Neutral Conductors	0
Insulation Type	COATED		Neutral Size / Dim.	N/A

Comments:

Recorded By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 3 of 4)

System ID: PRESCOTT M4 Device ID: T1

Electrical Tests

Turn Ratio Test

Test Voltage: Automatic [X] Other ____ V

Tap Position / Designation		Tap Voltage V	Calculated Ratio	H 1 To H 2 / X 1 To X 0	H 2 To H 3 / X 2 To X 0	H 3 To H 1 / X 3 To X 0
1 / A	105.00%	45048				
2 / B	102.50%	44000				
3 / C	100.00%	42952	17.883	17.895	17.894	17.898
4 / D	97.50%	41904				
5 / E	95.00%	40857				

		Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation	Excitation Currrent	Percent Deviation
Tap Position As Found	3	0.400 mA	0.060 %	0.270 mA	0.060 %	0.290 mA	0.080 %
Tap Position As Left		mA	%	mA	%	mA	%

Primary Winding Resistance

Resistance in ohms at 0.5 A after 1 minute

H0 - H1	N/A Ω	H1 - H2	2.010 Ω
H0 - H2	N/A Ω	H2 - H3	2.010 Ω
H0 - H3	N/A Ω	H3 - H1	2.010 Ω

Stabilization Time > 1 Minute

Secondary Winding Resistance

Resistance in milli-ohms at 5 A after 1 minute

X0 - X1	7.780 mΩ	X1 - X2	14.190 mΩ
X0 - X2	7.850 mΩ	X2 - X3	14.270 mΩ
X0 - X3	7.890 mΩ	X3 - X1	14.320 mΩ

Stabilization Time > 1 Minute

Capacitance Test

	Low - Ground	Low - Guard	UST (High - Low)	High - Guard	High - Ground
Capacitance in pico-farads	6986 pF	2138 pF	4859 pF	4716 pF	9569 pF
Uncorrected D.F. (%)	1.260 %	0.745 %	1.450 %	0.864 %	1.160 %
Corrected to 20 °C (%)	0.995 %	0.589 %	1.146 %	0.683 %	0.916 %

Temp. Correction Factor 0.79

Lightning Arrestor Insulation Resistance

Resistance in meg-ohms @ 10000 V DC after 1 minute

Phase A to Ground	2000 MΩ
Phase B to Ground	2520 MΩ
Phase C to Ground	7540 MΩ

Secondary Conductor Insulation Resistance

Resistance in meg-ohms @ 5000 V DC after 1 minute

Phase A to Ground	>500000 MΩ	Phase A to Phase B	N/A MΩ
Phase B to Ground	>500000 MΩ	Phase B to Phase C	N/A MΩ
Phase C to Ground	451000 MΩ	Phase C to Phase A	N/A MΩ

Comments / Observations

Test Instrument(s)	Manufacturer / Model	Ratio	Winding	Cap Bridge	Megger
	Serial #	0311	51006	5563	1261

Tested By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

TRANSFORMER TEST SHEET (Pg. 4 of 4)

System ID PRESCOTT M4 **Device ID** T1

Dielectric Absorption Test (Insulation Resistance)

Time	High to Low & Gnd		Low to High & Gnd		High & Low to Gnd	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
15 sec	1860 MΩ	2418 MΩ	467 MΩ	607 MΩ	3380 MΩ	4394 MΩ
30 sec	2350 MΩ	3055 MΩ	525 MΩ	683 MΩ	3510 MΩ	4563 MΩ
45 sec	2700 MΩ	3510 MΩ	611 MΩ	794 MΩ	3720 MΩ	4836 MΩ
1 min	3050 MΩ	3965 MΩ	717 MΩ	932 MΩ	4110 MΩ	5343 MΩ
2 min	3670 MΩ	4771 MΩ	967 MΩ	1257 MΩ	4370 MΩ	5681 MΩ
3 min	4350 MΩ	5655 MΩ	1310 MΩ	1703 MΩ	4530 MΩ	5889 MΩ
4 min	4810 MΩ	6253 MΩ	1580 MΩ	2054 MΩ	4640 MΩ	6032 MΩ
5 min	5070 MΩ	6591 MΩ	1690 MΩ	2197 MΩ	4710 MΩ	6123 MΩ
Test Voltage	10000 V		1000 V		1000 V	
Multiplier	1		1		1	
TCC 1.30	Insulation Resistance Readings Corrected to 20 °C					

Insulation Resistance

Resistance in meg-ohms after 1 minute.

High to Low & Ground	3965	MΩ @	10000	V
Low to High & Ground	932	MΩ @	1000	V
High & Low to Ground	5343	MΩ @	1000	V

Core Ground Insulation Resistance

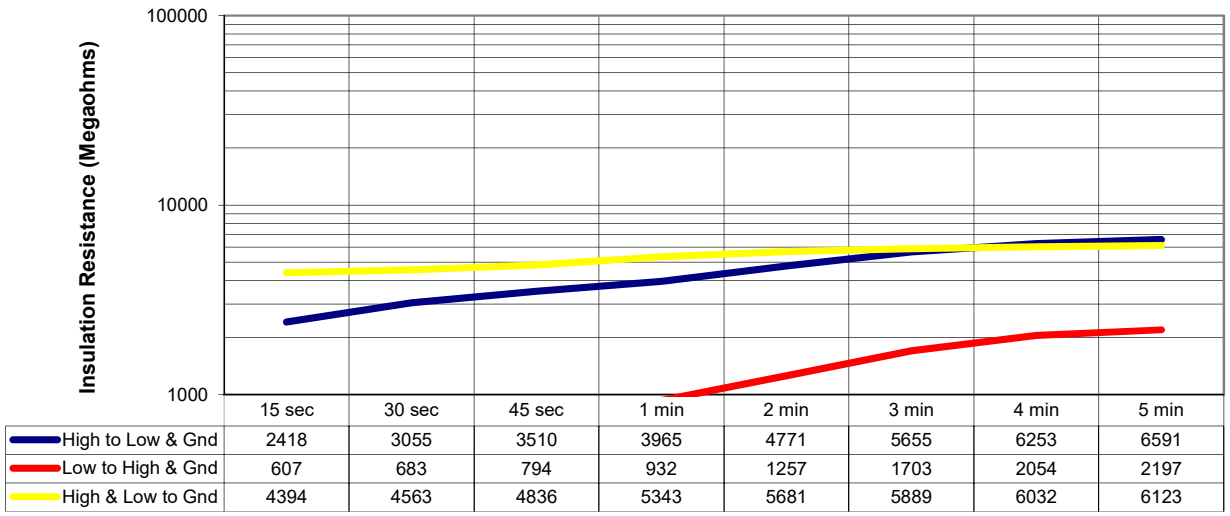
Resistance in meg-ohms after 1 minute.

Core Ground Accessible Yes [ ] No [X]

Test Voltage _____ V

Core Ground Resistance _____ MΩ

Dielectric Absorption Test



Test Instrument(s) Manufacturer / Model: **Megger**

Serial #: **1261**

Comments: _____

Tested By: D. MACLEAN, C. MERCIER

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

RECLOSER
DATA SHEET (Pg. 1 of 1)

System ID PRESCOTT M4 **Device ID** 30F1

Customer	Rideau St. Lawrence Distrtibution Inc.	Date	May 24th, 2018
Customer Address	985 Industrial Rd., Prescott, ON	Job #	18001
Site	MS#4		
Site Address	Boundary Rd., Prescott, ON		

Nameplate Data

Manufacturer	COOPER POWER SYSTEMS	Catalog #	KYLER RECLOSER TYPE "W"
Serial #	12178	Max Voltage	15.5KV V
Ampacity	400 A	Inter. Capacity	12 KA
Year	1991	Operating Voltage	4.16KV V
Oil Type	NON-PCB	Oil Volume	N/A
Total Weight of Unit	N/A		
Comments			

Visual Inspection

							Comments
Compare Nameplate with Drawings	Satisfactory	X	Not Satisfactory		N/A		
Inspect Anchorage, Alignment, Grounding	Satisfactory	X	Not Satisfactory		N/A		
Inspect Physical and Mechanical Condition	Satisfactory	X	Not Satisfactory		N/A		
Inspect for Correct Insulation Liquid Level	Satisfactory	X	Not Satisfactory		N/A		

Comments

Electrical Tests

Insulation Resistance

Resistance in meg-ohms after 1 minute.

Test Voltage 1 kV [ ] 2.5 kV [X] 5 kV [ ] 10 kV [ ]

	Phase A (A to B)	Phase B (B to C)	Phase C (C to A)
Open - Pole to Pole	302000 MΩ	357000 MΩ	415000 MΩ
Closed - Pole to Frame	1320 MΩ	1800 MΩ	357000 MΩ

Contact Resistance

Resistance in meg-ohms after 1 minute.

Test Current 10 A

	Phase A	Phase B	Phase C
As Found	414 µΩ	406 µΩ	615 µΩ
As Left	414 µΩ	407 µΩ	588 µΩ

Contact Measurement

	Phase A	Phase B	Phase C
Contact Gap	N/A	N/A	N/A
Contact Erosion			

Counter Reading

Counter as Found	93
Counter as Left	97

Operational Tests

							Comments
Trip and Close Recloser with Control Switch	Satisfactory	X	Not Satisfactory		N/A		
Trip Recloser by Operating each Protect Relay	Satisfactory		Not Satisfactory		N/A	X	
Trip and Close Recloser with Control Switch	Satisfactory	X	Not Satisfactory		N/A		
Trip Recloser by Operating each Protect Relay	Satisfactory		Not Satisfactory		N/A	X	

Comments

Comments / Observations

CONTACTS IN SATISFACTORY CONDITION.

FEEDER CABLES TESTED @10kV - A - 276000MΩ, B - 1200000MΩ, C - 232000MΩ

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	1261	6839

Tested By: **D. MACLEAN, C. IVANY**

TALTREES POWER SERVICES
A SPARKPOWER COMPANY

RECLOSER
DATA SHEET (Pg. 1 of 1)

System ID PRESCOTT M4 **Device ID** 30F2

Customer	Rideau St. Lawrence Distrtibution Inc.	Date	May 24th, 2018
Customer Address	985 Industrial Rd., Prescott, ON	Job #	18001
Site	MS#4		
Site Address	Boundary Rd., Prescott, ON		

Nameplate Data

Manufacturer	COOPER POWER SYSTEMS	Catalog #	KYLER RECLOSER TYPE "W"
Serial #	12176	Max Voltage	15.5KV V
Ampacity	400 A	Inter. Capacity	12 KA
Year	1991	Operating Voltage	4.16KV V
Oil Type	NON-PCB	Oil Volume	N/A
Total Weight of Unit	N/A		
Comments			

Visual Inspection

							Comments
Compare Nameplate with Drawings	Satisfactory	X	Not Satisfactory		N/A		
Inspect Anchorage, Alignment, Grounding	Satisfactory	X	Not Satisfactory		N/A		
Inspect Physical and Mechanical Condition	Satisfactory	X	Not Satisfactory		N/A		
Inspect for Correct Insulation Liquid Level	Satisfactory	X	Not Satisfactory		N/A		

Comments

Electrical Tests

Insulation Resistance

Resistance in meg-ohms after 1 minute.

Test Voltage 1 kV [ ] 2.5 kV [X] 5 kV [ ] 10 kV [ ]

	Phase A (A to B)	Phase B (B to C)	Phase C (C to A)
Open - Pole to Pole	296000 MΩ	422000 MΩ	327000 MΩ
Closed - Pole to Frame	>500000 MΩ	>500000 MΩ	360000 MΩ

Contact Resistance

Resistance in meg-ohms after 1 minute.

Test Current 10 A

	Phase A	Phase B	Phase C
As Found	365 µΩ	391 µΩ	394 µΩ
As Left	371.2 µΩ	383.2 µΩ	391 µΩ

Contact Measurement

	Phase A	Phase B	Phase C
Contact Gap	N/A	N/A	N/A
Contact Erosion			

Counter Reading

Counter as Found	88
Counter as Left	91

Operational Tests

							Comments
Trip and Close Recloser with Control Switch	Satisfactory	X	Not Satisfactory		N/A		
Trip Recloser by Operating each Protect Relay	Satisfactory		Not Satisfactory		N/A	X	
Trip and Close Recloser with Control Switch	Satisfactory	X	Not Satisfactory		N/A		
Trip Recloser by Operating each Protect Relay	Satisfactory		Not Satisfactory		N/A	X	

Comments **INSTALLED WINDLASS ON THIS UNIT.**

Comments / Observations

CONTACTS IN SATISFACTORY CONDITION.

FEEDER CABLES TESTED @10kV - A -2400000MΩ, B - 1240000MΩ, C - 84900MΩ

Test Instrument(s)	Manufacturer / Model	Megger	Ductor
	Serial #	1261	6839

Tested By: **D. MACLEAN, C. IVANY**

June 20th, 2018

Rideau St. Lawrence Distribution Inc
985 Industrial Rd.
Prescott, ON.
K0E 1T0

Attention: Darryl Reynolds

Re: Oil Analysis Report - Our Ref: 18001
Site: Prescott M4 – 800 Boundary Rd., Prescott, ON.

To whom it may concern,

Please find attached the oil analysis results of samples taken recently at your facility.

- **Transformer - Reliance, Serial no. 292867 (Main TX)**
  - ***Chemical Analysis (ASTM/Water)***

    The chemistry (ASTM) tests show the oil to be in satisfactory condition, except for ***Dielectric Breakdown.*** *The transformer oil has* remained clear with zero amount of sediment detected and having a slight amount of water content (30 *ppm*). The Dielectric Breakdown **(26KV)** is lower than recommend limit (40KV). ***Dielectric Breakdown*** *of an insulating oil is a measure of the oils ability to withstand electrical stress without failure. Contaminants such as particles, contaminants and water can reduce the dielectric strength of an insulating liquid.* All the other measured parameters remained within IEEE recommended limits for acceptable in-service operation. **We recommend resampling at your earliest convenience to verify Dielectric Breakdown.**

  - ***Dissolved Gas Analysis (DGA)***

    The gas in oil analysis indicates that the oil appears to be in satisfactory condition. All the dissolved gases remained within IEEE recommended limits. **We recommend resampling annually (every 12 months), to monitor gases.**

  - ***Polychlorinated biphenyl Analysis (PCB)***

    The PCB analysis indicates the oil appears to be in satisfactory condition for continued service. The insulation fluid contains trace amounts ***(17ppm)*** of PCB content. Insulating fluid containing between 2-50ppm PCB may continue to be used in equipment until it is removed from the equipment for any reason (including maintenance and repair). If any insulating fluid is removed from the unit, it must be replaced with new liquid containing less than 2ppm PCB.

- **Recloser - Cooper, Serial no. 12178 (30F1)**
  - ***Chemical Analysis***

    The dielectric breakdown of recloser unit tested with a 2mm gap shows the insulating fluid to be in unsatisfactory condition. Dielectric breakdown is (27KV), which is below the recommended limit of 40KV. All the measured parameters remained within IEEE recommended limits for acceptable in-service operation. **We recommend resampling at your earliest convenience to verify Dielectric Breakdown.**

  - ***Polychlorinated biphenyl Analysis (PCB)***

    The PCB analysis indicates the oil appears to be in satisfactory condition. With insulation fluid containing ***(<1ppm)*** of PCB content. Insulating fluid containing less than 2ppm is considered to be non-PCB liquid.

- **Recloser - Cooper, Serial no. 12176 (30F2)**
  - ***Chemical Analysis***

    The dielectric breakdown of recloser unit tested with a 2mm gap shows the insulating fluid to be in unsatisfactory condition. Dielectric breakdown is (27KV), which is below the recommended limit of 40KV. All the measured parameters remained within IEEE recommended limits for acceptable in-service operation. **We recommend resampling at your earliest convenience to verify Dielectric Breakdown.**

  - ***Polychlorinated biphenyl Analysis (PCB)***

    The PCB analysis indicates the oil appears to be in satisfactory condition. With insulation fluid containing ***(<1ppm)*** of PCB content. Insulating fluid containing less than 2ppm is considered to be non-PCB liquid.

Please call us if you have any questions regarding this analysis.

We look forward to being of continued service to Rideau St. Lawrence in the future.

Yours Sincerely,

Darren Galbraith, P. Eng.
Project Manager
TALTREES POWER SERVICES
A SPARKPOWER COMPANY
102 Parks Drive
Belleville, ON K8N 4Z5
(613) 403 7804
dgalbraith@taltrees.ca
www.sparkpower.ca

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : RSCU 18001

Lab No . . . : T 2018-0825
File No . . . : 16913
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUN 01 2018
Analysis Date : JUN 12 2018

BELLEVILLE ON
K8N 4Z5

Analyzed By : MC
Reviewed By : SJD

SAMPLE IDENTIFICATION

Description : MS3-800 BOUNDARY RD

Rating :	5 MVA	Volume :	1100 US GALLONS
HV_Rating :	44 kV	Sample Port :	BOTTOM - MAIN TANK
Manuf. / Date:	RELIANCE 1991	Sampled By :	CM
Serial No :	292867	Sample Date :	MAY 24 2018

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min) 1816 -	26
	D877	KV (Min) 877 -	
Neutralization Number	D974	0.2 Max (0.5 - Scrap) Milligrams KOH/gram	0.02
Interfacial Tension	D971	25 Dynes/cm (Minimum)	32
Specific Gravity	D1298	(60/60°F)	0.852
API Gravity			34.5
Colour	D1500	0.5 – 8.0	1.0
Visual Condition		Clarity	CLEAR
	D1524	Sediment	NONE
		Free Water	NO
Water Content	D1533	35 p.p.m. max	30
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

NEUTRALIZATION NUMBER IS GOOD
INTERFACIAL TENSION IS GOOD
WATER CONTENT IS GOOD
DIELECTRIC BREAKDOWN IS LOW FOR HV RATING

RECOMMENDATIONS: RE-SAMPLE TO VERIFY THE DIELECTRIC BREAKDOWN

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

DISSOLVED GAS ANALYSIS - OIL
ASTM Method D3612 Part C

Cust PO : 18001 RSCU

Lab No : D 2018-0857
File No : 16913
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUN 01 2018
Analysis Date : JUN 01 2018

BELLEVILLE ON
K8N 4Z5

Analyzed By : MJ
Reviewed By : SwD

SAMPLE IDENTIFICATION

Description : MS3-800 BOUNDARY RD

Rating : 5 MVA
HV Rating : 44 kV
Manuf. / Date: RELIANCE
Serial No : 292867
Sample Port : BOTTOM - MAIN TANK

Fluid Temp. : (°C)
Volume :
Preservation : SEALED
Syringe Serial: CM125
Sampled By : C.M
Sample Date : MAY 24 2018

COMPONENT	MEASURED PPM		% COMBUSTIBLES
Hydrogen (H2)	6		9.7
Oxygen + Argon (O2 + A)	38084		-----
Nitrogen (N2)	56315		-----
Methane (CH4)	1		1.6
Carbon Monoxide (CO)	53		85.5
Carbon Dioxide (CO2)	2466		-----
Ethylene (C2H4)	2		3.2
Ethane (C2H6)	<1		.0
Acetylene (C2H2)	<1		.0
Propane (C3H8)	<2		.0
Total Gas Content	9.69	%	
Combustible Gas Content	62	ppm	.064 %

*PPM = Part Per Million by volume N.D. = Not Detectable

General Comments: FAULT GAS CONCENTRATIONS HAVE REMAINED WITHIN NORMAL RANGE SINCE DEC/16.

Recommendations : SAMPLE AS PER SCHEDULE FOR DISSOLVED GASES

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

PCB IN OIL ANALYSIS RESULTS

Cust PO : RSCU 18001

Sheet No : 18107
File No : 16913
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUN 01 2018
Analysis Date : JUN 04 2018
Analyzed By : MJ

BELLEVILLE ON
K8N 4Z5

Sampled By : C.M
Sample Date : MAY 24 2018
Reviewed By : SwD

Lab No	Location	Serial No	Manufacturer	Volume	Aroclor	PPM	F
2018-0289	T1	292867	RELIANCE POWER EQ	1100 US	1260	17	

TEST METHOD per ASTM D4059 DETECTION LIMIT 1 PPM

Location :

Notes :
Test results relate only to samples tested as received.

Comments : According to the Canadian Environmental Protection Act, 1999, insulating fluid containing 50 ppm or more PCB is considered to be PCB liquid. Under amendments to the Act made in September, 2008, insulating liquid containing 2 ppm or more, but less than 50 ppm PCB may continue to be used in equipment until such time as it is removed from the equipment. Any such liquid removed from the equipment, in whole or in part, for any reason (including maintenance and repair activities), may not be returned to the equipment. It must be disposed of in accordance with Environmental Regulations and replaced with liquid containing less than 2 ppm PCB.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : RSCU 18001

Lab No . . . : T 2018-0827
File No . . . : 16913
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUN 01 2018
Analysis Date : JUN 04 2018
Analyzed By : MC
Reviewed By : SwD

BELLEVILLE ON
K8N 4Z5

SAMPLE IDENTIFICATION

Description : 30F1

Rating : MVA
HV_Rating : 4.16 kV
Manuf. / Date: COOPER 1991
Serial No : 12178

Volume :
Sample Port : RECLOSER
Sampled By : CI
Sample Date : MAY 24 2018

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min)	1816 - 27
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max (0.5 - Scrap) Milligrams KOH/gram	
Interfacial Tension	D971	25 Dynes/cm (Minimum)	
Specific Gravity API Gravity	D1298	(60/60°F)	
Colour	D1500	0.5 — 8.0	
Visual Condition	D1524	Clarity Sediment Free Water	
Water Content	D1533	35 p.p.m. max	
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

DIELECTRIC BREAKDOWN IS LOW FOR HV RATING

RECOMMENDATIONS: RE-SAMPLE TO VERIFY THE DIELECTRIC BREAKDOWN

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

PCB IN OIL ANALYSIS RESULTS

Cust PO : RSCU 18001

TALTREES POWER SERVICES
102 PARKS DRIVE

BELLEVILLE ON
K8N 4Z5

Sheet No : 18108
File No : 16913
Cust No : TLT02

Date Received : JUN 01 2018
Analysis Date : JUN 04 2018
Analyzed By : MJ

Sampled By : C.I
Sample Date : MAY 24 2018
Reviewed By : SJD

Lab No	Location	Serial No	Manufacturer	Volume	Aroclor	PPM	F
2018-0290	30F1 RE-CLOSURE	12178	COOPER			<1	

TEST METHOD per ASTM D4059 DETECTION LIMIT 1 PPM

Location :

Notes :
Test results relate only to samples tested as received.

Comments : According to the Canadian Environmental Protection Act, 1999, insulating fluid containing 50 ppm or more PCB is considered to be PCB liquid. Under amendments to the Act made in September, 2008, insulating liquid containing 2 ppm or more, but less than 50 ppm PCB may continue to be used in equipment until such time as it is removed from the equipment. Any such liquid removed from the equipment, in whole or in part, for any reason (including maintenance and repair activities), may not be returned to the equipment. It must be disposed of in accordance with Environmental Regulations and replaced with liquid containing less than 2 ppm PCB.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

OIL SAMPLE ANALYSIS RESULTS
IN SERVICE - OIL

Cust PO : RSCU 18001

Lab No . . . : T 2018-0828
File No . . . : 16913
Cust No . . . : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUN 01 2018
Analysis Date : JUN 04 2018

BELLEVILLE ON
K8N 4Z5

Analyzed By : MC
Reviewed By : SJD

SAMPLE IDENTIFICATION

Description : 30F2

Rating : MVA
HV_Rating : 4.16 kV
Manuf. / Date: COOPER 1991
Serial No : 12176

Volume :
Sample Port : RECLOSER
Sampled By : CI
Sample Date : MAY 24 2018

TEST	ASTM NO.	RECOMMENDED LIMITS	TEST VALUES
Dielectric Breakdown	D1816	2mm Gap 40 KV (Min)	1816 - 27
	D877	KV (Min)	877 -
Neutralization Number	D974	0.2 Max (0.5 - Scrap) Milligrams KOH/gram	
Interfacial Tension	D971	25 Dynes/cm (Minimum)	
Specific Gravity API Gravity	D1298	(60/60°F)	
Colour	D1500	0.5 — 8.0	
Visual Condition	D1524	Clarity Sediment Free Water	
Water Content	D1533	35 p.p.m. max	
Power Factor (25 C)	D924	0.5 % max	
Power Factor (100°C)	D924	5.0 % max	

TEST EVALUATION

DIELECTRIC BREAKDOWN IS LOW FOR HV RATING

RECOMMENDATIONS: RE-SAMPLE TO VERIFY THE DIELECTRIC BREAKDOWN

Notes :
Test results relate only to samples tested as received.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

PCB IN OIL ANALYSIS RESULTS

Cust PO : RSCU 18001

Sheet No : 18110
File No : 16913
Cust No : TLT02

TALTREES POWER SERVICES
102 PARKS DRIVE

Date Received : JUN 01 2018
Analysis Date : JUN 04 2018
Analyzed By : MJ

BELLEVILLE ON
K8N 4Z5

Sampled By : C.I
Sample Date : MAY 24 2018
Reviewed By : SwO

Lab No	Location	Serial No	Manufacturer	Volume	Aroclor	PPM	F
2018-0291	30F2	12176	COOPER			<1	

TEST METHOD per ASTM D4059 DETECTION LIMIT 1 PPM

Location : RE-CLOSURE

Notes :
Test results relate only to samples tested as received.

Comments : According to the Canadian Environmental Protection Act, 1999, insulating fluid containing 50 ppm or more PCB is considered to be PCB liquid. Under amendments to the Act made in September, 2008, insulating liquid containing 2 ppm or more, but less than 50 ppm PCB may continue to be used in equipment until such time as it is removed from the equipment. Any such liquid removed from the equipment, in whole or in part, for any reason (including maintenance and repair activities), may not be returned to the equipment. It must be disposed of in accordance with Environmental Regulations and replaced with liquid containing less than 2 ppm PCB.

RONDAR INC. 333 Centennial Parkway North Hamilton, Ontario L8E 2X6
Telephone : (905) 561-2808 Fax : (905) 561-8871

APPENDIX C: OPERATING SYSTEM MAPS

Default

- Breaker
- Recloser
- Switch
- Fuse
- PME
- Elbow
- Junction
- Riser
- Service Point
- Conductor
- Transformer

Map Base

- Pole
- Junction Cabinet
- Substations
- Transformer Multiline Text
- Transformer ID#
- Switches_Text
- Fuse_Text
- Service Point_Text
- Pole_Text
- Substations_Text
- Project ID Text
- Service Areas
- Streets
- Major Roads
- Field Verification
- Service_Area

Projects

- 2015
- 2016
- 2017
- 2018

- STREET_NAME
- PARCEL
- BUILDING

Roads

- Lakes
- PROJECTS

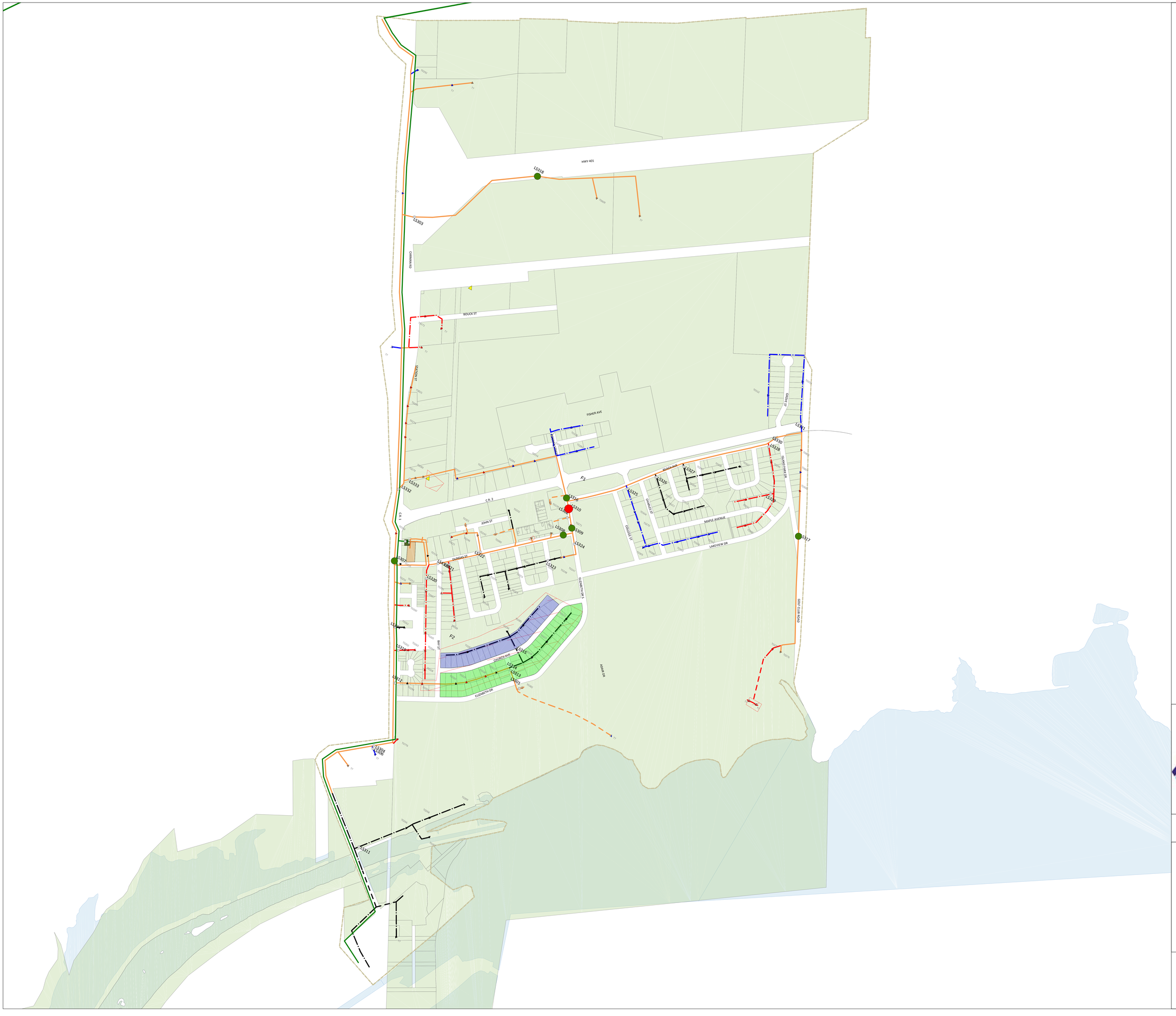
RIDEAU ST. LAWRENCE DISTRIBUTION INC.

Plot Date:4/21/2016

Cardinal

Operating Map

Prepared By:
Oakley Engineering



Default

- Conductor
- Breaker
- Elbow
- Fuse
- Junction
- Meter
- Recloser
- Riser
- Service Point
- Switches
- Transformers

Map Base

- Pole
- Junction Cabinet
- Substations
- Transformer Multiline Text
- Transformer ID#
- Switches_Text
- Fuse_Text
- Service Point_Text
- Pole_Text
- Substations_Text
- Project ID Text
- Service Areas
- Streets
- Major Roads
- STREET_NAME
- PARCEL
- BUILDING

SYSTEM_PROJECTS

- 2016
- 2017
- 2018
- 2019
- 2020
- FUTURE

- Lakes

Roads

RIDEAU ST. LAWRENCE DISTRIBUTION INC.

Plot Date:4/21/2016

Iroquois

Operating Map

Prepared By:
Oakley Engineering

Default

- Conductor
- Breaker
- Elbow
- Fuse
- Junction
- Meter
- Recloser
- Riser
- Service Point
- Switches
- Transformers

Map Base

- Pole
- Junction Cabinet
- Substations
- Transformer Multiline Text
- Transformer ID#
- Switches_Text
- Fuse_Text
- Service Point_Text
- Pole_Text
- Substations_Text
- Project ID Text
- Service Areas
- Streets
- Major Roads
- STREET_NAME
- PARCEL
- BUILDING

SYSTEM_PROJECTS

- 2016
- 2017
- 2018
- 2019
- 2020
- FUTURE

- Lakes

Roads

RIDEAU ST. LAWRENCE DISTRIBUTION INC.

Plot Date:4/7/2016

Morrisburg

Operating Map

Prepared By:
Oakley Engineering

Default

- Breaker
- Recloser
- Switch
- Fuse
- PME
- Elbow
- Junction
- Riser
- Service Point
- Conductor
- Transformer

Map Base

- Pole
- Junction Cabinet
- Substations
- Transformer Multiline Text
- Transformer ID#
- Switches_Text
- Fuse_Text
- Service Point_Text
- Pole_Text
- Substations_Text
- Project ID Text
- Service Areas
- Streets
- Major Roads
- Field Verification
- Service_Area

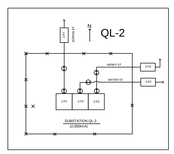
Projects

- 2015
- 2016
- 2017
- 2018

- STREET_NAME
- PARCEL
- BUILDING

Roads

- Lakes
- PROJECTS



RIDEAU ST. LAWRENCE DISTRIBUTION INC.

Plot Date:4/21/2016

Prescott

Operating Map

Prepared By:
Oakley Engineering