



Jamaica Public Service Company Limited

**GENERATOR GAP3 & TWO COIL REWIND AND ROTOR BORE LEAD OUT
CONDUCTOR REPLACEMENT**

**ANNUAL OVERHAUL 2021 CONTRACTOR WORK SCOPE
BOGUE POWER STATION**

Request for Proposals

GENERATOR GAP 3 SERVICES

RFP# 883801

QUESTIONS & ANSWERS

Questions & Answers

Please see below where answers are in blue.

1. Specifically, what kind of Brush generator is this? [Generator is a GE Brushless Generator](#)
2. Can we get a photo of the data plate? [Name plate will be attached to document](#)
3. Please provide total weight, field body length, and field RR OD for the field. [Rotor weight in pounds: 34,000lbs field body length 222 inches](#)
4. The RFP specified Outage Date(s) of 1Q2022. Can we get better-confirmed dates? [Planned outage date is March 18th 2022](#)
5. Will JPSCO be providing NDE services? [JPS will provide this service.](#)
6. Is it possible to get some pictures of this unit (generator field, under the retaining rings)? [Not at this time](#)
7. Is it possible to get a copy of the report from the 2018 repairs that were performed? [Yes](#)
8. Does the plant have any drawings for this unit to supply prior to award? [Technical Drawings are proprietary and will be supplied after the award.](#)
9. Can JPS recommend local blast cleaning companies? [Yes this resource is readily available on the island](#)
10. The schedule at 21 days is likely not achievable as the materials to rewind the 2 coils cannot be procured until the existing coils are removed and gather the necessary data. In addition to that, the new bore copper will likely not be available quick enough to meet such a turnaround. Does the customer have flexibility to extend the schedule? [This may be extended to 28 days but with clear strategy outlined on how timeline will be achieved, and approval of extension for the project team.](#)
11. Can JPS provide the shipping drawing for the generator field? Looking for: total weight, field body length, field RR OD. [Question answered above.](#)
12. Can you provide date to when the outage will start? [Plan outage date March 18, 2022](#)
13. Can JPS provide some pictures of this unit (generator field, under the retaining rings)? [Not at this time](#)
14. Is it possible to get a copy of the report from the 2018 repairs that were performed? [See attached Documents](#)
15. Does the plant have any drawings for this unit? [Yes](#)
16. Can JPS provide a picture of the actual generator nameplate? [Attached below](#)

Section	Paragraph	Question
1.3 Project Scope/Objectives	Provision of parts.	The paragraph mentions that JPSCo will provide all parts. Please provide a list of the parts that JPSCo is providing. Diodes and spares for Grounds fault detection system
7.10 Distribution of Responsibilities	Tooling/Equipment	Please confirm if the specialized tooling to remove the generator rotor was originally supplied with the unit. Specialized tools for removal of Generator field are on site.
	Supplies	Please provide a photo of the generator supports that JPSCo will provide. See attached pics
Appendix III	Inspection, Testing, and Hand Cleaning of Components	Please confirm if the magnetic-particle inspection should only be performed on the areas of the rotor that are easily accessible; i.e., rotor ends and couplings. Yes this is correct.
	Inspection, Testing, and Hand Cleaning of Components	Please confirm if JPSCo will provide the sandblasting equipment and blasting media for this activity. The resource is available on the island we can put you InTouch with contractors that offer this service.
	Bore Lead Replacement	a. Please confirm if JPSCo would consider a full-rewind of the generator field rotor (with existing copper) at a qualified service center. This can be offered as an option for cost comparison in your proposal
	Two-Coil Rewind Utilizing Existing Copper and New Insulation	

Generator Name Plate



Air Cooled Generator

GENERATOR NO. 290T608

2 POLES 3 PHASE WYE CONN. 50 HERTZ

TOTAL TEMPERATURE AT RATING

GUARANTEED NOT TO EXCEED:

124° C ON ARMATURE BY DETECTOR

120° C ON FIELD BY RESISTANCE

MAXIMUM COLD AIR TEMPERATURE 41°

INLET WATER: 37.5°C

RATING

PEAK
CAPABILITY

KVA: 50588

ARMATURE AMPS: 2540

ARMATURE VOLTS: 11500

FIELD AMPS: 810

EXCITATION VOLTS: 155

POWER FACTOR: 0.85

RPM: 3000

CAUTION! BEFORE INSTALLING, OPERATING OR DISMANTLING, READ INST. V01488

GE Power Systems

General Electric Company

Manufactured by

ELIN

In Weiz, Austria
Elin S/N

Specialized Tools



JPS Bogue Station

Montego Bay

290T608



Image #1

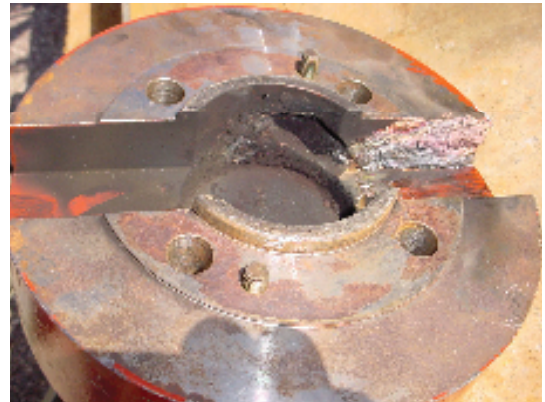


Image #2



Image #3

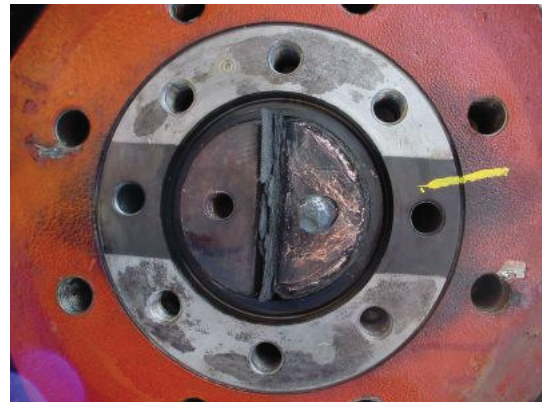


Image #4

Photo Layout

JPS Bogue Station

Montego Bay

290T608



Image #5



Image #6



Image #7



Image #8

Photo Layout

JPS Bogue Station

Montego Bay

290T608



Image #9



Image #10

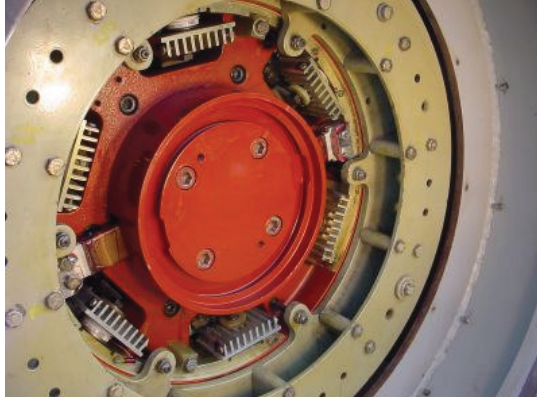


Image #11



Image #12

Photo Layout

JPS Bogue Station

Montego Bay

290T608

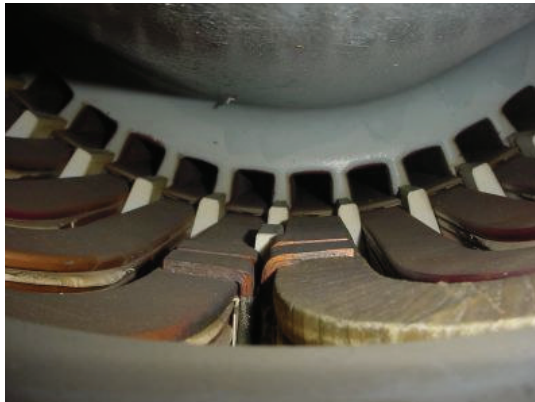


Image #13

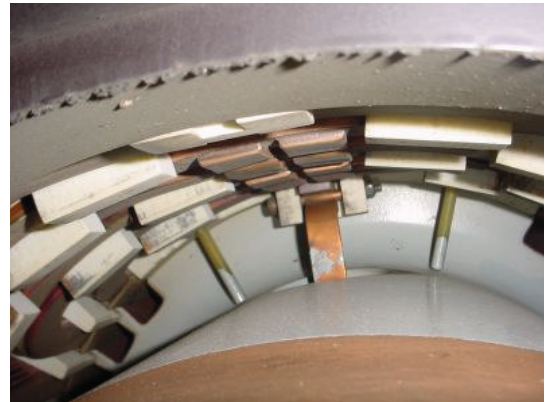


Image #14

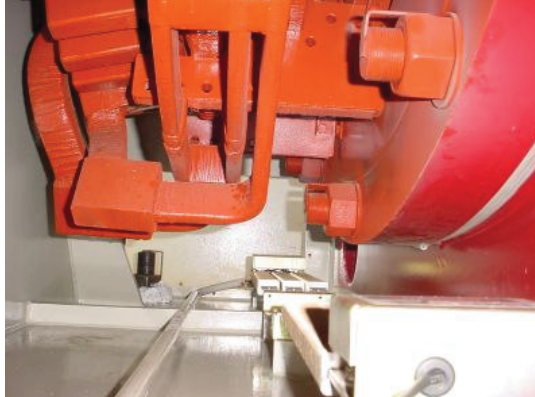


Image #15

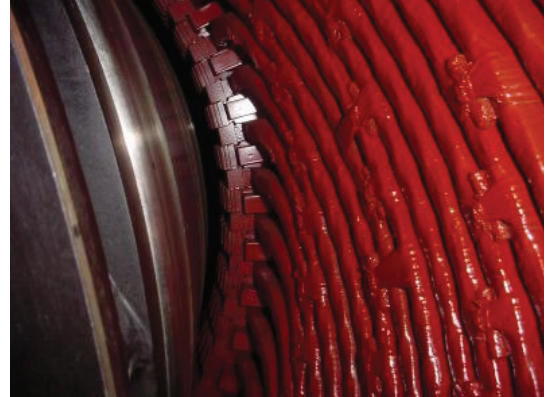


Image #16

Photo Layout



GENERATOR INSPECTION REPORT

Brushless Exciter Inspection and Repair

for

JAMAICA PUBLIC SERVICE COMPANY, LI
Bogue Station, Unit 14

Equipment Serial #: 290T608

Associated Turbine Serial #: 270T608

Job Start Date: 9/16/2005

Report Issued: 9/27/2005

FSR#: 94JM0127

Report Printed: September 27, 2005

Prepared By:
Carlos Dalmau
Field Engineer

Approved By:
Andres Jaramillo
Service Manager



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JOB SUMMARY

Customer: JAMAICA PUBLIC SERVICE COMPANY, LI
Station: Bogue Station
Unit No.: 14

Equipment Serial #: 290T608 Rating: 50 MW
Assoc. Turbine: 270T608 Service Year: 2003
Eng. Responsibility: Gen

Generator Stator Details:

Rating: 50 KVA Code: 6A6
KV: 12 Amps: 2540
Slots: 0 Circuits: 1
Max H2 Pressure: 0 #Turns per Coil: 1
Orig Serv Date: 6/1/2003
Insulation: GEGARD
Liquid Cooling Type: None
Gas Cooling Type: Air TEWAC
Support System: Conventional
Blocking: Conforming, Textolite
Ties: Glass Cord
End Winding: Radius Strip
Series Loop: Cap Inject Liq Cool
Wedge:
Ripple Springs: Side
Bushing Cooling: Not Applicable
Last Rewind Date:

Generator Field Details:

Field Serial #: 290T608 Forging Number: 290T608
Volts: 155 Amps: 810
RPM: 3000 Poles: 2
Field Cooling: Radial
End Winding: Round Corner
Retaining Ring Type: Body
Retaining Ring Matl: Non-Magnetic 18-18
Retaining Ring Dwg:
Last Rewind Date:

Service Type: Tech Direction



JOB SUMMARY

Office Location: JAMAICA FIELD SVCS
FSR#: 94JM0127
Service Manager: Andres Jaramillo
Service Director: Augusto Medina
Field Engineer: Carlos Dalmau

Job Start Date: 9/16/2005 Completion Date: 9/26/2005
Job Type: Maintenance

GE Site Personnel:

<u>Name</u>	<u>Responsibility</u>
Carlos Dalmau	Generator Specialist

Customer Site Personnel:

<u>Name</u>	<u>Responsibility</u>
Gaston Boyle	Mirant Electrical Engineer
David Stamp	Plant Manager
Alston Watson	
Chris Macfarlane	



JOB SUMMARY

This reports documents the activities performed during the Generator Unit 290T608 forced outage of Jamaica Public Service, Montego Bay Station. The outage was caused by a failure on the main leads connection from the diode wheel assembly of the rotating exciter to the bore copper of the generator field winding.

Some preliminary research showed that EX2000 was alarming days before the failure. Unfortunately the alarm is a "General EX2000 alarm" viewed at the steam turbine control and it does not specify what type of internal alarm is it.

Our primary target was to put the unit back into service. In order to do this a **temporary** patch was performed at the bore copper area and new diode wheel components were used. **THIS PATCH TO THE BORE COPPER CANNOT BE CONSIDERED AS PERMANENT. THIS FIX WILL ALLOW TO OPERATE THE UNIT WHILE JPS CAN PROGRAM AND OUTAGE AND REPLACE THE BORE COPPER IN A ROTOR PARTIAL REWIND. THIS SHOULD BE DONE NO LATER THAN SIX MONTHS FROM THE COMPLETION OF THIS OUTAGE.**

GE Engineering should be contacted in order to obtain proper information about parts replacement, material availability. The schedule of this outage can be prepared along with engineering recommendations.

On the EX2000, the Ground Field Alarm was changed to trip on unit 14. As a recommendation in this area, it should be considered by JPS to send their maintenance and I&C engineers to Salem, VA. This is to obtain the EX2000 training certification since it's very important that this personnel understands and know how to troubleshoot the EX2000.

Attached to this report is all the data obtained from the electrical testing performed during this outage.

Pictures of the as-found condition and the repairs of the bore copper and diode wheel assembly are also included in this report.



INSPECTION SUMMARY

Inspection No.	Shift No.	<u>Section</u> Component	Location	Description	Action
8		<u>Stator</u> End Winding	CE, TE	Visual Inspection	Good Condition - No Visual Defects
1		Winding	CE	Electrical Testing	Results Acceptable
5	1	<u>Field</u> Bore Copper	CE	Burned	Repaired
3		Winding	CE	Electrical Testing	Results Acceptable
7	1	<u>Excitation System</u> Detector	Ground	Defective	Used As Is - Warrants Replacement
6		System		Software	Software Update
4	1	<u>Exciter Rotor</u> Diode	CE	Burned	Replaced
2	1	Winding	CE	Electrical Testing	Results Acceptable



RECOMMENDATIONS

SHOULD BE DONE IMMEDIATELY...

1. Field; Bore Copper; CE

THIS PATCH TO THE BORE COPPER CANNOT BE CONSIDERED AS PERMANENT. THIS FIX WILL ALLOW TO OPERATE THE UNIT WHILE JPS CAN PROGRAM AND OUTAGE AND REPLACE THE BORE COPPER IN A ROTOR PARTIAL REWIND. THIS SHOULD BE DONE NO LATER THAN SIX MONTHS FROM THE COMPLETION OF THIS OUTAGE.



RECOMMENDATIONS

SHOULD BE DONE AT THE NEXT OUTAGE...

1. Stator; Winding; CE

Insulation and polarization index show be performed at the next unit outage. Results should be compared with this report. Any abnormally should be reported to GE Engineering.

2. Field; Winding; CE

Winding resistance, Insulation and polarization index show be performed at the next unit outage. Results should compared with this report. Any abnormally should be reported to GE Engineering.

3. Excitation System; Detector; Ground

An outage should be planned to replace the Diode Fault Monitor transmitter. The amount of time required to disassembly the rotating exciter, replace the sensor and re-assembly will be approximately around 3 to 4 shifts.

4. Exciter Rotor; Winding; CE

Insulation and polarization index show be performed at the next unit outage. Results should be compared with this report. Any abnormally should be reported to GE Engineering.



GENERATOR STATOR

Stator

End Winding; CE, TE

Visual Inspection on the end windings on both ends of the generator was performed. The generator end windings are clean and the overall condition is good. No components were found defective and all blocking was in good condition.

Images 15 and 16 show the typical condition of this generator's end windings.

Stator

Winding; CE

Electrical testing was performed on this generator. A 5000 Vdc megger was used. JPS performed the test and results were copied into this report. From the obtained data it can be concluded that the generator stator is in good condition. Insulation level is good and the polarization index is above the GE recommended value of 2.

Insulation and polarization index show be performed at the next unit outage. Results should be compared with this report. Any abnormally should be reported to GE Engineering.

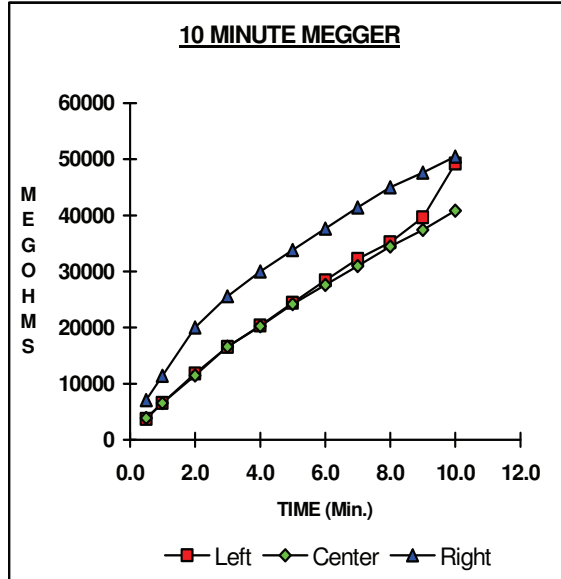


Armature Insulation Resistance / HV Proof Tests

Date 9/19/2005 Generator Serial No. 290T608 Prepared by Carlos Dalmau
 Manufacture GE ELIN Turbine Serial No. 270T608
 Customer JPS BOGUE FSR No. 97M0001
 Sketch No. _____

DC INSULATION RESISTANCE (Megohms)
 Voltage: 5000 Volts

Time(Min)	Left	Center	Right
0.5	3680	3860	7050
1.0	6600	6550	11400
2.0	11800	11500	20000
3.0	16500	16600	25600
4.0	20400	20200	30000
5.0	24400	24200	33800
6.0	28400	27600	37600
7.0	32200	31000	41400
8.0	35200	34400	45000
9.0	39600	37400	47600
10.0	49200	40800	50500
PI	7.5	6.2	4.4



HIGH VOLTAGE PROOF TEST

(One minute test on each phase with the other phases grounded.)

Rated Voltage (E): _____ KV

Test At:

60 Hz	_____
0.1 Hz	_____
DC	_____

RECOMMENDED TEST VOLTAGES

AC Test Voltage (60 Hz): _____ KV

AC Test Voltage (0.1 Hz): _____ KV

DC Test Voltage: _____ KV DC

Actual Test Voltage: _____ KV

	LEFT	CENTER	RIGHT
Passed test at	_____	_____	_____
Failed test at	_____	_____	_____

Winding Temp:	_____	C
Wet Bulb:	_____	F
Dry Bulb:	_____	F
Rel. Humidity:	_____	%

AC HIPOT DATA (60 HZ) if applicable:

Test Set: _____

	LEFT	CENTER	RIGHT
Excitation Voltage	_____	_____	_____
Current (Amps)	_____	_____	_____

Polarization Index	_____
PI = 10min/1min	_____

Comments:	_____

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GENERATOR FIELD

Field

Bore Copper; CE

The bore copper is the component that took most of the damage. The insulation between the bore copper was totally burned at that area. The insulation around both bars of the bore copper was damaged too. It can be noticed on image 3 and 4 the bore copper that took most of the damage as it still had a melted bolt into the bore copper. The insulation of the bore copper was carbonized due to the extreme heat on that area.

To perform a partial fix in this area two areas were addressed:

1- The insulation between the bore copper. The burned insulation was partially removed using a file and sand paper. A piece of G11 was cut and reduced to a size were it could introduced between the bore copper. Then it was glued with Barco Bond in place. The area where the copper was removed due to the high temperatures during the incident was filled with Barco Bond too.

2- The insulation around the bore copper was protected with Nomex 5 mills thick. The Nomex was glued with Barco Bond to the bore copper insulation and then pressed together with varnished glass tape.

Images 5 and 6 show the cleaned bore copper area after the burnout and image 10 show the bore copper with the patch fix.

After the patch was completed electrical testing were performed to verify the integrity of the insulation.

Images 12, 13 and show a good visual condition of the rotor winding under the retaining ring, the slots ventilation paths and the main terminal stud to the rotor windings.

THIS PATCH TO THE BORE COPPER CANNOT BE CONSIDERED AS PERMANENT. THIS FIX WILL ALLOW TO OPERATE THE UNIT WHILE JPS CAN PROGRAM AND OUTAGE AND REPLACE THE BORE COPPER IN A ROTOR PARTIAL REWIND. THIS SHOULD BE DONE NO LATER THAN SIX MONTHS FROM THE COMPLETION OF THIS OUTAGE.



GENERATOR FIELD

Field

Winding; CE

Electrical testing was performed on the generator field. A 500 Vdc megger was used. JPS performed the test and results were copied into this report. From the obtained data it can be concluded that the generator rotor is in good condition. Insulation level is good and the polarization index is above the GE recommended value of 1.

Winding resistance was also obtained using a DLRO. The obtained values are good are were compared to the factory measured values at 25 0C.

Pole Balance Test was performed showing a good balance between both field winding poles. The test was performed using AC voltage.

AC Impedance test was performed using a variac stepping the voltage on 10 volts increments. The plot from the results show a linear pattern which is usually an indication of no turn to turn shorts.

Winding resistance, Insulation and polarization index show be performed at the next unit outage. Results should compared with this report. Any abnormally should be reported to GE Engineering.



Field Measurements

Pole Balance Test

Date (m/d/y) 9/21/2005 Generator Serial No. 209T608 Prepared by C DALMAU
 Customer JPS BOGUE Turbine Serial No. _____ FSR # _____
 Manufacturer GE - ELIN

POLE BALANCE TEST

Apply approximately 100 volts AC or 15-20 volts DC across the collector rings. Measure the voltage drop from the inboard ring to the pole-to-pole connector. Measure the voltage drop from the outboard ring to the pole-to-pole connector. Also measure the applied voltage, across the collector rings.

Test Data:

- Inboard collector ring to pole-to-pole connector
- Outboard collector ring to pole-to-pole connector
- Applied voltage across both collector rings

Measured Voltage

57.1	Volts
57.0	Volts
114.1	Volts

Applied Voltage

AC	<input checked="" type="checkbox"/>
DC	<input type="checkbox"/>

Calculated Values:

1) The voltages from each collector ring to the pole-to-pole connector should add to approximately the same value as the applied voltage measured across both collector rings. If the sum is not approximately the same, the test should be repeated with a more stable test voltage supply, and more accurate measurements. The error should be less than 3%.

Inboard collector ring to pole-to-pole connector (Test 1)	57.1	Volts
Outboard collector ring to pole-to-pole connector (Test 2)	57.0	Volts
Sum of voltages (Test 1 plus Test 2)	114.1	Volts
Applied Voltage across both collector rings (Test 3)	114.1	Volts
	GOOD	

2) If no shorted turns exist, the voltages from each collector ring to the pole-to-pole connector should be approximately equal. The error should be less than 2% when comparing these voltages.

Percent voltage from inboard ring to connector	50%
Percent voltage from outboard ring to connector	50%
Comparison of inboard ring to outboard ring voltages	GOOD

Discussion:

If there are equal number of turns on each pole and no shorted turns exist, then the applied voltage across the collector rings will divide equally across each pole. If a shorted turn exists within one pole, the resistance and reactance of that pole will be less than the opposite pole. This will cause a lower test voltage to appear across the pole with the shorted turn. This test voltage imbalance will be more pronounced as the number of shorted turns increase.

Comments:
ROTOR INSIDE STATOR, MEASURE FROM COLLECTOR END.

Pole Balance D316313(a)



EXCITATION

Excitation System

System:

EX2000 settings were modified in the steam unit to perform a trip when a ground fault condition was detected on the rotor. The original settings were to alarm the EX2000 when a ground condition was detected.

Exciter Rotor

Diode; CE

This unit was forced out of service due to a failure of the rotating excitation system. Apparently one of the main leads got loose and it caused a permanent ground that melt of main leads connectors. The diode wheel assembly was severely damaged, one of the diodes and heat sink were damaged too. After removing the diode wheel assembly the diode wheel forging was found damaged at the same location where the diode failed.

All components were removed from the diode wheel assembly except the diode wheel forging. New diodes, heat sinks and bolts were installed and it was verified their correct operation. The original diode failure monitor and field ground monitor transmitters were cleaned, revised and installed back on the diode wheel assembly.

Images 7 and 8 show the original condition of the diodes and the heat sink after the unit's failure.

Image 8 show the original condition of the diode wheel assembly after the unit's failure.

Image 11 show the condition of the diode wheel assembly after all components were installed on the rotor.



EXCITATION

Exciter Rotor

Winding; CE

Electrical testing was performed on this exciter rotor. A 500 Vdc megger was used. JPS performed the test and results were copied into this report. From the obtained data it can be concluded that the exciter rotor is in good condition. Insulation level is good and the polarization index is above the GE recommended value of 1.

Insulation and polarization index show be performed at the next unit outage. Results should be compared with this report. Any abnormally should be reported to GE Engineering.



Brushless Exciter Field Ground Detection System Inspection

Date(m/d/y) 9/26/2005 Generator Serial No. 290T608 Prepared by Carlos Dalmau
 Turbine Serial No. _____
 Field Serial No. 290T608 FSR No. 94JM0127
 Exciter Serial Number _____ Sketch No. _____

A. FIELD GROUND DETECTOR VISUAL

	Satisfactory	Remarks
1. Rotor Mounted Transmitter	OK	
a) Physical Damage	OK	
b) Broken Light Emitting Diodes	OK	
2. Stationary Receiver Condition	OK	
3. Relay alarm Panel Condition	OK	
4. Transmitter Lead Condition	OK	
5. Receiver Lead Condition	OK	

B. TRANSMITTER CIRCUIT

	Satisfactory	Remarks
1. Transmitter Operational Check	OK	

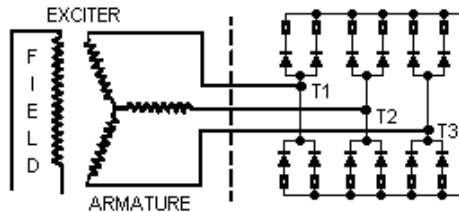
C. RECEIVER OPERATIONAL TEST (Fluorescent Light Needed)

	Satisfactory	Remarks
	NOT OK	FAILED DIAGNOSTIC TEST

D. RELAY ALARM PANEL TEST

	Satisfactory	Remarks
1. Timer	N/A	
2. Electrical Check Out	N/A	

E. WINDING RESISTANCE



	T 1-2	T 2-3	T 3-1	Field	PMG Stator
Resistance @ _____ °C					
Resist. Corrected to 25°C					
Factory Resist @ 25°C					
Prior Test Dt. _____					

*Most fields have a jumper to connect the two halves in series.
 Polarity of the two halves must be correct.

Comments:

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Brushless Exciter Inspection and Test

Date(m/d/y) 9/19/2005 Generator Serial No. 290T608 Prepared by Carlos Dalmau
 Turbine Serial No. _____
 Field Serial No. _____ FSR No. 97M0001
 Exciter Serial Number _____ Sketch No. _____

A. BRUSHLESS EXCITER INSPECTION

	Satisfactory	Remarks
1. PMG Rotor Condition	NA	
2. PMG Stator Winding Condition	NA	
3. Fuse Conditions	NA	
4. Diode Condition	OK	DIODE WHEEL WAS REPLACED
5. Exciter Stator Condition	OK	
6. Exciter Rotor Condition	OK	DIODE WHEEL WAS REPLACED
7. Overheating or Burning	YES	DIODE WHEEL WAS REPLACED
8. Hardware Secure	OK	
9. Cleanliness	OK	CLEANED AND PAINTED DURING THIS REPAIR

B. DC INSULATION RESISTANCE (MEGGER) @ =< 500 VOLTS.

Time (min.)	Diode Wheel and Armature	Field
0.50	545	476
1.00	525	515
2.00	600	580
3.00	695	585
4.00	715	605
5.00	765	620
6.00	780	635
7.00	770	640
8.00	770	650
9.00	765	645
10.00	760	655
PI	1.45	1.27

Field Temp. 41 °C
 Excit. Temp 34 °C
 Air Temp. 34 °C
 Wet Bulb _____ °C
 Dry Bulb _____ °C
 Rel. Humidity 70 °C

Note: Short Diodes Before Megohm Test

Polarization Index PI=(10min/1min)

Comments:
AFTER DIODE WHEEL ASSEMBLY AND BORE COPPER PATCH

D317106(a).xls