newfoundland labrador hydro
a nalcor energy company

Hydro Place. 500 Columbus Drive.
P.O. Box 12400. St. John's. NL
Canada A1B 4K7
t. 709.737.1400 f. 709.737.1800
www.nlh.nl.ca

April 24, 2013

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL
A1A 5B2

ATTENTION: Ms. Cheryl Blundon
Director of Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: An Application by Newfoundland and Labrador Hydro (Hydro) pursuant to Subsection 41 (3) of the Act for approval of a capital project to replace the alternator on the Hardwoods Gas Turbine

Please find enclosed the original and eight copies of the above-noted Application, plus supporting affidavit, project proposal, and draft order.

The project proposed in the Application replacement of the Hardwoods Gas Turbine alternator, after problems with a similar gas turbine in Stephenville have raised concerns about the safe and reliable operation of the hardwoods Gas Turbine.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Geoffrey P. Young
Legal Counsel

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Thomas Johnson – Consumer Advocate
Dean Porter – Poole Althouse

IN THE MATTER OF the *Electrical Power Control Act,* RSNL 1994, Chapter E-5.1 (the EPCA) and the *Public Utilities Act*, RSNL 1990, Chapter P-47 (the Act), and regulations thereunder;

AND IN THE MATTER OF an Application by Newfoundland and Labrador Hydro pursuant to Subsections 41(3) of the Act, for the approval of replacement of the Hardwoods Gas Turbine alternator.

TO: The Board of Commissioners of Public Utilities (the Board)

THE APPLICATION OF NEWFOUNDLAND AND LABRADOR HYDRO (Hydro) STATES THAT:

1. Hydro is a corporation continued and existing under the *Hydro Corporation Act, 2007*, is a public utility within the meaning of the Act and is subject to the provisions of the *Electrical Power Control Act, 1994*.

2. The Hardwoods Gas Turbine is a 50 MW generating unit constructed in 1977 that, among other things, is used as a synchronous condenser, provides peaking support to the Island Interconnected System, and assists with black starting requirements of the Holyrood Thermal Generating Station.

3. In January of 2013, it was determined that the Hardwoods Gas Turbine should only be used in emergency conditions, as parts may be near failure. The concerns were identified based upon findings related to the rewind of the stator and rotor in the similar gas turbine plant located in Stephenville.

4. To restore the Hardwoods Gas Turbine to safe and reliable working condition in time for the 2013/2014 winter season, immediate action is required to replace its alternator, as detailed in the project proposal report attached to this Application.

5. The estimated cost to replace the Hardwoods Gas Turbine Alternator is $8,105,800. Planning and the ordering of parts with a long lead time will begin upon approval of this proposal. The unit is scheduled to be back in service in December of this year.

6. Therefore, Hydro makes Application that the Board make an Order approving, pursuant to Section 41(3) of the *Act*, the capital expenditure of $$8,105,800 for replace the Hardwoods Gas Turbine Alternator.

DATED AT St. John's in the Province of Newfoundland and Labrador this 24th day of April, 2013.

Geoffrey P. Young
Newfoundland and Labrador Hydro,
500 Columbus Drive, P.O. Box 12400
St. John's, Newfoundland, A1B 4K7
Telephone: (709) 737-1277
Facsimile: (709) 737-1782

IN THE MATTER OF the *Electrical Power Control Act,* RSNL 1994, Chapter E-5.1 (the EPCA) and the *Public Utilities Act*, RSNL 1990, Chapter P-47 (the Act), and regulations thereunder;

AND IN THE MATTER OF an Application by Newfoundland and Labrador Hydro for the approval, pursuant to Section 41 (3) of the Act, the approval of replacement of the Hardwoods Gas Turbine alternator.

AFFIDAVIT

I, David Hicks, Professional Engineer, of St. John's in the Province of Newfoundland and Labrador, make oath and say as follows:

1. I am Manager, Electrical Engineering, for Newfoundland and Labrador Hydro, the Applicant named in the attached Application.

2. I have read and understand the foregoing Application.

3. I have personal knowledge of the facts contained therein, except where otherwise indicated, and they are true to the best of my knowledge, information and belief.

SWORN at St. John's in the)
Province of Newfoundland and)
Labrador)
this 24th day of April 2013,)
before me:)

Barrister – Newfoundland and Labrador

David Hicks

(DRAFT ORDER)
NEWFOUNDLAND AND LABRADOR
BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

AN ORDER OF THE BOARD

NO. P.U. __ (2013)

IN THE MATTER OF the *Electrical Power Control Act,* RSNL 1994, Chapter E-5.1 (the EPCA) and the *Public Utilities Act*, RSNL 1990, Chapter P-47 (the *"Act"*), and regulations thereunder;

AND

IN THE MATTER OF an application by Newfoundland and Labrador Hydro for approval to proceed with replacement of the Hardwoods Gas Turbine alternator, pursuant to Section 41(3) of the Act.

WHEREAS Newfoundland and Labrador Hydro ("Hydro") is a corporation continued and existing under the *Hydro Corporation Act, 2007*, is a public utility within the meaning of the Act, and is subject to the provisions of the *EPCA;* and

WHEREAS Section 41(3) of the Act requires that a public utility not proceed with the construction, purchase or lease of improvements or additions to its property where:

a) the cost of construction or purchase is in excess of $50,000; or
b) the cost of the lease is in excess of $5,000 in a year of the lease,

without prior approval of the Board; and

WHEREAS safety and reliability issues were identified in January, 2013 related to Hydro's Gas Turbine located at Hardwoods;

WHEREAS on April 24, 2011 Hydro submitted a capital proposal to replace the alternator on the Hardwoods Gas Turbine to address these safety and reliability issues; and

WHEREAS in Order Nos. P.U. 2(2013) and P.U. 4(2013) the Board approved Hydro's 2013 Capital Budget; and

WHEREAS the Board approved supplementary 2013 capital expenditures in

(i) Order No. P.U. 1(2013) in the amount of $284,100 for the refurbishment of the stop logs at the Burnt Dam Spillway

(ii) Order No. P.U.12(2013) in the amount of $5,198,000 for the refurbishment of the marine terminal at the Holyrood Thermal Generating Station; and

WHEREAS the Board is satisfied that the 2013 supplemental capital expenditure for replacement of the alternator on the Hardwoods Gas Turbine is necessary to allow Hydro to provide service and facilities which are reasonably safe and adequate and just and reasonable.

IT IS THEREFORE ORDERED THAT:

1. The proposed capital expenditure of $8,105,800 for the replacement of the alternator on the Hardwoods Gas Turbine is approved.

2. Hydro shall pay all expenses of the Board arising from this Application.

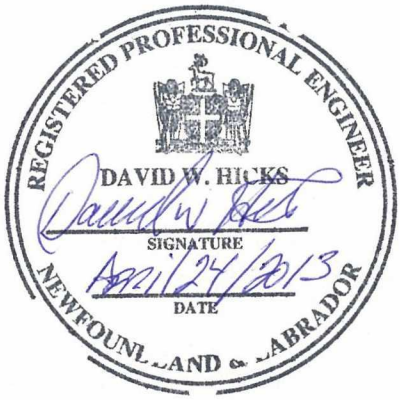
DATED at St. John's, Newfoundland and Labrador, this day of , .

_____

_____

_____ _____

A REPORT TO
THE BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

	Electrical
	Mechanical
	Civil
	Protection & Control
	Transmission & Distribution
	Telecontrol
	System Planning

Hardwoods Gas Turbine Alternator Replacement 2013

April, 2013

newfoundland labrador hydro
a nalcor energy company

SUMMARY

The Hardwoods Gas Turbine, located in the St. John's area, provides several critical transmission functions for the Island Interconnected System. The unit is operated as a synchronous condenser for voltage support of the transmission system on the Avalon Peninsula, and to generate power under system peak and Avalon Peninsula emergency/ contingency conditions. The unit is also utilized to enable efficient operation of the Holyrood Thermal Generating Station (Holyrood) by providing fast starting power in response to a contingency which would otherwise have to be provided by having an additional unit operating at Holyrood. Therefore, it is critical that the Hardwoods Gas Turbine be available and in a state of readiness as it is a major component in ensuring reliable and efficient power for the Island Interconnected System.

As of late January 2013, the Hardwoods Gas Turbine can be operated only in emergency conditions. This restriction is based primarily on recommendations from Brush GMS (Brush), the Original Equipment Manufacturer (OEM) as parts may be near failure.

It is now recommended by Newfoundland and Labrador Hydro (Hydro) that the strategy to return the alternator to a safe and reliable working condition involves replacing the stator and rotor along with a protection upgrade in October 2013. This strategy would minimize the amount of time the unit would be unavailable, allowing it to be available for operation in emergency situations during the 2013 summer season. During the summer of 2013 no Holyrood units are planned to be operated for power production. Therefore, it is essential that the Hardwoods unit be available in the event of a contingency situation. The optimum period to perform the work proposed under this project is in the 2013 fall season when Avalon loads are increasing and Holyrood units are placed into service. The proposed work in the fall of 2013 would result in the Hardwoods unit being available and in a reliable working condition prior to the next (2013-2014) peak winter season. The overall project cost is estimated to be $8,015,800.

TABLE OF CONTENTS

1 INTRODUCTION

Hydro owns and operates two 50 MW Gas Turbine plants as part of the Island Interconnected System, one at Stephenville Terminal Station and one at Hardwoods Terminal Station in the St. John's area. These plants are primarily used to produce power during peak and emergency periods and to provide voltage support for the Island Interconnected transmission system. The Hardwoods Gas Turbine, as a fast starting power source, is also utilized to provide for efficient operation of Holyrood. Otherwise, additional units would be required to operate at Holyrood to respond to Avalon contingencies.

Figure 1: Hardwoods Gas Turbine Plant

The Hardwoods Gas Turbine has been in service since 1977. The unit is used to produce power during system contingencies (i.e. loss of generation or 230 kV transmission) and is available for power generation over peak load periods should system/load conditions warrant its operation.

The unit is equipped with a clutch so that the electric generator (alternator) can be

connected to the power system and then the prime mover (turbine) is shut down. In this mode of operation the unit produces no real power (i.e. MW), but rather functions as a synchronous condenser to provide voltage support in the form of reactive power (i.e. MVAR) to the transmission system on the Avalon Peninsula. Operation of the Hardwoods Gas Turbine in synchronous condenser mode assists in maintaining acceptable voltages within the Avalon Peninsula portion of the system under normal operation and under system contingencies.

In 2008, a four-year Hardwoods refurbishment program was approved by the Board of Commissioners of Public Utilities (the Board) and the project work planned for the 2009 to 2013 period, has been ongoing each year since then to complete items from a list of recommended site refurbishments. One of the items on this list that has not been completed to date is the inspection and refurbishment of the alternator and excitation system. There is currently $2.1 million dollars assigned in that budget to complete this work.

In 2009, Hydro initiated the four-year refurbishment program to implement the recommendations for Hardwoods. In addition, Hydro planned to initiate a three year program to implement a refurbishment program for the Stephenville Gas Turbine plant, starting in 2012. However, as a result of prioritization, the refurbishment plan for the Stephenville site has been delayed until 2014.

In late December 2011, the Stephenville Gas Turbine experienced an alternator winding fault resulting in the unit being unavailable for service. The faulted condition was confirmed in early January 2012, when Brush performed the failure assessment which was also witnessed by Hydro's insurer, FM Global.

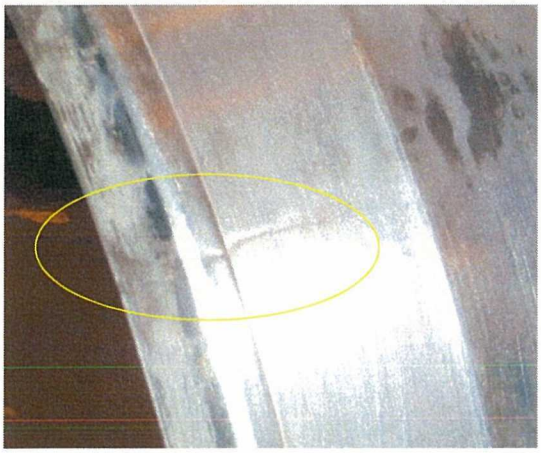
As a result of this failure, a supplemental project to complete a full stator and rotor rewind of the Stephenville Gas Turbine alternator was submitted and approved by the Board in Order No. P.U. 25 (2012). The stator and rotor rewind and related plant upgrade work is

currently ongoing and the unit is expected to be back in service in May 2013.

At the time of the failure, the Stephenville alternator refurbishment was given precedence over the Hardwoods alternator refurbishment as the Stephenville unit was forced out of service while the Hardwoods unit was still in working condition.

As part of the Stephenville alternator refurbishment work, the unit was dismantled and the alternator rotor assembly with attached retaining rings was sent to the Brush manufacturing facility in Pittsburg, Pennsylvania for inspection and rewind. During this inspection, it was discovered that the rotor retaining rings had stress corrosion cracks. (Refer to Appendix A - Stephenville Findings and Recommendations). Figures 2 and 3 show the Stephenville retaining rings and the cracks that were discovered.

Figure 2: Retaining Ring



Crack that has propagated through the entire nose of the ring

Figure 3: Retaining Ring Crack

Based upon the Stephenville findings, Brush's recommendations and the fact that Stephenville and Hardwoods are sister units of the same vintage, Hydro restricted the Hardwoods unit to operation under emergency conditions only. The Hardwoods Gas Turbine is a critical asset in ensuring a reliable and efficient power supply on the system and to the Avalon Peninsula. Consequently, immediate action is needed to replace the retaining rings on the unit and complete the recommended alternator replacement.

The recommended stator and rotor replacement was not included in Hydro's Capital Budget Application (CBA) for 2013 as the condition of the retaining rings in Stephenville was not discovered until early January 2013, leading to the decision by Hydro to run Hardwoods in emergency conditions only. Based on Hydro's present load forecast, this project must be completed in 2013 as the unit is required to be available during the 2013/2014 winter peak season for the Island Interconnected System.

The purpose of this report is to support the justification of a replacement of the stator and rotor for the Hardwoods unit to allow for a return to a safe and reliable working condition.

2 PROJECT DESCRIPTION

As a result of the findings in Stephenville and Brush's recommendations, the Hardwoods Gas Turbine is currently available to be run in emergency conditions only. There is a high probability that the retaining rings are near failure, which has resulted in the restriction that the unit can be run only in an emergency situation.

An assessment of the site was completed by Brush in late February 2013 (refer to Appendix B - Site Survey). Hydro then identified and assessed the viable alternatives to return the gas turbine to service, as indicated in Section 3.8. This project includes the following actions to return the unit to a safe and reliable operating condition:

1. Complete replacement of the stator and rotor including disassembly, reassembly and commissioning of the unit.
2. Complete necessary upgrades to auxiliary equipment to allow for a successful start-up and maintainability, including an upgrade to the protection system.

The replacement of the stator and rotor also includes the replacement of the retaining rings and exciter.

It should be noted that to replace only the retaining rings, it would still require disassembly of the alternator, extraction of the rotor and reassembly. Therefore, it is recommended that since the unit will need to be disassembled and reassembled at a considerable cost (over $2.6 million), given the current age of the alternator at Hardwoods, and the fact that a sister unit in Stephenville failed in 2011, the stator and rotor replacement should occur at the same time as the retaining ring replacement.

To replace the stator and rotor as a unit (including retaining rings), complete disassembly of the gas turbine module must occur, including:

- Asbestos abatement to facilitate the disassembly of the Gas Turbine;

- Disconnection and reconnection of the fire protection system and recertification;
- Alternator air treatment system removal;
- Removal of the stator canopy and enclosure walls; and
- Disconnection of all auxiliary systems such as electrical systems and clutch modules.

The reassembly will include installing and threading the new rotor into the new stator on site and installing the unit as a whole. This will require the use of a crane and a full alignment of the stator assembly will need to be done. Finally, the alternator will need to be completely reassembled and commissioned.

Upon completion of this work, it is expected that the alternator will be able to operate reliably for the next 15 years. The new rotor and stator will also come with a three year guaranteed service and replacement agreement.

3 JUSTIFICATION

The Hardwoods Gas Turbine is currently available only for emergencies, and is required to be in safe and reliable operation condition, as it provides several critical reliability functions on the Island Interconnected power system.

- It is part of the island system reserve capacity and thus provides power under system peaking and emergency/contingency conditions;
- In synchronous condenser mode, the unit provides reactive voltage support for the major load centers on the Avalon Peninsula;
- The unit provides power and reactive output to enable the reliable supply of power to the Avalon Peninsula which is heavily reliant on the transfer of power over transmission lines from off the Avalon Peninsula, as well as the production of power from Holyrood. This unit provides a critical backup in the event of a contingency such as the loss of a Holyrood generating unit or loss of a major transmission line into the area;
- The gas turbine is a part of the contingency plan for the reliable supply of power to the St. John's area;
- The gas turbine may be called upon to assist with black starting requirements of the Holyrood generation facility following major system disturbances; and
- The unit is also used to facilitate planned generation outages and planned Avalon Peninsula transmission outages.

It is critical that the Hardwoods Gas Turbine be available and in a state of readiness in order to be operated if required for System or Avalon Peninsula contingencies.

In addition to its critical reliability role, during periods when the system is not operating near peak capacity, the Hardwoods unit enables lower production costs at Holyrood because it can provide fast starting power in response to a contingency which would otherwise have to be provided by having an additional unit operating at Holyrood at minimum load and ready for increased output. Holyrood units can take from several hours

to days to start-up, so they must be started and remain on-line at a base, or minimum, load of 70 MW to be available in the event of a contingency, to prevent prolonged service interruptions. This is a very costly and inefficient mode of operation. At the current Holyrood inventory fuel price of $111/bbl and a fuel conversion rate of 600 kWh/bbl, which is typically experienced at this load, the cost to run a Holyrood unit in this manner is in the order of $310,000/day. In addition to the fuel efficiency impact, Hydro's reservoir storage is currently in a favorable position. By running Holyrood units at minimum loads to support the Avalon, the utilization of hydroelectric resources is decreased and the probability of spill from Hydro's reservoirs increases.

In order to minimize the cost of restoring the Hardwoods generating unit to a safe and reliable condition, it was determined that the optimum period to perform the work proposed under this project is during the last quarter of 2013, when Avalon Peninsula loads are increasing and Holyrood units are typically placed into service. The outage to the Hardwoods unit during this period will result in some additional Holyrood operating requirements (extra days of operation), however these additional requirements would not be nearly as onerous as they would be during the summer when all the Holyrood units would be shut down. The potential cost impact of the timing of the outage to perform the work is presented later in the evaluation of alternatives, Section 3.9.

In order to minimize the probability of a unit failure, from the present time to the time of the proposed outage in October, Hydro will maintain the ability to operate the unit in an 'emergency only' mode of operation, an acceptable compromise given the significant impact of taking the outage during the summer.

3.1 Reliability Performance

This project is being justified based upon the fact that currently Hardwoods operation is restricted to emergency conditions only, based upon recommendations from Brush resulting from findings on the Stephenville unit (i.e. the cracked retaining rings), and not upon poor reliability statistics. However, to ensure future reliability as part of the overall

refurbishment and life extension plan, Hydro is proposing a complete replacement of the stator and rotor and a primary protection upgrade.

3.2 Legislative or Regulatory Requirements

This project is not being justified on a legislative or regulatory requirement.

3.3 Safety Performance

Due to asbestos being known to be present in the work area of the gas turbine and alternator which will require equipment and structures to be removed, asbestos abatement has been identified as a portion of this work.

Abiding by the recommendations from Brush, the Hardwoods Gas Turbine should only be operated on an emergency basis and the operation should be remote and unmanned given the safety risks associated with respect to potential retaining ring failures.

3.4 Environmental Performance

No significant environmental impacts will occur as part of this project.

3.5 Vendor Recommendations

Brush has recommended that the Hardwoods retaining rings made of 18-5 MnCr steel be replaced by rings that are forged from an 18-18 MnCr alloy that has a high stress corrosion resistance based upon industry standards and findings. (Refer to Appendix A - Stephenville Findings and Recommendations).

The Hardwoods and Stephenville Gas Turbine retaining rings are made of 18-5 MnCr stainless steel. This material was widely used in the power generation industry for retaining rings but its use was discontinued in the late 1980s when it was found to be susceptible to stress corrosion cracking. Stress corrosion cracking requires the material to be under stress and exposed to a corrosive element in order to be initiated. In the instance of 18-5 MnCr stainless steel the corrosive element is water or airborne moisture. It has been well

established in industry through reports by General Electric Power (GE) and other generator vendors, that 18-5 MnCr retaining rings in coastal climates, or locations with high humidity, are more susceptible to stress corrosion cracking than retaining rings in dry climates.

3.6 Maintenance History

The table below presents the five-year maintenance history for the Hardwoods Gas Turbine.

Table 1: Five Year Maintenance History

Year	Preventative Maintenance $000	Corrective Maintenance $000	Total Maintenance $000
2008	26	271	297
2009	37	184	221
2010	57	283	340
2011	43	285	328
2012	23	230	254

3.7 Anticipated Useful Life

With the ongoing refurbishment work related to the Hardwoods Gas Turbine, along with the current proposed stator and rotor replacement, the service life of the unit is anticipated to be extended until the 2025 to 2028 time frame.

3.8 Development of Alternatives

In reviewing the work required to restore the Hardwoods Gas Turbine to a safe and reliable operating condition, the following alternatives have been considered for both the stator and rotor including:

1. Completion of a full rewind of the stator and rotor (including new retaining rings) – following the same method as in the Stephenville Gas Turbine rewind work.

2. Replacement of the stator and rotor.

3.9 Evaluation of Alternatives

Stator and Rotor Rewind

This option would involve a full stator and rotor rewind similar to the work that is being completed on the Stephenville Gas Turbine.

This option was determined to not be feasible as it would involve having the Hardwoods Gas Turbine disassembled and out of service for a period of over four months, part of which would occur during the critical summer months when the Hardwoods Gas Turbine is required to allow the complete shutdown of all the Holyrood units and in order to meet the required return to service timing of December 2013 to provide the power requirements for the 2013/2014 winter peak period.

The capital cost for this option is estimated at $8,110,800.

Stator and Rotor Replacement

Brush UK has recently shared a proposal to manufacture and provide new stator and rotors with improved delivery timings to their customers. This option is the recommended option as it will require the outage window to be only from October 1st, 2013 to mid December 2013, allowing for emergency operation of the Hardwoods unit in the summer, while still meeting the required return to service date. This is also the most cost effective option as the availability of the Hardwoods unit during the summer will help prevent Hydro from having to run a Holyrood unit in order to cover a 230 kV Avalon transmission line contingency. See Section 3 - Justification, for a further explanation of the outage window timing impact. This option is also preferred as the stator and rotor would be new and have a three year warranty (compared to one year warranty for a rewind) for a similar project cost.

The capital cost for this option is estimated at $8,015,810.

Table 2 below summarizes the two options and the potential cost savings realized by doing the replacement versus the rewind by referring to the number of additional days and energy required to run Holyrood (HRD). The loss energy impact of doing the rewind versus the replacement is estimated at $9.2 million. The loss energy results from the displacement of hydroelectric generation and the increased potential of energy spill from the reservoirs.

Table 2: Evaluation of Hardwoods Alternatives

2013 Hardwood Gas Turbine Refurbishment Evaluation of Alternatives		
	Scenario	
	Rewind	Replacement
GT Outage Window	Aug 1 - Dec 15	Oct 1 - Dec 15
Additional HRD Unit Days Required	68	15
Additional HRD Energy Requirement (GWh)	114.2	25.2
Amount Spilled (GWh)	57	7
HRD Conversion Rate (kWh/bbl)	600	600
Fuel Cost ($/bbl)	$111	$111
Energy Spilled ($ Million)	$10.5	$1.3

3.10 Energy Efficiency Benefits

The Hardwoods unit is an important contributor to maintain the efficiency of Holyrood. Using a Holyrood generating unit when the use of the Hardwoods Gas Turbine would suffice, results in lower efficiency on that Holyrood unit due to the low loading. It is also expected that the new stator and rotor windings will result in lower losses and, as a result, have an energy savings in comparison to the existing windings. The energy efficiency benefits are not quantifiable.

3.11 Major work and upgrades

The following table summarizes the major capital work and upgrades completed in Hardwoods over the past three years as part of the Hardwoods Life Extension project.

Table 3: Major Work at Hardwoods 2010 - Present

Description	Year Completed
Power Turbine Inspection - End A	2010
Clutch Inspection / Refurbishment - End A	2010
Miscellaneous Structural Repairs on Inlet Air Systems	2010
Replaced Bird Screens on Inlet Air System End B	2010
Alternator and Excitation System - In-situ Testing	2010
Alternator Bearing Replacement	2010
Control Building - Installed new roof	2010
Engine 2022-24 Overhaul	2011
Power Turbine Inspection - End B	2011
Clutch Inspection / Refurbishment - End B	2011
Replaced Speed Governor / Fuel Valve assembly - End B	2011
Replaced Bird Screens on Inlet Air System End A	2011
Repaired leaks in Main Bus Duct	2011
Data Control System - Replaced power supply	2011
Control Building - Recoated exterior	2011
Fuel Unloading Building - Recoated exterior	2011
Fuel Forwarding Building - Recoated exterior	2011
Auxiliary Module Building - Recoated exterior	2011
Maintenance and Parts Storage Building - Recoated exterior	2011
High Voltage Switchgear Building - Repaired roof and Recoated exterior	2011
Engine 2022-23 Overhaul	2012
Recoated Fuel Oil Storage Tank	2012
Data Control System - Purchased critical spares	2012
Purchased Main Lube Oil AC Pumps	2012

4 CONCLUSION

It is recommended that the rotor and stator be replaced for the Hardwoods Gas Turbine by mid- December 2013 in order to return the unit to a safe and reliable working condition prior to the next peak winter season.

Hydro is proposing that an order be placed with Brush as soon as possible once Hydro receives Board approval, to allow for the work to take place in the recommended and most cost effective outage period of October to December, 2013.

4.1 Project Estimate

The budget estimate to complete this project is provided below:

Table 4: Budget Estimate

Project Cost *($x1,000)*	2013	Beyond	Total
Material Supply	71.2	0.0	71.2
Labour	380.8	0.0	380.8
Consultant	35.0	0.0	35.0
Contract Work	6,058.9	0.0	6,058.9
Other direct costs	48.4	0.0	48.4
Interest and Escalation	102.6	0.0	102.6
Contingency	1,318.9	0.0	1,318.9
TOTAL	**8,015.8**	**0.0**	**8,015.8**

This is a Class 3 estimate to be used for project authorization. Within the cost estimate for the project, the estimated contingency has been set at 20%, in alignment with a Class 3 estimate definition. This is consistent with the Association for Advancement of Cost Engineering (AACE) estimate classification system.

It should be noted that there is currently $2.1 million dollars in capital funds approved for 2013 by the Board as part of the Hardwoods Life Extension project to inspect and refurbish the alternator and exciter system. That portion of the approved project will no longer be necessary.

4.2 Project Schedule

The anticipated project schedule is provided below.

Table 5: Project Schedule

Activity		Start Date	End Date
Planning	Planning Activity	May 2013	June 2013
Design	Front End Engineering Design	May 2013	September 2013
Procurement	Long lead items ordered	May 2013	September 2013
Delivery	Stator and Rotor available and delivered to site	October 2013	October 2013
Construction	Disassembly of alternator, installation of rotor and stator and reassembly	October 2013	November 2013
Commissioning	Estimated 8-9 days	November 2013	December 2013
Start up	Unit is back online	December 2013	December 2013

APPENDIX A
Stephenville Findings and Recommendations

Gillian Norman
Newfoundland and Labrador Hydro
500 Columbus drive
St John's, Newfoundland

April 23rd, 2013

Findings and Recommendations
Stephenville Rotor Retaining Rings

The purpose of this document is to report on findings and recommendations of recent work completed by Brush and NL Hydro for the Stephenville Gas Turbine Refurbishment and Rewind in Stephenville, Newfoundland (Contract # 51662). We have identified a serious concern as to the level of stress corrosion cracking found in the rotor retaining rings of the Stephenville Gas Turbine.

Upon inspection of the Stephenville rotor retaining rings it was observed that visible cracks were found in the inboard end of the retaining rings. See Figures 1 and 2.

Retaining rings are among the most heavily stressed components in the generator as they bear extremely high centrifugal and thermal forces during operation. The alloys that the retaining rings were originally comprised of are 18-5 MnCr stainless steel. This material has been found to be susceptive to stress corrosion cracking. There is supporting industry experience that retaining rings fabricated with 18-5 stainless steel are prone to failure. This problem is well documented. As a result, these types of retaining rings are being replaced with 18-18 MnCr alloy retaining rings as this has become industry standard.

Given that the Hardwoods Gas Turbine is a sister unit of the same vintage, unless the retaining rings have been previously replaced, we strongly recommend that NL Hydro prioritize the replacement of the Hardwoods Gas Turbine retaining rings as expeditiously as possible.

Consistent with our previous discussions with respect to ongoing operations of the Hardwoods unit, in the event the NL Hydro is required to run the Hardwoods unit, it is our recommendation that the Hardwoods Gas Turbine should only operate on an emergency basis and that the operation should be remote and unmanned given the safety risks associated with respect to potential retaining ring failures.

Andrew Tesla
Andrew Tesla Consulting, Inc.
Authorized Brush-GMS Representative
Montreal, Canada

For
Brush –GMS LLC

BRUSH GMS
601 Braddock Avenue, Turtle Creek, PA 15145, United States
T +1 412 829 7500 F +1 412 829 1692 E service@brushgms.com www.gmsinternational.com

Figure 1: Exciter End Retaining Ring with Visible Cracks

BRUSH GMS
601 Braddock Avenue, Turtle Creek, PA 15145, United States
T +1 412 829 7500 F +1 412 829 1692 E service@brushgms.com www.gmsinternational.com

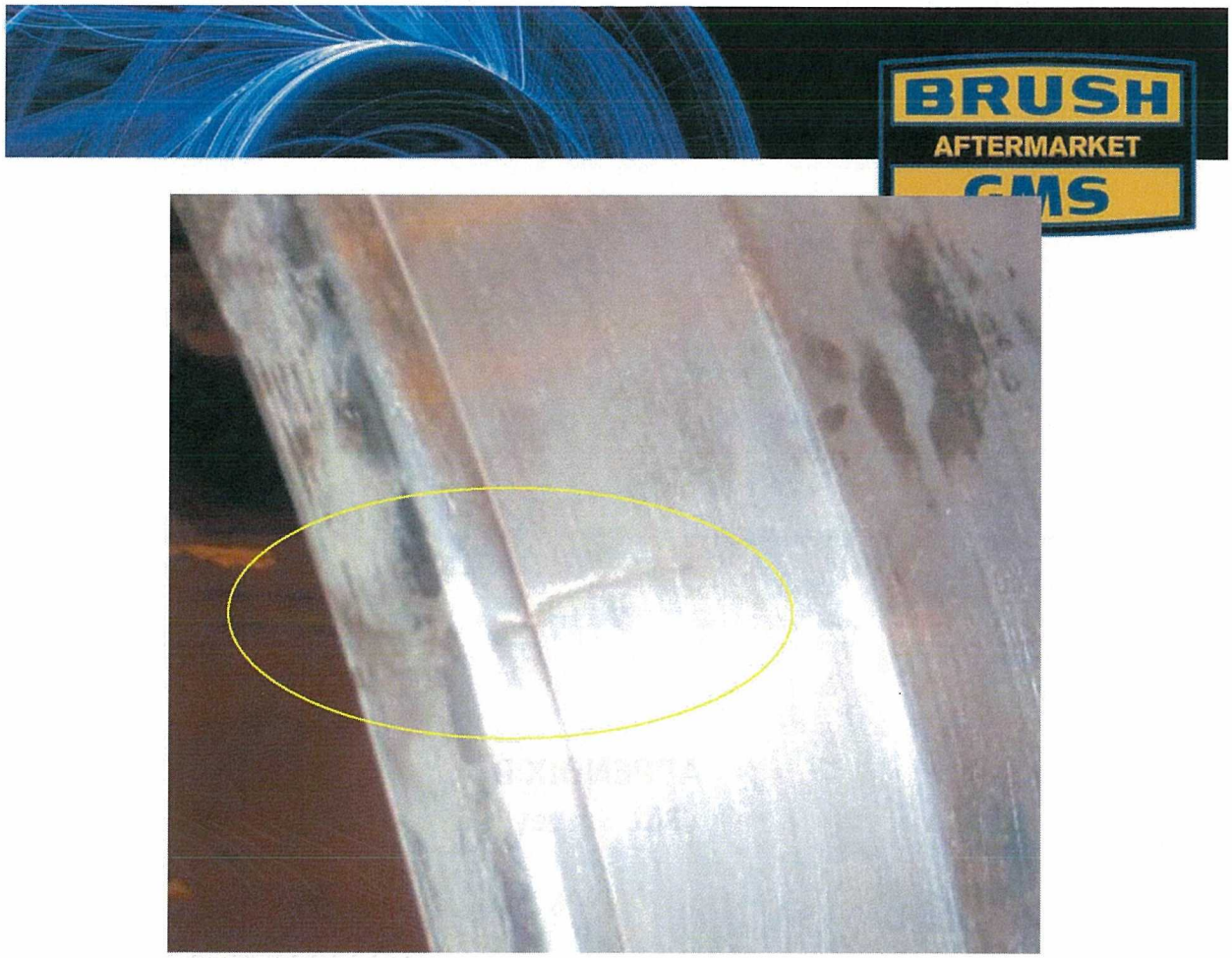
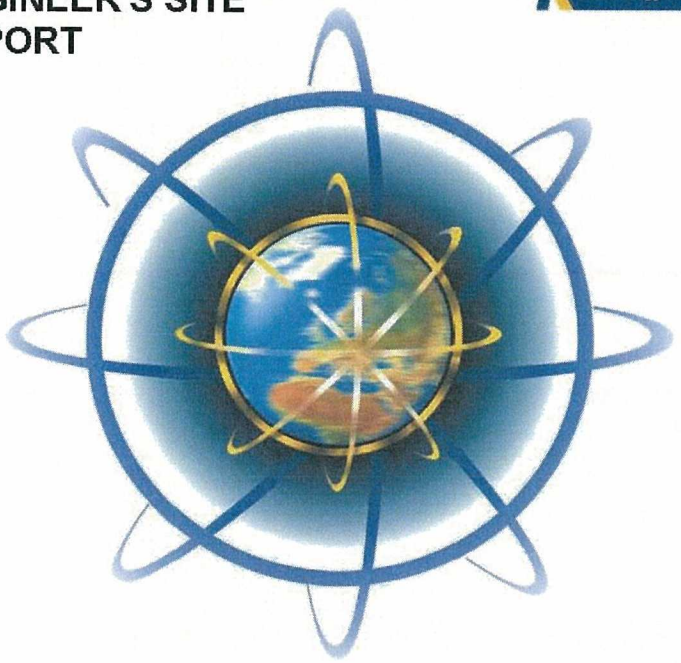


Figure 2:

APPENDIX B
Site Survey

SERVICE ENGINEER'S SITE REPORT

FKI Energy Technology



BRUSH
BRUSH BEM Ltd.

February-13

BRUSH BEM LTD.
SERVICE DEPARTMENT

BRUSH — BRUSH B E M Ltd. —

BEM SERVICE DEPARTMENT

SERVICE ENGINEER'S SITE REPORT

FKI Energy Technology

Index of Contents

BRUSH AFTERMARKET

BRUSH AFTERMARKET

QC(S)-001M, Service Report (Mechanical)

Customer : Newfoundland & Labrador Hydro

Site : Hardwoods
St John's
Newfoundland

Sales Order No : NA

Work Order No's : NA

Customer P.O. No : NA

Ex Contract No : 01/75575

Generator Serial No : 75575-1

Generator Frame Size : B-DAX 8-280P

Engineer(s) : Colin Brown

Project Manager : NA

Date of Visit
from: 19 February 2013
to : 22 February 2013

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

REPORT INDEX

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

CUSTOMER : Newfoundland & Labrador Hydro **SITE :** Hardwoods

WORK ORDER No : NA **SALES ORDER No :** NA

DATE OF VISIT :
from : February 19, 2013
to : February 22, 2013

EX CONTRACT No : 75575-1

ENGINEER : Colin Brown **CUSTOMER P.O. No:** NA

1. WORK DESCRIPTION

Site Survey

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

2 UNIT DETAILS

2.1 Generator

kVA	63440	Frame	B-DAX 8-280P
Rpm	3600	Machine No	75575-1
Volts	13800	Rating	M.C.R.
Amps	2650	Specification	ANSI C50-13
Exciter Volts	245	Ambient temp	15°C
Exciter Amps	437	Altitude	Up To 1000M
Phase Hz	3/60	Insulation Stator/Rotor	Class B
P.F.	0.85	Year of Manufacture	1978

2.2 Associated Equipment

AVR Type : ABB
AVR Serial Number :
QC48 Number :
Prismic Type :
Prismic Serial Number :

Customer's Unit No. :

2.3 Prime Mover

Type: Olympus Gas Generator each end

Coupling: SSS Clutch each end

Foundations: Generator steel bed on concrete foundation

2.4 Running Details

Total Running Hours Unknown
Total Fired Starts
MW Hours
MVAR Hours

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

3. SUMMARY

Newfoundland and Labrador Hydro (Hydro) owns and operates two 50 MW Gas Turbine plants as part of the Island Interconnected System. They are: Stephenville Gas Turbine Plant, located in Stephenville; and Hardwoods Gas Turbine Plant (Hardwoods), located in the west end of St. John's.

The Island Interconnected System experiences constant voltage fluctuations that result from changes in supply and demand of electricity. Since voltage fluctuations are undesirable, the system requires constant voltage correction to maintain the proper voltage levels. The system voltage is corrected using a process known as synchronous condensing. This process stabilizes the voltage of the system by acting as a shock absorber if the system experiences a voltage drop. During synchronous condensing, the voltage drop is limited to no more than five percent below the nominal operating levels of 230, 138, or 66 kV. Synchronous condensing is the main function of the Hardwoods and Stephenville Gas Turbine Plants.

The Hardwoods plant mainly operates as a synchronous condenser but produces electricity during peak and emergency times. This results in a very high number of starts and stops of the equipment annually. Frequent starts and stops of the equipment reduce its useful life far below the anticipated useful life of a base load plant.

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

4. DIARY OF EVENTS

Date	Description of Site Activity
19-Feb-13	C Brown & Laura Stewart in transit to St John's, Newfoundland
	Accommodation pre-arranged by Richard Lowrance at Holiday Inn, St John's
20-Feb-13	After meeting with Richard Lowrance, we travelled to the Hydro office for a meeting and then on to the Hardwoods plant to measure and photograph the generator to establish the preferred method of generator removal and reinstallation
	Mr Greg of All Canadian Crane visited site to confirm the crane position will be acceptable to lift the proposed load and re-site on the yard for further dismantling including rotor removal
21-Feb-13	A further meeting was held at Hydro office to discuss the previous days findings and future actions
	C Brown & Laura Stewart in transit to UK
22-Feb-13	C Brown & Laura Stewart in transit to UK

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

5. FINDINGS & RECOMMENDATIONS

Stator Removal

Removal of the original stator would require disconnection of Mains and Neutral busbars, removal of the terminal housing and possibly the terminals Drawing 960315200

Removal of stator air seal Drawing 312207000

Removal of top half stator housing (36 off M16 x 55 & 64 off M10 x 25 Hex Head Screws

Removal of 12 stator holding down bolts, M36.

Removal of the coupling bolts, at both ends at the clutch housings, and disconnection of the exciter Drawing 312395100 & Clutch manual

Removal of the complete exciter armature shaft, exciter magnet and third bearing for refurbishment. Drawing 312383800

Removal of all lubrication oil pipes, all open flanges to be protected.
Drawing 312413700

Removal of walkways. M12 Fixings

Removal of Top Air Box complete with Snow Hood
Drawing 312298700

Preferred method of removal would be to lift stator/rotor from East side onto a waiting trailer and either transport out of the gate on the roadway or remove the rotor before transportation

Final method of stator removal would possibly be decided by heavy lift company

Stator/Rotor weight is approximately 80 tonnes

Stator/Rotor lift would need a purpose built cradle (larger than skid blocks) to secure the rotor inside the

Old Stator and Rotor will be transported from site to a place designated by Hydro who will arrange with heavy haulage company

Generator Installation

It is assumed that the reinstallation of the new alternator would be a reversal of the removal method

Reassembly of stator with new foot liners. Drawing 312362000

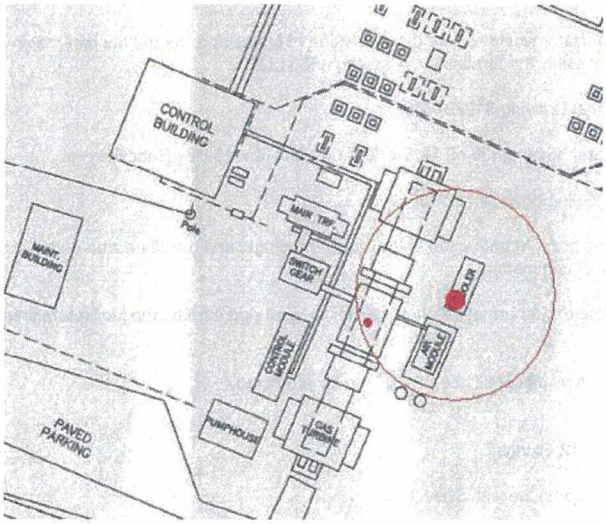
Reconnection of Mains and Neutral busbars. Drawing 960315200

Reassembly of Top Air Box complete. (New Fixings) (New Filters)

Reassembly of walkways. (New Fixings)

New Stator and Rotor will be transported from the dock to site which will be arranged by heavy haulage company after instructions from Brush

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C



Crane will be sited at the oil cooler position after removal of the oil cooler, and will reach the centre of the generator with access to the yard for laydown area

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

Hardwoods site visit -DAY 1

February-20-13
8:09 AM

Attendees: Gillian Norman--PM Project Execution
Paul Keough- - Production Diesel Maintenance Supervisor
Jim Wheeler- -Asset Specialist
Dave Hicks- Electrical Manager
Rich Lowrance-- Brush PM -US
Laura Stewart- Brush Tendering Engineer- UK
Colin Brown- Brush Senior Servicing Engineer- UK
Matthew Halloran- Engineering student

On site Operator: Jabez Lane

- Safety Moment--Paul Keough
  - Car safety--accident --led to fatality, distractions --need to pay attention.
- Purpose of Meeting--Gillian Norman
  - Site visit for Brush UK and US to prepare quote and leadtime.
  - Need this information to prepare the document to the PUB.

- Plan for Day 1 site visit--Logistics/Site PPE
  - Isolation needs to be done to enter the unit--Jabez
  - Covers on clutches
  - Stator winding inspection

  - Site safety overview
  - Site tour--Paul/Jabe
  - Brush taking measurements, site review

Hardwoods site visit -DAY 2

February-20-13
8:09 AM

Attendees: Gillian Norman--PM Project Execution
Paul Keough- - Production Diesel Maintenance Supervisor
Jim Wheeler- -Asset Specialist
Dave Hicks- Electrical Manager
Rich Lowrance-- Brush PM -US
Laura Stewart- Brush Tendering Engineer- UK
Colin Brown- Brush Senior Servicing Engineer- UK
Matthew Halloran- Engineering

- Safety Moment--Gillian Norman

- Review of yesterday's site visit

Questions remaining & notes:
- Can the roadway and site take the weight of a new stator and rotor? Can confirm trenches

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

underground etc. Need to wait until snow leaves to confirm.

- Assume oil was flushed out --may want to confirm with Reg day.
- Need to confirm all bearings were done--we know 3 Generator bearings were done.
- Didn't need to take off caps of clutches--they were a different type--they were already refurbished in 2010
    - Gillian to send out scanned docs for clutches
- All canadian crane confirmed better option is to relocate MLO cooler to get crane in place--no need to remove stack.
- Unit is about 75 tons--with other equipment will be 125 tons. Greg All canadian crane is working on quote to relocate new stator& rotor from Harbor to site.
- Measured gateway--20 ft wide.
- Best option to bring truck up to turning round road and back up into site via goldhauffer.
- Stator and rotor come separate. So tent will be a necessity anyway to assemble unit whether it's a rewind or a replacement.
- Outriggers on crane --may affect sump pump area?
- Might need to check the overpass heights?

Include in quote:

- Alternator disassembly and reassembly
- Re-commissioning
- New Stator & rotor
- Stator and rotor rewind
- Exciter inspect & clean
- Labyrinth seals on exciter shaft--option--aluminum
- New retaining rings
- Cost of exciter rewind if needed
- When bearings are removed, insulation should be replaced.
- Include asbestos removal for all areas and replacement of insulation blankets. Include beam cutting if necessary.
- Alternator air treatment module--sandblasting and painting
- Include in separate line item filters.
- Transportation costs/shipping overseas and to site.
- Separate line item- compressed air system
    - Valves, lines and tanks (evaluate and replace if required).
- Exhaust stack silencers replacement.

Also include in quote--2013 HWDS LT scope items:

-Recoat interior and exterior air inlet system

- Exhaust stack exterior--replace light gauge cladding
- Recoat exterior glycol cooler
- Recoat gas generator/power turbine enclosure
- Recoat exterior alternator enclosure
- Outdoor junction boxes 7A-7B replacement

Aside: May need to look at compressed air system as part of LT program--may need to be replaced at some point.

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6. APPENDIX

LIST OF CONTENTS

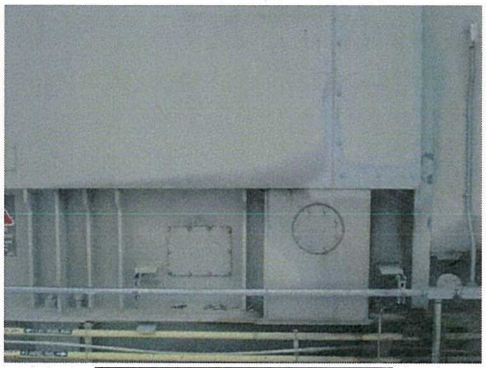
BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS

Top Air Box & Bus Duct

Top Air Box & Bus Duct

Bedplate Access Exciter End



Bedplate Access Drive End

Snow Hood

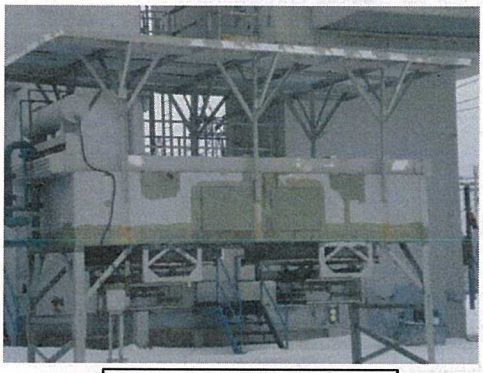
Air Tanks

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS

Lube Oil Pump House

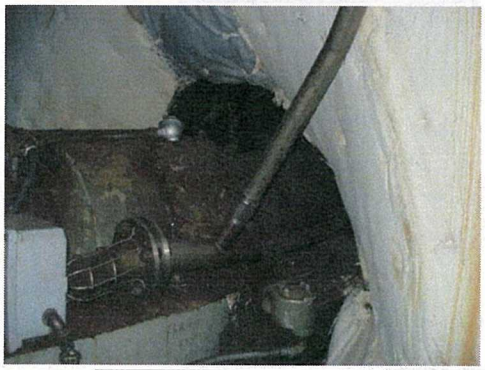
Lube Oil Cooler Pipes



Lube Oil Cooler

Air Box Roof Ladder

Exciter End Clutch Housing

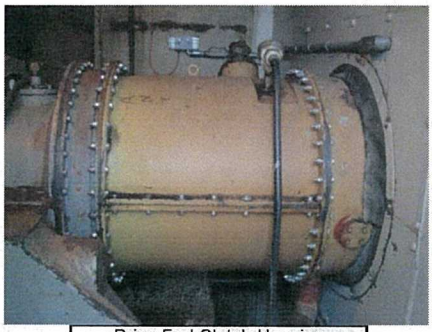


Exciter End Exhaust Insulation

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

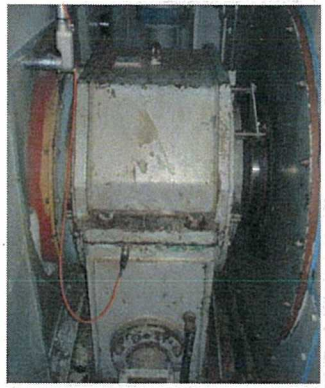
6.2 PHOTOGRAPHS

Drive End Exhaust Insulation



Drive End Clutch Housing

Rotor Shaft Earthing Brush



Drive End Bearing Pedestal

Rotor Shaft Air Seal

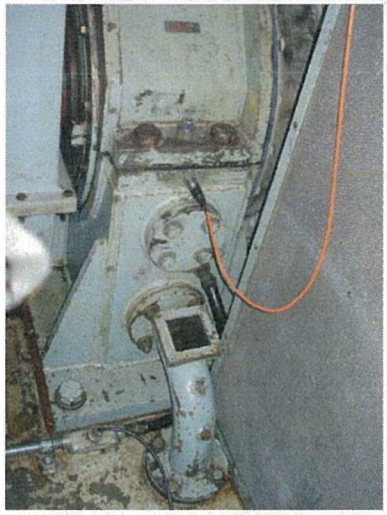
Exciter End Bearing Pedestal

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS

Exciter

Exciter Shaft



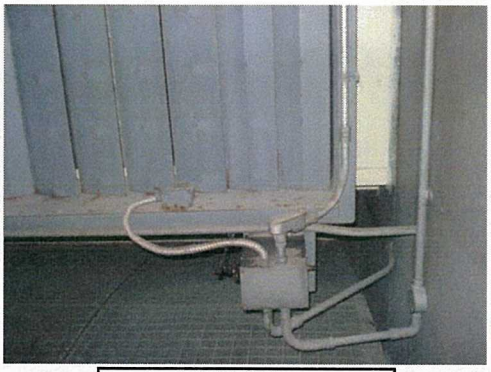
3rd Bearing

Exciter End Firewall

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS

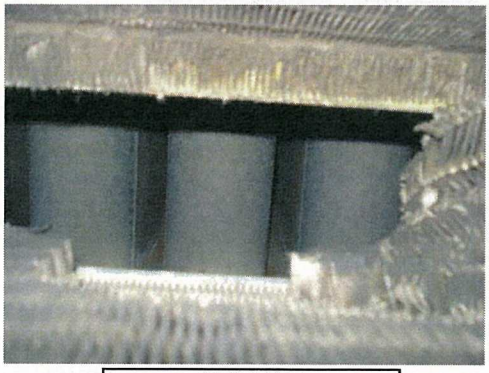
Air Box Walkway



Air Box Louvre

Air Box Louvre

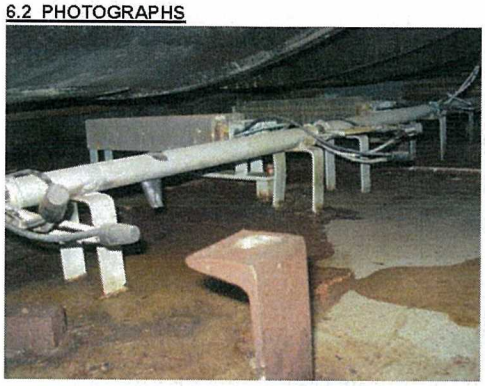
Air Box Filter



Air Box Filter

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

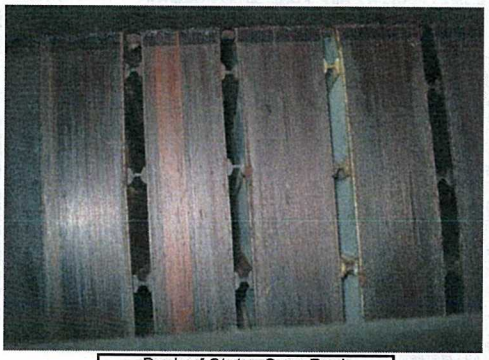
6.2 PHOTOGRAPHS



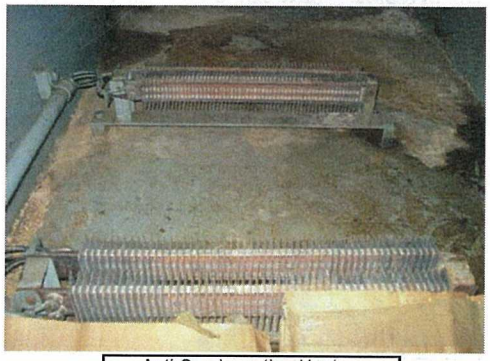
Bedplate Centre

Bedplate Shim Pack

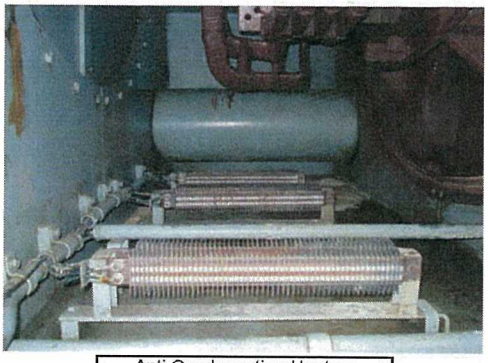
Back of Stator Core Pack



Back of Stator Core Pack



Anti Condensation Heaters

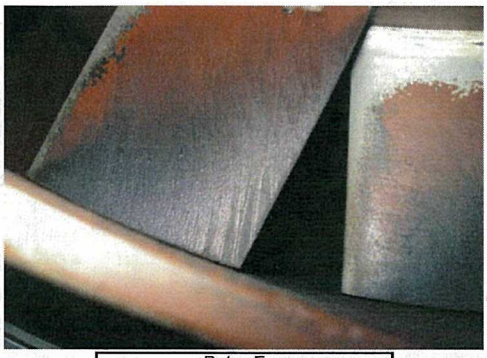


Anti Condensation Heaters

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

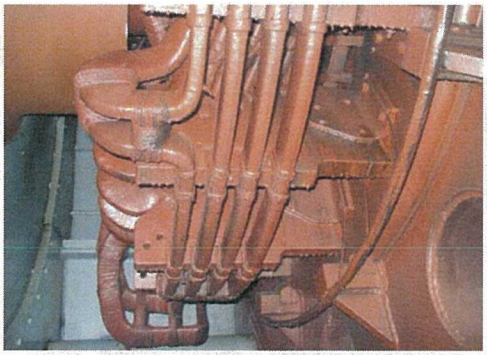
6.2 PHOTOGRAPHS

Rotor Fan

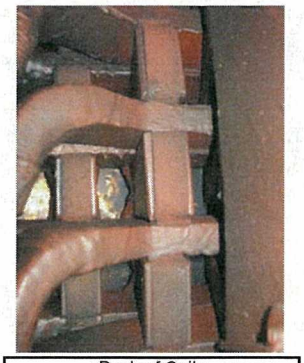


Rotor Fan

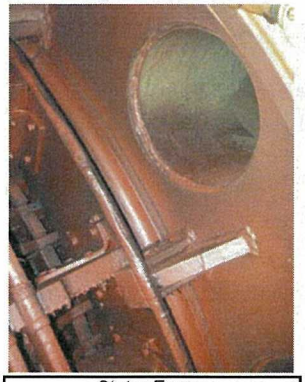
Stator Terminals



Coil Connections



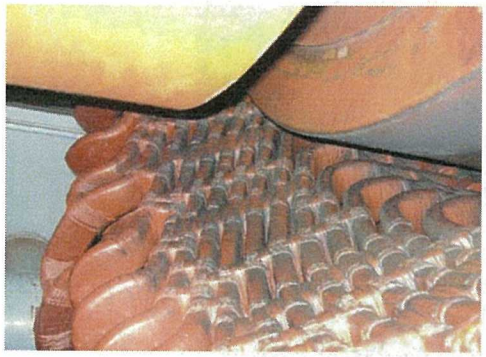
Back of Coils



Stator Frame

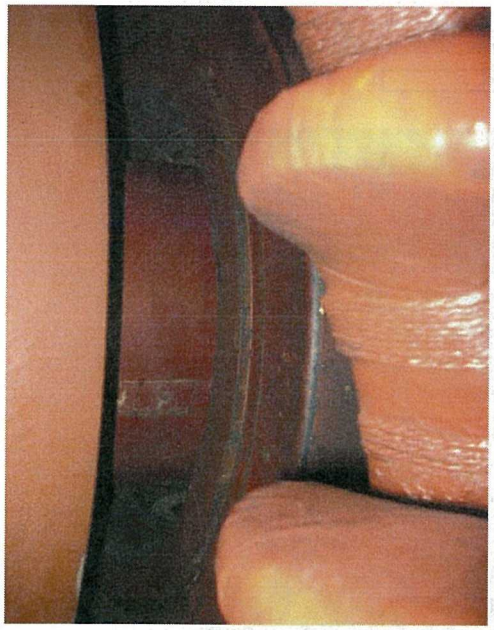
BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS

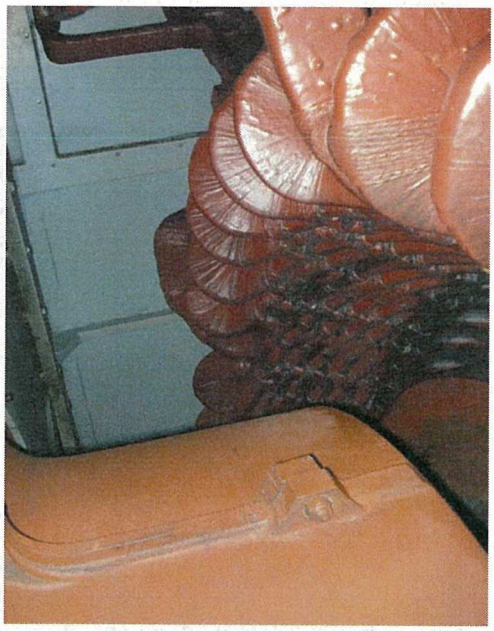


Fan Shroud

Back of Coils



End Cap

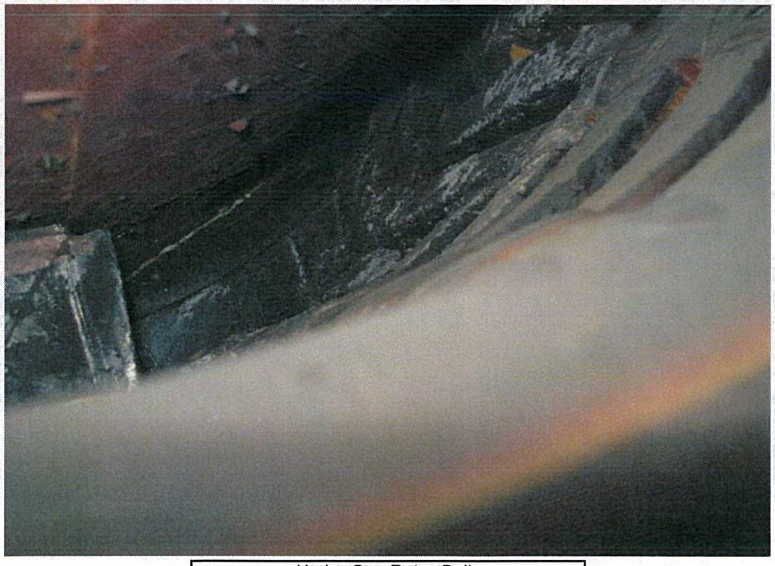


Fan Shroud

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS

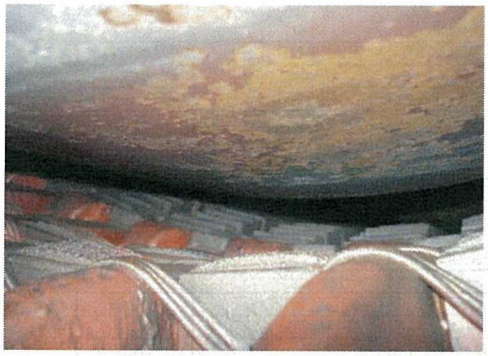
Under Cap Rotor Coils



Under Cap Rotor Coils

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)		QC(S) - 001M	
Service Report	Newfoundland & Labrador Hydro Hardwoods St John's Newfoundland	Form No.		
		Rev	Apr-04	C

6.2 PHOTOGRAPHS



Air Gap Between Cap & Core Pack

Air Gap Between Cap & Core Pack

Air Gap Between Cap & Core Pack

Air Gap Between Cap & Core Pack

Contaminated Coils

Contaminated Coils

Document approved by Quality/Test Manager and Service Manager, April 2004

Page 23 of 28

BRUSH AFTERMARKET	SERVICE REPORT (MECHANICAL)	Doc No.	QC(S)-001M	
	Newfoundland & Labrador Hydro	Form No.		
Service Report	Hardwoods St John's Newfoundland	Rev	Apr-04	C

6.3 RECOMMENDED SPARE PART REPLACEMENTS

ITEM	DRAWING NUMBER	PART NUMBER	QUANTITY
Top Air Box Fixings M16 x 35 long		021862292	76
M16 Lock Washer		021184420	76
Stator Top Half Housing Fixings M16 x 55 long		021862296	36
M16 Lock Washer		021184420	36
Stator Top Half Housing Fixings M10 x 25 long		021862210	64
M10 Lock Washer		021184417	64
Walkway Fixings M12			
M12 Lock Washer		021184418	
Stator Top Gasket	312423600		Suff
Foot Liner Set		312362000	1 Set
Stator Air Seal	312207000		
Soft Sponge Rubber Cord	312167700		Suff
Locking Plates Stator Air Seal	312167700	312033406	Suff
Locking Plates Detuning Strut		311902802	
Dowel		312488501	6
Steel Tube		312488601	6
Steel Washer		312488671	6
M24 Nut		021881270	6
Insulation Board Exciter Pedestal			1
Insulation Tubes Exciter Pedestal			4
Insulation Washers Exciter Pedestal			4
Insulation Board 3rd Bearing			1
Insulation Tubes 3rd Bearing			4
Insulation Washers 3rd Bearing			4
Copper Finning		013615402	30M
Copper Caulking		013611361	30M
Hylomar Sealant		018711115	Suff
Neoprene Gasket 20 x 25		018757662	Suff
Silicone sealant		018711174	Suff
Unial Jointing Compound		017321508	1 Tin
Fan Shroud Locking Plates			
Replacement pipe gaskets	312413700		Suff
Possible replacement gaskets after disassembly			Suff
Contact Adhesive		017521592	Suff
Insulation materials for stator terminals			Suff
Jacking oil system overhaul kit	312415900		
Cradle Assy For Lifting Rotor & Stator Together			

BRUSH AFTERMARKET

SITE WORK ZONE SAFETY INSPECTION

- This form is intended to assist you in identifying and controlling the significant risks on customers' sites.
- Risks arise from the existence of hazards (situations which have the potential to cause harm) and the likelihood of dangerous occurrences taking place as a result of the existence of those hazards. The measures which should justifiably be taken to manage or eliminate any particular risk will depend upon the risk assessment, which grades risks in terms of the severity of the harm they could cause and the likelihood of that harm occurring. If a hazard has potentially very serious consequences then, even though the likelihood of a dangerous occurrence may be small, foolproof measures to eliminate or manage the risk may be justifiable.
- If the potential consequences of a particular hazard are minor, but the likelihood of harm occurring is high, e.g. because people are repeatedly exposed to the hazard, then action to eliminate or manage the hazard is justifiable.
- The action taken will always have an associated cost and it is necessary to balance the cost of dealing with the hazard against the potential consequences of a dangerous occurrence arising from its existence.
- Where possible, hazards should be eliminated. Sometimes hazards can be reduced but not eliminated. Occasionally the only option is to isolate personnel from the risk by using personal protective equipment (PPE), but this option should always be adopted only as a last resort. Correct assessment of risks is essential if the right decisions are to be made concerning their elimination, control and management.
- Certain actions should always be taken, such as: following established procedures for isolation and lock-off, use of the correct tools for the job, ensuring that tools are in good condition, exclusion of personnel from the work zone who have no justifiable reason to be there, etc.

1.0 Customer/Site Details:

Customer Name:	Newfoundland & Labrador Hydro	**Sales Order Number:**	
Site Name/Address:	Hardwoods St John's Newfoundland	**Work Order Number:**	
Inspection Date/Time:	February 20, 2013 9:30 AM		

2.0 Description of Work to be Carried Out:

Site Survey

3.0 Facilities and Working Conditions

		Yes	No	N/A
3.1	Are adequate washing and toilet facilities available near the workzone?	X		
3.2	Is drinking water available near the workzone?	X		
3.3	Is access to and egress from the work zone free of hazards?	X		
3.4	Is lighting adequate in the workzone?	X		
3.5	Is ventilation adequate in the workzone?	X		
3.6	Is working space adequate in the workzone? (Note: If confined space working is required, complete Section 8).	X		
3.7	Is the work zone and its routes of ingress and egress free of slip/trip/fall hazards?	X		
3.8	Have you been made aware of the arrangements for fire and emergency evacuation?	X		

If "NO" to any of questions 3.1 to 3.8, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.

Will these measures be implemented before work commences? X

If not, why not?

3.9	Are other contractors/customer's personnel carrying out other work in the same work zone?		X	
3.10	Is the presence of other contractors' personnel likely to cause any conflicts affecting safety?		X	
3.11	Is any work being carried out overhead of the work zone?		X	

If "YES" to any of questions 3.9 to 3.11, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.

Will these measures be implemented before work commences? X

If not, why not?

4.0 Working at Heights (See Health & Safety Manual HS 02, Section 4.7)

4.1	Is any work to be carried out at a dangerous height?		X	
4.2	Is any work to be carried out on scaffolding?		X	
4.3	Does the scaffolding lack safety rails?			X
4.4	Are any scaffold walkways (planks) insecure?			X
4.5	Does the scaffolding lack safety tags?			X
4.6	Are you concerned that the scaffolding does not provide a safe working platform?			X

If "YES" to any of questions 4.1 to 4.6, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.

Will these measures be implemented before work commences? X

If not, why not?

BRUSH AFTERMARKET

SITE WORK ZONE SAFETY INSPECTION

		Yes	No	N/A
5.0	**Working with Personal Protective Equipment** (See Health & Safety Manual HS 02, Section 8.6)			
5.1	Is any hazard present which necessitates the use of personal protective equipment (PPE)?	x		
	If "YES" to question 5.1, identify below the hazards concerned and measures necessary to eliminate or minimize these risks, including the type of PPE to be used.			
5.2	Can the necessity to use PPE be avoided by dealing with this hazard in a different way?			x
5.3	Is suitable PPE available for use?	x		
5.4	Is the PPE in good condition?	x		
	If "NO" to any of questions 5.3 to 5.4, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			x
	If not, why not?			
6.0	**Permit to Work** (See Health & Safety Manual HS 02, Sections 4.3 and 8)			
6.1	Is a Permit to Work system in operation?	x		
6.2	Does your Permit identify:			
6.2.1	All danger points?	x		
6.2.2	All earth points?	x		
6.2.3	All kick-off points?	x		
6.3	Does your Permit cover, where applicable:			
6.3.1	Electrical work?	x		
6.3.2	Hot Work?			x
6.3.3	Confined space working?			x
6.3.4	Working at heights?			x
6.4	Has the Permit to Work been signed by the customer's Senior Authorised Person?			x
6.5	Have all auxiliary circuits (e.g. heaters, etc) been isolated?			x
6.6	Have all possible backfeed circuits (e.g. voltage transformers, etc) been isolated?			x
6.7	Have all electrical supplies to the equipment to be worked on been isolated and locked off using your own padlocks? (See Health & Safety Manual HS 02, Section 8)			x
6.8	Has the equipment to be worked on been proved dead in your presence and earthed?			x
6.9	Has the proving dead device been demonstrated to you to be in working order both before and after proving the equipment dead? (See Health & Safety Manual HS 02, Section8)			x
6.10	In the case of rotating plant, have all means of mechanically energizing the plant, and any other mechanical stored energy devices (e.g. spring charged and compressed air/gas mechanisms, fire fighting systems, etc), been demonstrated in your presence to have been discharged, disabled and locked off using your own padlocks?			x
6.11	Have all electrical stored energy devices included in the circuits to be worked on, e.g. batteries, capacitors, high voltage windings, etc, been discharged and connected to earth? (See Health & Safety Manual HS 02, Sections 4.18 and 8)			x
6.12	Has the Senior Authorised Person identified to you all adjacent items of equipment which are **live**?	x		
6.13	Have all sanctions for test in relation to the equipment specified on the Permit to Work been cancelled?	x		
6.14	Are you satisfied with the arrangements for cancelling and re-issuing permits when the work is interrupted?	x		
6.15	Are you satisfied in all respects with regard to the Permit to Work?	x		
6.16	Have you identified all of the dangers to all other personnel in the team?	x		
6.17	Have you seen and agreed with all items in sub-sections 6.2 to 6.15?	x		
	If "NO" to any of questions 6.1 to 6.17, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			x
	If not, why not?			
7.0	**Sanction for Test** (See Health & Safety Manual HS 02, Section 8)			
7.1	Has a Sanction for Test been received?			x
7.2	Does the Sanction for Test clearly specify the equipment to be energised?			x
7.3	Have all Permits to Work in relation to the equipment specified on the Sanction for Test been cancelled?			x
7.4	Do you have any reservations with regard to the sanction for test?			x
7.5	Are you satisfied with the procedure for canceling and re-issuing Sanctions for Test when the work is interrupted, e.g. for end of shift, re-issue of Permit to Work, etc?			x
7.6	Has access to the workzone been restricted by barriers and pickets?			x
7.7	Have sufficient warning signs been erected around the workzone?			x
7.8	Will another person be present at all times during the work?			x
7.9	Are sufficient measures in place to ensure safety prior to commencing the test?			x
	If "NO" to any of questions 7.1 to 7.5, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			x
	If not, why not?			

BRUSH AFTERMARKET

SITE WORK ZONE SAFETY INSPECTION

		Yes	No	N/A
8.0	**Confined Space Welding** (See Health & Safety Manual HS 02, Section 4.14)			
8.1	Is work to be carried out in a confined space?		X	
	If "YES" to question 8.1, identify below the hazards concerned (e.g. extreme temperature, lack of oxygen, explosive/poisonous atmosphere, etc) and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			X
	If not, why not?			
8.2	Will another person (the watchperson) be present **outside the confined space** at all times during the work?			X
8.3	Has the watchperson been instructed in his/her duties and been given a written instruction sheet?			X
	IF "NO" to question 8.2 or 8.3, THE WORK CANNOT PROCEED.			
9.0	**Control of Substances Hazardous to Health (COSHH)** (See Health & Safety Manual HS 02, Section 4.15)			
9.1	Does the work involve the use of any substances which may be hazardous to health?		X	
9.2	Do you lack any relevant COSSH data sheets for the substances to be used?		X	
9.3	Will the work generate any dangerous waste?		X	
	If "YES" to any of questions 9.1 to 9.2, identify below the substances and hazards concerned and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			X
	If not, why not?			
10.0	**Work in a Hazardous Area** (See Health & Safety Manual HS 02, Section 4.2.9, 7, 8, 9 and 11)			
10.1	Is the work to be carried out in or near to a hazardous area?		X	
	N.B. Hazardous areas may be so designated because of explosion risks, e.g. in mines, petrochemical installations, etc., or because of other hazards such as presence of toxic or suffocating gases, risk of flooding, etc.			
	If "YES" to question 10.1, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			X
	If not, why not?			
11.0	**Hot Work**			
11.1	Does the work to be carried out involve "hot work"?		X	
11.2	Is a "Hot Work Permit" required?			X
11.3	Has a "Hot Work Permit" been received?			X
11.4	Are fire extinguishers/fire blankets at hand?			X
11.5	Will another person be present at all times during the "hot work"?			X
	If "YES" to any of questions 11.1 to 11.4, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.			
	Will these measures be implemented before work commences?			X
	If not, why not?			
12.0	**Manual Handling**			
12.1	Does the work involve lifting/moving of heavy components?	X		
12.2	Are adequate facilities available to enable this to be done safely?	X		
12.3	Are adequate lifting facilities/anchorage points available at all necessary locations to avoid the need for manual handling of heavy/awkward components?			X
	If "NO" to any of questions 12.1 to 12.3, identify below, or on a separate sheet to be attached, the manual handling hazards, the associated risks and the respective methods of safely dealing with such risks.			
	Will these measures be implemented before work commences?			X
	If not, why not?			
12.4	Do any manual handling hazards remain for which no satisfactory solution can be devised?		X	
	IF "YES" TO QUESTION 12.4, THE WORK CANNOT PROCEED UNTIL A SAFE METHOD HAS BEEN DEVISED.			

BRUSH AFTERMARKET

SITE WORK ZONE SAFETY INSPECTION

13.0 Hazards and Risks Not Previously Identified

	Yes	No	N/A
13.1 Are there any other hazards and risks not mentioned above?		X	

If "YES" to question 13.1, identify below the hazards concerned and the measures necessary to eliminate or minimize these risks.

Will these measures be implemented before work commences?			X

If not, why not?

14.0 Conclusion

14.1 Are you satisfied that all hazards have been identified and appropriate action has been taken to eliminate or minimize the associated risks?	X		
Will these measures be implemented before work commences?			X

If "NO" to question 14.1, identify below additional measures to be taken to ensure safety before proceeding with the work?.

If not, why not?

14.2 Are you satisfied that the work can proceed in safety?	X		

IF NOT, YOU MUST NOT PROCEED WITH THE WORK UNTIL YOU ARE SATISFIED THAT IT CAN PROCEED IN SAFETY.

In case of serious conflict with the customer's site manager, refer the facts to the Chief Service Engineer.

15.0 Notes

15.1 It is recognized that during any one assignment numerous Permits to Work/Sanctions for Test may be issued and cancelled, as necessary, as the work progresses. This inspection is intended to ensure that service personnel are actively involved in assessing risks and implementing safe systems of work at each site. It is not necessary to complete an inspection form for every Permit/Sanction issued, but this should always be done in respect of the first of each such document received.

15.2 It is recognized that some sections of this form may have to be completed at different times to other sections, e.g. Section 7.0 cannot be completed until a Sanction for Test is issued and this may be some considerable time after arrival at site or commencement of work under a Permit to Work. In such cases, complete all possible sections as soon as possible and where other sections are completed later, indicate this by noting the date/time in the respective section(s).

15.3 It is permissible to delete or modify wording to render the form more relevant to conditions on particular sites.

15.4 Before answering "yes" to the question "will these measures be implemented before work commences?" you must either implement the measures in question yourself or obtain the agreement of the customer's site manager that they will be implemented.

16.0 Record of Permits to Work/Sanction for Tests

Use the table below to record details of Permits to Work and Sanctions for Test.

Permit/Sanction Number	Date & Time Issued

17.0 Signature

Signed: _____

Print Name and Title: Colin Brown, Senior Service Engineer Date: 20 February 2013 Time: 9:30 AM