

TECHNICAL APPENDIX 13.7: WIND TURBINE SOUND POWER DATA

Kirkton Energy Park
Prepared for: Kirkton Wind Farm Ltd

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Noise level, Power curves, Thrust curves

Nordex N133/4.8

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Noise level measurement requirements

Nordex N133/4.8 – Noise level measurement requirements

Basis: The specified sound power levels are expected values in terms of statistics. Results of single measurements will be within the confidence interval according to IEC 61400-14 [4].

Remarks:
Verification according to: Measurements are to be carried out by a measuring institute accredited for noise emission measurements at wind turbines according to ISO/IEC 17025 [3] at the reference position as defined in IEC 61400-11 [1]. The data analysis must be carried out according to the preferred method 1 of IEC 61400-11 [1]. The tonal penalties in the vicinity of wind turbines K_{TN} based on these measurements are to be determined according to „Technische Richtlinien für Windenergieanlagen“ [2].

Tonality: The noise can be tonal in the vicinity of wind turbines. The specified sound power level includes potential tonal penalties according to „Technische Richtlinien für Windenergieanlagen“ [2], without taking into account any tonality $K_{TN} \leq 2$ dB.

- [1] IEC 61400-11 ed. 2: Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques; 2002-12
- [2] Technische Richtlinie für Windenergieanlagen - Teil 1: Bestimmung der Schallemissionswerte, Revision 18; FGW 2008-02
- [3] ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories; 2017-11
- [4] IEC 61400-14, Wind turbines - Part 14: Declaration of apparent sound power level and tonality values, first edition, 2005-03

Abbreviations

L_{WA} ...	A-weighted sound power level
v_s ...	wind speed converted to reference conditions (hub height 10 m, roughness length 0.05 m) using a logarithmic profile
v_H ...	hub height wind speed
STE ...	Serrated Trailing Edge



Noise level, rated power and available hub heights

Nordex N133/4.8 – Noise level, rated power and available hub heights

operating mode	rated power [kW]	Maximum sound power level over the complete operating range of the wind turbine		available hub heights [m]		
		L _{WA} [dB(A)]	L _{WA} (STE) [dB(A)]	78	83	110
Mode 0	4800	107.5	106.0	•	•	•
Mode 1	4700	107.0	105.5	•	•	•
Mode 2	4580	106.5	105.0	•	•	•
Mode 3	4480	106.0	104.5	•	•	•
Mode 4	4380	105.5	104.0	•	•	–
Mode 5	4290	105.0	103.5	•	•	–
Mode 6	4190	104.5	103.0	•	•	–
Mode 7	4090	104.0	102.5	•	•	–
Mode 8	3720	102.0	100.5	•	•	•
Mode 9	3640	101.5	100.0	•	•	•
Mode 10	3560	101.0	99.5	•	•	•
Mode 11	3460	100.5	99.0	•	•	•
Mode 12	3380	100.0	98.5	•	•	•
Mode 13	3300	99.5	98.0	•	•	•

- mode available
- mode not available

Noise level – Mode 0



Nordex N133/4.8 – Noise level – Mode 0

Standardized wind speed [m/s]	hub height 78 m			hub height 83 m		
	apparent sound power level [dB(A)]		hub height wind speed [m/s]	apparent sound power level [dB(A)]		hub height wind speed [m/s]
	L_{WA} (w/o STE)	L_{WA} (with STE)		L_{WA} (w/o STE)	L_{WA} (with STE)	
v_s			v_H			
3.0	95.0	93.5	4.2	95.0	93.5	4.2
4.0	95.5	94.0	5.6	95.7	94.2	5.6
5.0	101.0	99.5	6.9	101.2	99.7	7.0
6.0	105.2	103.7	8.3	105.4	103.9	8.4
7.0	107.5	106.0	9.7	107.5	106.0	9.8
8.0	107.5	106.0	11.1	107.5	106.0	11.2
9.0	107.5	106.0	12.5	107.5	106.0	12.6
10.0	107.5	106.0	13.9	107.5	106.0	14.0
11.0	107.5	106.0	15.3	107.5	106.0	15.4
12.0	107.5	106.0	16.7	107.5	106.0	16.8



Octave sound power levels

Nordex N133/4.8

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operation modes and hub heights



Nordex N133/4.8 – operation modes and hub heights

operating mode	rated power [kW]	available hub heights [m]		
		78	83	110
Mode 0	4800	•	•	•
Mode 1	4700	•	•	•
Mode 2	4580	•	•	•
Mode 3	4480	•	•	•
Mode 4	4380	•	•	–
Mode 5	4290	•	•	–
Mode 6	4190	•	•	–
Mode 7	4090	•	•	–
Mode 8	3720	•	•	•
Mode 9	3640	•	•	•
Mode 10	3560	•	•	•
Mode 11	3460	•	•	•
Mode 12	3380	•	•	•
Mode 13	3300	•	•	•

- mode available
- mode not available

Abbreviations

- v_s ... wind speed converted to reference conditions
(hub height 10 m, roughness length 0.05 m) using a logarithmic profile
- STE ... Serrated Trailing Edge

Octave sound power levels without serrated trailing edge



Nordex N133/4.8 – Octave sound power levels without serrated trailing edge

Basis:

The expected octave sound power levels of the Nordex N133/4.8 are to be determined on basis of aerodynamical calculations and expected sound power levels. These values are valid for 78 m, 83 m and 110 m (see available hub heights on pg. 2).
The expected octave sound power levels are only for information and will not be warranted.



Octave sound power levels without serrated trailing edge – Mode 0

Mode 0

hub height 78 m – 107.5 dB(A)

octave sound power levels [dB(A)] at standardized wind speeds v_s										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	66.4	66.9	70.3	74.5	76.8	79.4	79.4	79.4	79.4	79.4
63 Hz	76.5	77.0	81.0	85.2	87.5	89.0	89.0	89.0	89.0	89.0
125 Hz	83.5	84.0	88.1	92.3	94.6	94.8	94.8	94.8	94.8	94.8
250 Hz	88.0	88.5	92.9	97.1	99.4	98.0	98.0	98.0	98.0	98.0
500 Hz	89.3	89.8	95.3	99.5	101.8	100.4	100.4	100.4	100.4	100.4
1000 Hz	89.1	89.6	95.9	100.1	102.4	102.3	102.3	102.3	102.3	102.3
2000 Hz	86.6	87.1	93.4	97.6	99.9	101.4	101.4	101.4	101.4	101.4
4000 Hz	80.9	81.4	85.9	90.1	92.4	96.0	96.0	96.0	96.0	96.0
8000 Hz	69.8	70.3	73.6	77.8	80.1	82.2	82.2	82.2	82.2	82.2
Total sound power level	95.0	95.5	101.0	105.2	107.5	107.5	107.5	107.5	107.5	107.5

hub height 83 m – 107.5 dB(A)

octave sound power levels [dB(A)] at standardized wind speeds v_s										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	66.4	67.1	70.5	74.7	76.8	79.4	79.4	79.4	79.4	79.4
63 Hz	76.5	77.2	81.2	85.4	87.5	89.0	89.0	89.0	89.0	89.0
125 Hz	83.5	84.2	88.3	92.5	94.6	94.8	94.8	94.8	94.8	94.8
250 Hz	88.0	88.7	93.1	97.3	99.4	98.0	98.0	98.0	98.0	98.0
500 Hz	89.3	90.0	95.5	99.7	101.8	100.4	100.4	100.4	100.4	100.4
1000 Hz	89.1	89.8	96.1	100.3	102.4	102.3	102.3	102.3	102.3	102.3
2000 Hz	86.6	87.3	93.6	97.8	99.9	101.4	101.4	101.4	101.4	101.4
4000 Hz	80.9	81.6	86.1	90.3	92.4	96.0	96.0	96.0	96.0	96.0
8000 Hz	69.8	70.5	73.8	78.0	80.1	82.2	82.2	82.2	82.2	82.2
Total sound power level	95.0	95.7	101.2	105.4	107.5	107.5	107.5	107.5	107.5	107.5

hub height 110 m – 107.5 dB(A)

octave sound power levels [dB(A)] at standardized wind speeds v_s										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	66.4	67.9	71.3	75.5	76.8	79.4	79.4	79.4	79.4	79.4
63 Hz	76.5	78.0	82.0	86.2	87.5	89.0	89.0	89.0	89.0	89.0
125 Hz	83.5	85.0	89.1	93.3	94.6	94.8	94.8	94.8	94.8	94.8
250 Hz	88.0	89.5	93.9	98.1	99.4	98.0	98.0	98.0	98.0	98.0
500 Hz	89.3	90.8	96.3	100.5	101.8	100.4	100.4	100.4	100.4	100.4
1000 Hz	89.1	90.6	96.9	101.1	102.4	102.3	102.3	102.3	102.3	102.3
2000 Hz	86.6	88.1	94.4	98.6	99.9	101.4	101.4	101.4	101.4	101.4
4000 Hz	80.9	82.4	86.9	91.1	92.4	96.0	96.0	96.0	96.0	96.0
8000 Hz	69.8	71.3	74.6	78.8	80.1	82.2	82.2	82.2	82.2	82.2
Total sound power level	95.0	96.5	102.0	106.2	107.5	107.5	107.5	107.5	107.5	107.5

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