NEXTera ENERGY	TRANSFORMER SPECIFICATION PARKHILL T.S. DETAIL REQUIREMENTS	Spec. No. Exhibit 1 Rev. No. 0 Date 7/20/12 Page 1 of 3

TRANSFORMER RATINGS

Application: (Wind Farm / Solar) Generator Step-Up (GSU)

Phase	3	Cooling	HV Volts		XV Volts		YV Volts		ZV(TV) Volts		Sound Level dBA
Frequency	60	Class	525 kV		121 kV						
Cooling medium	Oil	Connection	Wye		Delta						
Phasor Diagram	YND1	ONAN	135	MVA	135	MVA		MVA		MVA	75@
Oil preservation	Conservator	ONAF	180	MVA	180	MVA		MVA		MVA	Top
	/diaphragm	ONAF	225	MVA	225	MVA		MVA		MVA	ONAF

ADDITIONAL TAP VOLTAGES

Terminal	Style	Taps or kV	Capacity
HV	MR	± 10 % HV Line Voltage (33 Taps ULTC)	Full Capacity ULTC
XV	N/A	N/A	

PERCENT IMPEDANCE VOLTS

%	Windings	At MVA
10.0	H - X	135 MVA
	H - Y	
	X - Y	

TEMPERATURE RISES

	°C	MVA
Winding	≤65	Top ONAF
Metallic Part	≤100	Top ONAF
Metallic Part in contact with paper	≤80	Top ONAF
Top Oil	≤65	Top ONAF

PD = <300 pC
RIV = < 100 uV

Winding and Bushing Ratings

Terminal	Winding MVA	Winding Voltage (kV)	Winding BIL (kV)	Winding Ampere (A)	Bushing Class (kV)	Bushing BIL (kV)	Bushing Ampere (A)	Min Strike Dist Ph to Ph	Min Strike Dist Ph to Gnd	Ext. Creep
HV Line	225	525	1550		525	1675				
HV Neutral			200		36	200				
XV Line	225	121	550		145	650				
XV Neutral										
YV Line										
YV Neutral										

UNUSUAL SERVICE CONDITIONS
Yes x No (Check one) – Conform to CSA-C88-M90

Ambient Temp. in ºC (Max, Avg, Min)	38, 20, -30
Elevation/Wind Speed	See Exhibit 2
Seismic Zone Designation (see Appendix H)	See Exhibit 2
Snow/Ice Accumulation (under energized, but no load)	See Exhibit 2
Short-time emergency Overloading (except GSU)	See IEEE C57.91-1995 Table 8
Long-time emergency Overloading (except GSU)	
Abnormal harmonic currents solid-state short circuits	no
Geomagnetically Induced Current (GIC) location	yes
High-current isolated-phase bus duct connection	no
Parallel operation	yes
Neutral grounding resistor	no

FOUNDATION
Specific Details and Measurements

Foundation Type:	
Distance from Center of Foundation:	
To Segment 1	
To Segment 2	
To Segment 3	
To Segment 4	**LOSS EVALUATION**
No Load losses per kW will be evaluated at	See Appendix F
Load losses per kW will be evaluated at	See Appendix F
Auxiliary losses per kW will be evaluated at	See Appendix F

Exhibit 1 **NEXTERA ENERGY Transformer Detailed Requirements**

Prolec GE is providing the attached proposal drawing and mechanical data for a 135//225MVA-525kV-121kV transformer. Note that this drawing is not for construction.

Jim Roomy

Account Manager – GE Digital Energy

(954) 478-4694 phone

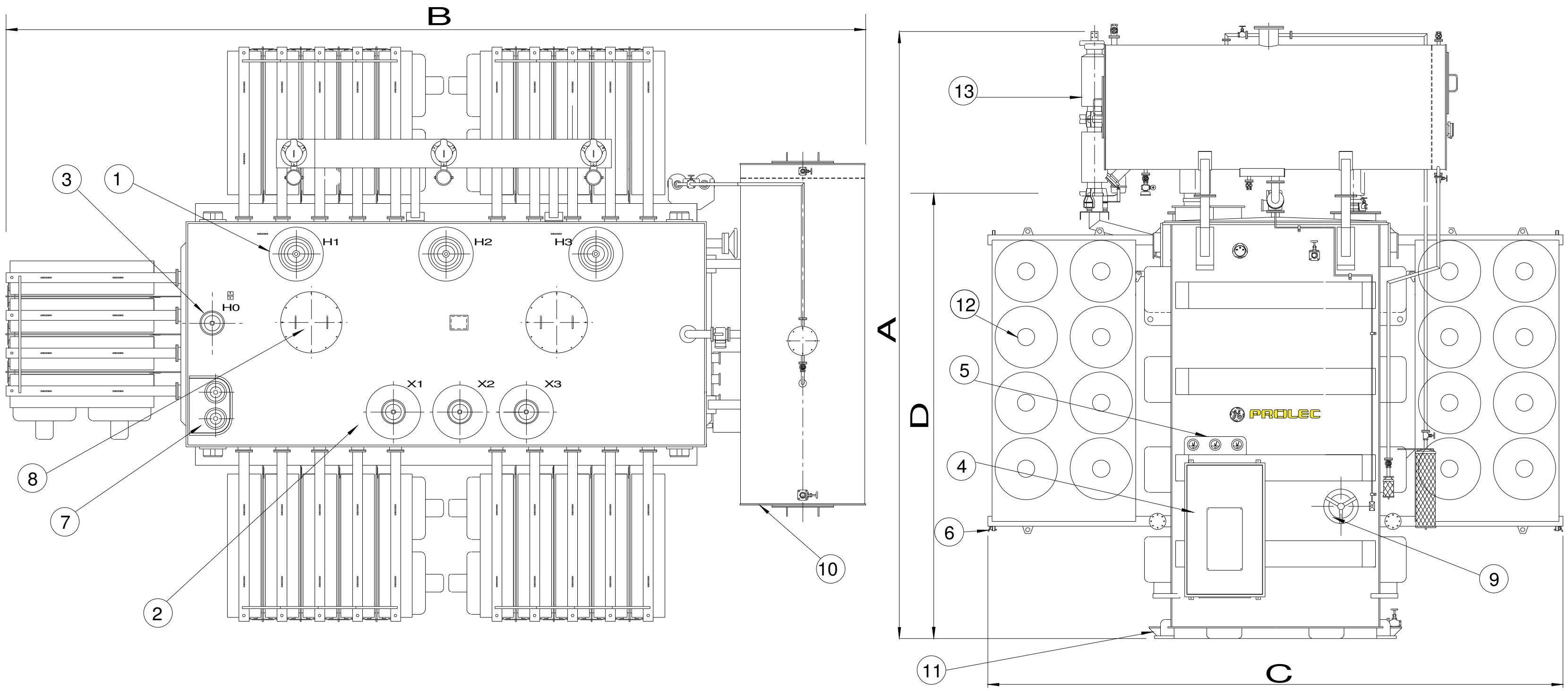
jim.roomy@ge.com

<<Parkhill Transformer - Outline Drawing - BB15.doc>>

MECHANICAL DATA

Not for Construction Purposes

Dimensions (Approximate)		Ft. (Mts.)
Height	(A)	26.9 (8.20)
Width	(B)	40.4 (12.30)
Depth	(C)	19.4 (5.95)
Height over Cover	(D)	14.6 (4.45)
Untanking (Plus slings)	(E)	27.4 (8.35)
Shipping Dimensions:Ft	W x D x H	28.1 x 12.5 x 14.6
Masses (Approximate)		pounds (Kg)



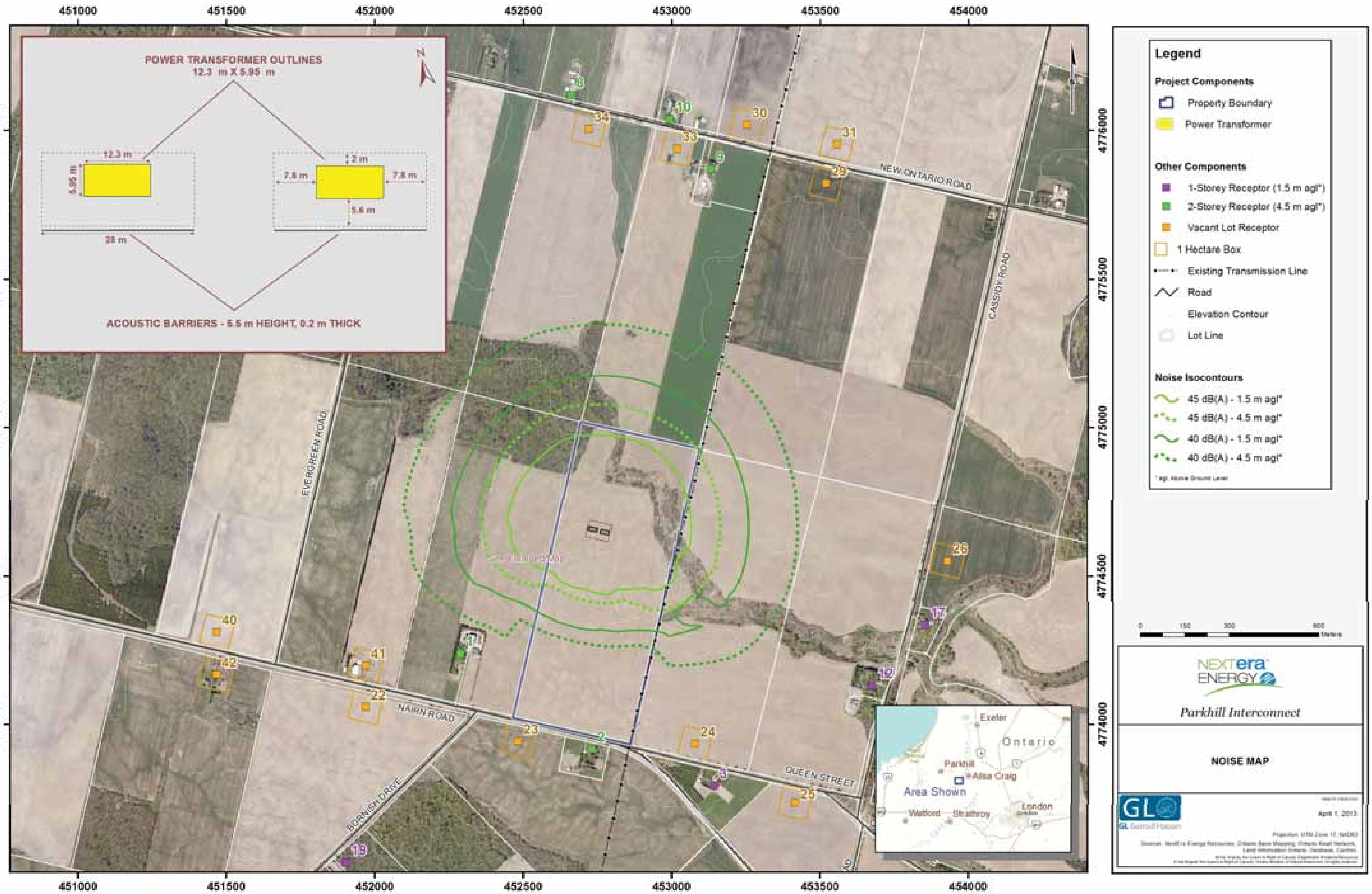
1.- H. V. BUSHINGS "H"
2.- L. V. BUSHINGS "X"
3.- NEUTRAL BUSHING
4.- CONTROL CABINET
5.- INSTRUMENTS
6.- RADIATORS
7.- MECHANICAL PRESSURE DEVICE
8.- MANHOLE
9.- NO LOAD TAP CHANGER
10.- CONSERVATOR TANK
11.- BASE
12.- FANS (IF SUPPLIED)
13.- H.V. SURGE ARRESTERS (IF SUPPLIED)

NOTE: THIS DRAWING IS A PRELIMINARY PROPOSAL AND DOES NOT INDICATE THE EXACT DETAILS OF CONSTRUCTION, ARRANGEMENT OF ACCESSORIES OR THE FINAL DIMENSIONS OF THE TRANSFORMER. THIS INFORMATION SHOULD NOT BE USED FOR FINAL CONSTRUCTION ARRANGEMENTS OR FOR THE FOUNDATION UNLESS SPECIFICALLY APPROVED BY THE FACTORY. ALL DIMENSIONS AND WEIGHTS ARE APPROXIMATE

PROLEC

Drawing:
No. BB15

APPENDIX D SIMULATED NOISE ISO-CONTOURS



451000
451500
452000
452500
453000
453500
454000
4776000
4775500
4775000
4774500
4774000
POWER TRANSFORMER OUTLINES
12.3 m X 5.95 m
12.3 m
5.95 m
28 m
2 m
7.8 m
7.8 m
5.6 m
ACOUSTIC BARRIERS - 5.5 m HEIGHT, 0.2 m THICK
N
NEW ONTARIO ROAD
CASSIDY ROAD
EVERGREEN ROAD
NAIRN ROAD
QUEEN STREET
BORNISH DRIVE
Legend
Project Components
Property Boundary
Power Transformer
Other Components
1-Storey Receptor (1.5 m agl*)
2-Storey Receptor (4.5 m agl*)
Vacant Lot Receptor
1 Hectare Box
Existing Transmission Line
Road
Elevation Contour
Lot Line
Noise Isocontours
45 dB(A) - 1.5 m agl*
45 dB(A) - 4.5 m agl*
40 dB(A) - 1.5 m agl*
40 dB(A) - 4.5 m agl*
* agl: Above Ground Level
Meters
NEXTera ENERGY
Parkhill Interconnect
NOISE MAP
Exeter
Ontario
Parkhill
Ailsa Craig
Area Shown
Watford
Strathroy
London
GL Garrad Hassan
April 1, 2013
Projection: UTM Zone 17, NAD83

APPENDIX E POINT OF RECEPTION NOISE IMPACT TABLE

The following table represents the contribution of every noise source on the most-impacted PoR and VLR as per [2].

Source ID	Point of Reception 1		Point of Reception 24	
	Distance to PoR 1 [m]	**Sound Level at PoR 1 [dBA] [1]**	**Distance to PoR 24 [m]**	**Sound Level at PoR 24 [dBA] Day[1]**
T1	610	36.7	800	31.4
T2	635	34.7	775	33.2
TOTAL		**38.8**		**35.4**

1- 5 dBA tonal penalty included.
2- Effect of Sound Barrier included

Appendix C: Equipment Noise Emission Data and Calculations

SWT-2.3-113, Rev. 1, Max. Power 2030 kW Contract Acoustic Emission, Hub Height 99.5 m Ontario - Canada

Sound Power Levels

The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 99.5 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (LWA) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Up to cut-out**
Max. Power 2030kW	96.4	101.3	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0

Table 1: Acoustic emission, L_{WA} [dB(A) re 1 pW]

Typical Sound Power Frequency Distribution

Typical spectra for L_{WA} in dB(A) re 1pW for the corresponding centre frequencies are tabulated below for 6 - 10 m/s referenced to a height of 10.0 m above ground level.

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	**6**	**7**	**8**	**9**	**10**
63	84.3	83.6	83.1	83.2	82.9
125	90.2	89.0	88.1	87.6	86.7
250	96.4	95.5	95.1	94.5	93.8
500	95.2	95.5	95.5	95.3	95.1
1000	96.0	96.3	96.1	96.0	96.3
2000	94.4	94.7	95.2	95.4	95.9
4000	83.8	87.0	89.3	91.2	91.4
8000	66.9	70.7	73.1	73.1	73.0

Table 2: Typical octave bands for 6-10 m/s, L_{WA} [dB(A) re 1 pW]

Tonality

Typical tonal audibility for the Siemens wind turbine generators has not exceeded 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

A measurement uncertainty range of -1.5dB(A) to +1.5dB(A) is applicable.

SWT-2.3-113, Rev. 1, Max. Power 2126 kW Contract Acoustic Emission, Hub Height 99.5 m Ontario - Canada

Sound Power Levels

The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 99.5 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (LWA) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Up to cut-out**
Max. Power 2126kW	96.5	102.3	103.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0

Table 1: Acoustic emission, L_{WA} [dB(A) re 1 pW]

Typical Sound Power Frequency Distribution

Typical spectra for L_{WA} in dB(A) re 1pW for the corresponding centre frequencies are tabulated below for 6 - 10 m/s referenced to a height of 10.0 m above ground level.

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	**6**	**7**	**8**	**9**	**10**
63	84.6	83.9	83.3	83.4	83.2
125	90.6	89.3	88.5	88.0	87.2
250	97.0	96.3	96.3	95.7	95.0
500	96.7	96.9	97.0	96.9	96.6
1000	97.4	97.7	97.0	97.0	97.3
2000	95.0	95.2	96.0	96.2	96.8
4000	84.0	87.0	89.3	91.2	91.4
8000	66.3	70.4	73.0	73.1	73.0

Table 2: Typical octave bands for 6-10 m/s, L_{WA} [dB(A) re 1 pW]

Tonality

Typical tonal audibility for the Siemens wind turbine generators has not exceeded 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

A measurement uncertainty range of -1.5dB(A) to +1.5dB(A) is applicable.

SWT-2.3-113, Rev. 1, Max. Power 2221 kW Contract Acoustic Emission, Hub Height 99.5 m Ontario - Canada

Sound Power Levels

The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 99.5 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (LWA) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Up to cut-out**
Max. Power 2221kW	96.6	102.6	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0

Table 1: Acoustic emission, L_{WA} [dB(A) re 1 pW]

Typical Sound Power Frequency Distribution

Typical spectra for L_{WA} in dB(A) re 1pW for the corresponding centre frequencies are tabulated below for 6 - 10 m/s referenced to a height of 10.0 m above ground level.

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	**6**	**7**	**8**	**9**	**10**
63	84.8	83.6	83.5	83.7	83.4
125	90.9	91.3	88.8	88.3	87.5
250	97.6	97.7	97.2	96.7	95.9
500	98.2	98.0	97.8	97.7	97.4
1000	98.8	98.7	98.0	98.0	98.3
2000	95.6	95.4	97.1	97.4	97.9
4000	84.1	87.8	90.8	92.7	92.9
8000	65.6	71.2	74.5	74.6	74.5

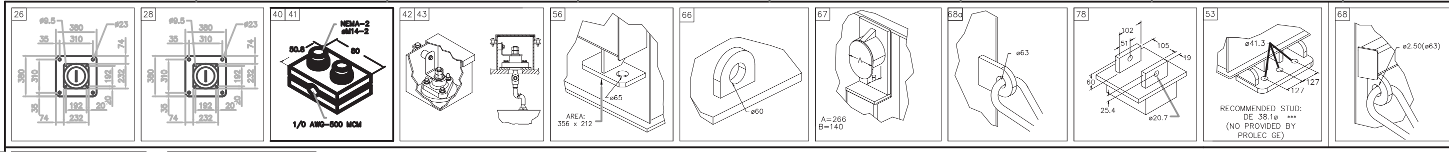
Table 2: Typical octave bands for 6-10 m/s, L_{WA} [dB(A) re 1 pW]

Tonality

Typical tonal audibility for the Siemens wind turbine generators has not exceeded 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

A measurement uncertainty range of -1.5dB(A) to +1.5dB(A) is applicable.



GUIDE		QTY.	ITEM	DESCRIPTION	CAT./MOD.
		1	1d	LIQUID TEMPERATURE INDICATOR (26Q-1)	QUALITROL, 104-885-03
		1	2d	THERMO-WELL FOR LIQUID TEMPERATURE INDICATOR	
5.4	*	2	4	PRESSURE RELIEF DEVICE WITH SEMAPHORE (63PR-1,2)	QUALITROL, 208-60F
5.6	*	1	5	RAPID PRESSURE RELAY (OIL) (63FP-1)	QUALITROL, 900-003-02
		1	5b	RAPID PRESSURE RELAY VALVE (2.00 ø) BALL-TYPE	
		1	7	THERMO-WELL FOR RESISTANCE TEMPERATURE DEVICE FOR ETM (TOP)	
		1	10	ELECTRONIC TEMPERATURE MONITOR (INSIDE CONTROL CABINET)	APT, ECLIPSE-000H
		1	10a	RESISTANCE TEMPERATURE DEVICE FOR ETM (TOP OIL) RTD-1	
		1	10c	RESISTANCE TEMPERATURE DEVICE FOR ETM (AMBIENT) RTD-2	
		1	11	PRESSURE-VACUUM GAUGE FOR SHIPPING	QUALITROL, 050-35E
5.15	*	3	14	H.V. BUSHING EXTERNAL CONNECTOR	DELTA, PM50C12-1-4N4-E
5.15	*	3	14a	L.V. BUSHING EXTERNAL CONNECTOR	DELTA, PM80C12-1-422-M1-E
5.15	*	1	14d	NEUTRAL BUSHING H0 EXTERNAL CONNECTOR	BURNDY, FD67C12W
3.2	*	3	15	H.V. BUSHING	PCORE, POC650G1210CMS
3.2	*	3	16	L.V. BUSHING	ABB 034Z3000AS
3.2	*	1	19	NEUTRAL BUSHING H0	ABB 034Z0412UT
4.2	*	3	25	H.V. SURGE-ARRESTERS	SIEMENS, 3EQ4 108-2PK31-4NH5
	*	3	25a	H.V. BUSHING TO SURGE-ARRESTER FLEXIBLE CONNECTOR	
4.1	*	1	26	H.V. SURGE-ARRESTER SUPPORT	
4.2	*	3	27	L.V. SURGE-ARRESTER	SIEMENS 3EQ4 045-2PD31-4NH5
	*	3	27a	L.V. BUSHING TO SURGE-ARRESTER FLEXIBLE CONNECTOR	
4.1	*	1	28	L.V. SURGE-ARRESTER SUPPORT	
	*	5	37	H.V. SURGE-ARRESTERS GROUND CABLE CONNECTOR	
	*	5	37a	L.V. SURGE-ARRESTERS GROUND CABLE CONNECTOR	
	*	1	38	H.V. SURGE-ARRESTERS COPPER GROUND CABLE	
	*	1	38a	L.V. SURGE-ARRESTERS COPPER GROUND CABLE	
		5	40	GROUND PAD	
		1	41	NEUTRAL H0 GROUND PAD	
		1	42	CORE GROUND BUSHING TERMINAL BOX (MAIN UNIT)	
		1	43	FRAME GROUND BUSHING BOX	
		1	46	NAMEPLATE	
		7	46b	IDENTIFICATION NAMEPLATE	
		1	47	CONTROL CABINET	
		1	51	REINFORCED BASE WELDED TO TANK	
		4	53	TRANSFORMER ANCHOR PADS	
		13	55	TANK BRACES	
		4	55a	COVER BRACES	
		4	56	JACKING PADS AND PULLING EYES	
		1	57	MAIN COVER	
		3	58	INSPECTION MANHOLE (COVER)	
		2	60	INSPECTION RECTANGULAR MANHOLE (COVER)	
		3	65	CT TERMINAL BOX	
		4	66	LIFTING EYE COVER ONLY	
		4	67	LIFTING HOOK FOR LIFTING COMPLETE UNIT	
		4	68	SHIPPING LUGS FOR SECURING THE UNIT LONGITUDINALLY (SHORT LUGS)	
		4	68a	SHIPPING LUGS FOR SECURING THE UNIT LONGITUDINALLY (LONG LUGS)	
		1	72c	TOP FILTER PRESS VALVE (50.8 ø) GLOBE-TYPE	
		1	73	MAIN TANK DRAIN VALVE (50.8ø) GLOBE-TYPE WITH SAMPLING DEVICE (9.65) AND PLUG	
		1	74	IMPACT RECORDER FOR SHIPPING	
		1	74a	ELECTRONIC IMPACT RECORDER FOR SHIPPING	
1.3	*	9	75	COOLING RADIATORS	
		18	75b	RADIATOR VENT AND DRAIN PLUG (25.4 ø)	
		18	75c	RADIATOR VALVE BUTTERFLY-TYPE (101.6 ø)	
		24	75h	COOLING FAN	KRENZ, F26-A8678
1.4	*	4	75n	TOP/BOTTOM RADIATOR SUPPORTS	
1.2	*	7	75o	RADIATOR BRACE	
2.3	*	1	76	CONSERVATOR TANK WITH INTERNAL BLADDER	
2.1	*	2	76a	CONSERVATOR TANK SUPPORT	
2.2	*	1	76b	CONSERVATOR MAGNETIC LIQUID LEVEL GAUGE (71Q-1)	QUALITROL, 042-144-07
		1	76c	HANDHOLE TO INSTALL BLADDER	
5.8	*	1	76d	SILICA-GEL BREATHER WITH PIPE	MESSKO, DB200-RM-T
		2	76e	CONSERVATOR MANHOLE	
5.8	*	1	76f	SILICA-GEL SHUT OFF VALVE (12.7 ø) BALL-TYPE	
		1	76g	CONSERVATOR PRESSURE EQUALIZATION VALVE (25.4 ø) GLOBE-TYPE	
		1	76h	CONSERVATOR FILL VALVE (50.8 ø) GLOBE-TYPE	
		1	76i	CONSERVATOR DRAIN VALVE (50.8 ø) GLOBE-TYPE	
		1	76j	CONSERVATOR TANK NIPPLE FOR VENT WITH CAP.	
2.2	*	1	76k	CONSERVATOR TANK TO MAIN TANK VALVE (76.2 ø) BALL-TYPE	
		1	76l	GAS SAMPLING DEVICE	
5.13	*	1	76n	GAS ACCUMULATION DEVICE (63G-1)	QUALITROL, 038-002-02
2.4	*	1	76p	EXPANSION JOINT FOR PIPING	
		1	77	ON-LOAD TAP-CHANGER	MR, RMV-II-1500-72.5
		1	77a	LTC MAGNETIC LIQUID LEVEL GAUGE (71Q-2)	
		1	77b	LTC PRESSURE RELIEF DEVICE (63PR-4)	
		1	77i	LTC DRAIN VALVE (25.4 ø) GATE-TYPE WITH SAMPLING DEVICE (9.65 ø) AND PLUG	
5.8	*	1	77k	LTC SILICA-GEL BREATHER WITH PIPE	
		1	77l	LTC MOTOR DRIVE CABINET	
		1	78	TETHER POLE MOUNTING PLATE	
		2	79	VALVES FOR INSTALLATION OF A KELMAN MINITRANS DGA MONITOR (BALL TYPE)	

NOTES:
a) ITEMS REMOVED FOR SHIPMENT ARE MARKED WITH (*).
b) NUMBERING IS ACCORDING WITH G.E. PROLEC STD. LIST.
c) THE NUMBER IN COLUMN "GUIDE" CORRESPOND TO THE "IN-FIELD ASSEMBLY GUIDE".

OPERATION CENTER OF GRAVITY
SHIPPING CENTER OF GRAVITY

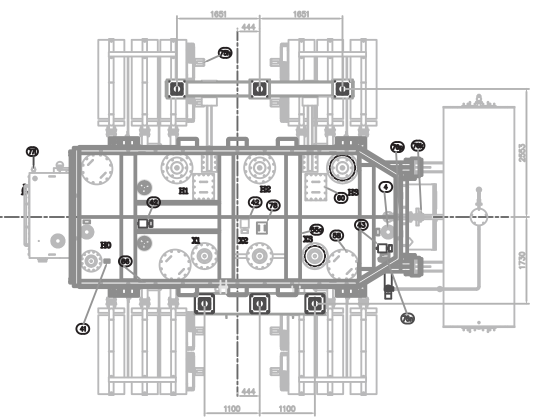
TOLERANCES

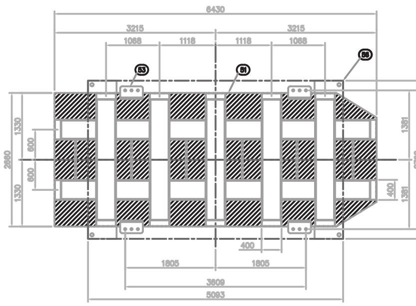
GENERAL ELECTRIC CANADA
P.O. No: 512-03118
GE Req No: TD7-04344
CUSTOMER ID: JERICHO
PROLEC GE Serial No: G2994-01

STEP UP TRANSFORMER
ONAN/ONAF/ONAF
102/136/170 MVA
60 HZ. THREE PHASE, 65°C, 1000 MASL
121/69.86 KV ⅄ – 34.5 KV ◁

APPROVAL DRAWING
FEB/15/2013
DEAR CUSTOMER :
WE WANT TO SERVE YOU BETTER. PLEASE REVIEW THIS DRAWING AND SEND BACK WITH YOUR COMMENTS TO PROLEC-GE IN THE TIMEFRAME OF 10 DAYS AFTER THE DATE MARKED IN THIS STAMP.

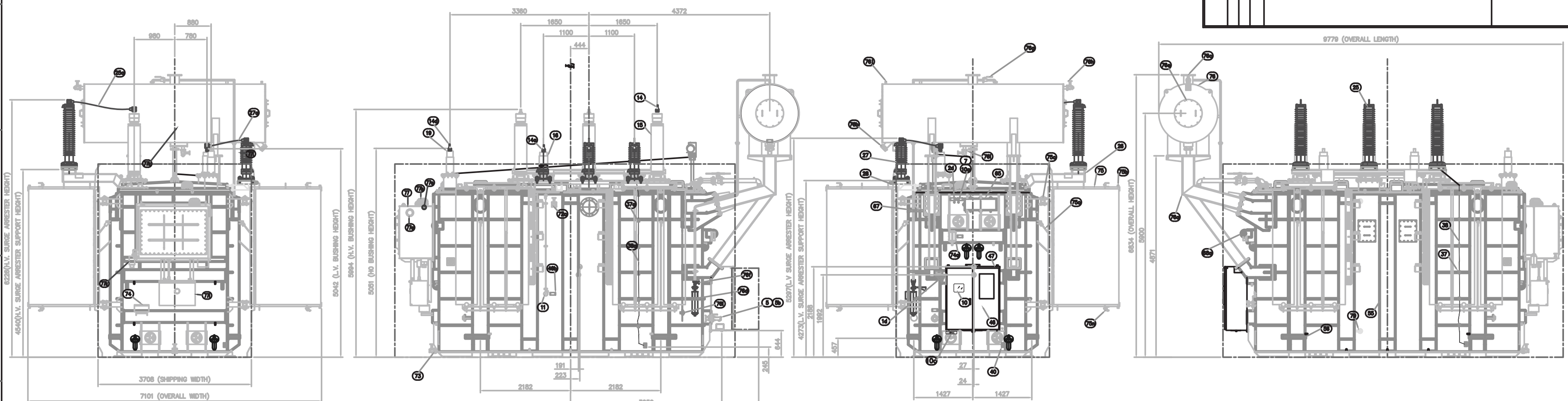
APPROXIMATE WEIGHTS (KGS)	
CORE AND COILS	94780
TANK AND FITTINGS	40330
MAIN TANK INSULATING LIQUID (45730 LTS)	41160
COOLING EQUIPMENT INSULATING LIQUID (4015 LTS)	3615
CONSERVATOR TANK INSULATING LIQUID (2355 LTS)	2120
LTC TANK INSULATING LIQUID (1300 LTS)	1170
TOTAL WEIGHT	183175
UNTANKING WEIGHT (HEAVIEST PIECE)	94780
SHIPPING WEIGHT (WITHOUT INSULATING LIQUID)	116240





SECTION A – A

* THE HATCHED AREA REPRESENT THE BOTTOM OF THE TRANSFORMER, THIS AREA IS NOT IN CONTACT WITH FOUNDATION OR PAD



REV	DESCRIPTION	DESIGN GROUP 2

PROLEC GE

THIS DRAWING CONTAINS PROPRIETARY INFORMATION WHICH CAN NOT BE REPRODUCED WITHOUT PERMISSION OF PROLEC GE.

PROLEC GE ENGINEERING POWER DIVISION
http://www.prolecge.com

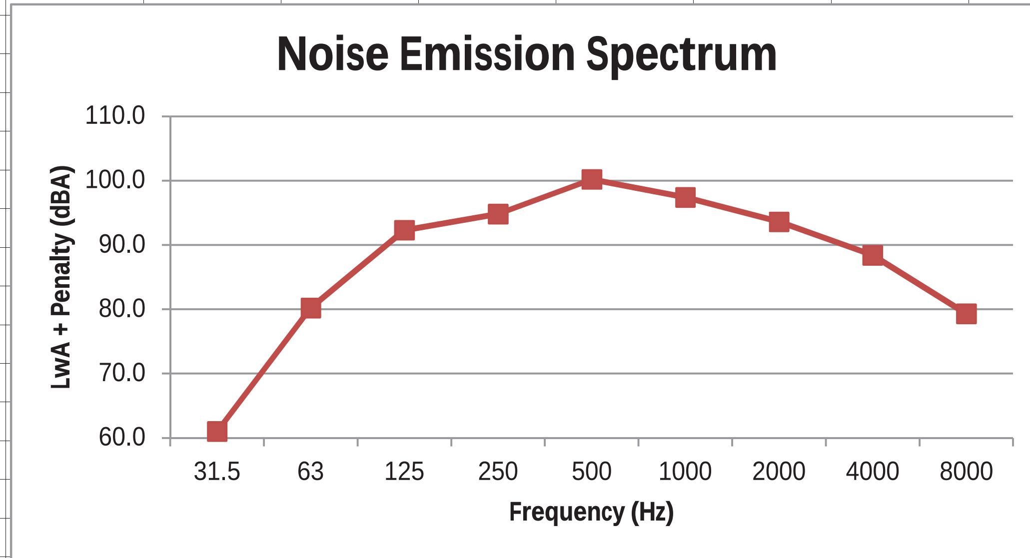
TITLE: TRANSFORMER'S OUTLINE

DFTM: CTC 01/18/2013
CHKD: CSP 01/18/2013

PROJECTION
SCALE: 1:45
DIMENSIONS: MM
REVISION: INDICATED
DRAWING NO.: G299401D801
sheet: 1 of 1

Transformer Noise Emissions

Noise Rating	**75.0**	**dBA**
Measurement Dist	0.30	m
Measurement Surface Area	238.7	m^2
Sound Power Level	98.78	dBA
Tonal Penalty	5.0	dB
Sound Power Level	103.8	dBA



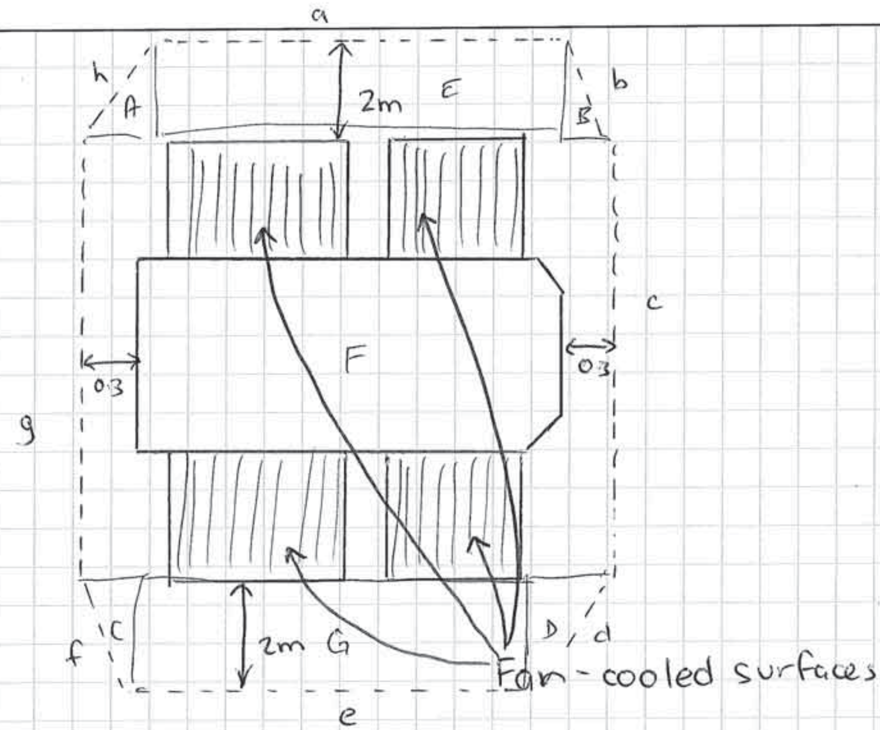
Octave Band Emission Estimates

Centre Frequency	Corr[1]	Ncor[2]	Lw	LwA	Tonal Penalty	Lw + Penalty	LwA + Penalty
31.5	-1.0	-2.37	95.4	56.0	5.0	100.4	61.0
63	5.0	-2.37	101.4	75.2	5.0	106.4	80.2
125	7.0	-2.37	103.4	87.3	5.0	108.4	92.3
250	2.0	-2.37	98.4	89.8	5.0	103.4	94.8
500	2.0	-2.37	98.4	95.2	5.0	103.4	100.2
1000	-4.0	-2.37	92.4	92.4	5.0	97.4	97.4
2000	-9.0	-2.37	87.4	88.6	5.0	92.4	93.6
4000	-14.0	-2.37	82.4	83.4	5.0	87.4	88.4
8000	-21.0	-2.37	75.4	74.3	5.0	80.4	79.3
Overall Sound Power Level			107.4	**98.78**		112.4	**103.8**

1. Correction from "Engineering Noise Control", David A. Bies and Colin H. Hansen
2. Normalization correction to ensure total sound power after band corrections does not exceed measured overall value

AECOM

JOB TITLE Jericho Wind Energy Centre
JOB NO. 60155032
ORIGINATOR AD
REVIEWER
SCALE
CALCULATION NO.
DATE Measurement Area
DATE Genset
SHEET NO. OF



Perimeter = a + b + c + d + e + f + g + h

$e = a = 6.43\,m$ (from drawing)

$f = h = d = b = \sqrt{2^2 + 0.3^2} = 2.02\,m$

$c = g = 7.10\,m$

∴ Perimeter = 35.14 m

Top Area = 4 triangles (A + B + C + D)
+ 2 Rectangles (E + G)
+ 1 Rectangle (F)

Area of A = B = C = D = $\frac{1}{2} \times 2 \times 0.3$
$= 0.6\,m^2$

Area of E = $a \times 2 = 12.86\,m^2$ = G

Area of F = $[a + (2 \times 0.3)] \times c$

$= 49.9\,m^2$

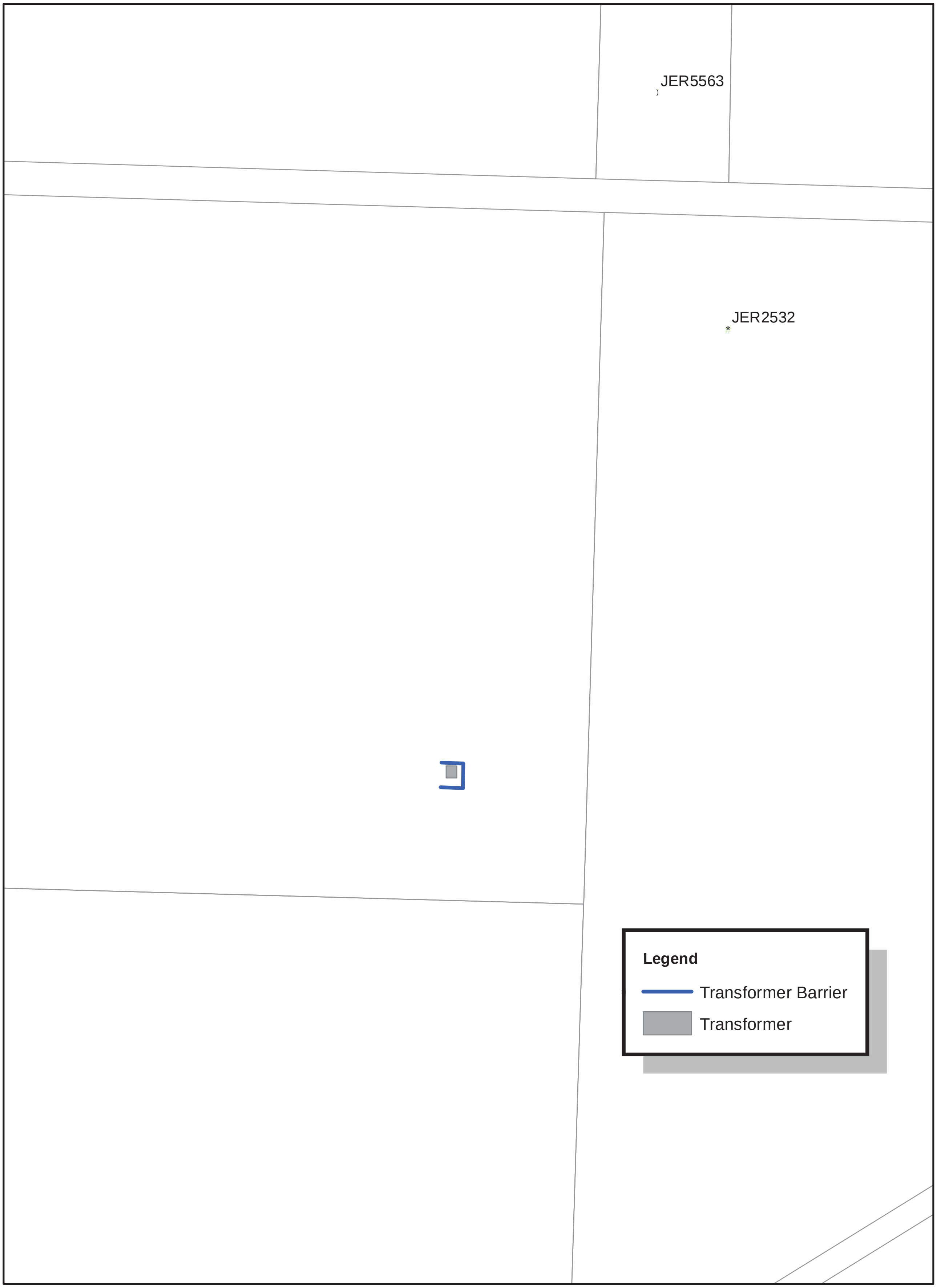
∴ Top area = $78.02\,m^2$

Side area = perimeter × (height + 0.3)
$= 35.14 \times 4.573 = 160.7\,m^2$

∴ Total area = ~~78.0~~ + 160.7

Area = $238.7\,m^2$

Grid: 5x5 = 1 in


JER5563
JER2532
Legend
Transformer Barrier
Transformer

GE Power & Water

– Original Instructions –

Technical Documentation Wind Turbine Generator Systems 1.6-100 with LNTE 50 Hz and 60 Hz

Product Acoustic Specifications

Normal Operation according to IEC
Incl. Octave Band Spectra
Incl. 1/3rd Octave Band Spectra

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Table of Contents

1 Introduction

This document summarizes the acoustic emission characteristics of the 1.6-100 with Low Noise Trailing Edge (LNTE) wind turbine for normal operation, including calculated apparent sound power levels $L_{WA,k}$, as well as uncertainty levels associated with the apparent sound power levels, tonal audibility, and calculated third octave band apparent sound power level.

All provided sound power levels are A-weighted.

GE continuously verifies specifications with measurements, including those performed by independent institutes. If a wind turbine noise performance test is carried out, it needs to be done in accordance with the regulations of the international standard IEC 61400-11, ed. 2.1: 2006 and Machine Noise Performance Test document.

2 Normal Operation Calculated Apparent Sound Power Level

The apparent sound power levels $L_{WA,k}$ are initially calculated as a function of the hub height wind speed v_{HH}. The corresponding wind speeds v_{10m} at 10 m height above ground level have been evaluated assuming a logarithmic wind profile. In this case a surface roughness of z_{0ref} = 0.05 m has been used, which is representative of average terrain conditions.

$$v_{10m} = v_{HH} \frac{\ln\left(10m / z_{0ref} \right)}{\ln\left(\text{hub height} / z_{0ref} \right)} \; ^{*}$$

The calculated apparent sound power levels $L_{WA,k}$ and the associated octave-band spectra are given in Table 1 and Table 2 for two different hub heights. The values are provided as mean levels as a function of v_{10m} for Normal Operation (NO) over cut-in to cut-out wind speed range. The uncertainties for octave sound power levels are generally higher than for total sound power levels. Guidance is given in IEC 61400-11, Annex D.

1.6-100 with LNTE – Normal Operation Octave Spectra									
Standard wind speed at 10 m [m/s]		3	4	5	6	7	8	9	10-Cutout
Hub height wind speed at 80 m [m/s]		4.2	5.6	7.0	8.4	9.7	11.1	12.5	14-Cutout
Frequency (Hz)	31.5	62.5	62.2	66.1	70.1	73.5	73.7	73.6	73.5
	63	72.1	71.9	75.9	80.3	84.0	84.1	84.1	84.0
	125	79.0	79.2	83.8	88.4	91.6	91.8	91.8	91.7
	250	84.0	84.6	89.4	94.7	95.4	95.3	95.4	95.5
	500	85.5	84.9	89.7	95.5	97.1	96.6	96.7	97.0
	1000	83.4	83.0	86.9	91.8	97.1	97.5	97.6	97.8
	2000	81.7	83.4	87.9	92.4	95.7	95.7	95.5	95.1
	4000	74.9	77.7	83.5	88.9	89.7	89.1	88.4	87.9
	8000	55.5	57.6	63.5	70.3	70.4	70.6	69.4	69.1
	16000	7.9	13.2	18.9	24.7	27.2	26.6	27.5	29.0
Total apparent sound power level $L_{WA,k}$ [dB]		90.4	90.7	95.3	100.5	103.0	103.0	103.0	103.0

Table 1: Normal Operation Calculated Apparent Sound Power Level, 1.6-100 with LNTE with 80 m hub height as a function of 10 m wind speed (z_{0ref} = 0.05 m), the octave band spectra are for information only

* Simplified from IEC 61400-11, ed. 2.1: 2006 equation 7

1.6-100 with LNTE – Normal Operation Octave Spectra									
Standard wind speed at 10 m [m/s]		**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10-Cutout**
Hub height wind speed at 96 m [m/s]		**4.3**	**5.7**	**7.1**	**8.6**	**10.0**	**11.4**	**12.8**	**14-Cutout**
Frequency (Hz)	**31.5**	62.4	62.4	66.6	70.6	73.7	73.7	73.6	73.5
	63	72.1	72.0	76.5	80.8	84.1	84.1	84.1	84.0
	125	79.0	79.5	84.4	89.0	91.6	91.8	91.8	91.7
	250	84.0	84.9	90.1	95.0	95.3	95.3	95.5	95.5
	500	85.4	85.0	90.3	96.0	96.8	96.6	96.8	97.0
	1000	83.4	83.1	87.5	92.4	97.2	97.4	97.7	97.8
	2000	81.8	83.7	88.5	92.9	95.8	95.7	95.4	95.1
	4000	75.1	78.2	84.2	89.3	89.7	88.8	88.4	87.9
	8000	55.7	57.9	64.4	70.7	71.1	69.8	69.3	69.1
	16000	8.4	13.6	19.5	25.2	27.3	26.4	27.8	29.0
Total apparent sound power level $L_{WA,k}$ [dB]		**90.4**	**90.9**	**96.0**	**101.0**	**103.0**	**103.0**	**103.0**	**103.0**

Table 2: Normal Operation Calculated Apparent Sound Power Level, 1.6-100 with LNTE with 96 m hub height as a function of 10 m wind speed (z_{0ref} = 0.05 m), the octave band spectra are for information only

At 10 m wind speeds lower than 5 m/s the sound power levels decreases, and may get so low that the wind turbine noise becomes indistinguishable from the background noise. For a conservative calculation the data at 5 m/s may be used.

For 10 m wind speeds above 10 m/s, the wind turbine has reached rated power and the blade pitch regulation acts in a way that tends to decrease the noise levels. For a conservative calculation the data at 10 m/s may be used.

The highest normal operation calculated apparent sound power level for the 1.6-100 with LNTE is $L_{WA,k}$ = 103.0 dB.

3 Uncertainty Levels

The apparent sound power levels given above are calculated mean levels. If a wind turbine noise performance test is carried out, it needs to be done in accordance with the regulations of the international standard IEC 61400-11, ed. 2.1: 2006. Uncertainty levels associated with measurements are described in IEC/TS 61400-14.

Per IEC/TS 61400-14, L_{WAd} is the maximum apparent sound power level for 95 % confidence level resulting from n measurements performed according to IEC 61400-11 standard: $L_{Wad} = L_{WA} + K$, where L_{WA} is the mean apparent sound power level from IEC 61400-11 testing reports and $K = 1.645\ \sigma_T$.

The testing standard deviation values σ_T, σ_R and σ_P for measured apparent sound power level are described by IEC/TS 61400-14, where σ_T is the total standard deviation, σ_P is the standard deviation for product variation and σ_R is the standard deviation for test reproducibility.

Assuming $\sigma_R < 0.8$ dB and $\sigma_P < 0.8$ dB as typical values leads to a calculated $K < 2$ dB for 95 % confidence level.

4 Tonal Audibility

The tonal audibility (**$\Delta L_{a,k}$**), when measured in accordance with the IEC 61400-11 standard, for the GE's 1.6-100 with LNTE is less than or equal to 2 dB.

5 IEC 61400-11 and IEC/TS 61400-14 Terminology

- **$L_{WA,K}$** is wind turbine apparent sound power level (referenced to 10^{-12}W) measured with A-weighting as function of reference wind speed **v_{10m}**. Derived from multiple measurement reports per IEC 61400-11, it is considered as a mean value
- **σ_P** is the product variation i.e. the 1.6-100 with LNTE unit-to-unit product variation; typically < 0.8 dB
- **σ_R** is the overall measurement testing reproducibility as defined per IEC 61400-11; typically < 0.8 dB with adequate measurement conditions and sufficient amount of data samples
- **σ_T** is the total standard deviation combining both **σ_P** and **σ_R**
- **$K = 1.645\ \sigma_T$** is defined per IEC/TS 61400-14 for 95 % confidence level
- **R_0** is the ground measuring distance from the wind turbine tower axis per IEC 61400-11, which shall equal the hub height plus half the rotor diameter
- **$\Delta L_{a,k}$** is the tonal audibility according to IEC 61400-11, described as potentially audible narrow band sound

6 1/3rd Octave Band Spectra

The tables in Annex I are showing the 1/3rd octave band values for different hub heights in different wind speeds.

Reference:

- IEC 61400-1. Wind turbines – part 1: Design requirements. ed. 2. 1999
- IEC 61400-11, wind turbine generator systems part 11: Acoustic noise measurement techniques, ed. 2.1, 2006-11
- IEC/TS 61400-14, Wind turbines – part 14: Declaration of apparent sound power level and tonality values, ed. 1, 2005-03
- MNPT – Machine Noise Performance Test, Technical documentation, GE 2011

Appendix I - Calculated 1/3rd Octave Band Apparent Sound Power Level $L_{WA,k}$

1.6-100 with LNTE - Normal Operation 1/3rd Octave Band Spectra									
Standard wind speed at 10 m [m/s]		3	4	5	6	7	8	9	10-Cutout
Hub height wind speed at 80 m [m/s]		4.2	5.6	7.0	8.4	9.7	11.1	12.5	14-Cutout
Frequency (Hz)	25	52.2	52.1	55.8	59.7	63.0	63.2	63.1	62.9
	32	56.6	56.4	60.2	64.2	67.5	67.7	67.7	67.5
	40	60.6	60.3	64.2	68.3	71.6	71.9	71.8	71.7
	50	63.7	63.5	67.4	71.6	75.0	75.2	75.2	75.0
	63	66.5	66.2	70.3	74.6	78.1	78.3	78.3	78.2
	80	69.7	69.5	73.6	78.0	81.8	82.0	81.9	81.8
	100	72.3	72.2	76.5	81.0	84.8	84.9	84.9	84.7
	125	74.1	74.2	78.7	83.3	86.6	86.9	86.9	86.8
	160	75.6	76.1	80.8	85.6	88.3	88.5	88.6	88.5
	200	77.5	78.1	83.0	87.9	89.7	89.9	90.0	90.0
	250	79.5	80.1	85.0	90.2	91.0	90.9	91.0	91.1
	315	80.3	80.7	85.6	91.0	91.1	90.8	90.8	91.0
	400	80.7	80.6	85.4	91.1	91.5	91.0	91.0	91.2
	500	81.0	80.4	85.1	91.0	92.4	91.9	91.9	92.2
	630	80.3	79.4	84.0	89.9	92.9	92.6	92.7	93.0
	800	79.0	78.0	82.3	87.8	92.6	92.6	92.7	93.0
	1000	78.4	77.9	81.7	86.4	92.3	92.7	92.8	93.0
	1250	78.5	78.7	82.4	86.6	92.1	92.8	92.9	93.0
	1600	77.9	78.7	82.8	87.0	91.4	91.9	91.9	91.6
	2000	77.0	78.8	83.3	87.8	91.1	91.0	90.6	90.2
	2500	75.7	78.5	83.4	88.1	90.4	89.7	89.1	88.6
	3150	73.2	76.1	81.8	86.9	88.1	87.2	86.7	86.1
	4000	69.1	71.7	77.7	83.5	83.6	83.5	82.5	82.2
	5000	63.7	65.4	72.0	78.0	78.0	78.2	76.7	76.7
	6300	55.3	57.3	63.3	70.0	70.1	70.2	69.1	68.7
	8000	42.6	45.5	51.0	57.4	58.6	58.8	57.9	57.4
	10000	27.1	31.3	36.5	42.5	44.6	44.4	44.4	44.4
	12500	7.9	13.2	18.9	24.6	27.2	26.6	27.4	29.0
	16000	-19.0	-13.2	-6.1	-0.3	1.9	1.8	4.0	6.3
	20000	-47.8	-42.5	-34.1	-26.9	-25.9	-24.6	-21.8	-19.1
Total apparent sound power level $L_{WA,k}$ [dB]		90.4	90.7	95.3	100.5	103.0	103.0	103.0	103.0

Table 3: Calculated Apparent 1/3rd Octave Band Sound Power Level (A-weighted) 1.6-100 with LNTE with 80 m hub height as Function of Wind Speed v_{10m}

1.6-100 with LNTE - Normal Operation 1/3rd Octave Band Spectra									
Standard wind speed at 10 m [m/s]		3	4	5	6	7	8	9	10-Cutout
Hub height wind speed at 96 m [m/s]		4.3	5.7	7.1	8.6	10.0	11.4	12.8	14-Cutout
Frequency (Hz)	25	52.1	52.2	56.4	60.2	63.2	63.2	63.1	62.9
	32	56.6	56.5	60.7	64.7	67.7	67.7	67.6	67.5
	40	60.6	60.5	64.7	68.8	71.8	71.9	71.8	71.7
	50	63.7	63.6	67.9	72.1	75.2	75.2	75.2	75.0
	63	66.5	66.4	70.8	75.1	78.3	78.3	78.3	78.2
	80	69.7	69.7	74.2	78.6	81.9	81.9	81.9	81.8
	100	72.3	72.4	77.0	81.5	84.9	84.9	84.9	84.7
	125	74.0	74.5	79.3	83.8	86.7	86.9	86.9	86.8
	160	75.6	76.4	81.4	86.1	88.3	88.5	88.6	88.5
	200	77.5	78.5	83.6	88.4	89.7	89.9	90.0	90.0
	250	79.5	80.4	85.6	90.6	90.9	90.9	91.1	91.1
	315	80.3	81.0	86.2	91.4	90.9	90.8	90.9	91.0
	400	80.7	80.8	86.1	91.5	91.2	90.9	91.1	91.2
	500	80.9	80.5	85.8	91.5	92.1	91.8	92.0	92.2
	630	80.3	79.4	84.7	90.5	92.7	92.6	92.8	93.0
	800	78.9	78.1	82.9	88.5	92.5	92.5	92.8	93.0
	1000	78.3	78.1	82.2	87.2	92.5	92.6	92.9	93.0
	1250	78.5	78.8	82.9	87.2	92.4	92.8	93.0	93.0
	1600	77.9	78.9	83.3	87.5	91.6	91.9	91.9	91.6
	2000	77.1	79.1	83.9	88.3	91.1	90.9	90.6	90.2
	2500	75.9	78.8	84.0	88.6	90.3	89.6	89.0	88.6
	3150	73.4	76.5	82.4	87.3	87.9	87.0	86.6	86.1
	4000	69.2	72.2	78.4	83.8	83.7	83.2	82.5	82.2
	5000	63.8	65.9	72.8	78.3	78.4	77.5	76.8	76.7
	6300	55.4	57.6	64.1	70.4	70.8	69.4	69.0	68.7
	8000	42.9	45.8	51.8	57.9	59.1	58.4	57.7	57.4
	10000	27.5	31.6	37.2	43.0	44.9	44.1	44.4	44.4
	12500	8.4	13.6	19.5	25.2	27.3	26.4	27.8	29.0
	16000	-18.5	-12.7	-5.4	0.2	1.8	2.0	4.6	6.3
	20000	-47.5	-41.9	-33.2	-26.3	-26.0	-24.1	-21.1	-19.1
Total apparent sound power level $L_{WA,k}$ [dB]		90.4	90.9	96.0	101.0	103.0	103.0	103.0	103.0

Table 4: Calculated Apparent 1/3rd Octave Band Sound Power Level (A-weighted), 1.6-100 with LNTE with 96 m hub height as Function of Wind Speed v_{10m}

Wind Shear Calculation

Night-time Monthly Average Wind Speed Data (2300 to 0700)

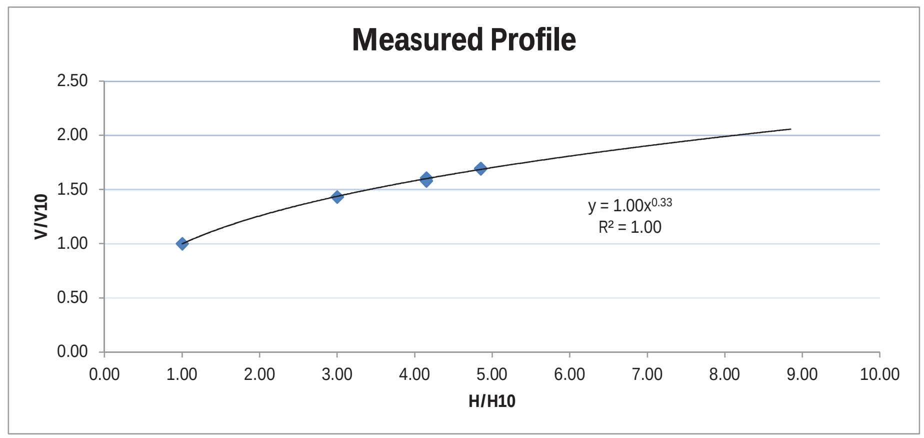
Data Set	Wind Speed Sensor	Height	Wind Speed (m/s)											
			Winter	Winter	Winter	Spring	Spring	Spring	Summer	Summer	Summer	Fall	Fall	Fall
			January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	48.5m_W	48.50	6.78	6.71	6.03	6.48	5.33	4.66	4.53	4.92	5.29	6.33	6.81	7.49
2	48.5m_S	48.50	6.72	6.68	5.95	6.40	5.28	4.64	4.48	4.90	5.32	6.38	6.84	7.55
3	41.5m_W	41.00	6.59	6.51	5.80	6.12	5.07	4.44	4.28	4.67	5.02	6.09	6.56	7.30
4	41.5m_S	41.00	6.59	6.43	5.68	6.17	5.01	4.38	4.21	4.55	4.97	6.04	6.58	7.36
5	30m_W	30.00	6.22	6.14	5.38	5.72	4.65	4.03	3.81	4.14	4.49	5.60	6.13	6.96
6	10m_W	10.00	5.32	5.16	4.34	4.59	3.62	3.06	2.66	2.82	3.21	4.23	4.94	6.03

Summer Average Night-time Monthly Average Wind Speed - Based on Measurements

Data Set	Wind Speed Sensor	Height (m)	Vsavg (m/s)	H/H10	Vsavg/V10
1	spd_avg_48.5m_W_ch01	48.50	4.91	4.85	1.70
2	spd_avg_48.5m_S_ch02	48.50	4.90	4.85	1.69
3	spd_avg_41.5m_W_ch03	41.50	4.66	4.15	1.61
4	spd_avg_41.5m_S_ch04	41.50	4.58	4.15	1.58
5	spd_avg_30m_W_ch05	30.00	4.15	3.00	1.43
6	spd_avg_10m_W_ch06	10.00	2.90	1.00	1.00

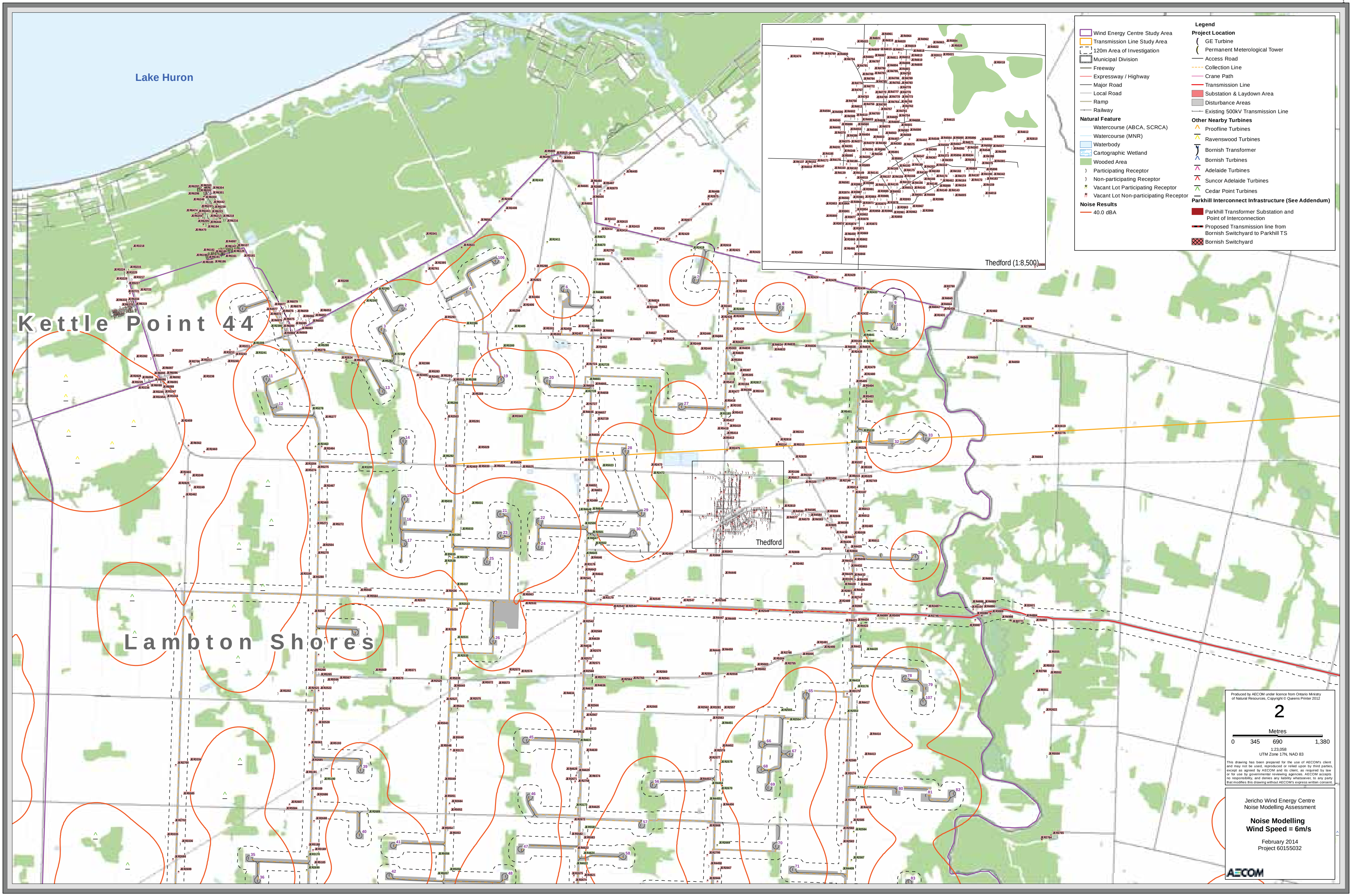
Model	Vsavg(hub) = Vsavg(10m)*k k=C*(H/H10)^(n)
Hub Height (m)	80
C	1
n	0.33
k	1.99

Vsavg - Summer Average Night-time Wind Speed (July, August and Sept)
V10 - Vsavg at 10m height



Appendix D: Noise Contour Maps

Noise Contours calculated at 4.5 metres above grade


Lake Huron
Kettle Point 44
Lambton Shores
Thedford
Thedford (1:8,500)
Legend
Wind Energy Centre Study Area
Transmission Line Study Area
120m Area of Investigation
Municipal Division
Freeway
Expressway / Highway
Major Road
Local Road
Ramp
Railway
Natural Feature
Watercourse (ABCA, SCRCA)
Watercourse (MNR)
Waterbody
Cartographic Wetland
Wooded Area
Participating Receptor
Non-participating Receptor
Vacant Lot Participating Receptor
Vacant Lot Non-participating Receptor
Noise Results
40.0 dBA
Project Location
GE Turbine
Permanent Meterological Tower
Access Road
Collection Line
Crane Path
Transmission Line
Substation & Laydown Area
Disturbance Areas
Existing 500kV Transmission Line
Other Nearby Turbines
Proofline Turbines
Ravenswood Turbines
Bornish Transformer
Bornish Turbines
Adelaide Turbines
Suncor Adelaide Turbines
Cedar Point Turbines
Parkhill Interconnect Infrastructure (See Addendum)
Parkhill Transformer Substation and Point of Interconnection
Proposed Transmission line from Bornish Switchyard to Parkhill TS
Bornish Switchyard
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2
Metres
0 345 690 1,380
1:23,058
UTM Zone 17N, NAD 83
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Jericho Wind Energy Centre
Noise Modelling Assessment
Noise Modelling
Wind Speed = 6m/s
February 2014
Project 60155032
AECOM