



Noise level, Power curves, Thrust curves

Nordex N163/5.X

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Nordex N163/5.X – 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)]	108	118	120	148	164
Mode 0	5700	109.2	107.2	●	●	○	●	●
Mode 1	5600	108.8	106.8	●	●	○	●	●
Mode 2	5500	108.4	106.4	●	●	●	●	●
Mode 3	5400	108.0	106.0	●	●	●	●	●
Mode 4	5270	107.5	105.5	●	●	●	●	●
Mode 5	5150	107.0	105.0	●	●	●	●	●
Mode 6	5040	106.5	104.5	●	●	●	–	●
Mode 7	4930	106.0	104.0	●	●	●	–	●
Mode 8	4810	105.5	103.5	○	○	○	–	○
Mode 9	4700	105.0	103.0	○	○	○	–	○
Mode 10	4290	103.0	101.0	○	○	○	○	○
Mode 11	4170	102.5	100.5	○	○	○	○	○
Mode 12	3990	102.0	100.0	●	●	●	●	●
Mode 13	3700	101.5	99.5	●	●	●	●	●
Mode 14	3450	101.0	99.0	●	●	–	●	●
Mode 15	3200	100.5	98.5	●	●	–	●	●
Mode 16	2980	100.0	98.0	●	●	–	●	●
Mode 17	2800	99.5	97.5	●	●	–	●	●
Mode 18	2580	99.0	97.0	●	●	–	●	●

- mode available
- mode on request
- mode not available

Technical Documentation

Wind Turbine Generator Systems

5.3-158 - 50/60 Hz



Calculated Power Curve and Thrust Coefficient

Normal Operation (NO) 106 dB

Attachments to this pdf can be found by clicking the paper clip icon (📎) commonly found on the left-hand side when using Adobe Acrobat.



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3 Technical Data for the 5.3-158

Turbine	5.3-158
Rated output [MW]	5.3
Rotor diameter [m]	158
Number of blades	3
Swept area [m ²]	19607
Rotational direction (viewed from an upwind location)	Clockwise
Maximum speed of the blade tips [m/s]	80.3
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brake	Full feathering
Color of outer components	RAL 7035 (light grey) and RAL 7023 (concrete grey, for concrete sections of hybrid tower only)
Reflection degree/Gloss degree Steel tower	30 - 60 gloss units measured at 60° as per ISO 2813
Reflection degree/Gloss degree Rotor blades, Nacelle, Hub	60 - 80 gloss units measured at 60° as per ISO 2813
Reflection degree/Gloss degree Hybrid Tower	Concrete gray (similar RAL 7023); gloss matte

Table 1: Technical data 5.3-158 wind turbine

Technical Documentation

Wind Turbine Generator Systems

6.0-164 - 50 Hz



Technical Description and Data

preliminary version for product development purposes

Doc-0079264 - Rev. 01 - EN

2019-12-19



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3 Technical Data for the 6.0-164

Turbine	6.0-164
Rated output [MW]	6.0
Rotor diameter [m]	164
Number of blades	3
Swept area [m ²]	21124
Rotational direction (viewed from an upwind location)	Clockwise
Maximum speed of the blade tips [m/s]	83.3 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brake	Full feathering
Color of outer components	RAL 7035 (light grey) and RAL 7023 (concrete grey, for concrete sections of hybrid tower only)
Reflection degree/Gloss degree Steel tower	30 - 60 gloss units measured at 60° as per ISO 2813
Reflection degree/Gloss degree Rotor blades, Nacelle, Hub	60 - 80 gloss units measured at 60° as per ISO 2813
Reflection degree/Gloss degree Hybrid Tower	Concrete gray (similar RAL 7023); gloss matte

Table 1: Technical data 6.0-164 wind turbine

Nominal Sound Power Level (dB)	Nominal Rotor Speed (rpm)	Nominal Electrical Power (kW)			
		101.0m Hub Height	120.9m Hub Height	150.0m Hub Height	161.0m Hub Height
106.0	9.70	5300, 5500 6000	5300, 5500 6000	5300, 5500 6000	5300, 5500 6000
105.0	9.35	5300	N/A	5300	5300
104.0	9.00	4800, 5100	N/A	4500, 4800, 5100	4500, 4800, 5100
103.0	8.54	4800	4500, 4800	4500, 4800	4500, 4800
102.0	8.20	4650	4500, 4650	4500, 4650	4500, 4650
101.0	7.66	4340	4340	4340	4340
100.0	7.22	4090	4090	4090	4090

Table 1: Overview of configurations for each apparent sound power level.

3 Apparent Sound Power Levels as a Function of Wind Speed

The following table presents calculated reference apparent sound power levels as a function of hub height wind speed.

Hub Height Wind Speed (m/s)	106.0 dB Mode	105.0 dB Mode	104.0 dB Mode	103.0 dB Mode	102.0 dB Mode	101.0 dB Mode	100.0 dB Mode
4	93.8	93.8	93.8	93.8	93.8	93.8	93.8
5	94.5	94.5	94.5	94.5	94.5	94.5	94.5
6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
7	101.0	101.0	101.0	101.0	101.0	101.0	100.0
8	103.9	103.7	103.5	103.0	102.0	101.0	100.0
9	106.0	105.0	104.0	103.0	102.0	101.0	100.0
10	106.0	105.0	104.0	103.0	102.0	101.0	100.0
11	106.0	105.0	104.0	103.0	102.0	101.0	100.0
12	106.0	105.0	104.0	103.0	102.0	101.0	100.0
13	106.0	105.0	104.0	103.0	102.0	101.0	100.0
14	106.0	105.0	104.0	103.0	102.0	101.0	100.0
15	106.0	105.0	104.0	103.0	102.0	101.0	100.0

Table 2: Reference apparent sound power levels

The corresponding wind speed at 10 m height depends on hub height. It can be calculated for a given surface roughness using a logarithmic trend for wind shear:

$$V_{10m\ height} = V_{hub} \frac{\ln\left(\frac{10m}{z_0}\right)}{\ln\left(\frac{hub\ height}{z_0}\right)}$$

Typical values for on land surface roughness (z0) are 0.05 m, depending on terrain conditions. Assuming this surface roughness, wind speeds at 10 m height for each hub height are listed in Annex I.

4 Octave Band Spectra and 1/3rd Octave Band Spectra

Octave band and 1/3rd octave band apparent sound power level values are provided for all available operational modes at different hub height wind speeds. The corresponding wind speeds at 10 m height for all available hub heights are provided in Annex I. Operational information, including rated electrical power and rotor speed are listed along with each set of spectra. Additionally, the list of compatible hub heights for each mode is also provided.

4.1 106.0 dB Apparent Sound Power Level

The octave band spectra and 1/3rd octave band spectra in this section are applicable to the following nominal electrical power, nominal rotor speed, and hub heights.

Hub Height (m)	Nominal Rotor Speed (rpm)	Nominal Electrical Power (kW)
101.0	9.70	5300, 5500, 6000
120.9	9.70	5300, 5500, 6000
150.0	9.70	5300, 5500, 6000
161.0	9.70	5300, 5500, 6000

* Simplified from IEC 61400-11: 2006 equation 7

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V162-6.0 MW™ IEC S

Facts & figures

POWER REGULATION Pitch regulated with variable speed

OPERATING DATA

Rated power 6,000kW
 Cut-in wind speed 3m/s
 Cut-out wind speed* 25m/s
 Wind class IEC S
 Standard operating temperature range from -20°C* to +45°C

*High Wind Operation available as standard
 **Subject to different temperature options

SOUND POWER

Maximum 104.3dB(A)**
 ***Sound Optimised Modes available dependent on site and country

ROTOR

Rotor diameter 162m
 Swept area 20,612m²
 Aerodynamic brake full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency 50/60Hz
 Converter full scale

GEARBOX

Type two planetary stages

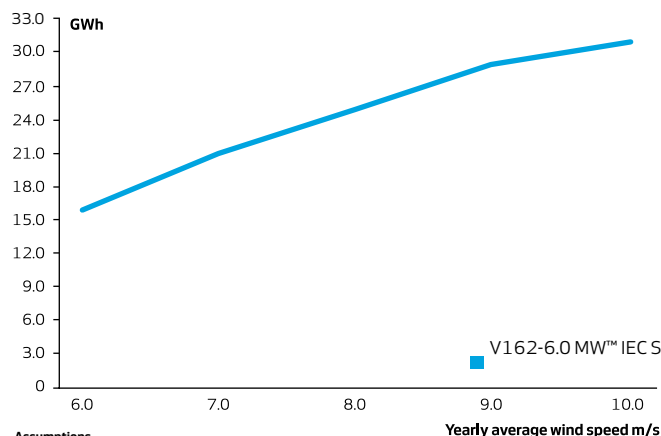
TOWER

Hub height 119m (IEC S/DIBt S), 125m (IEC S), 149m (IEC S), 166m (IEC S), 169m (DIBt S)

TURBINE OPTIONS

- Condition Monitoring System
 - Oil Debris Monitoring System
 - Service Personnel Lift
 - Low Temperature Operation to -30°C
 - Vestas Ice Detection™
 - Vestas Anti-Icing System™
 - Vestas IntelliLight®
 - Vestas Shadow Detection System
 - Aviation Lights
 - Aviation Markings on the Blades
 - Fire Suppression System
 - Vestas Bat Protection System
 - Lightning Detection System
 - Load Optimised Modes
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ANNUAL ENERGY PRODUCTION



Assumptions
 One wind turbine, 100% availability, 0% losses, k factor =2,
 Standard air density = 1.225, wind speed at hub height

Standard Acoustic Emission, Rev. 0, AM 0 - AM-6, N1 - N7

SG 6.0-170

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Standard Acoustic Emission, Rev. 0, AM 0 - AM-6, N1 - N7

Typical Sound Power Levels

The sound power levels are presented with reference to the code IEC 61400-11 ed. 3.0 (2012). The sound power levels (L_{WA}) presented are valid for the corresponding wind speeds referenced to the hub height.

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	12	Up tp cut-out
AM 0	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
AM-1	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
AM-2	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
AM-3	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
AM-4	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
AM-5	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
AM-6	92.0	92.0	94.5	98.4	101.8	104.7	106.0	106.0	106.0	106.0	106.0
N1	92.0	92.0	94.5	98.4	101.8	105.5	105.5	105.5	105.5	105.5	105.5
N2	92.0	92.0	94.5	98.4	101.8	104.5	104.5	104.5	104.5	104.5	104.5
N3	92.0	92.0	94.5	98.4	101.8	103.0	103.0	103.0	103.0	103.0	103.0
N4	92.0	92.0	94.5	98.4	101.8	102.0	102.0	102.0	102.0	102.0	102.0
N5	92.0	92.0	94.5	98.4	101.0	101.0	101.0	101.0	101.0	101.0	101.0
N6	92.0	92.0	94.5	98.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N7	92.0	92.0	94.5	98.4	99.0	99.0	99.0	99.0	99.0	99.0	99.0

Table 1: Acoustic emission, $L_{WA}[dB(A) \text{ re } 1 \text{ pW}](10 \text{ Hz to } 10\text{kHz})$

Wind speed [m/s]	6	8
AM 0	87.6	93.9
AM-1	87.6	93.9
AM-2	87.6	93.9
AM-3	87.6	93.9
AM-4	87.6	93.9
AM-5	87.6	93.9
AM-6	87.6	93.9
N1	87.6	93.9
N2	87.6	93.9
N3	87.6	92.7
N4	87.6	91.9
N5	87.6	91.0
N6	87.6	90.2
N7	87.6	89.3

Table 2: Acoustic emission, $L_{WA}[dB(A) \text{ re } 1 \text{ pW}](10 \text{ Hz to } 160 \text{ Hz})$

Low Noise Operations

The lower sound power level is also available and can be achieved by adjusting the turbines controller settings, i.e. an optimization of rpm and pitch. The noise settings are not static and can be applied to optimize the operational output of the turbine. Noise settings can be tailored to time of day as well as wind direction to offer the most suitable solution for a specific location. This functionality is controlled via the SCADA system and is described further in the white paper on Noise Reduction Operations. Furthermore, tailored power curves can be provided which take wind speed into consideration allowing for management of the turbine output power and noise emission level to comply with site specific noise requirements. Tailored power curves are project and turbine specific and will therefore require Siemens Gamesa Siting involvement to provide the optimal solutions. The lower sound power levels may not be applicable to all tower variants. Please contact Siemens Gamesa for further information.