REGIONE CAMPANIA

Province di Avellino

COMUNI DI Andretta (AV) e Bisaccia (AV)

PROGETTO

POTENZIAMENTO PARCO EOLICO ANDRETTA-BISACCIA

PROGETTO DEFINITIVO

COMMITTENTE:

ERG Wind 4

ERG
EVOLVING ENERGIES

PROGETTISTA:

GOLDER
Via Sante Bargellini, 4
00157 - Roma (RM)

GOLDER

OGGETTO DELL'ELABORATO:

ALLEGATO 13

SCHEDE TECNICHE DEI MODELLI DI AEROGENERATORI

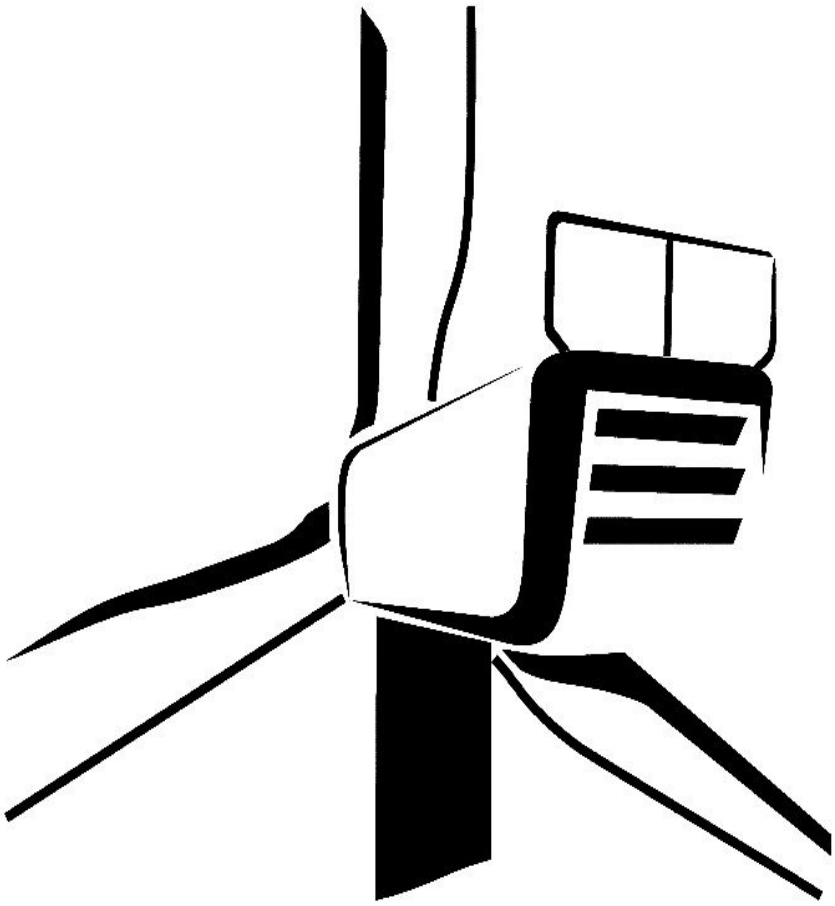
CODICE PROGETTISTA	DATA	SCALA	FOGLIO	FORMATO	CODICE DOCUMENTO				
					IMP.	DISC.	TIPO DOC.	PROG.	REV.
	06/2020	/	1 di 151	A4	BIS	ENG	REL	0038	00

NOME FILE: GRE-ENG-REL-0038_00_Schede tecniche degli aerogeneratori.doc
ERG Wind 4 2 S.r.l. si riserva tutti i diritti su questo documento che non può essere riprodotto neppure parzialmente senza la sua autorizzazione scritta.

General documentation

Technical description

Wind turbine class Nordex Delta4000



E0004109668

Revision 02 / 2017-08-31

- Translation of the original instructions -

Document is published in electronic form.

Original document at Nordex Energy GmbH, Engineering.

© 2017 by Nordex Energy GmbH

This document was produced by Nordex Energy GmbH and/or affiliated companies within the meaning of section 15 et seq. of the German Stock Corporation Act (AktG).

This document, including any presentation of its contents in whole or in parts, is the intellectual property of Nordex Energy GmbH and/or affiliated companies within the meaning of section 15 et seq. of the AktG. The information contained in this document must be treated as confidential and must not, neither in whole nor in part, be disclosed to third parties without the express consent of Nordex Energy GmbH.

All rights reserved.

Any disclosure, duplication, translation or other use of this document or parts thereof, regardless if in printed, handwritten, electronic or other form, without the explicit approval of Nordex Energy GmbH is prohibited.

Copyright 2017 by Nordex Energy GmbH.

Contact details

For questions relating to this documentation please contact:

Nordex Energy GmbH

Langenhorner Chaussee 600

22419 Hamburg

Germany

Phone: +49 40 30030 1000

Fax: +49 40 30030 1101

http://www.nordex-online.com

info@nordex-online.com

1. Structure

The Nordex Delta4000 wind turbine class comprises speed-variable wind turbines with a rotor diameter of 149 m and a nominal power of 4500 kW, which can be adapted depending on location. The wind turbine is designed for class IIIS in accordance with IEC 61400-1 or wind zone S in accordance with DIBt 2012 and is available in 50 Hz and 60 Hz variants.

A class Nordex Delta4000 wind turbine consists of the following main components:

- Rotor, with rotor hub, three rotor blades and the pitch system
- Nacelle with drive train, generator, yaw system, medium-voltage transformer and converter
- Tubular tower or hybrid tower with MV switchgear on a foundation

1.1 Tower

A class Nordex Delta4000 wind turbine can be erected on a steel tower or on a hybrid tower. The steel tower is cylindrical and consists of 4 or 5 sections. This tower is bolted to the anchor cage embedded in the foundation. The bottom part of the hybrid tower consists of a concrete tower and the top part of a tubular steel tower with two sections.

Corrosion protection is ensured by a tower surface coating system in accordance with ISO 12944. A service lift, the vertical ladder with fall protection system as well as resting and working platforms inside the tower allow for a weather-protected ascent to the nacelle.

The foundation design of all towers depends on the ground conditions at the intended site.

The tower base contains a low-voltage cabinet with control units and the medium-voltage switchgear.

1.2 Rotor

The rotor consists of the rotor hub with three pitch bearings and three pitch drives for blade adjustment as well as three rotor blades.

The **rotor hub** consists of a base element with support structure and a spinner. The base element consists of a stiff cast structure, on which the pitch bearings and the rotor blades are assembled. The rotor hub is covered with the spinner which enables the direct access from the nacelle into the rotor hub.

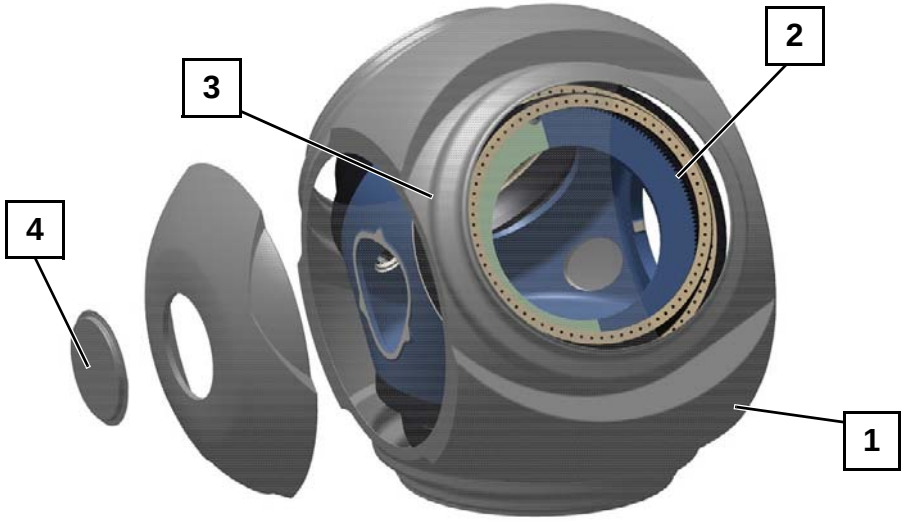


Fig. 1 Rotor hub and spinner or the Nordex Delta4000

1	Spinner segment	2	Rotor hub base element
3	Spinner support structure (not visible)	4	Escape hatch

The **rotor blades** are made of high-quality glass-fiber reinforced and carbon-fiber reinforced plastics. The rotor blade is statically and dynamically tested in accordance with the guidelines IEC 61400-23 and DNVGL-ST-0376 (2015). Optionally the rotor blades can be equipped with serrations, which optimize the sound power level.

The **pitch system** serves to adjust the pitch angle of the rotor blades set by the control system. For each individual rotor blade the pitch system comprises an electromechanical drive with 3-phase motor, planetary gear and drive pinion, as well as a control unit with frequency converter and emergency power supply. Power supply and signal transfer are realized through a slip ring in the nacelle.

1.3 Nacelle

The nacelle contains essential mechanical and electrical components of the wind turbine. The nacelle can be pivoted on the tower.

The **rotor shaft** is mounted in the rotor bearing in the nacelle. A rotor lock is integrated in the rotor bearing, with which the rotor can be reliably locked in place mechanically.

The **gearbox** increases the rotor speed until it reaches the speed required for the generator.

The bearings and gearings are continuously lubricated with oil. A 2-stage pump enables the oil circulation. A combined filter element with integrated coarse, fine and superfine filter removes solids. The control system monitors the contamination of the filter element.

The gear oil used for lubrication also cools the gearbox. The temperatures of the gearbox bearings and the oil are continuously monitored. If the optimum operating temperature is not yet reached, a thermal bypass directs the gear oil

directly back to the gearbox. If the operating temperature of the gear oil is exceeded it is cooled down.

The gearbox cooling is realized with an oil/water cooler that is installed directly at the gearbox. The heated cooling water is cooled together with the cooling water of the generator, converter and transformer in a passive cooler on the roof of the nacelle.

The **generator** is a 6-pole doubly-fed induction machine. An air/water heat exchanger is mounted on the generator. The cooling water is recooled together with the cooling water of the other large components in a passive cooler on the nacelle roof.

The **mechanical rotor brake** is used to lock the rotor during maintenance.

The **yaw drives** optimally rotate the nacelle into the wind. The yaw drives are located on the machine frame in the nacelle. A yaw drive consists of an electric motor, multi-stage planetary gear, and a drive pinion. The drive pinions mesh with the external teeth of the yaw bearing.

When the nacelle is properly positioned it is locked by means of the yaw drives.

If necessary, the oil pressure for the rotor brake is generated by a hydraulic pump.

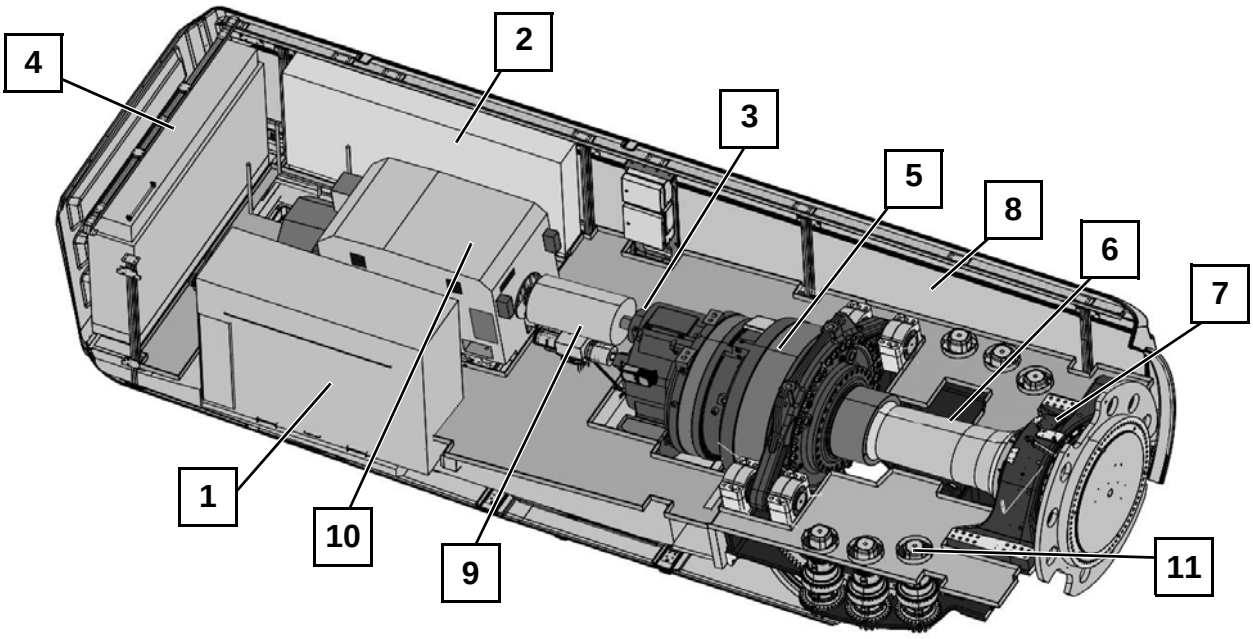


Fig. 2 Schematic representation of the nacelle

1	Transformer	2	Switch cabinet	3	Rotor brake
4	Converter	5	Gearbox	6	Rotor shaft
7	Rotor bearing	8	Nacelle housing	9	Coupling
10	Generator	11	Yaw drives		

1.4 Auxiliary systems

Generator bearing, pitch gearing and yaw gearing are each equipped with an **automatic lubrication system**.

Gearbox, generator, the cooling circuit and all switch cabinets are equipped with **heaters**.

An electric **chain hoist** is installed in the nacelle which is used for lifting tools, components and other work materials from the ground into the nacelle. A second, movable **overhead crane** is used for carrying the materials within the nacelle.

Various options of additional equipment are available for the wind turbine.

Cooling system

Gearbox, generator, converter and transformer are cooled via a coupled air/ water heat exchanger. A pump conveys the mixture through the heat exchanger. At startup the lightly heated gear oil is directly fed back into the gearbox via a thermal bypass and only directed into the plate-type heat exchanger after reaching operating temperature.

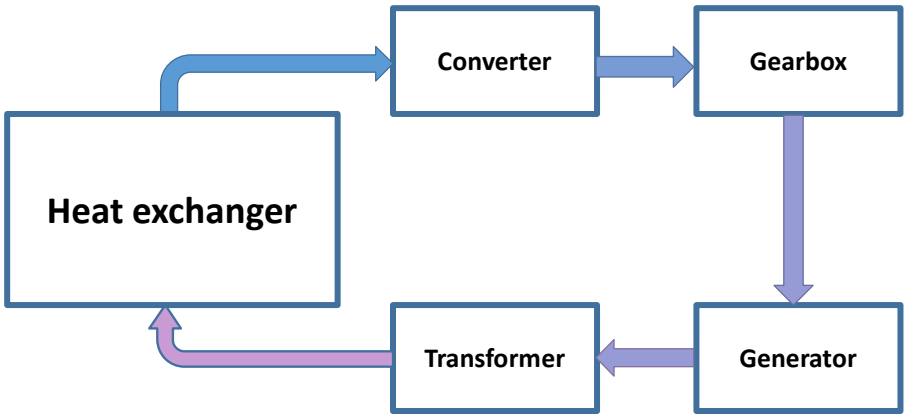


Fig. 3 Schematic diagram of the cooling of the large components in the nacelle

2. Medium-voltage switchgear

The medium-voltage components are used to connect a WT to the medium-voltage grid in the wind farm or to the grid of the local grid operator. The **MV switchgear** is located in the tower base. It consists of a transformer panel with circuit breaker, two or three ring cable units as standard or four as option (depending on the WF configuration) and a pressure absorber duct. The transformer panel consists of a vacuum circuit breaker and the disconnector with ground switch. The ring cable panel consist of a switch disconnector with a ground switch The entire MV switchgear is assembled on a support/adapter frame.

Additional properties of the MV switchgear:

- Routine tests of each switchgear in compliance with IEC 62271-200
- Type tested, SF6 insulation
- Indoor switchgear for self-contained electrical operating sites (min. IP2X)
- SF6 tank: metal-clad, metal-enclosed (min. IP65), independent of environmental influences
- Switch positions shown "On – Off – Grounded"
- Test terminal strip for secondary test
- Low-maintenance in accordance with class E2 (IEC 62271-100)

The system protection of the MV switchgear is achieved through the following items:

- Pressure relief by pressure absorber duct in case of arcing
- Improved personal safety and system protection in case of arcing by type testing in compliance with IEC 62271-200
- Protective device with inrush detection and supplied by converter current as definite-time overcurrent relay
- Actuating openings for switchgear are interlocked to preclude operation of more than one simultaneously, and can be locked as an option
- Corrosion protection of the switchgear cells through hot-dip galvanization and painted surfaces

Transformer and converter are located in the nacelle. The transformer has been specified in accordance with IEC 60076-16 and meets the ecodesign requirements in compliance with 548/2014/EU. The transformer protection level is IP54.

The steel components at the transformer have been designed in accordance with corrosion protection class C3 (H).

Other protection measures:

- Grounded shell
- Overtemperature protection through PT100 temperature sensors and relays

3. Functional principle

The turbine operates automatically. A programmable logic controller (PLC) continuously monitors the operating parameters using various sensors, compares the actual values with the corresponding setpoints and issues the required control signals to the WT components. The operating parameters are specified by Nordex and are adapted to the individual location.

When there is no wind the WT remains in idle mode. Only various auxiliary systems are operational or activated as required: e.g., heaters, gear lubrication or PLC, which monitors the data from the wind measuring system. All other systems are switched off and do not use any energy. The rotor idles. When the optional SATCOM function has been enabled, the converter remains in operation and enables reactive power supply to the grid. When the cut-in wind speed is reached, the wind turbine will change to the mode 'Ready for operation'. Now all systems are tested, the nacelle turns into the wind and the rotor blades turn into the wind. When a certain speed is reached, the generator is connected to the grid and the WT produces energy.

At low wind speeds the WT operates at part load. During this the rotor blades remain fully turned into the wind. The power produced by the WT depends on the wind speed.

When the nominal wind speed is reached, the WT switches over to the nominal load range. If the wind speed continues to increase, the speed control changes the rotor blade angle so that the rotor speed and thus the power output of the WT remain constant.

The yaw system ensures that the nacelle is always optimally aligned to the wind. To this end, two separate wind measuring systems located on the nacelle measure the wind direction. Only one wind measuring system is used for the control system, while the second system monitors the first and takes over in case the first system fails. If the measured wind direction deviates too greatly from the alignment of the nacelle, the nacelle is yawed into the wind.

The wind energy absorbed from the rotor is converted into electrical energy using a doubly-fed induction machine with slip ring rotor. Its stator is directly connected to the MV transformer, which connects the wind turbine to the grid, and its rotor via a specially controlled frequency converter. Thus only part of the power must be routed via the converter, permitting low electrical system loss.

Safety systems

Nordex wind turbines are equipped with extensive equipment and accessories to provide for personal and turbine safety and ensure continuous operation. The entire turbine is designed in accordance with the Machinery Directive 2006/42/EC and certified as per IEC 61400. For details on the safety devices refer to the current safety manual.

If certain parameters concerning turbine safety are exceeded, the WT will cut out immediately and is put into a safe state. Depending on the cut-out cause, different brake programs are tripped. In case of external causes, such as exces-

sive wind speeds or if the operating temperature is not met, the wind turbine is softly braked by means of rotor blade adjustment.

Lightning/surge protection, electromagnetic compatibility (EMC)

The lightning/surge protection of the wind turbine is based on the EMC-compliant lightning protection zone concept, which comprises the implementation of internal and external lightning/surge protection measures under consideration of the standard IEC 61400-24.

The wind turbine falls into lightning protection level I. All components of the internal and external lightning/surge protection are designed in accordance with lightning protection level I.

The wind turbine with the electrical equipment, consumers, the measurement, control, protection, information and telecommunication technology meets the EMC requirements according to IEC 61400-1, item 10.11.

Low-voltage network types

The **660 V low voltage network** is grounded as an IT system and a three-phase system and is the primary low-voltage electrical system of the wind turbine. The elements of the electrical equipment and measuring instruments of this network are grounded directly or by means of separate protective bonding conductors. A central insulation monitor was installed as another protective measure for personal and turbine safety in the 660 V IT system.

The **400 V/230 V low-voltage network** has its neutral point grounded directly at the supplying network transformers as TN system and three-phase system. The equipment grounding conductor PE and the neutral conductor are available separately. The bodies of the electrical equipment and consumers are connected directly and straight to the neutral points of the supplying network transformers via equipment grounding conductors, including the protective equipotential bonding. The 400 V/230 V low voltage network is the auxiliary low voltage system of the wind turbine.

Auxiliary power of the wind turbine

The auxiliary low voltage required by the wind turbine in stand-by mode and feed-in mode is requested by the following consumers:

- Wind turbine control including main converter control
- 400 V/230 V auxiliary power of the main converter
- 230 V AC UPS supply including 24 V DC supply
- Yaw system
- Pitch system
- Auxiliary drives such as pumps, fans and lubrication units
- Heaters and lighting

- Auxiliary systems such as service lift, obstacle lights

Based on measurements, simulations and existing operating experience, a coincidence factor of 0.6 can be estimated for the installed low voltage auxiliary power for the worst load case of the auxiliary low voltage system as well as the feed-in operation mode of the WT. In the worst load case as well as in stand-by mode of the WT, a coincidence factor of 0.2 is estimated. In addition, measurements and simulations show that the average power factor cos (ϕ) at the supply points of the auxiliary low voltage system does not permanently fall below approx. 0.97 in any WT operating point/load case.

Long-term measurements show that the average base load (average active power) of the auxiliary low voltage system during WT feed-in operation mode is approx. 15 kW, based on one year.

Wind turbines at sites with an average annual wind speed of 6.5 m/s have an internal consumption of approx. 10,000 kWh. This value, however, depends greatly on the site. The internal consumption is defined as the energy that the WT consumes from the grid in the time period during which the WT does not feed current into the grid.

4. Technical data

Design	
Design temperature	Standard -20 °C to +45 °C CCV -40 °C to +45 °C
Operating temperature range	-20 °C to +40 °C[1)]
Operating temperature range CCV	-30 °C to +40 °C[1)]
Standstill	Standard: -20 °C, restart at -18 °C CCV: -30 °C, restart at -28 °C
Max. height above MSL	2000 m[2)]
Certificate	In accordance with IEC 61400-1 and DIBt 2012
Type	3-blade rotor with horizontal axis Up-wind turbine
Output control	Active single blade adjustment
Nominal power	4500 kW[1)2)3)]
Nominal power starting at wind speeds of (at air density of 1.225 kg/m^3)	Approx. 11.5 m/s
Operating speed range of the rotor	6.43 min^{-1} to 12.25 min^{-1}
Nominal speed	10.7 min^{-1}
Cut-in wind speed	3 m/s
Cut-out wind speed	20 m/s[4)]
Cut-back-in wind speed	19.5 m/s[4)]
Calculated service life	At least 20 years

[1)] Nominal power is reached up to defined temperature ranges. Limited project-specific operating ranges are possible and must be agreed to with Nordex.
[2)] At installation altitudes above 1000 m, the nominal power is reached up to defined temperature ranges.
[3)] Project-specific adjustments between 4000 and 4500 kW are possible.
[4)] Temperature-dependent adjustments are possible

Towers	TS105	TS125	TCS164
Hub height	105 m	125 m	164 m
Wind class	DIBt S/ IEC S	DIBt S/ IEC S	DIBt S/ IEC S
Number of tower sections	4	5	2 steel sections 1 concrete part
Layout drawing	E0004109731	E0004043036	E0003944701

Rotor	
Rotor diameter	149.1 m
Swept area	17460 m^2
Nominal power/area	257.7 W/m^2
Rotor shaft inclination angle	5 °
Blade cone angle	3.5 °

Rotor blade	
Materials	Glass-fiber and carbon-fiber reinforced plastic
Total length	72.40 m

Rotor shaft/rotor bearing	
Type	Forged hollow shaft
Materials	42CrMo4 or 34CrNiMo6
Bearing type	Spherical roller bearing
Lubrication	Regularly with lubricating grease

Mechanical brake	
Type	Actively actuated disk brake
Location	On the high-speed shaft
Number of brake calipers	1
Brake pad material	Organic pad material

Gearbox	
Type	Multi-stage planetary gear + spur gear stage
Gear ratio	50 Hz: i = 113.5 60 Hz: i = 136.2
Lubrication	Forced-feed lubrication
Oil quantity including cooling circuit	Max. 650 l
Oil type	VG 320
Max. oil temperature	77 °C
Oil change	Change, if required

Electrical system	
Nominal power P_{nG}	4500 kW*
Nominal voltage	3 x AC 660 V ± 10 % (specific to grid code)
Nominal current at full reactive current feed-in I_{nG} at S_{nG}	4503 A
Nominal apparent power S_{nG} at P_{nG}	5148 kVA
Power factor at P_{nG}	1.00 as default setting 0.869 underexcited (inductive) up to 0.885 overexcited (capacitive) possible
Frequency	50 and 60 Hz

* Nominal power is reached within defined voltage ranges. Limited project-specific operating ranges are possible and must be agreed to with Nordex.

NOTE

The nominal power is subject to system-specific tolerances and varies by ± 100 kW. Practice has shown that negative deviations occur rarely and in most cases are <25 kW. For precisely complying with external power specifications the nominal power of the individual wind turbine can be parameterized accordingly. Alternatively, the wind farm can be parameterized accordingly using the Wind Farm Portal®.

Transformer*		
Total weight	Max. 9 t	
Insulating material	Cast resin or ester	
Rated voltage OV, U_r	0.66 kV	
Maximum rated voltage OV, dependent on MV grid, U_r	Up to 33 kV	
Taps, overvoltage side	± 2 x 2.5 %	
Rated frequency, f_r	50/60 Hz	
Vector group	Dy5	
Power factor, cos(phi)	0.90 inductive/capacitive	
Installation altitude (above MSL)	Up to 2000 m	
Rated apparent power S_r	5000 kVA[1)]	
Impedance voltage, u_z	8 to 9 % ±10 % tolerance	
Minimum Peak Efficiency Index, η	99.483 % / 99.354 %[2)]	
Inrush current	12 x I_N	
Power loss No load losses Short-circuit losses	Dry-type transformer (20 kV) 6700 W 38900 W	Ester transformer (33 kV) 2750 W 60750 W

[1] The values apply to a nominal power of 4500 kW; project-specific adjustments are possible
[2] Values for liquid-filled or dry-type transformer
All values are maximum values. The values may deviate depending on the rated voltage, rated apparent power and WT active power

MV switchgear	
Rated voltage (dependent on MV grid)	24 or 36 kV
Rated current	630 A
Rated short-circuit duration	1 s
Rated short-circuit current	16 kA, 20 kA, 25 kA (for 36 kV only)
Minimum/maximum ambient temperature during operation	NCV: -25 °C to +40 °C
	CCV: -30 °C to +40 °C
Connector type	Connector cone type C according to EN 50181
Circuit breaker	
Number of switching cycles with rated current	E2
Number of switching cycles with short-circuit breaking current	E2
Number of mechanical switching cycles	M1
Switching of capacitive currents	Min. C1 – low
Disconnector	
Number of switching cycles with rated current	E3
Number of switching cycles with short-circuit breaking current	E3
Number of mechanical switching cycles	M1
Disconnector	
Number of mechanical switching cycles	M0
Ground switch	
Number of switching cycles with rated short-circuit breaking current	E2
Number of mechanical switching cycles	≥1000

Generator	
Degree of protection	IP 54 (slip ring box IP 23)
Nominal voltage	660 V
Frequency	50 and 60 Hz
Speed range	50 Hz: 730 to 1390 min^{-1} 60 Hz: 876 to 1668 min^{-1}
Poles	6
Weight	Approx. 10.6 t

Gearbox cooling and filtration	
Type	1st cooling circuit: Oil circuit with oil/water heat exchanger and thermal bypass 2nd cooling circuit: Water/air together with generator cooling
Filter	Coarse filter 50 µm / fine filter 10 µm / super fine filter: <5 µm
Flow rate	Stage 1: approx. 100 l/min / stage 2: approx. 200 l/min

Generator and converter cooling	
Type	Water circuit with water/air heat exchanger and thermal bypass
Flow rate	Approx. 160 l/min
Coolant	Water/glycol-based coolant

Transformer cooling	
Type	**1st cooling circuit:** Version 1: Ester circuit with ester/water heat exchanger Version 2: Closed air circuit with water/air heat exchanger **2nd cooling circuit:** Water/air together with generator, converter and gearbox

Pitch system	
Pitch bearing	Double-row four-point contact bearing
Gearing/raceway lubrication	Automatic lubrication unit with grease
Drive	Electric motor incl. spring-actuated brake and multi-stage planetary gear
Emergency power supply	VRLA batteries

Yaw drive	
Motor	Electric motors incl. spring-actuated brake
Gearbox	4-stage planetary gear
Number of drives	6
Lubrication	Oil, ISO VG 150
Yaw speed	Approx. 0.5 °/s
Brakes	Electric spring-applied brake on every driving motor

© 2017 by Nordex Energy GmbH

Nordex Energy GmbH
Langenhorner Chaussee 600
22419 Hamburg
Germany
http://www.nordex-online.com
info@nordex-online.com

© 2017 by Nordex Energy GmbH

Noise level, Power curves, Thrust curves

Nordex N149/4.0-4.5

Variable Power Curve Modes

© Nordex Energy GmbH, Langenhorner Chaussee 600, D-22419 Hamburg, Germany
All rights reserved. Observe protection notice ISO 16016.

Nordex N149/4.0-4.5 – 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

STE … Serrated Trailing Edge

Nordex N149/4.0-4.5 – 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)]	105	125	135	145	155	164
Mode 0.a	4800	108.1	106.1	●	●	●	●	●	–
Mode 0.b	4500	108.1	106.1	●	●	●	●	●	●
Mode 1.b	4380	107.5	105.5	●	●	●	●	●	●
Mode 2.a	4500	107.0	105.0	●	●	●	●	●	●
Mode 3.b	4200	106.6	104.6	●	●	●	●	●	●
Mode 5.a	4200	105.6	103.6	●	●	●	●	●	●
Mode 5.b	4000	105.6	103.6	●	●	●	●	●	●

● mode available
– mode not available

Nordex N149/4.0-4.5 – Verification conditions power curve

Basis:	These power curve values according to IEC 61400-12-1 are based on aerodynamic calculations by Nordex Energy GmbH.

Determinations for the power curve verification:

Verification according to:	IEC 61400-12-1
Type of anemometer:	Thies First Class (Advanced) or Vector A100
Type of LiDAR:	Windcube V2 or Zephir 300
Measurement of power:	low voltage side, 660/690 VAC
Air density:	normalization to the nearest air density shown in the table
Filter of turbulence intensity:	9 % $\leq$ TI $\leq$ 20 %
Filter of wind shear:	0 $\leq \alpha \leq$ 0.3 Wind shear measurement and determination according to the requirements of MEASNET power performance measurement procedure, Version 5, December - 2009, chapter 3.3 and 3.8
Filter of inflow angle:	-2° $\leq \psi \leq$ +2°
Filter of temperature:	$\theta \leq$ 25 °C
Ice / snow on the blades:	No (determined with ice detectors)
Filter of grid voltage U (for mode 2.a and 5.a only):	U $>$ 92% U_N (of nominal voltage U_N)
Filter of grid reactive power:	Power factor = 1.0
Status signal:	Ready for unlimited operation in the corresponding operational mode without consideration of the cut-out hysteresis

Abbreviations

TI ...	turbulence intensity
α ...	Hellmann exponent
ψ ...	vertical inflow angle
v_H ...	hub height wind speed

Nordex N149/4.0-4.5 – Power curves – Mode 0.a

for hub heights 105 m, 125 m, 135 m, 145 m and 155 m
(mode not available for 164 m)

wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	**0.925**	**0.950**	**0.975**	**1.000**	**1.025**	**1.050**	**1.075**	**1.100**
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1123	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1569	1612	1655	1698	1741	1784	1827	1870
8.0	1856	1908	1960	2012	2064	2115	2167	2218	2270
8.5	2228	2290	2351	2413	2475	2536	2597	2659	2720
9.0	2633	2706	2778	2850	2922	2994	3066	3138	3210
9.5	3051	3134	3218	3301	3385	3466	3546	3625	3705
10.0	3467	3562	3652	3741	3829	3905	3972	4038	4104
10.5	3861	3957	4036	4110	4183	4245	4299	4353	4406
11.0	4183	4263	4327	4387	4446	4494	4535	4575	4615
11.5	4422	4487	4537	4581	4626	4661	4688	4714	4741
12.0	4592	4641	4677	4707	4737	4758	4770	4783	4795
12.5	4706	4740	4760	4776	4791	4798	4799	4800	4800
13.0	4772	4790	4796	4798	4800	4800	4800	4800	4800
13.5	4797	4800	4800	4800	4800	4800	4800	4800	4800
14.0	4800	4800	4800	4800	4800	4800	4800	4800	4800
14.5	4800	4800	4800	4800	4800	4800	4800	4800	4800
15.0	4800	4800	4800	4800	4800	4800	4800	4800	4800
15.5	4800	4800	4800	4800	4800	4800	4800	4800	4800
16.0	4800	4800	4800	4800	4800	4800	4800	4800	4800
16.5	4800	4800	4800	4800	4800	4800	4800	4800	4800
17.0	4800	4800	4800	4800	4800	4800	4800	4800	4800
17.5	4800	4800	4800	4800	4800	4800	4800	4800	4800
18.0	4800	4800	4800	4800	4800	4800	4800	4800	4800
18.5	4800	4800	4800	4800	4800	4800	4800	4800	4800
19.0	4800	4800	4800	4800	4800	4800	4800	4800	4800
19.5	4761	4761	4761	4761	4761	4761	4761	4761	4761
20.0	4655	4655	4655	4655	4655	4655	4655	4655	4655
20.5*	4482	4482	4482	4482	4482	4482	4482	4482	4482
21.0*	4307	4307	4307	4307	4307	4307	4307	4307	4307
21.5*	4131	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 0.a

for hub heights 105 m, 125 m, 135 m, 145 m and 155 m (mode not available for 164 m)								
wind speed v_H [m/s]	**Power P_{el} [kW] at air density ρ [kg/m³]**							
	1.125	**1.150**	**1.175**	**1.200**	**1.225**	**1.250**	**1.275**	**1.300**
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1433
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1912	1955	1998	2040	2083	2125	2168	2210
8.0	2321	2373	2424	2476	2527	2578	2630	2680
8.5	2781	2842	2901	2959	3016	3072	3127	3180
9.0	3278	3343	3404	3464	3520	3575	3629	3680
9.5	3770	3824	3875	3923	3969	4014	4057	4098
10.0	4158	4199	4239	4276	4311	4344	4376	4405
10.5	4447	4477	4504	4529	4552	4574	4594	4613
11.0	4643	4660	4676	4690	4703	4715	4726	4736
11.5	4757	4763	4768	4774	4778	4782	4786	4790
12.0	4800	4800	4800	4800	4800	4800	4800	4800
12.5	4800	4800	4800	4800	4800	4800	4800	4800
13.0	4800	4800	4800	4800	4800	4800	4800	4800
13.5	4800	4800	4800	4800	4800	4800	4800	4800
14.0	4800	4800	4800	4800	4800	4800	4800	4800
14.5	4800	4800	4800	4800	4800	4800	4800	4800
15.0	4800	4800	4800	4800	4800	4800	4800	4800
15.5	4800	4800	4800	4800	4800	4800	4800	4800
16.0	4800	4800	4800	4800	4800	4800	4800	4800
16.5	4800	4800	4800	4800	4800	4800	4800	4800
17.0	4800	4800	4800	4800	4800	4800	4800	4800
17.5	4800	4800	4800	4800	4800	4800	4800	4800
18.0	4800	4800	4800	4800	4800	4800	4800	4800
18.5	4800	4800	4800	4800	4800	4800	4800	4800
19.0	4800	4800	4800	4800	4800	4800	4800	4800
19.5	4761	4761	4761	4761	4761	4761	4761	4761
20.0	4655	4655	4655	4655	4655	4655	4655	4655
20.5*	4482	4482	4482	4482	4482	4482	4482	4482
21.0*	4307	4307	4307	4307	4307	4307	4307	4307
21.5*	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 0.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1124	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1569	1612	1655	1698	1741	1784	1827	1870
8.0	1856	1908	1960	2012	2064	2115	2167	2219	2270
8.5	2228	2290	2351	2413	2475	2536	2597	2659	2720
9.0	2633	2705	2778	2850	2923	2995	3066	3137	3207
9.5	3051	3135	3218	3299	3379	3458	3530	3590	3649
10.0	3462	3551	3635	3702	3769	3836	3894	3942	3990
10.5	3816	3890	3960	4014	4068	4121	4167	4203	4238
11.0	4083	4142	4199	4239	4279	4319	4352	4376	4399
11.5	4273	4318	4360	4387	4414	4441	4460	4470	4479
12.0	4398	4429	4456	4468	4481	4493	4500	4500	4500
12.5	4470	4485	4498	4499	4500	4500	4500	4500	4500
13.0	4498	4499	4500	4500	4500	4500	4500	4500	4500
13.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
14.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
14.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
15.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
15.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
16.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
16.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
17.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
17.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
18.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
18.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
19.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
19.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
20.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
20.5*	4455	4455	4455	4455	4455	4455	4455	4455	4455
21.0*	4307	4307	4307	4307	4307	4307	4307	4307	4307
21.5*	4131	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 0.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1433
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1912	1955	1998	2040	2083	2125	2168	2210
8.0	2322	2373	2424	2476	2527	2578	2629	2680
8.5	2781	2842	2901	2959	3016	3072	3127	3180
9.0	3275	3339	3401	3458	3506	3553	3600	3644
9.5	3706	3759	3810	3857	3894	3930	3966	3999
10.0	4035	4077	4116	4151	4177	4203	4227	4250
10.5	4271	4301	4328	4351	4367	4381	4394	4407
11.0	4419	4437	4453	4465	4470	4474	4478	4481
11.5	4487	4493	4498	4500	4500	4500	4500	4500
12.0	4500	4500	4500	4500	4500	4500	4500	4500
12.5	4500	4500	4500	4500	4500	4500	4500	4500
13.0	4500	4500	4500	4500	4500	4500	4500	4500
13.5	4500	4500	4500	4500	4500	4500	4500	4500
14.0	4500	4500	4500	4500	4500	4500	4500	4500
14.5	4500	4500	4500	4500	4500	4500	4500	4500
15.0	4500	4500	4500	4500	4500	4500	4500	4500
15.5	4500	4500	4500	4500	4500	4500	4500	4500
16.0	4500	4500	4500	4500	4500	4500	4500	4500
16.5	4500	4500	4500	4500	4500	4500	4500	4500
17.0	4500	4500	4500	4500	4500	4500	4500	4500
17.5	4500	4500	4500	4500	4500	4500	4500	4500
18.0	4500	4500	4500	4500	4500	4500	4500	4500
18.5	4500	4500	4500	4500	4500	4500	4500	4500
19.0	4500	4500	4500	4500	4500	4500	4500	4500
19.5	4500	4500	4500	4500	4500	4500	4500	4500
20.0	4500	4500	4500	4500	4500	4500	4500	4500
20.5*	4455	4455	4455	4455	4455	4455	4455	4455
21.0*	4307	4307	4307	4307	4307	4307	4307	4307
21.5*	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 1.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1124	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1569	1612	1655	1698	1741	1784	1827	1870
8.0	1856	1908	1960	2012	2064	2115	2167	2219	2270
8.5	2226	2288	2349	2411	2473	2534	2595	2657	2718
9.0	2619	2691	2762	2834	2906	2978	3051	3125	3199
9.5	3018	3101	3184	3268	3351	3434	3508	3572	3634
10.0	3410	3502	3594	3665	3735	3806	3866	3916	3965
10.5	3758	3835	3912	3968	4023	4079	4124	4159	4193
11.0	4015	4076	4137	4175	4214	4253	4283	4302	4322
11.5	4193	4236	4279	4301	4324	4346	4361	4366	4371
12.0	4304	4328	4354	4361	4369	4377	4380	4380	4380
12.5	4360	4369	4379	4380	4380	4380	4380	4380	4380
13.0	4378	4379	4380	4380	4380	4380	4380	4380	4380
13.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
14.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
14.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
15.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
15.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
16.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
16.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
17.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
17.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
18.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
18.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
19.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
19.5	4380	4380	4380	4380	4380	4380	4380	4380	4380
20.0	4380	4380	4380	4380	4380	4380	4380	4380	4380
20.5*	4364	4364	4364	4364	4364	4364	4364	4364	4364
21.0*	4281	4281	4281	4281	4281	4281	4281	4281	4281
21.5*	4131	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 1.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1433
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1912	1955	1998	2040	2083	2126	2168	2211
8.0	2322	2373	2424	2476	2527	2578	2629	2678
8.5	2779	2840	2900	2959	3017	3076	3132	3186
9.0	3272	3346	3401	3453	3503	3552	3599	3644
9.5	3697	3761	3803	3842	3880	3918	3952	3985
10.0	4014	4063	4094	4120	4146	4170	4192	4213
10.5	4227	4262	4279	4293	4305	4316	4327	4337
11.0	4341	4361	4366	4368	4370	4372	4374	4376
11.5	4376	4380	4380	4380	4380	4380	4380	4380
12.0	4380	4380	4380	4380	4380	4380	4380	4380
12.5	4380	4380	4380	4380	4380	4380	4380	4380
13.0	4380	4380	4380	4380	4380	4380	4380	4380
13.5	4380	4380	4380	4380	4380	4380	4380	4380
14.0	4380	4380	4380	4380	4380	4380	4380	4380
14.5	4380	4380	4380	4380	4380	4380	4380	4380
15.0	4380	4380	4380	4380	4380	4380	4380	4380
15.5	4380	4380	4380	4380	4380	4380	4380	4380
16.0	4380	4380	4380	4380	4380	4380	4380	4380
16.5	4380	4380	4380	4380	4380	4380	4380	4380
17.0	4380	4380	4380	4380	4380	4380	4380	4380
17.5	4380	4380	4380	4380	4380	4380	4380	4380
18.0	4380	4380	4380	4380	4380	4380	4380	4380
18.5	4380	4380	4380	4380	4380	4380	4380	4380
19.0	4380	4380	4380	4380	4380	4380	4380	4380
19.5	4380	4380	4380	4380	4380	4380	4380	4380
20.0	4380	4380	4380	4380	4380	4380	4380	4380
20.5*	4364	4364	4364	4364	4364	4364	4364	4364
21.0*	4281	4281	4281	4281	4281	4281	4281	4281
21.5*	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 2.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1123	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1569	1612	1655	1698	1741	1784	1827	1869
8.0	1857	1908	1960	2012	2064	2116	2167	2219	2270
8.5	2221	2282	2344	2405	2467	2528	2589	2650	2707
9.0	2599	2671	2742	2813	2885	2956	3027	3094	3151
9.5	2975	3056	3138	3220	3301	3380	3458	3526	3579
10.0	3341	3432	3520	3606	3691	3762	3827	3882	3923
10.5	3681	3773	3851	3922	3993	4050	4102	4145	4174
11.0	3957	4033	4097	4154	4211	4254	4293	4322	4341
11.5	4163	4224	4273	4316	4358	4389	4414	4432	4443
12.0	4311	4358	4393	4422	4450	4467	4479	4486	4491
12.5	4412	4444	4465	4479	4494	4499	4500	4500	4500
13.0	4472	4489	4497	4499	4500	4500	4500	4500	4500
13.5	4497	4500	4500	4500	4500	4500	4500	4500	4500
14.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
14.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
15.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
15.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
16.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
16.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
17.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
17.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
18.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
18.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
19.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
19.5	4500	4500	4500	4500	4500	4500	4500	4500	4500
20.0	4500	4500	4500	4500	4500	4500	4500	4500	4500
20.5*	4455	4455	4455	4455	4455	4455	4455	4455	4455
21.0*	4307	4307	4307	4307	4307	4307	4307	4307	4307
21.5*	4131	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 2.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1433
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1912	1955	1998	2041	2084	2126	2168	2209
8.0	2321	2371	2420	2468	2516	2562	2607	2650
8.5	2761	2814	2864	2912	2959	3004	3047	3088
9.0	3205	3256	3304	3349	3393	3434	3473	3510
9.5	3628	3674	3714	3749	3783	3814	3843	3870
10.0	3961	3996	4024	4049	4071	4092	4112	4130
10.5	4200	4224	4243	4259	4273	4286	4298	4309
11.0	4358	4374	4385	4394	4402	4409	4416	4422
11.5	4453	4462	4468	4471	4474	4477	4479	4482
12.0	4495	4499	4500	4500	4500	4500	4500	4500
12.5	4500	4500	4500	4500	4500	4500	4500	4500
13.0	4500	4500	4500	4500	4500	4500	4500	4500
13.5	4500	4500	4500	4500	4500	4500	4500	4500
14.0	4500	4500	4500	4500	4500	4500	4500	4500
14.5	4500	4500	4500	4500	4500	4500	4500	4500
15.0	4500	4500	4500	4500	4500	4500	4500	4500
15.5	4500	4500	4500	4500	4500	4500	4500	4500
16.0	4500	4500	4500	4500	4500	4500	4500	4500
16.5	4500	4500	4500	4500	4500	4500	4500	4500
17.0	4500	4500	4500	4500	4500	4500	4500	4500
17.5	4500	4500	4500	4500	4500	4500	4500	4500
18.0	4500	4500	4500	4500	4500	4500	4500	4500
18.5	4500	4500	4500	4500	4500	4500	4500	4500
19.0	4500	4500	4500	4500	4500	4500	4500	4500
19.5	4500	4500	4500	4500	4500	4500	4500	4500
20.0	4500	4500	4500	4500	4500	4500	4500	4500
20.5*	4455	4455	4455	4455	4455	4455	4455	4455
21.0*	4307	4307	4307	4307	4307	4307	4307	4307
21.5*	4131	4131	4131	4131	4131	4131	4131	4131
22.0*	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 3.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m

wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1123	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1569	1612	1655	1698	1741	1784	1827	1869
8.0	1856	1908	1960	2012	2064	2115	2167	2219	2270
8.5	2215	2280	2340	2402	2462	2522	2583	2644	2705
9.0	2583	2660	2730	2801	2872	2944	3017	3095	3173
9.5	2947	3038	3119	3204	3292	3379	3458	3525	3593
10.0	3307	3409	3504	3585	3660	3734	3799	3851	3901
10.5	3641	3724	3805	3870	3927	3983	4030	4062	4094
11.0	3892	3952	4014	4057	4093	4129	4156	4170	4184
11.5	4061	4100	4138	4162	4177	4193	4200	4200	4200
12.0	4158	4175	4193	4199	4200	4200	4200	4200	4200
12.5	4196	4198	4200	4200	4200	4200	4200	4200	4200
13.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
13.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
14.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
14.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
15.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
15.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
16.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
16.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
17.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
17.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
18.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
18.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
19.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
19.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
20.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
20.5*	4200	4200	4200	4200	4200	4200	4200	4200	4200
21.0*	4185	4185	4185	4185	4185	4185	4185	4185	4185
21.5*	4102	4102	4102	4102	4102	4102	4102	4102	4102
22.0*	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 3.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1433
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1912	1955	1998	2040	2083	2126	2168	2211
8.0	2322	2373	2424	2475	2526	2577	2628	2678
8.5	2766	2826	2894	2962	3029	3097	3159	3213
9.0	3250	3323	3383	3443	3502	3562	3615	3659
9.5	3659	3720	3765	3811	3856	3901	3940	3969
10.0	3952	3996	4026	4054	4083	4111	4135	4152
10.5	4127	4153	4166	4179	4191	4200	4200	4200
11.0	4198	4200	4200	4200	4200	4200	4200	4200
11.5	4200	4200	4200	4200	4200	4200	4200	4200
12.0	4200	4200	4200	4200	4200	4200	4200	4200
12.5	4200	4200	4200	4200	4200	4200	4200	4200
13.0	4200	4200	4200	4200	4200	4200	4200	4200
13.5	4200	4200	4200	4200	4200	4200	4200	4200
14.0	4200	4200	4200	4200	4200	4200	4200	4200
14.5	4200	4200	4200	4200	4200	4200	4200	4200
15.0	4200	4200	4200	4200	4200	4200	4200	4200
15.5	4200	4200	4200	4200	4200	4200	4200	4200
16.0	4200	4200	4200	4200	4200	4200	4200	4200
16.5	4200	4200	4200	4200	4200	4200	4200	4200
17.0	4200	4200	4200	4200	4200	4200	4200	4200
17.5	4200	4200	4200	4200	4200	4200	4200	4200
18.0	4200	4200	4200	4200	4200	4200	4200	4200
18.5	4200	4200	4200	4200	4200	4200	4200	4200
19.0	4200	4200	4200	4200	4200	4200	4200	4200
19.5	4200	4200	4200	4200	4200	4200	4200	4200
20.0	4200	4200	4200	4200	4200	4200	4200	4200
20.5*	4200	4200	4200	4200	4200	4200	4200	4200
21.0*	4185	4185	4185	4185	4185	4185	4185	4185
21.5*	4102	4102	4102	4102	4102	4102	4102	4102
22.0*	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 5.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1124	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1570	1613	1656	1699	1741	1784	1827	1870
8.0	1850	1902	1953	2005	2058	2108	2160	2212	2263
8.5	2186	2247	2308	2368	2435	2489	2554	2613	2673
9.0	2520	2590	2659	2728	2806	2868	2945	3014	3083
9.5	2842	2922	2999	3077	3166	3240	3329	3414	3496
10.0	3146	3237	3325	3416	3514	3598	3672	3743	3815
10.5	3441	3542	3640	3718	3795	3869	3921	3974	4028
11.0	3715	3800	3881	3941	3997	4050	4084	4118	4151
11.5	3926	3988	4051	4088	4125	4157	4172	4187	4200
12.0	4073	4113	4152	4169	4185	4199	4200	4200	4200
12.5	4159	4177	4195	4197	4199	4200	4200	4200	4200
13.0	4193	4197	4200	4200	4200	4200	4200	4200	4200
13.5	4199	4200	4200	4200	4200	4200	4200	4200	4200
14.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
14.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
15.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
15.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
16.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
16.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
17.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
17.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
18.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
18.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
19.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
19.5	4200	4200	4200	4200	4200	4200	4200	4200	4200
20.0	4200	4200	4200	4200	4200	4200	4200	4200	4200
20.5*	4200	4200	4200	4200	4200	4200	4200	4200	4200
21.0*	4185	4185	4185	4185	4185	4185	4185	4185	4185
21.5*	4102	4102	4102	4102	4102	4102	4102	4102	4102
22.0*	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 5.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1434
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1913	1955	1998	2041	2083	2126	2169	2211
8.0	2314	2365	2416	2467	2518	2569	2617	2665
8.5	2733	2793	2852	2912	2978	3044	3097	3147
9.0	3158	3233	3309	3384	3444	3500	3544	3584
9.5	3563	3628	3694	3758	3803	3845	3875	3902
10.0	3865	3914	3963	4011	4040	4067	4081	4095
10.5	4060	4091	4122	4153	4166	4176	4182	4186
11.0	4166	4180	4193	4200	4200	4200	4200	4200
11.5	4200	4200	4200	4200	4200	4200	4200	4200
12.0	4200	4200	4200	4200	4200	4200	4200	4200
12.5	4200	4200	4200	4200	4200	4200	4200	4200
13.0	4200	4200	4200	4200	4200	4200	4200	4200
13.5	4200	4200	4200	4200	4200	4200	4200	4200
14.0	4200	4200	4200	4200	4200	4200	4200	4200
14.5	4200	4200	4200	4200	4200	4200	4200	4200
15.0	4200	4200	4200	4200	4200	4200	4200	4200
15.5	4200	4200	4200	4200	4200	4200	4200	4200
16.0	4200	4200	4200	4200	4200	4200	4200	4200
16.5	4200	4200	4200	4200	4200	4200	4200	4200
17.0	4200	4200	4200	4200	4200	4200	4200	4200
17.5	4200	4200	4200	4200	4200	4200	4200	4200
18.0	4200	4200	4200	4200	4200	4200	4200	4200
18.5	4200	4200	4200	4200	4200	4200	4200	4200
19.0	4200	4200	4200	4200	4200	4200	4200	4200
19.5	4200	4200	4200	4200	4200	4200	4200	4200
20.0	4200	4200	4200	4200	4200	4200	4200	4200
20.5*	4200	4200	4200	4200	4200	4200	4200	4200
21.0*	4185	4185	4185	4185	4185	4185	4185	4185
21.5*	4102	4102	4102	4102	4102	4102	4102	4102
22.0*	3951	3951	3951	3951	3951	3951	3951	3951
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 5.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	9	11	13	14	16	18	19	21	23
3.5	77	80	84	87	91	94	98	101	105
4.0	169	175	181	187	193	199	205	211	217
4.5	282	291	300	309	318	327	336	346	355
5.0	417	430	443	455	468	481	494	507	520
5.5	576	593	611	628	645	662	680	697	714
6.0	763	786	808	831	853	875	898	920	942
6.5	982	1010	1039	1067	1095	1124	1152	1180	1208
7.0	1235	1271	1306	1341	1376	1411	1446	1481	1516
7.5	1526	1570	1613	1656	1699	1741	1784	1827	1870
8.0	1850	1902	1953	2005	2059	2110	2160	2211	2262
8.5	2186	2247	2309	2369	2437	2496	2554	2614	2675
9.0	2520	2590	2664	2731	2812	2881	2952	3034	3115
9.5	2843	2921	3010	3091	3190	3280	3369	3440	3511
10.0	3156	3253	3359	3453	3535	3613	3688	3741	3793
10.5	3473	3562	3650	3729	3784	3841	3895	3925	3954
11.0	3725	3792	3852	3908	3939	3972	4000	4000	4000
11.5	3897	3937	3971	4000	4000	4000	4000	4000	4000
12.0	3991	4000	4000	4000	4000	4000	4000	4000	4000
12.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
13.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
13.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
14.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
14.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
15.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
15.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
16.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
16.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
17.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
17.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
18.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
18.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
19.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
19.5	4000	4000	4000	4000	4000	4000	4000	4000	4000
20.0	4000	4000	4000	4000	4000	4000	4000	4000	4000
20.5*	4000	4000	4000	4000	4000	4000	4000	4000	4000
21.0*	4000	4000	4000	4000	4000	4000	4000	4000	4000
21.5*	3992	3992	3992	3992	3992	3992	3992	3992	3992
22.0*	3918	3918	3918	3918	3918	3918	3918	3918	3918
22.5*	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Power curves – Mode 5.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Power P_{el} [kW] at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	24	26	28	29	31	32	34	36
3.5	108	112	115	119	122	126	129	133
4.0	223	229	235	241	247	253	259	265
4.5	364	373	382	391	400	409	419	428
5.0	533	545	558	571	584	597	610	622
5.5	731	748	766	783	800	817	834	852
6.0	964	987	1009	1031	1054	1076	1098	1120
6.5	1236	1265	1293	1321	1349	1377	1405	1433
7.0	1551	1586	1621	1656	1691	1726	1761	1796
7.5	1913	1955	1998	2041	2084	2126	2169	2211
8.0	2314	2365	2416	2467	2518	2569	2620	2675
8.5	2735	2798	2869	2940	3012	3083	3146	3198
9.0	3196	3271	3336	3399	3464	3526	3578	3615
9.5	3582	3646	3692	3739	3785	3832	3866	3886
10.0	3845	3888	3915	3942	3969	3996	4000	4000
10.5	3984	4000	4000	4000	4000	4000	4000	4000
11.0	4000	4000	4000	4000	4000	4000	4000	4000
11.5	4000	4000	4000	4000	4000	4000	4000	4000
12.0	4000	4000	4000	4000	4000	4000	4000	4000
12.5	4000	4000	4000	4000	4000	4000	4000	4000
13.0	4000	4000	4000	4000	4000	4000	4000	4000
13.5	4000	4000	4000	4000	4000	4000	4000	4000
14.0	4000	4000	4000	4000	4000	4000	4000	4000
14.5	4000	4000	4000	4000	4000	4000	4000	4000
15.0	4000	4000	4000	4000	4000	4000	4000	4000
15.5	4000	4000	4000	4000	4000	4000	4000	4000
16.0	4000	4000	4000	4000	4000	4000	4000	4000
16.5	4000	4000	4000	4000	4000	4000	4000	4000
17.0	4000	4000	4000	4000	4000	4000	4000	4000
17.5	4000	4000	4000	4000	4000	4000	4000	4000
18.0	4000	4000	4000	4000	4000	4000	4000	4000
18.5	4000	4000	4000	4000	4000	4000	4000	4000
19.0	4000	4000	4000	4000	4000	4000	4000	4000
19.5	4000	4000	4000	4000	4000	4000	4000	4000
20.0	4000	4000	4000	4000	4000	4000	4000	4000
20.5*	4000	4000	4000	4000	4000	4000	4000	4000
21.0*	4000	4000	4000	4000	4000	4000	4000	4000
21.5*	3992	3992	3992	3992	3992	3992	3992	3992
22.0*	3918	3918	3918	3918	3918	3918	3918	3918
22.5*	3776	3776	3776	3776	3776	3776	3776	3776
23.0*	3600	3600	3600	3600	3600	3600	3600	3600
23.5*	3420	3420	3420	3420	3420	3420	3420	3420
24.0*	3245	3245	3245	3245	3245	3245	3245	3245
24.5*	3065	3065	3065	3065	3065	3065	3065	3065
25.0*	2885	2885	2885	2885	2885	2885	2885	2885
25.5*	2705	2705	2705	2705	2705	2705	2705	2705
26.0*	2529	2529	2529	2529	2529	2529	2529	2529

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – General remarks thrust curves

Basis:

The represented thrust coefficients are based on aerodynamical calculations by the Nordex Energy GmbH. The thrust curves are only for information and will not be warranted.

Nordex N149/4.0-4.5 – Thrust curves – Mode 0.a

for hub heights 105 m, 125 m, 135 m, 145 m and 155 m
(mode not available for 164 m)

wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	**0.925**	**0.950**	**0.975**	**1.000**	**1.025**	**1.050**	**1.075**	**1.100**
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.787	0.787	0.787	0.787	0.787	0.787	0.787	0.787	0.787
8.0	0.783	0.783	0.783	0.783	0.783	0.783	0.783	0.783	0.783
8.5	0.767	0.767	0.767	0.767	0.767	0.767	0.767	0.767	0.767
9.0	0.744	0.744	0.744	0.744	0.743	0.743	0.740	0.738	0.736
9.5	0.715	0.714	0.713	0.710	0.708	0.705	0.701	0.697	0.694
10.0	0.679	0.676	0.673	0.669	0.665	0.662	0.656	0.651	0.647
10.5	0.637	0.633	0.629	0.624	0.619	0.615	0.609	0.603	0.597
11.0	0.592	0.588	0.583	0.577	0.572	0.567	0.560	0.554	0.548
11.5	0.547	0.542	0.536	0.530	0.524	0.519	0.512	0.505	0.499
12.0	0.502	0.496	0.490	0.484	0.477	0.472	0.465	0.458	0.452
12.5	0.457	0.451	0.445	0.438	0.432	0.426	0.419	0.412	0.405
13.0	0.414	0.408	0.402	0.394	0.388	0.382	0.374	0.368	0.361
13.5	0.374	0.367	0.361	0.354	0.347	0.341	0.334	0.327	0.320
14.0	0.338	0.331	0.325	0.318	0.311	0.305	0.297	0.290	0.284
14.5	0.305	0.298	0.292	0.285	0.278	0.272	0.264	0.258	0.251
15.0	0.275	0.269	0.262	0.255	0.248	0.242	0.236	0.230	0.224
15.5	0.248	0.242	0.235	0.229	0.222	0.217	0.211	0.206	0.202
16.0	0.224	0.218	0.212	0.206	0.201	0.196	0.191	0.186	0.182
16.5	0.203	0.197	0.192	0.187	0.182	0.178	0.174	0.170	0.166
17.0	0.186	0.181	0.176	0.171	0.167	0.163	0.159	0.156	0.152
17.5	0.171	0.166	0.162	0.158	0.154	0.151	0.147	0.144	0.141
18.0	0.159	0.155	0.151	0.147	0.143	0.140	0.137	0.134	0.131
18.5	0.148	0.144	0.141	0.137	0.134	0.131	0.128	0.125	0.123
19.0	0.140	0.136	0.133	0.129	0.126	0.123	0.121	0.118	0.116
19.5	0.132	0.129	0.126	0.123	0.120	0.117	0.114	0.112	0.110
20.0	0.126	0.123	0.120	0.117	0.114	0.112	0.109	0.107	0.105
20.5*	0.116	0.114	0.111	0.108	0.105	0.103	0.101	0.099	0.097
21.0*	0.106	0.103	0.101	0.098	0.096	0.094	0.091	0.090	0.088
21.5*	0.095	0.092	0.090	0.088	0.086	0.084	0.082	0.080	0.079
22.0*	0.085	0.083	0.081	0.079	0.077	0.076	0.074	0.072	0.071
22.5*	0.076	0.075	0.073	0.071	0.069	0.068	0.066	0.065	0.064
23.0*	0.069	0.067	0.066	0.064	0.062	0.061	0.060	0.058	0.057
23.5*	0.061	0.060	0.059	0.057	0.056	0.055	0.053	0.052	0.051
24.0*	0.055	0.054	0.053	0.051	0.050	0.049	0.048	0.047	0.046
24.5*	0.050	0.049	0.048	0.047	0.045	0.045	0.043	0.043	0.042
25.0*	0.045	0.044	0.043	0.042	0.041	0.040	0.039	0.039	0.038
25.5*	0.041	0.040	0.039	0.038	0.037	0.036	0.035	0.035	0.034
26.0*	0.037	0.036	0.035	0.035	0.034	0.033	0.032	0.032	0.031

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 0.a

for hub heights 105 m, 125 m, 135 m, 145 m and 155 m (mode not available for 164 m)								
wind speed v_H [m/s]	**Thrust coefficients c_T at air density ρ [kg/m³]**							
	1.125	**1.150**	**1.175**	**1.200**	**1.225**	**1.250**	**1.275**	**1.300**
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.788	0.788	0.787	0.787	0.786	0.785	0.785	0.784
8.0	0.783	0.783	0.781	0.778	0.775	0.772	0.769	0.766
8.5	0.767	0.764	0.759	0.754	0.748	0.743	0.739	0.734
9.0	0.734	0.728	0.722	0.715	0.708	0.702	0.696	0.690
9.5	0.690	0.684	0.676	0.668	0.661	0.654	0.647	0.641
10.0	0.642	0.635	0.627	0.619	0.611	0.603	0.596	0.589
10.5	0.593	0.585	0.577	0.568	0.560	0.552	0.544	0.537
11.0	0.543	0.535	0.526	0.517	0.509	0.501	0.494	0.486
11.5	0.494	0.486	0.477	0.468	0.460	0.452	0.444	0.437
12.0	0.446	0.438	0.429	0.420	0.411	0.403	0.396	0.388
12.5	0.399	0.391	0.383	0.374	0.366	0.358	0.350	0.343
13.0	0.355	0.347	0.339	0.331	0.323	0.316	0.309	0.303
13.5	0.314	0.306	0.299	0.292	0.285	0.279	0.273	0.267
14.0	0.278	0.271	0.264	0.258	0.252	0.246	0.241	0.236
14.5	0.245	0.239	0.234	0.229	0.224	0.219	0.215	0.211
15.0	0.219	0.214	0.209	0.205	0.201	0.197	0.193	0.189
15.5	0.197	0.193	0.189	0.185	0.181	0.177	0.174	0.171
16.0	0.178	0.174	0.171	0.167	0.164	0.161	0.158	0.155
16.5	0.162	0.159	0.156	0.153	0.150	0.147	0.144	0.142
17.0	0.149	0.146	0.143	0.140	0.138	0.135	0.133	0.130
17.5	0.138	0.135	0.132	0.130	0.127	0.125	0.123	0.121
18.0	0.128	0.126	0.123	0.121	0.119	0.117	0.114	0.112
18.5	0.120	0.118	0.116	0.113	0.111	0.109	0.107	0.106
19.0	0.113	0.111	0.109	0.107	0.105	0.103	0.101	0.100
19.5	0.108	0.105	0.103	0.101	0.100	0.098	0.096	0.095
20.0	0.103	0.101	0.099	0.097	0.095	0.093	0.092	0.090
20.5*	0.095	0.093	0.091	0.090	0.088	0.086	0.085	0.083
21.0*	0.086	0.085	0.083	0.081	0.080	0.078	0.077	0.076
21.5*	0.077	0.076	0.074	0.073	0.071	0.070	0.069	0.068
22.0*	0.070	0.068	0.067	0.066	0.064	0.063	0.062	0.061
22.5*	0.062	0.061	0.060	0.059	0.058	0.056	0.056	0.055
23.0*	0.056	0.055	0.054	0.053	0.052	0.051	0.050	0.049
23.5*	0.050	0.049	0.048	0.047	0.046	0.045	0.045	0.044
24.0*	0.045	0.044	0.044	0.043	0.042	0.041	0.040	0.040
24.5*	0.041	0.040	0.039	0.039	0.038	0.037	0.037	0.036
25.0*	0.037	0.036	0.036	0.035	0.034	0.034	0.033	0.032
25.5*	0.033	0.033	0.032	0.031	0.031	0.030	0.030	0.029
26.0*	0.030	0.030	0.029	0.029	0.028	0.027	0.027	0.027

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 0.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.787	0.787	0.787	0.787	0.787	0.787	0.788	0.787	0.787
8.0	0.783	0.783	0.783	0.783	0.783	0.783	0.783	0.783	0.783
8.5	0.767	0.767	0.767	0.767	0.767	0.767	0.767	0.765	0.762
9.0	0.744	0.743	0.743	0.741	0.738	0.736	0.734	0.729	0.725
9.5	0.712	0.709	0.706	0.703	0.698	0.694	0.690	0.684	0.679
10.0	0.671	0.667	0.663	0.658	0.652	0.647	0.643	0.636	0.629
10.5	0.626	0.621	0.616	0.610	0.604	0.598	0.593	0.586	0.579
11.0	0.580	0.574	0.568	0.562	0.555	0.549	0.543	0.536	0.528
11.5	0.533	0.527	0.521	0.514	0.507	0.500	0.494	0.486	0.479
12.0	0.487	0.480	0.474	0.467	0.459	0.453	0.446	0.438	0.431
12.5	0.442	0.435	0.428	0.421	0.413	0.406	0.400	0.392	0.385
13.0	0.398	0.391	0.384	0.377	0.369	0.362	0.356	0.348	0.340
13.5	0.358	0.350	0.343	0.336	0.328	0.321	0.315	0.307	0.299
14.0	0.321	0.314	0.307	0.299	0.292	0.285	0.278	0.271	0.264
14.5	0.288	0.281	0.274	0.267	0.259	0.252	0.246	0.240	0.234
15.0	0.259	0.251	0.244	0.238	0.231	0.225	0.219	0.214	0.209
15.5	0.232	0.225	0.219	0.213	0.207	0.202	0.197	0.193	0.188
16.0	0.209	0.203	0.197	0.192	0.187	0.183	0.179	0.174	0.171
16.5	0.190	0.184	0.180	0.175	0.171	0.167	0.163	0.159	0.156
17.0	0.174	0.169	0.165	0.160	0.157	0.153	0.149	0.146	0.143
17.5	0.160	0.156	0.152	0.148	0.145	0.141	0.138	0.135	0.132
18.0	0.149	0.145	0.141	0.138	0.135	0.131	0.129	0.126	0.123
18.5	0.139	0.136	0.132	0.129	0.126	0.123	0.120	0.118	0.115
19.0	0.131	0.128	0.124	0.122	0.119	0.116	0.114	0.111	0.109
19.5	0.124	0.121	0.118	0.115	0.113	0.110	0.108	0.105	0.103
20.0	0.118	0.115	0.112	0.110	0.107	0.105	0.103	0.101	0.099
20.5*	0.109	0.106	0.103	0.102	0.099	0.097	0.095	0.093	0.091
21.0*	0.099	0.096	0.094	0.092	0.090	0.088	0.086	0.085	0.083
21.5*	0.089	0.086	0.084	0.083	0.080	0.079	0.077	0.076	0.074
22.0*	0.080	0.078	0.076	0.074	0.072	0.071	0.070	0.068	0.067
22.5*	0.072	0.070	0.068	0.067	0.065	0.064	0.062	0.061	0.060
23.0*	0.064	0.063	0.061	0.060	0.058	0.057	0.056	0.055	0.054
23.5*	0.058	0.056	0.055	0.054	0.052	0.051	0.050	0.049	0.048
24.0*	0.052	0.051	0.049	0.048	0.047	0.046	0.045	0.044	0.044
24.5*	0.047	0.046	0.045	0.044	0.043	0.042	0.041	0.040	0.039
25.0*	0.043	0.042	0.040	0.040	0.039	0.038	0.037	0.036	0.036
25.5*	0.038	0.037	0.036	0.036	0.035	0.034	0.033	0.033	0.032
26.0*	0.035	0.034	0.033	0.032	0.032	0.031	0.030	0.030	0.029

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 0.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.787	0.787	0.787	0.786	0.786	0.785	0.785	0.784
8.0	0.783	0.783	0.781	0.778	0.774	0.770	0.767	0.763
8.5	0.760	0.757	0.753	0.748	0.741	0.735	0.730	0.725
9.0	0.721	0.716	0.711	0.704	0.696	0.690	0.683	0.677
9.5	0.674	0.668	0.662	0.654	0.646	0.639	0.632	0.625
10.0	0.624	0.618	0.611	0.603	0.594	0.586	0.579	0.572
10.5	0.572	0.566	0.559	0.550	0.542	0.534	0.526	0.519
11.0	0.522	0.515	0.508	0.499	0.490	0.482	0.475	0.467
11.5	0.472	0.465	0.458	0.449	0.440	0.432	0.425	0.417
12.0	0.424	0.417	0.409	0.401	0.392	0.384	0.376	0.369
12.5	0.378	0.371	0.363	0.355	0.346	0.338	0.330	0.323
13.0	0.333	0.326	0.319	0.311	0.303	0.296	0.290	0.283
13.5	0.292	0.285	0.279	0.272	0.266	0.260	0.254	0.249
14.0	0.257	0.251	0.245	0.240	0.234	0.230	0.225	0.221
14.5	0.228	0.223	0.218	0.213	0.209	0.205	0.201	0.197
15.0	0.204	0.200	0.196	0.192	0.188	0.184	0.181	0.177
15.5	0.184	0.180	0.177	0.173	0.170	0.166	0.163	0.160
16.0	0.167	0.163	0.160	0.157	0.154	0.151	0.148	0.146
16.5	0.152	0.149	0.146	0.143	0.141	0.138	0.136	0.133
17.0	0.140	0.137	0.134	0.132	0.129	0.127	0.125	0.123
17.5	0.130	0.127	0.124	0.122	0.120	0.118	0.116	0.114
18.0	0.121	0.118	0.116	0.114	0.112	0.110	0.108	0.106
18.5	0.113	0.111	0.109	0.107	0.105	0.103	0.101	0.100
19.0	0.107	0.105	0.103	0.101	0.099	0.097	0.096	0.094
19.5	0.101	0.099	0.097	0.096	0.094	0.092	0.091	0.089
20.0	0.097	0.095	0.093	0.091	0.090	0.088	0.087	0.085
20.5*	0.090	0.088	0.086	0.084	0.083	0.081	0.080	0.078
21.0*	0.081	0.080	0.078	0.076	0.076	0.074	0.073	0.071
21.5*	0.073	0.071	0.070	0.068	0.068	0.066	0.065	0.064
22.0*	0.066	0.064	0.063	0.062	0.061	0.060	0.059	0.058
22.5*	0.059	0.058	0.056	0.055	0.055	0.053	0.053	0.052
23.0*	0.053	0.052	0.051	0.050	0.049	0.048	0.048	0.046
23.5*	0.047	0.046	0.045	0.044	0.044	0.043	0.042	0.041
24.0*	0.043	0.042	0.041	0.040	0.040	0.039	0.038	0.037
24.5*	0.039	0.038	0.037	0.036	0.036	0.035	0.035	0.034
25.0*	0.035	0.034	0.034	0.033	0.032	0.032	0.031	0.031
25.5*	0.031	0.031	0.030	0.029	0.029	0.028	0.028	0.027
26.0*	0.029	0.028	0.027	0.027	0.027	0.026	0.026	0.025

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 1.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
8.0	0.776	0.776	0.776	0.776	0.776	0.776	0.776	0.776	0.776
8.5	0.756	0.756	0.756	0.756	0.756	0.756	0.756	0.753	0.751
9.0	0.728	0.728	0.728	0.727	0.724	0.722	0.720	0.716	0.712
9.5	0.695	0.692	0.690	0.687	0.683	0.679	0.675	0.670	0.665
10.0	0.653	0.649	0.645	0.641	0.636	0.631	0.627	0.621	0.615
10.5	0.608	0.603	0.598	0.593	0.587	0.582	0.577	0.570	0.564
11.0	0.561	0.556	0.550	0.545	0.538	0.532	0.527	0.520	0.513
11.5	0.515	0.508	0.503	0.497	0.490	0.484	0.478	0.471	0.464
12.0	0.468	0.462	0.456	0.449	0.442	0.436	0.430	0.423	0.416
12.5	0.423	0.417	0.410	0.404	0.397	0.390	0.384	0.377	0.370
13.0	0.381	0.374	0.368	0.361	0.354	0.347	0.341	0.334	0.327
13.5	0.343	0.336	0.329	0.323	0.316	0.309	0.303	0.295	0.288
14.0	0.309	0.302	0.295	0.288	0.281	0.274	0.268	0.261	0.254
14.5	0.278	0.271	0.264	0.257	0.250	0.244	0.237	0.232	0.226
15.0	0.250	0.243	0.236	0.230	0.223	0.218	0.212	0.207	0.202
15.5	0.224	0.218	0.212	0.206	0.201	0.196	0.191	0.187	0.182
16.0	0.202	0.197	0.191	0.186	0.182	0.177	0.173	0.169	0.165
16.5	0.184	0.179	0.174	0.170	0.165	0.161	0.158	0.154	0.151
17.0	0.168	0.164	0.159	0.155	0.152	0.148	0.145	0.142	0.139
17.5	0.155	0.151	0.147	0.144	0.140	0.137	0.134	0.131	0.128
18.0	0.144	0.140	0.137	0.134	0.130	0.127	0.125	0.122	0.119
18.5	0.135	0.131	0.128	0.125	0.122	0.119	0.117	0.114	0.112
19.0	0.127	0.124	0.121	0.118	0.115	0.113	0.110	0.108	0.106
19.5	0.120	0.117	0.114	0.112	0.109	0.107	0.104	0.102	0.100
20.0	0.115	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096
20.5*	0.106	0.103	0.101	0.099	0.096	0.094	0.092	0.090	0.089
21.0*	0.096	0.094	0.091	0.090	0.087	0.086	0.084	0.082	0.081
21.5*	0.086	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072
22.0*	0.078	0.076	0.074	0.072	0.070	0.069	0.068	0.066	0.065
22.5*	0.070	0.068	0.066	0.065	0.063	0.062	0.061	0.059	0.058
23.0*	0.063	0.061	0.060	0.058	0.057	0.056	0.055	0.054	0.052
23.5*	0.056	0.055	0.053	0.052	0.051	0.050	0.049	0.048	0.047
24.0*	0.051	0.049	0.048	0.047	0.046	0.045	0.044	0.043	0.042
24.5*	0.046	0.045	0.043	0.043	0.041	0.041	0.040	0.039	0.038
25.0*	0.042	0.040	0.039	0.039	0.038	0.037	0.036	0.035	0.035
25.5*	0.037	0.036	0.035	0.035	0.034	0.033	0.032	0.032	0.031
26.0*	0.034	0.033	0.032	0.032	0.031	0.030	0.030	0.029	0.028

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 1.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.786	0.786	0.786	0.786	0.786	0.785	0.784	0.782
8.0	0.776	0.776	0.776	0.773	0.770	0.766	0.763	0.759
8.5	0.749	0.748	0.745	0.740	0.734	0.729	0.724	0.718
9.0	0.708	0.705	0.700	0.694	0.687	0.681	0.675	0.668
9.5	0.660	0.656	0.650	0.644	0.636	0.629	0.623	0.615
10.0	0.609	0.604	0.598	0.591	0.583	0.576	0.569	0.562
10.5	0.558	0.552	0.546	0.539	0.531	0.523	0.516	0.508
11.0	0.507	0.501	0.495	0.487	0.479	0.471	0.464	0.456
11.5	0.457	0.451	0.445	0.437	0.429	0.421	0.414	0.406
12.0	0.409	0.403	0.396	0.389	0.380	0.373	0.365	0.358
12.5	0.363	0.357	0.350	0.342	0.334	0.327	0.320	0.313
13.0	0.320	0.314	0.307	0.300	0.292	0.286	0.279	0.273
13.5	0.281	0.275	0.269	0.262	0.256	0.251	0.245	0.240
14.0	0.248	0.242	0.237	0.231	0.227	0.222	0.217	0.213
14.5	0.221	0.216	0.211	0.206	0.202	0.198	0.194	0.191
15.0	0.198	0.193	0.189	0.185	0.182	0.178	0.175	0.171
15.5	0.178	0.174	0.171	0.167	0.164	0.161	0.158	0.155
16.0	0.162	0.158	0.155	0.152	0.149	0.146	0.144	0.141
16.5	0.148	0.144	0.142	0.139	0.136	0.134	0.131	0.129
17.0	0.136	0.133	0.130	0.128	0.125	0.123	0.121	0.119
17.5	0.126	0.123	0.121	0.118	0.116	0.114	0.112	0.110
18.0	0.117	0.115	0.112	0.110	0.108	0.106	0.104	0.103
18.5	0.110	0.108	0.105	0.103	0.102	0.100	0.098	0.096
19.0	0.103	0.101	0.100	0.098	0.096	0.094	0.093	0.091
19.5	0.098	0.096	0.095	0.093	0.091	0.090	0.088	0.087
20.0	0.094	0.092	0.090	0.089	0.087	0.086	0.084	0.083
20.5*	0.087	0.085	0.083	0.082	0.080	0.079	0.078	0.077
21.0*	0.079	0.077	0.076	0.075	0.073	0.072	0.070	0.070
21.5*	0.071	0.069	0.068	0.067	0.065	0.065	0.063	0.062
22.0*	0.064	0.062	0.061	0.060	0.059	0.058	0.057	0.056
22.5*	0.057	0.056	0.055	0.054	0.053	0.052	0.051	0.050
23.0*	0.051	0.050	0.049	0.049	0.048	0.047	0.046	0.045
23.5*	0.046	0.045	0.044	0.043	0.042	0.042	0.041	0.041
24.0*	0.041	0.040	0.040	0.039	0.038	0.038	0.037	0.037
24.5*	0.037	0.037	0.036	0.035	0.035	0.034	0.033	0.033
25.0*	0.034	0.033	0.032	0.032	0.031	0.031	0.030	0.030
25.5*	0.030	0.030	0.029	0.029	0.028	0.028	0.027	0.027
26.0*	0.028	0.027	0.027	0.026	0.026	0.025	0.025	0.024

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 2.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m

wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	**0.925**	**0.950**	**0.975**	**1.000**	**1.025**	**1.050**	**1.075**	**1.100**
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.785	0.785	0.785	0.785	0.785	0.785	0.785	0.785	0.785
8.0	0.769	0.769	0.769	0.769	0.769	0.770	0.769	0.769	0.769
8.5	0.745	0.745	0.745	0.745	0.745	0.745	0.745	0.745	0.744
9.0	0.715	0.715	0.715	0.715	0.715	0.714	0.712	0.710	0.707
9.5	0.681	0.680	0.680	0.678	0.675	0.673	0.670	0.666	0.662
10.0	0.642	0.640	0.637	0.634	0.631	0.627	0.623	0.618	0.613
10.5	0.599	0.595	0.592	0.587	0.583	0.579	0.574	0.569	0.563
11.0	0.553	0.549	0.545	0.540	0.535	0.530	0.525	0.519	0.513
11.5	0.508	0.503	0.498	0.493	0.487	0.482	0.476	0.470	0.464
12.0	0.462	0.457	0.452	0.446	0.440	0.435	0.429	0.423	0.417
12.5	0.418	0.413	0.407	0.401	0.396	0.390	0.384	0.378	0.371
13.0	0.378	0.373	0.367	0.361	0.355	0.349	0.343	0.337	0.330
13.5	0.342	0.336	0.331	0.325	0.318	0.313	0.306	0.300	0.294
14.0	0.310	0.304	0.298	0.292	0.286	0.280	0.273	0.267	0.261
14.5	0.280	0.274	0.269	0.262	0.256	0.250	0.244	0.238	0.232
15.0	0.254	0.248	0.242	0.236	0.229	0.224	0.218	0.213	0.208
15.5	0.230	0.224	0.218	0.212	0.206	0.201	0.196	0.191	0.187
16.0	0.208	0.202	0.196	0.191	0.186	0.182	0.177	0.173	0.169
16.5	0.189	0.183	0.178	0.174	0.169	0.165	0.161	0.158	0.154
17.0	0.173	0.168	0.163	0.159	0.155	0.152	0.148	0.145	0.142
17.5	0.159	0.155	0.151	0.147	0.144	0.140	0.137	0.134	0.131
18.0	0.148	0.144	0.140	0.137	0.133	0.130	0.127	0.125	0.122
18.5	0.138	0.135	0.131	0.128	0.125	0.122	0.119	0.117	0.114
19.0	0.130	0.127	0.124	0.121	0.118	0.115	0.113	0.110	0.108
19.5	0.123	0.120	0.117	0.114	0.112	0.109	0.107	0.104	0.102
20.0	0.117	0.114	0.112	0.109	0.106	0.104	0.102	0.100	0.098
20.5*	0.108	0.105	0.103	0.101	0.098	0.096	0.094	0.092	0.090
21.0*	0.098	0.096	0.094	0.091	0.089	0.087	0.086	0.084	0.082
21.5*	0.088	0.086	0.084	0.082	0.080	0.078	0.077	0.075	0.074
22.0*	0.079	0.077	0.076	0.074	0.072	0.070	0.069	0.068	0.066
22.5*	0.071	0.069	0.068	0.066	0.064	0.063	0.062	0.061	0.059
23.0*	0.064	0.062	0.061	0.060	0.058	0.057	0.056	0.055	0.054
23.5*	0.057	0.056	0.055	0.053	0.052	0.051	0.050	0.049	0.048
24.0*	0.051	0.050	0.049	0.048	0.047	0.046	0.045	0.044	0.043
24.5*	0.047	0.045	0.045	0.043	0.042	0.041	0.041	0.040	0.039
25.0*	0.042	0.041	0.040	0.039	0.038	0.038	0.037	0.036	0.035
25.5*	0.038	0.037	0.036	0.035	0.034	0.034	0.033	0.032	0.032
26.0*	0.035	0.034	0.033	0.032	0.031	0.031	0.030	0.030	0.029

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 2.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.787	0.787	0.787	0.786	0.785	0.783
7.5	0.784	0.781	0.778	0.776	0.773	0.770	0.767	0.763
8.0	0.766	0.762	0.757	0.752	0.748	0.744	0.739	0.733
8.5	0.740	0.733	0.727	0.720	0.714	0.708	0.702	0.695
9.0	0.701	0.693	0.686	0.678	0.671	0.664	0.656	0.648
9.5	0.655	0.646	0.638	0.629	0.621	0.614	0.606	0.598
10.0	0.606	0.596	0.587	0.579	0.570	0.562	0.554	0.545
10.5	0.555	0.546	0.536	0.527	0.519	0.511	0.502	0.493
11.0	0.505	0.495	0.486	0.477	0.468	0.460	0.451	0.443
11.5	0.456	0.446	0.437	0.427	0.419	0.410	0.402	0.394
12.0	0.408	0.399	0.390	0.381	0.372	0.364	0.357	0.350
12.5	0.363	0.354	0.346	0.338	0.331	0.324	0.317	0.311
13.0	0.322	0.315	0.308	0.301	0.294	0.288	0.282	0.276
13.5	0.287	0.280	0.274	0.267	0.262	0.256	0.251	0.246
14.0	0.255	0.249	0.243	0.238	0.233	0.228	0.223	0.218
14.5	0.227	0.221	0.216	0.212	0.207	0.203	0.199	0.195
15.0	0.203	0.198	0.194	0.190	0.186	0.182	0.179	0.175
15.5	0.183	0.179	0.175	0.171	0.168	0.165	0.162	0.159
16.0	0.165	0.162	0.159	0.155	0.152	0.149	0.147	0.144
16.5	0.151	0.148	0.145	0.142	0.139	0.137	0.134	0.132
17.0	0.139	0.136	0.133	0.130	0.128	0.126	0.123	0.121
17.5	0.128	0.126	0.123	0.121	0.119	0.116	0.114	0.112
18.0	0.119	0.117	0.115	0.113	0.111	0.109	0.107	0.105
18.5	0.112	0.110	0.108	0.106	0.104	0.102	0.100	0.098
19.0	0.106	0.104	0.102	0.100	0.098	0.096	0.094	0.093
19.5	0.100	0.098	0.096	0.095	0.093	0.091	0.090	0.088
20.0	0.096	0.094	0.092	0.090	0.089	0.087	0.086	0.084
20.5*	0.089	0.087	0.085	0.083	0.082	0.080	0.079	0.078
21.0*	0.081	0.079	0.077	0.076	0.075	0.073	0.072	0.070
21.5*	0.072	0.071	0.069	0.068	0.067	0.065	0.065	0.063
22.0*	0.065	0.064	0.062	0.061	0.060	0.059	0.058	0.057
22.5*	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051
23.0*	0.052	0.051	0.050	0.049	0.049	0.048	0.047	0.046
23.5*	0.047	0.046	0.045	0.044	0.043	0.042	0.042	0.041
24.0*	0.042	0.041	0.040	0.040	0.039	0.038	0.038	0.037
24.5*	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.033
25.0*	0.035	0.034	0.033	0.032	0.032	0.031	0.031	0.030
25.5*	0.031	0.030	0.030	0.029	0.029	0.028	0.028	0.027
26.0*	0.028	0.028	0.027	0.027	0.026	0.026	0.025	0.025

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 3.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788
7.5	0.782	0.782	0.782	0.782	0.782	0.782	0.782	0.782	0.782
8.0	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764
8.5	0.737	0.737	0.737	0.737	0.737	0.737	0.737	0.736	0.734
9.0	0.705	0.705	0.705	0.705	0.702	0.700	0.698	0.695	0.692
9.5	0.669	0.667	0.665	0.663	0.659	0.655	0.652	0.648	0.643
10.0	0.626	0.623	0.619	0.616	0.611	0.607	0.603	0.598	0.592
10.5	0.580	0.576	0.572	0.567	0.562	0.557	0.552	0.547	0.541
11.0	0.533	0.528	0.523	0.519	0.513	0.507	0.502	0.496	0.490
11.5	0.486	0.481	0.476	0.471	0.464	0.458	0.453	0.447	0.440
12.0	0.440	0.435	0.429	0.424	0.417	0.411	0.405	0.399	0.393
12.5	0.397	0.391	0.385	0.379	0.373	0.367	0.361	0.354	0.348
13.0	0.358	0.352	0.346	0.340	0.333	0.327	0.321	0.315	0.308
13.5	0.323	0.317	0.310	0.305	0.298	0.292	0.286	0.279	0.273
14.0	0.291	0.285	0.279	0.273	0.266	0.260	0.254	0.248	0.241
14.5	0.263	0.256	0.250	0.244	0.238	0.231	0.226	0.220	0.215
15.0	0.237	0.230	0.224	0.218	0.212	0.207	0.202	0.197	0.192
15.5	0.213	0.207	0.202	0.196	0.191	0.186	0.182	0.178	0.174
16.0	0.193	0.187	0.182	0.177	0.173	0.169	0.165	0.161	0.157
16.5	0.175	0.170	0.166	0.162	0.158	0.154	0.150	0.147	0.144
17.0	0.160	0.156	0.152	0.148	0.145	0.141	0.138	0.135	0.132
17.5	0.148	0.144	0.140	0.137	0.134	0.131	0.128	0.125	0.122
18.0	0.138	0.134	0.131	0.127	0.124	0.122	0.119	0.116	0.114
18.5	0.129	0.125	0.122	0.119	0.117	0.114	0.111	0.109	0.107
19.0	0.121	0.118	0.115	0.113	0.110	0.107	0.105	0.103	0.101
19.5	0.115	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096
20.0	0.110	0.107	0.104	0.102	0.099	0.097	0.095	0.093	0.091
20.5*	0.102	0.099	0.096	0.094	0.091	0.090	0.088	0.086	0.084
21.0*	0.092	0.090	0.087	0.086	0.083	0.081	0.080	0.078	0.076
21.5*	0.083	0.080	0.078	0.077	0.074	0.073	0.071	0.070	0.068
22.0*	0.074	0.072	0.070	0.069	0.067	0.066	0.064	0.063	0.062
22.5*	0.067	0.065	0.063	0.062	0.060	0.059	0.058	0.056	0.055
23.0*	0.060	0.058	0.057	0.056	0.054	0.053	0.052	0.051	0.050
23.5*	0.054	0.052	0.051	0.050	0.048	0.047	0.046	0.045	0.044
24.0*	0.048	0.047	0.046	0.045	0.044	0.043	0.042	0.041	0.040
24.5*	0.044	0.043	0.041	0.041	0.039	0.039	0.038	0.037	0.036
25.0*	0.040	0.039	0.038	0.037	0.036	0.035	0.034	0.034	0.033
25.5*	0.036	0.035	0.034	0.033	0.032	0.031	0.031	0.030	0.029
26.0*	0.032	0.032	0.031	0.030	0.029	0.029	0.028	0.027	0.027

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 3.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.788	0.788	0.788	0.788	0.787	0.787	0.787	0.787
7.5	0.782	0.782	0.782	0.782	0.782	0.782	0.782	0.782
8.0	0.764	0.764	0.763	0.761	0.760	0.759	0.758	0.755
8.5	0.732	0.731	0.727	0.724	0.720	0.717	0.714	0.710
9.0	0.688	0.685	0.681	0.676	0.671	0.667	0.663	0.658
9.5	0.639	0.635	0.629	0.624	0.619	0.614	0.609	0.604
10.0	0.587	0.582	0.577	0.571	0.565	0.560	0.555	0.549
10.5	0.535	0.530	0.524	0.518	0.512	0.506	0.501	0.495
11.0	0.484	0.479	0.472	0.466	0.460	0.454	0.448	0.442
11.5	0.434	0.429	0.422	0.416	0.409	0.403	0.398	0.392
12.0	0.386	0.381	0.374	0.367	0.361	0.355	0.350	0.343
12.5	0.342	0.336	0.329	0.323	0.316	0.310	0.305	0.299
13.0	0.302	0.296	0.290	0.283	0.276	0.271	0.265	0.259
13.5	0.266	0.261	0.254	0.248	0.243	0.238	0.232	0.228
14.0	0.235	0.230	0.225	0.220	0.215	0.211	0.207	0.203
14.5	0.210	0.205	0.201	0.196	0.192	0.188	0.185	0.181
15.0	0.188	0.184	0.180	0.176	0.173	0.170	0.166	0.163
15.5	0.170	0.166	0.163	0.159	0.156	0.153	0.150	0.148
16.0	0.154	0.151	0.148	0.145	0.142	0.139	0.137	0.134
16.5	0.141	0.138	0.135	0.132	0.130	0.127	0.125	0.123
17.0	0.129	0.127	0.124	0.122	0.120	0.117	0.115	0.113
17.5	0.120	0.117	0.115	0.113	0.111	0.109	0.107	0.105
18.0	0.112	0.109	0.107	0.105	0.103	0.101	0.100	0.098
18.5	0.105	0.103	0.101	0.099	0.097	0.095	0.094	0.092
19.0	0.099	0.097	0.095	0.093	0.092	0.090	0.088	0.087
19.5	0.094	0.092	0.090	0.089	0.087	0.085	0.084	0.083
20.0	0.090	0.088	0.086	0.085	0.083	0.082	0.080	0.079
20.5*	0.083	0.081	0.079	0.078	0.077	0.076	0.074	0.073
21.0*	0.076	0.074	0.072	0.071	0.070	0.069	0.067	0.066
21.5*	0.068	0.066	0.065	0.064	0.062	0.062	0.060	0.059
22.0*	0.061	0.060	0.058	0.058	0.056	0.056	0.054	0.053
22.5*	0.055	0.053	0.052	0.052	0.050	0.050	0.048	0.048
23.0*	0.049	0.048	0.047	0.046	0.045	0.045	0.044	0.043
23.5*	0.044	0.043	0.042	0.041	0.041	0.040	0.039	0.039
24.0*	0.040	0.039	0.038	0.037	0.037	0.036	0.035	0.035
24.5*	0.036	0.035	0.034	0.034	0.033	0.033	0.032	0.031
25.0*	0.032	0.032	0.031	0.031	0.030	0.030	0.029	0.029
25.5*	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.026
26.0*	0.027	0.026	0.025	0.025	0.024	0.024	0.024	0.023

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 5.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
7.5	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770
8.0	0.744	0.744	0.744	0.744	0.744	0.744	0.744	0.744	0.744
8.5	0.712	0.712	0.712	0.712	0.712	0.712	0.712	0.712	0.712
9.0	0.675	0.675	0.675	0.675	0.675	0.675	0.674	0.672	0.670
9.5	0.636	0.636	0.636	0.635	0.633	0.631	0.629	0.626	0.623
10.0	0.595	0.594	0.592	0.589	0.586	0.584	0.580	0.576	0.573
10.5	0.551	0.548	0.545	0.542	0.538	0.535	0.531	0.526	0.522
11.0	0.505	0.502	0.498	0.494	0.490	0.486	0.482	0.477	0.472
11.5	0.459	0.455	0.451	0.447	0.442	0.438	0.433	0.428	0.423
12.0	0.416	0.412	0.407	0.403	0.398	0.393	0.388	0.382	0.377
12.5	0.377	0.372	0.368	0.363	0.358	0.353	0.348	0.342	0.337
13.0	0.342	0.337	0.332	0.327	0.322	0.317	0.312	0.306	0.301
13.5	0.310	0.305	0.300	0.295	0.290	0.285	0.279	0.274	0.269
14.0	0.282	0.277	0.271	0.266	0.261	0.256	0.250	0.245	0.239
14.5	0.256	0.251	0.245	0.240	0.235	0.230	0.224	0.219	0.214
15.0	0.232	0.227	0.222	0.217	0.211	0.206	0.201	0.196	0.191
15.5	0.211	0.206	0.201	0.195	0.190	0.185	0.181	0.177	0.173
16.0	0.192	0.186	0.181	0.177	0.172	0.168	0.164	0.160	0.156
16.5	0.174	0.170	0.165	0.161	0.157	0.153	0.149	0.146	0.143
17.0	0.160	0.155	0.151	0.148	0.144	0.140	0.137	0.134	0.131
17.5	0.147	0.143	0.140	0.136	0.133	0.130	0.127	0.124	0.121
18.0	0.137	0.133	0.130	0.127	0.124	0.121	0.118	0.116	0.113
18.5	0.128	0.125	0.122	0.119	0.116	0.113	0.111	0.108	0.106
19.0	0.121	0.118	0.115	0.112	0.109	0.107	0.104	0.102	0.100
19.5	0.114	0.111	0.109	0.106	0.104	0.101	0.099	0.097	0.095
20.0	0.109	0.106	0.104	0.101	0.099	0.097	0.095	0.093	0.091
20.5*	0.101	0.098	0.096	0.093	0.091	0.090	0.088	0.086	0.084
21.0*	0.091	0.089	0.087	0.085	0.083	0.081	0.080	0.078	0.076
21.5*	0.082	0.080	0.078	0.076	0.074	0.073	0.071	0.070	0.068
22.0*	0.074	0.072	0.070	0.068	0.067	0.066	0.064	0.063	0.062
22.5*	0.066	0.064	0.063	0.061	0.060	0.059	0.058	0.056	0.055
23.0*	0.060	0.058	0.057	0.055	0.054	0.053	0.052	0.051	0.050
23.5*	0.053	0.052	0.051	0.049	0.048	0.047	0.046	0.045	0.044
24.0*	0.048	0.047	0.046	0.044	0.044	0.043	0.042	0.041	0.040
24.5*	0.043	0.042	0.041	0.040	0.039	0.039	0.038	0.037	0.036
25.0*	0.039	0.038	0.038	0.036	0.036	0.035	0.034	0.034	0.033
25.5*	0.035	0.034	0.034	0.033	0.032	0.031	0.031	0.030	0.029
26.0*	0.032	0.031	0.031	0.030	0.029	0.029	0.028	0.027	0.027

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 5.a

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
7.5	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.769
8.0	0.744	0.744	0.744	0.745	0.744	0.743	0.742	0.739
8.5	0.712	0.710	0.708	0.707	0.706	0.702	0.699	0.695
9.0	0.669	0.666	0.663	0.660	0.657	0.653	0.649	0.644
9.5	0.620	0.616	0.612	0.609	0.605	0.600	0.595	0.590
10.0	0.569	0.564	0.560	0.556	0.552	0.546	0.541	0.535
10.5	0.518	0.513	0.508	0.503	0.499	0.493	0.488	0.482
11.0	0.468	0.462	0.457	0.452	0.447	0.441	0.436	0.430
11.5	0.418	0.413	0.407	0.402	0.397	0.391	0.386	0.379
12.0	0.373	0.367	0.361	0.356	0.351	0.345	0.340	0.333
12.5	0.332	0.326	0.321	0.315	0.310	0.304	0.299	0.293
13.0	0.296	0.290	0.284	0.279	0.274	0.268	0.262	0.257
13.5	0.263	0.258	0.252	0.247	0.242	0.236	0.231	0.226
14.0	0.234	0.229	0.223	0.219	0.214	0.209	0.205	0.201
14.5	0.209	0.204	0.199	0.195	0.191	0.187	0.183	0.180
15.0	0.187	0.183	0.179	0.175	0.172	0.168	0.165	0.162
15.5	0.169	0.165	0.162	0.158	0.155	0.152	0.149	0.147
16.0	0.153	0.150	0.147	0.144	0.141	0.138	0.136	0.133
16.5	0.140	0.137	0.134	0.131	0.129	0.126	0.124	0.122
17.0	0.128	0.126	0.123	0.121	0.119	0.116	0.114	0.112
17.5	0.119	0.116	0.114	0.112	0.110	0.108	0.106	0.104
18.0	0.111	0.109	0.106	0.104	0.102	0.101	0.099	0.097
18.5	0.104	0.102	0.100	0.098	0.096	0.094	0.093	0.091
19.0	0.098	0.096	0.094	0.092	0.091	0.089	0.088	0.086
19.5	0.093	0.091	0.089	0.088	0.086	0.085	0.083	0.082
20.0	0.089	0.087	0.085	0.084	0.082	0.081	0.080	0.078
20.5*	0.082	0.080	0.078	0.078	0.076	0.075	0.074	0.072
21.0*	0.075	0.073	0.071	0.070	0.069	0.068	0.067	0.065
21.5*	0.067	0.065	0.064	0.063	0.062	0.061	0.060	0.059
22.0*	0.060	0.059	0.058	0.057	0.056	0.055	0.054	0.053
22.5*	0.054	0.053	0.052	0.051	0.050	0.049	0.048	0.047
23.0*	0.049	0.048	0.046	0.046	0.045	0.044	0.044	0.043
23.5*	0.043	0.042	0.041	0.041	0.040	0.040	0.039	0.038
24.0*	0.039	0.038	0.037	0.037	0.036	0.036	0.035	0.034
24.5*	0.035	0.035	0.034	0.033	0.033	0.032	0.032	0.031
25.0*	0.032	0.031	0.031	0.030	0.030	0.029	0.029	0.028
25.5*	0.029	0.028	0.027	0.027	0.026	0.026	0.026	0.025
26.0*	0.026	0.026	0.025	0.025	0.024	0.024	0.024	0.023

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 5.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m									
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]								
	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
7.5	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770
8.0	0.744	0.744	0.744	0.744	0.744	0.744	0.744	0.744	0.744
8.5	0.712	0.712	0.712	0.712	0.712	0.712	0.712	0.711	0.710
9.0	0.675	0.675	0.675	0.675	0.674	0.672	0.670	0.668	0.665
9.5	0.636	0.635	0.633	0.631	0.629	0.625	0.623	0.619	0.615
10.0	0.592	0.590	0.587	0.584	0.580	0.576	0.572	0.568	0.563
10.5	0.546	0.543	0.538	0.535	0.531	0.526	0.521	0.517	0.512
11.0	0.498	0.495	0.490	0.486	0.481	0.476	0.471	0.466	0.461
11.5	0.452	0.447	0.442	0.438	0.433	0.427	0.422	0.417	0.411
12.0	0.408	0.403	0.398	0.393	0.388	0.382	0.377	0.371	0.365
12.5	0.368	0.363	0.358	0.353	0.347	0.342	0.336	0.331	0.325
13.0	0.333	0.328	0.322	0.317	0.311	0.306	0.300	0.295	0.288
13.5	0.301	0.296	0.290	0.285	0.279	0.273	0.268	0.262	0.256
14.0	0.272	0.267	0.261	0.256	0.250	0.244	0.239	0.233	0.227
14.5	0.246	0.241	0.235	0.230	0.224	0.218	0.213	0.208	0.203
15.0	0.223	0.217	0.211	0.206	0.201	0.196	0.191	0.186	0.182
15.5	0.201	0.196	0.191	0.185	0.181	0.176	0.172	0.168	0.164
16.0	0.182	0.177	0.172	0.168	0.164	0.160	0.156	0.152	0.149
16.5	0.166	0.161	0.157	0.153	0.149	0.146	0.142	0.139	0.136
17.0	0.152	0.148	0.144	0.140	0.137	0.134	0.131	0.128	0.125
17.5	0.140	0.137	0.133	0.130	0.127	0.124	0.121	0.118	0.116
18.0	0.130	0.127	0.124	0.121	0.118	0.115	0.113	0.110	0.108
18.5	0.122	0.119	0.116	0.113	0.111	0.108	0.106	0.103	0.101
19.0	0.115	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096
19.5	0.109	0.106	0.104	0.101	0.099	0.097	0.095	0.093	0.091
20.0	0.104	0.101	0.099	0.097	0.094	0.092	0.090	0.088	0.087
20.5*	0.096	0.093	0.091	0.090	0.087	0.085	0.083	0.081	0.080
21.0*	0.087	0.085	0.083	0.081	0.079	0.077	0.076	0.074	0.073
21.5*	0.078	0.076	0.074	0.073	0.071	0.069	0.068	0.066	0.065
22.0*	0.070	0.068	0.067	0.066	0.064	0.062	0.061	0.060	0.059
22.5*	0.063	0.061	0.060	0.059	0.057	0.056	0.055	0.053	0.053
23.0*	0.057	0.055	0.054	0.053	0.051	0.050	0.049	0.048	0.048
23.5*	0.051	0.049	0.048	0.047	0.046	0.045	0.044	0.043	0.042
24.0*	0.046	0.044	0.044	0.043	0.041	0.040	0.040	0.039	0.038
24.5*	0.041	0.040	0.039	0.039	0.037	0.037	0.036	0.035	0.035
25.0*	0.038	0.036	0.036	0.035	0.034	0.033	0.032	0.032	0.031
25.5*	0.034	0.033	0.032	0.031	0.030	0.030	0.029	0.028	0.028
26.0*	0.031	0.030	0.029	0.029	0.028	0.027	0.027	0.026	0.026

* These values are based on a yield and load optimized operation that is not feasible at all sites.

Nordex N149/4.0-4.5 – Thrust curves – Mode 5.b

for hub heights 105 m, 125 m, 135 m, 145 m, 155 m and 164 m								
wind speed v_H [m/s]	Thrust coefficients c_T at air density ρ [kg/m³]							
	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	0.827	0.827	0.827	0.827	0.827	0.827	0.827	0.827
3.5	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
4.0	0.817	0.817	0.817	0.817	0.817	0.817	0.817	0.817
4.5	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808
5.0	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
5.5	0.794	0.794	0.794	0.794	0.794	0.794	0.794	0.794
6.0	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
6.5	0.789	0.789	0.789	0.789	0.789	0.789	0.789	0.789
7.0	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
7.5	0.770	0.770	0.770	0.770	0.770	0.770	0.771	0.770
8.0	0.745	0.745	0.744	0.743	0.741	0.740	0.739	0.736
8.5	0.708	0.707	0.704	0.701	0.698	0.695	0.692	0.688
9.0	0.662	0.659	0.655	0.651	0.647	0.643	0.640	0.634
9.5	0.611	0.607	0.603	0.598	0.593	0.589	0.585	0.579
10.0	0.559	0.554	0.549	0.544	0.539	0.534	0.529	0.523
10.5	0.507	0.502	0.496	0.491	0.485	0.480	0.475	0.469
11.0	0.455	0.450	0.445	0.439	0.433	0.428	0.423	0.417
11.5	0.406	0.400	0.395	0.389	0.383	0.378	0.372	0.366
12.0	0.360	0.354	0.349	0.342	0.337	0.331	0.326	0.320
12.5	0.319	0.314	0.308	0.302	0.296	0.290	0.285	0.279
13.0	0.283	0.277	0.272	0.265	0.260	0.254	0.249	0.244
13.5	0.250	0.245	0.239	0.234	0.229	0.224	0.219	0.215
14.0	0.222	0.217	0.212	0.207	0.203	0.199	0.195	0.191
14.5	0.198	0.194	0.189	0.185	0.182	0.178	0.174	0.171
15.0	0.178	0.174	0.170	0.167	0.163	0.160	0.157	0.154
15.5	0.161	0.157	0.154	0.151	0.148	0.145	0.142	0.140
16.0	0.146	0.143	0.140	0.137	0.134	0.132	0.129	0.127
16.5	0.133	0.130	0.128	0.125	0.123	0.121	0.118	0.116
17.0	0.122	0.120	0.118	0.115	0.113	0.111	0.109	0.107
17.5	0.113	0.111	0.109	0.107	0.105	0.103	0.101	0.099
18.0	0.106	0.104	0.102	0.100	0.098	0.096	0.094	0.093
18.5	0.099	0.097	0.095	0.094	0.092	0.090	0.089	0.087
19.0	0.094	0.092	0.090	0.088	0.087	0.085	0.084	0.082
19.5	0.089	0.087	0.086	0.084	0.083	0.081	0.080	0.078
20.0	0.085	0.083	0.082	0.080	0.079	0.077	0.076	0.075
20.5*	0.078	0.077	0.076	0.074	0.073	0.071	0.070	0.069
21.0*	0.071	0.070	0.069	0.067	0.066	0.065	0.064	0.063
21.5*	0.064	0.062	0.062	0.060	0.059	0.058	0.057	0.056
22.0*	0.058	0.056	0.056	0.054	0.053	0.052	0.051	0.051
22.5*	0.052	0.050	0.050	0.048	0.048	0.047	0.046	0.045
23.0*	0.046	0.045	0.045	0.044	0.043	0.042	0.041	0.041
23.5*	0.041	0.041	0.040	0.039	0.039	0.038	0.037	0.037
24.0*	0.037	0.037	0.036	0.035	0.035	0.034	0.033	0.033
24.5*	0.034	0.033	0.033	0.032	0.031	0.031	0.030	0.030
25.0*	0.031	0.030	0.030	0.029	0.029	0.028	0.027	0.027
25.5*	0.027	0.027	0.026	0.026	0.026	0.025	0.025	0.024
26.0*	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.022

* These values are based on a yield and load optimized operation that is not feasible at all sites.

© Siemens Gamesa Renewable Energy, S.A., 2018, All Rights Reserved

INDEX

INDEX 1
1 AIM 3
2 SCOPE 3
3 ABBREVIATIONS 3
4 FLEXIBLE RATING GENERAL DESCRIPTION 6
5 FLEXIBLE RATING ELECTRICAL PERFORMANCE ADDITIONAL INFORMATION 7
6 FLEXIBLE RATING POWER CURVES AND NOISE 9
6.1 GENERAL COMMENTS 9
6.2 SG 4.5-145 BASELINE AM0 (@4.5 MW RATED POWER) PERFORMANCE 9
6.3 SG 4.5-145 AM-3 (@4.2 MW RATED POWER) PERFORMANCE 10
6.3.1 Standard Power Curve 10
6.3.2 Annual Energy Production 11
6.3.3 C_P Curves 11
6.3.4 C_T Curves 12
6.3.5 Noise Levels 13
6.4 SG 4.5-145 AM-2 (@4.3 MW RATED POWER) PERFORMANCE 14
6.4.1 Standard Power Curve 14
6.4.2 Annual Energy Production 15
6.4.3 C_P Curves 15
6.4.4 C_T Curves 16
6.4.5 Noise Levels 17
6.5 SG 4.5-145 AM-1 (@4.4 MW RATED POWER) PERFORMANCE 18
6.5.1 Standard Power Curve 18
6.5.2 Annual Energy Production 19
6.5.3 C_P Curves 19
6.5.4 C_T Curves 20
6.5.5 Noise Levels 21
6.6 SG 4.5-145 AM+1 (@4.6 MW RATED POWER) PERFORMANCE 22
6.6.1 Standard Power Curve 22
6.6.2 Annual Energy Production 23
6.6.3 C_P Curves 23
6.6.4 C_T Curves 24
6.6.5 Noise Levels 25
6.7 SG 4.5-145 AM+2 (@4.7 MW RATED POWER) PERFORMANCE 26
6.7.1 Standard Power Curve 26
6.7.2 Annual Energy Production 27
6.7.3 C_P Curves 27
6.7.4 C_T Curves 28
6.7.5 Noise Levels 29
6.8 SG 4.5-145 AM+3 (@4.8 MW RATED POWER) PERFORMANCE 30
6.8.1 Standard Power Curve 30
6.8.2 Annual Energy Production 31
6.8.3 C_P Curves 31
6.8.4 C_T Curves 32
6.8.5 Noise Levels 33
7 LOW NOISE MODES 34
8 REFERENCES 34

RECORD OF CHANGES

Rev.	Date	Author	Description
0	22/06/2018	JEJGUERRERO / SNOVO / MAALONSO	Initial Version

1 AIM

This document describes the FLEXIBLE RATING functionality for the SG 4.5-145 wind turbine.

2 SCOPE

In order to have the best product and solution for our clients, SGRE SG 4.5-145 wind turbine is designed including OPTIMAFLEX philosophy: wind turbine rated power and tower configurations can be highly adapted case by case. Within OPTIMAFLEX, this document describes the FLEXIBLE RATING functionality (modification of the wind turbine rated power).

The information included in the present document is applicable to SG 4.5-145 wind turbine configuration with following hypothesis:

- STD thermal configuration.
- Altitude up to 1000m. For altitudes above this value, power de-ratings due to altitude and external ambient temperature shall be considered.

3 ABBREVIATIONS

- **WT**: Wind turbine.
- **OPTIMAFLEX:** Design philosophy aiming to a highly adaptable product that includes wind turbine rated power and tower configurations optimization.
- **FLEXIBLE RATING:** Within OPTIMAFLEX, functionality that allows increase/decrease WT rated power if specific conditions related to temperature, noise, reactive power production, grid conditions and mechanical loads are fulfilled.
- **AM**: Application Mode.
- **Maximum temperature (Text)**: Expressed in ºC, it is the maximum ambient temperature outside of the nacelle allowed for each Application Mode.
- **Power coefficient (cos PHI)**: Reactive and active power ratio. Cos phi equals to 1 means no reactive power production.
- **Nominal Voltage (Un):** Nominal Voltage.
- **Grid frequency (f):** Grid frequency 50/60Hz.
- **Power (P):** Expressed in kW, this is the electric power obtained at the generator terminals without considering the losses in the transformer or high voltage cables of the wind turbine, or the occasional power consumption which may exist in the same to supply a component. Averaged every 10 minutes.
- **Wind speed ($W_{S.}$):** Expressed in m/s, it is the horizontal wind component value at the height of the hub averaged every 10 minutes.
- **Power curve (PC):** Represents the change in the P in accordance with the W_S for the different WT operating modes.

- **Annual Output / Annual Energy Production (AEP)**: Expressed in [MWh], it is the total electrical energy produced by a wind turbine during a one-year period, in accordance with a given PC and a given wind distribution.

- **Wind distribution:** Weibull distribution is used for different K-distribution parameters and for annual average wind speed values (W_{ave}).

- **Power coefficient:** C_P

- **Thrust coefficient:** C_T

- **Noise level:** The expected sound power level values, expressed in dB(A), represent the sound power that the WT emits at the height of the hub for a given wind speed. In accordance with the IEC standard, the wind speed value (W_{10}) 10 m from the ground is used.

  The noise levels shown in this document are average expected values, called Lw in IEC-61400-14. To obtain the Lwd value, as defined in IEC-61400-14, an increase of 2 dB(A) shall be considered over said Lw values.

- **dB(A):** An A type frequency filter is applied, in accordance with the IEC standard.

4 FLEXIBLE RATING GENERAL DESCRIPTION

SG 4.5-145 wind turbine can be configured to operate with a flexible rated power functionality enabling site specific optimization. It is designed to work at 4.5 MW rated power as baseline, but additional ratings from 4.2 MW to 4.8 MW are also available under certain project-specific and environmental conditions.

SG 4.5-145 baseline design conditions at rated power 4.5 MW are:

- Wind class IIB.
- Maximum external ambient temperature below 1000m +35ºC (STD thermal configuration).
- Electrical performance description: Cos PHI 0.9 @[0.95,1.12]Un @ ±3%frequency. 0.9Un@1.06f.

Within the Optimaflex Flexible Rating strategy, different "**Application Modes (AM)"** from 4.2 MW to 4.8 MW rated powers are defined. Each "Application Mode (AM)" is associated with specific external ambient temperature, grid and wind conditions of the site.

- From an electrical point of view, the availability of a specific rated power other than the baseline 4.5 MW depends on several factors, such as: ambient temperature, reactive power production, grid voltage and grid frequency.

- From a mechanical loads point of view, it is possible to modify the rated power depending on the specific wind conditions in the wind farm. Each site shall be analysed to verify the viability of the rated power modification and the maximum rated power value allowed in each case.

In the following table, a summary of the FLEXIBLE RATING Application Modes (AM) is presented.

AM	Rated power	Wind Conditions [1]	Maximum Temperature [2]	Electrical performance limits	Maximum Noise Emission level [dB(A)] [3]
AM-3	4.2 MW	More demanding wind conditions	+35ºC	cos PHI 0.9 @[0.95,1.12]Un @±3%frequency 0.9Un@1.06f	106.9
AM-2	4.3 MW		+35ºC	cos PHI 0.9 @[0.95,1.12]Un @±3%frequency 0.9Un@1.06f	107.2
AM-1	4.4 MW		+35ºC	cos PHI 0.9 @[0.95,1.12]Un @±3%frequency 0.9Un@1.06f	107.5
AM0	**4.5 MW**	**IIB**	**+35ºC**	**cos PHI 0.9 @[0.95,1.12]Un @±3%frequency 0.9Un@1.06f**	**107.8**
AM+1	4.6 MW	Less demanding wind conditions	+30ºC	cos PHI 0.9 @[0.95,1.12]Un @±2%frequency 0.9Un@1.03f	108.1
AM+2	4.7 MW		+25ºC	cos PHI 0.9 @[0.95,1.12]Un @±2%frequency 0.9Un@1.03f	108.4
AM+3	4.8 MW		+20ºC	cos PHI 0.9 @[0.95,1.12]Un @±2%frequency 0.9Un@1.03f	108.7

[1] Each "Application Mode" is associated with a specific set of wind conditions.
[2] Maximum external ambient temperature outside nacelle, for altitudes below 1000m.
[3] Noise values presented correspond to the wind turbine configuration equipped with noise reduction add-ons attached to the blade. WTG can be supplied without noise reduction add-ons, if required, without impact in the other performance parameters.

5 FLEXIBLE RATING ELECTRICAL PERFORMANCE ADDITIONAL INFORMATION

As described in section 4, FLEXIBLE RATING allows the modification of the rated power in accordance with the conditions associated with the different "Application Modes (AM)". In the present section, further information about electrical performance under the different AM scenarios is presented.

The SG 4.5-145 FLEXIBLE RATING wind turbine reactive power capability delivered at the LV terminals of the WTG transformer is defined in the following figures. Reactive power values shown in Figure 1 and Table 1 can be permanently sustained under steady operational conditions. The variation of reactive power capability within operative voltage range is indicated in Figure 2 and Table 2. Linear interpolation between different voltage points shall be considered to obtain available Q at intermediate points.

It is also possible to offer the capability of providing Q at P=0 (when the WTG is not producing power at low winds). This is shown in the figure 3 and Table 3.

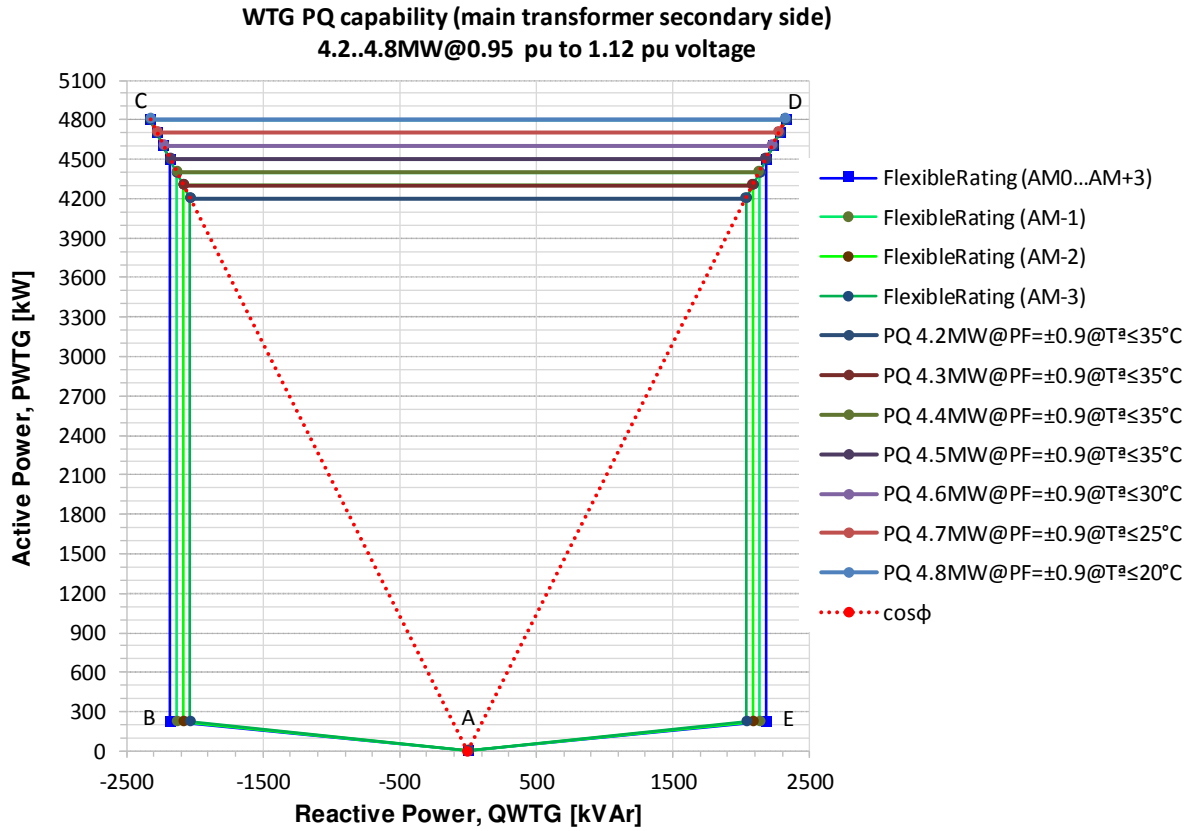


Figure 1 SG 4.5-145 FLEXIBLE RATING electrical performance. P vs Q.

	AM-3: 4.2 MW cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM-2: 4.3 MW** cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM-1: 4.4 MW** cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM0: 4.5 MW** cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM+1: 4.6 MW** cos ϕ=±0.90 T ext ≤ 30ºC F=±2%		**AM+2: 4.7 MW** cos ϕ=±0.90 T ext ≤25ºC F=±2%		**AM+3: 4.8 MW** cos ϕ=±0.90 T ext ≤ 20ºC F=±2%	
	Q (kVAr)	P (kW)	Q (kVAr)	P (kW)	Q (kVAr)	P (kW)	Q (kVAr)	P (kW)	Q (kVAr)	P (kW)	Q (kVAr)	P (kW)	Q (kVAr)	P (kW)
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	2034	225	2083	225	2131	225	2179	225	2179	225	2179	225	2179	225
C	2034	4200	2083	4300	2131	4400	2179	4500	2228	4600	2276	4700	2325	4800
D	-2034	4200	-2083	4300	-2131	4400	-2179	4500	-2228	4600	-2276	4700	-2325	4800
E	-2034	225	-2083	225	-2131	225	-2179	225	-2179	225	-2179	225	-2179	225

Table 1 SG 4.5-145 FLEXIBLE RATING electrical performance. P vs Q.

+Q represents capacitive mode: reactive power into the grid
-Q represents inductive mode: reactive power absorbed from the grid

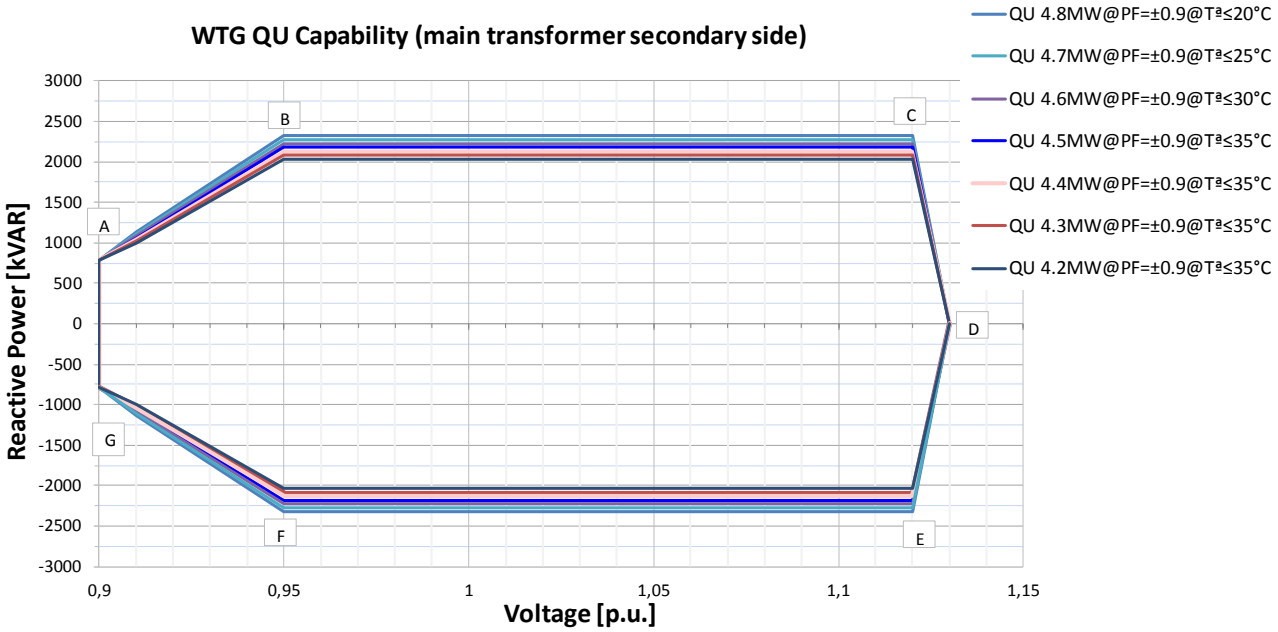


Figure 2 SG 4.5-145 FLEXIBLE RATING electrical performance. Q vs V**.**

	AM-3: 4.2 MW cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM-2: 4.3 MW** cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM-1: 4.4 MW** cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM0: 4.5 MW** cos ϕ=±0.90 T ext ≤35ºC F=±3%		**AM+1: 4.6 MW** cos ϕ=±0.90 T ext ≤30ºC F=±2%		**AM+2: 4.7 MW** cos ϕ=±0.90 T ext ≤25ºC F=±2%		**AM+3: 4.8 MW** cos ϕ=±0.90 T ext ≤ 20ºC F=±2%	
	Q (kVAr)	U (p.u.)	Q (kVAr)	U (p.u.)	Q (kVAr)	U (p.u.)	Q (kVAr)	U (p.u.)	Q (kVAr)	U (p.u.)	Q (kVAr)	U (p.u.)	Q (kVAr)	U (p.u.)
A	784	0.90	784	0.90	784	0.90	784	0.90	784	0.90	784	0.90	784	0.90
B	2034	0.95	2083	0.95	2131	0.95	2179	0.95	2228	0.95	2276	0.95	2325	0.95
C	2034	1.12	2083	1.12	2131	1.12	2179	1.12	2228	1.12	2276	1.12	2325	1.12
D	0	1.13	0	1.13	0	1.13	0	1.13	0	1.13	0	1.13	0	1.13
E	-2034	1.12	-2083	1.12	-2131	1.12	-2179	1.12	-2228	1.12	-2276	1.12	-2325	1.12
F	-2034	0.95	-2083	0.95	-2131	0.95	-2179	0.95	-2228	0.95	-2276	0.95	-2325	0.95
G	-784	0.90	-784	0.90	-784	0.90	-784	0.90	-784	0.90	-784	0.90	-784	0.90

Table 2 SG 4.5-145 FLEXIBLE RATING electrical performance. Q vs V**.**

The FLEXIBLE RATING functionality also includes the generation of Q at P = 0 (QwP0). (According to document GD375881)

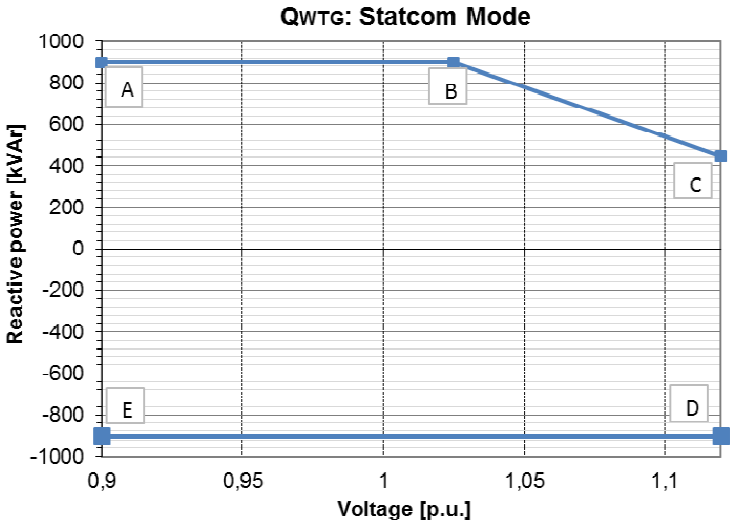


Figure 3 Q at P=0 (QwP0)

	Q (kVAr)	V (pu)
A	+900	0.9
B	+900	1.025
C	+445	1.12
D	-900	1.12
E	-900	0.9

Table 3 Q at P=0 (QwP0)

6 FLEXIBLE RATING POWER CURVES AND NOISE

6.1 GENERAL COMMENTS

When not specified otherwise, power curve data in the following sections are calculated using the parameters from Table 5. All power curve and annual energy production values in this document are subject to the validity ranges presented in Table 6.

Frequency	50 Hz / 60 Hz
Rotor Diameter	145 m
Angle of blade tip	Pitch control regulation
Air density	1.225 kg/m^3

Table 5: Calculation parameter values for the SG 4.5-145 wind turbine power curve.

Wind Shear (10min average)	≤ 0.3
Turbulence intensity TI [%] for bin i	$5\%\frac{(0.75v_i + 5.6)}{v_i} < TI_i < 12\%\frac{(0.75v_i + 5.6)}{v_i}$
Terrain	Not complex according to IEC 61400-12-1
Upflow β [º]	-2º ≤ β ≤ +2º
Grid frequency [Hz]	± 0.5 Hz

Table 6 Validity ranges for the SG 4.5-145 wind turbine power curve.

6.2 SG 4.5-145 BASELINE AM0 (@4.5 MW RATED POWER) PERFORMANCE

Please, refer to the following official SG 4.5-145 documentation:

[1] GD372187_SG 4.5-145 DEVELOPER PACKAGE
[2] GD372367_SG 4.5-145 POWER CURVE
[3] GD372368_SG 4.5-145 POWER CURVE & NOISE
[4] GD372369_SG 4.5-145 LOW NOISE MODES

6.3 SG 4.5-145 AM-3 (@4.2 MW RATED POWER) PERFORMANCE

6.3.1 Standard Power Curve

Table 7 shows the electrical power [kW] as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

P [kW]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2458	1873	1935	1997	2059	2120	2182	2244	2305	2367	2428	2488	2549
9	3342	2602	2686	2769	2851	2933	3012	3090	3165	3238	3308	3375	3439
10	3963	3315	3408	3496	3579	3655	3725	3788	3845	3896	3942	3982	4018
11	4173	3864	3932	3991	4040	4080	4111	4133	4150	4162	4170	4176	4180
12	4195	4141	4160	4172	4180	4184	4188	4190	4192	4193	4194	4195	4196
13	4199	4190	4192	4194	4195	4196	4197	4198	4198	4199	4199	4199	4199
14	4200	4197	4198	4199	4199	4199	4199	4199	4200	4200	4200	4200	4200
15	4200	4199	4199	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
16	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
17	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
18	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
19	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197
20	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187
21	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158
22	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098
23	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007
24	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892
25	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770
26	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656
27	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562

Table 7 Electric power [kW] of the SG 4.5-145 WT AM-3 (@4.2 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.3.2 Annual Energy Production

Table 8 shows the annual yield [MWh] for the SG 4.5-145 WT AM-3 (@4.2 MW rated power) for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. The values are calculated for 1.225 kg/m^3 standard air density and 10% turbulence intensity.

AEP [MWh]		Wave [m/s]										
		5	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**
Weibull K	**1.5**	9014	10669	12244	13717	15074	16308	17418	18402	19264	20008	20641
	2	8323	10326	12299	14188	15962	17604	19107	20470	21695	22785	23742
	2.5	7560	9749	11995	14205	16309	18268	20060	21681	23134	24430	25578

Table 8: Annual energy production [MWh] of the SG 4.5-145 WT AM-3 (@4.2 MW rated power) calculated as a function of W_{ave} [m/s]. (ref: *SG145OF_R00_29052018*)

6.3.3 C_P Curves

Table 9 shows the C_P values for the SG 4.5-145 WT AM-3 (@4.2 MW rated power).

Ws [m/s]	C_P [-]
3	0.2091
4	0.3755
5	0.4400
6	0.4623
7	0.4726
8	0.4747
9	0.4533
10	0.3918
11	0.3100
12	0.2400
13	0.1890
14	0.1513
15	0.1230
16	0.1014
17	0.0845
18	0.0712
19	0.0605
20	0.0517
21	0.0444
22	0.0381
23	0.0326
24	0.0278
25	0.0239
26	0.0206
27	0.0179

Table 9: C_P values for the SG 4.5-145 WT AM-3 (@4.2 MW rated power). (ref: *SG145OF_R00_29052018*)

6.3.4 C_T Curves

Table 10 shows the C_T curves as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

C_T [-]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914
4	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422
5	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214
6	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191
7	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184
8	0.8015	0.8026	0.8026	0.8026	0.8026	0.8025	0.8025	0.8024	0.8022	0.802	0.8017	0.8012	0.8005
9	0.7188	0.7395	0.7391	0.7385	0.7376	0.7364	0.7345	0.7322	0.7292	0.7255	0.7211	0.716	0.7103
10	0.5694	0.6403	0.6366	0.632	0.6263	0.6198	0.6121	0.6037	0.5946	0.5847	0.5744	0.5639	0.5531
11	0.4222	0.5244	0.5152	0.5051	0.4945	0.4836	0.4722	0.4609	0.4496	0.4384	0.4274	0.4168	0.4065
12	0.3145	0.411	0.3997	0.3884	0.3773	0.3665	0.3561	0.3461	0.3365	0.3274	0.3187	0.3104	0.3025
13	0.2413	0.3187	0.3086	0.2989	0.2898	0.2811	0.2729	0.2652	0.2579	0.251	0.2444	0.2383	0.2324
14	0.1905	0.2504	0.2423	0.2348	0.2276	0.221	0.2147	0.2087	0.2032	0.1979	0.1929	0.1882	0.1837
15	0.1539	0.2008	0.1945	0.1885	0.1829	0.1777	0.1728	0.1682	0.1638	0.1597	0.1557	0.152	0.1485
16	0.1265	0.1642	0.1591	0.1543	0.1499	0.1457	0.1417	0.138	0.1345	0.1312	0.1281	0.1251	0.1222
17	0.1057	0.1364	0.1322	0.1283	0.1247	0.1213	0.1181	0.115	0.1122	0.1095	0.1069	0.1045	0.1021
18	0.0893	0.1148	0.1114	0.1082	0.1052	0.1023	0.0997	0.0972	0.0948	0.0925	0.0904	0.0883	0.0864
19	0.0764	0.0978	0.0949	0.0922	0.0897	0.0873	0.0851	0.0829	0.0809	0.079	0.0772	0.0755	0.0739
20	0.0658	0.084	0.0815	0.0792	0.0771	0.0751	0.0732	0.0714	0.0697	0.0681	0.0666	0.0651	0.0637
21	0.057	0.0725	0.0704	0.0684	0.0666	0.0649	0.0633	0.0618	0.0603	0.0589	0.0576	0.0564	0.0552
22	0.0494	0.0626	0.0609	0.0592	0.0576	0.0562	0.0548	0.0535	0.0523	0.0511	0.05	0.0489	0.0479
23	0.0429	0.0541	0.0526	0.0512	0.0499	0.0486	0.0474	0.0463	0.0453	0.0443	0.0433	0.0424	0.0416
24	0.0372	0.0468	0.0455	0.0443	0.0432	0.0421	0.0411	0.0401	0.0392	0.0384	0.0376	0.0368	0.0361
25	0.0324	0.0407	0.0396	0.0385	0.0375	0.0366	0.0358	0.0349	0.0342	0.0334	0.0327	0.0321	0.0314
26	0.0285	0.0356	0.0347	0.0338	0.0329	0.0321	0.0314	0.0307	0.03	0.0294	0.0288	0.0282	0.0276
27	0.0253	0.0316	0.0308	0.03	0.0292	0.0285	0.0279	0.0273	0.0267	0.0261	0.0256	0.0251	0.0246

Table 10 C_T curves of the SG 4.5-145 WT AM-3 (@4.2 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.3.5 Noise Levels

Table 11 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

Ws [m/s]	LWA [dB(A)]
3	95.1
4	95.1
5	95.1
6	95.1
7	95.5
8	97.6
9	99.7
10	101.5
11	103.2
12	104.7
13	106.2
14	106.9
15	106.9
16	106.9
17	106.9
18	106.9
19	106.9
20	106.9
21	106.9
22	106.9
23	106.9
24	106.9
25	106.9
26	106.9
27	106.9

Table 11: Noise levels of the SG 4.5-145 WT AM-3 (@4.2 MW rated power) calculated as a function of W_S [m/s]. (ref: *SG145OF_R00_29052018*)

6.4 SG 4.5-145 AM-2 (@4.3 MW RATED POWER) PERFORMANCE

6.4.1 Standard Power Curve

Table 12 shows the electrical power [kW] as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

P [kW]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2459	1873	1935	1997	2059	2120	2182	2244	2305	2367	2428	2489	2550
9	3356	2602	2686	2770	2853	2935	3016	3096	3173	3248	3320	3390	3457
10	4014	3322	3418	3510	3597	3678	3753	3822	3884	3941	3991	4036	4076
11	4265	3899	3974	4039	4095	4143	4181	4211	4233	4249	4261	4269	4275
12	4294	4218	4245	4262	4273	4280	4284	4288	4290	4292	4293	4294	4295
13	4299	4287	4290	4292	4294	4295	4296	4297	4298	4298	4299	4299	4299
14	4300	4296	4297	4298	4299	4299	4299	4299	4299	4300	4300	4300	4300
15	4300	4299	4299	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300
16	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300
17	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300
18	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300
19	4296	4296	4296	4296	4296	4296	4296	4296	4296	4296	4296	4296	4296
20	4283	4283	4283	4283	4283	4283	4283	4283	4283	4283	4283	4283	4283
21	4246	4246	4246	4246	4246	4246	4246	4246	4246	4246	4246	4246	4246
22	4174	4174	4174	4174	4174	4174	4174	4174	4174	4174	4174	4174	4174
23	4066	4066	4066	4066	4066	4066	4066	4066	4066	4066	4066	4066	4066
24	3935	3935	3935	3935	3935	3935	3935	3935	3935	3935	3935	3935	3935
25	3799	3799	3799	3799	3799	3799	3799	3799	3799	3799	3799	3799	3799
26	3674	3674	3674	3674	3674	3674	3674	3674	3674	3674	3674	3674	3674
27	3573	3573	3573	3573	3573	3573	3573	3573	3573	3573	3573	3573	3573

Table 12 Electric power [kW] of the SG 4.5-145 WT AM-2 (@4.3 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.4.2 Annual Energy Production

Table 13 shows the annual output [MWh] for the SG 4.5-145 WT AM-2 (@4.3 MW rated power) for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. The values are calculated for 1.225 kg/m^3 standard air density and 10% turbulence intensity.

AEP [MWh]		Wave [m/s]										
		5	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**
Weibull K	**1.5**	9096	10781	12386	13890	15276	16539	17674	18681	19564	20326	20975
	2	8367	10399	12405	14333	16146	17827	19369	20769	22028	23148	24132
	2.5	7579	9789	12067	14315	16464	18469	20309	21977	23475	24812	25998

Table 13: Annual energy production [MWh] of the SG 4.5-145 WT AM-2 (@4.3 MW rated power) calculated as a function of W_{ave} [m/s]. (ref: *SG145OF_R00_29052018*)

6.4.3 C_P Curves

Table 14 shows the C_P values for the SG 4.5-145 WT AM-2 (@4.3 MW rated power).

Ws [m/s]	C_P [-]
3	0.2091
4	0.3755
5	0.4400
6	0.4623
7	0.4726
8	0.4748
9	0.4551
10	0.3969
11	0.3168
12	0.2457
13	0.1935
14	0.1549
15	0.1260
16	0.1038
17	0.0865
18	0.0729
19	0.0619
20	0.0529
21	0.0453
22	0.0388
23	0.0330
24	0.0281
25	0.0240
26	0.0207
27	0.0179

Table 14: C_P values for the SG 4.5-145 WT AM-2 (@4.3 MW rated power). (ref: *SG145OF_R00_29052018*)

6.4.4 C_T Curves

Table 15 shows the C_T curves as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

C_T [-]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914
4	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422
5	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214
6	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191
7	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184
8	0.8018	0.8026	0.8026	0.8026	0.8026	0.8026	0.8025	0.8025	0.8024	0.8022	0.8020	0.8016	0.8012
9	0.7233	0.7396	0.7394	0.7390	0.7384	0.7374	0.7361	0.7343	0.7319	0.7289	0.7252	0.7209	0.7160
10	0.5793	0.6423	0.6394	0.6357	0.6310	0.6252	0.6186	0.6111	0.6028	0.5938	0.5841	0.5741	0.5638
11	0.4324	0.5305	0.5222	0.5130	0.5031	0.4926	0.4819	0.4708	0.4598	0.4487	0.4378	0.4271	0.4167
12	0.3226	0.4193	0.4082	0.3972	0.3862	0.3754	0.3649	0.3548	0.3451	0.3358	0.3269	0.3184	0.3103
13	0.2474	0.3264	0.3162	0.3064	0.2971	0.2882	0.2799	0.2719	0.2644	0.2573	0.2506	0.2442	0.2382
14	0.1951	0.2567	0.2484	0.2406	0.2333	0.2264	0.2200	0.2139	0.2081	0.2027	0.1976	0.1927	0.1881
15	0.1575	0.2058	0.1992	0.1931	0.1874	0.1820	0.1770	0.1722	0.1677	0.1634	0.1594	0.1556	0.1520
16	0.1295	0.1681	0.1629	0.1580	0.1534	0.1491	0.1451	0.1413	0.1376	0.1342	0.1310	0.1280	0.1250
17	0.1080	0.1396	0.1353	0.1313	0.1276	0.1241	0.1208	0.1177	0.1147	0.1120	0.1093	0.1068	0.1044
18	0.0913	0.1175	0.1140	0.1107	0.1076	0.1047	0.1019	0.0993	0.0969	0.0946	0.0924	0.0903	0.0883
19	0.0780	0.1000	0.0970	0.0943	0.0917	0.0892	0.0869	0.0848	0.0827	0.0808	0.0789	0.0772	0.0755
20	0.0672	0.0858	0.0833	0.0810	0.0788	0.0767	0.0747	0.0729	0.0712	0.0695	0.0680	0.0665	0.0651
21	0.0581	0.0739	0.0718	0.0698	0.0680	0.0662	0.0645	0.0630	0.0615	0.0601	0.0588	0.0575	0.0563
22	0.0503	0.0637	0.0619	0.0602	0.0586	0.0572	0.0557	0.0544	0.0531	0.0520	0.0508	0.0497	0.0487
23	0.0434	0.0549	0.0533	0.0519	0.0506	0.0493	0.0481	0.0470	0.0459	0.0449	0.0439	0.0430	0.0421
24	0.0376	0.0473	0.0460	0.0448	0.0436	0.0425	0.0415	0.0406	0.0396	0.0388	0.0380	0.0372	0.0364
25	0.0326	0.0410	0.0399	0.0388	0.0378	0.0369	0.0360	0.0352	0.0344	0.0337	0.0330	0.0323	0.0317
26	0.0286	0.0358	0.0348	0.0339	0.0331	0.0323	0.0315	0.0308	0.0301	0.0295	0.0289	0.0283	0.0278
27	0.0254	0.0317	0.0309	0.0301	0.0293	0.0286	0.0280	0.0273	0.0267	0.0262	0.0256	0.0251	0.0247

Table 15 C_T curves of the SG 4.5-145 WT AM-2 (@4.3 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.4.5 Noise Levels

Table 16 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

Ws [m/s]	LWA [dB(A)]
3	95.1
4	95.1
5	95.1
6	95.1
7	95.5
8	97.6
9	99.7
10	101.5
11	103.2
12	104.7
13	106.2
14	107.2
15	107.2
16	107.2
17	107.2
18	107.2
19	107.2
20	107.2
21	107.2
22	107.2
23	107.2
24	107.2
25	107.2
26	107.2
27	107.2

Table 16: Noise levels of the SG 4.5-145 WT AM-2 (@4.3 MW rated power) calculated as a function of W_S [m/s]. (ref: *SG145OF_R00_29052018*)

6.5 SG 4.5-145 AM-1 (@4.4 MW RATED POWER) PERFORMANCE

6.5.1 Standard Power Curve

Table 17 shows the electrical power [kW] in function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

P [kW]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2459	1873	1935	1997	2059	2121	2182	2244	2306	2367	2428	2489	2550
9	3367	2602	2686	2771	2854	2937	3019	3100	3179	3256	3330	3402	3472
10	4062	3328	3427	3522	3612	3698	3778	3851	3919	3980	4036	4086	4131
11	4354	3929	4010	4083	4145	4200	4245	4282	4312	4332	4348	4360	4368
12	4392	4286	4324	4348	4364	4374	4380	4384	4388	4390	4392	4393	4394
13	4398	4383	4387	4390	4393	4394	4395	4396	4397	4398	4398	4399	4399
14	4400	4395	4397	4398	4398	4399	4399	4399	4399	4399	4400	4400	4400
15	4400	4399	4399	4399	4400	4400	4400	4400	4400	4400	4400	4400	4400
16	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400
17	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400
18	4399	4399	4399	4399	4399	4399	4399	4399	4399	4399	4399	4399	4399
19	4395	4395	4395	4395	4395	4395	4395	4395	4395	4395	4395	4395	4395
20	4379	4379	4379	4379	4379	4379	4379	4379	4379	4379	4379	4379	4379
21	4335	4335	4335	4335	4335	4335	4335	4335	4335	4335	4335	4335	4335
22	4250	4250	4250	4250	4250	4250	4250	4250	4250	4250	4250	4250	4250
23	4126	4126	4126	4126	4126	4126	4126	4126	4126	4126	4126	4126	4126
24	3977	3977	3977	3977	3977	3977	3977	3977	3977	3977	3977	3977	3977
25	3827	3827	3827	3827	3827	3827	3827	3827	3827	3827	3827	3827	3827
26	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691
27	3583	3583	3583	3583	3583	3583	3583	3583	3583	3583	3583	3583	3583

Table 17 Electric power [kW] of the SG 4.5-145 WT AM-1 (@4.4 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.5.2 Annual Energy Production

Table 18 shows the annual output [MWh] for the SG 4.5-145 WT AM-1 (@4.4 MW rated power) for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. The values are calculated for 1.225 kg/m^3 standard air density and 10% turbulence intensity.

AEP [MWh]		**Wave [m/s]**										
		5	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**
Weibull K	**1.5**	9175	10889	12525	14058	15474	16764	17925	18956	19859	20640	21304
	2	8408	10467	12507	14472	16324	18045	19625	21061	22353	23504	24516
	2.5	7596	9826	12133	14419	16611	18663	20550	22264	23807	25186	26410

Table 18: Annual energy production [MWh] of the SG 4.5-145 WT AM-1 (@4.4 MW rated power) calculated as a function of W_{ave} [m/s]. (ref: *SG145OF_R00_29052018*)

6.5.3 C_P Curves

Table 19 shows the C_P values for the SG 4.5-145 WT AM-1 (@4.4 MW rated power).

Ws [m/s]	**C_P [-]**
3	0.2091
4	0.3755
5	0.4400
6	0.4623
7	0.4726
8	0.4748
9	0.4566
10	0.4016
11	0.3235
12	0.2513
13	0.1979
14	0.1585
15	0.1289
16	0.1062
17	0.0885
18	0.0746
19	0.0634
20	0.0541
21	0.0463
22	0.0395
23	0.0335
24	0.0284
25	0.0242
26	0.0208
27	0.0180

Table 19: C_P values for the SG 4.5-145 WT AM-1 (@4.4 MW rated power). (ref: *SG145OF_R00_29052018*)

6.5.4 C_T Curves

Table 20 shows the C_T curves as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

C_T [-]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914
4	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422
5	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214
6	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191
7	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184
8	0.8021	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8025	0.8025	0.8024	0.8022	0.8020	0.8016
9	0.7270	0.7397	0.7396	0.7393	0.7389	0.7382	0.7373	0.7359	0.7340	0.7317	0.7286	0.7250	0.7208
10	0.5884	0.6439	0.6417	0.6386	0.6347	0.6299	0.6242	0.6175	0.6101	0.6019	0.5930	0.5836	0.5737
11	0.4425	0.5358	0.5284	0.5201	0.5109	0.5011	0.4909	0.4802	0.4694	0.4586	0.4478	0.4371	0.4267
12	0.3307	0.4270	0.4164	0.4056	0.3948	0.3841	0.3736	0.3634	0.3536	0.3441	0.3351	0.3264	0.3181
13	0.2535	0.3339	0.3237	0.3138	0.3043	0.2953	0.2868	0.2787	0.2710	0.2637	0.2568	0.2502	0.2440
14	0.1998	0.2629	0.2545	0.2465	0.2390	0.2320	0.2253	0.2191	0.2132	0.2076	0.2023	0.1973	0.1926
15	0.1611	0.2107	0.2040	0.1977	0.1919	0.1863	0.1811	0.1762	0.1716	0.1672	0.1631	0.1592	0.1555
16	0.1324	0.1721	0.1667	0.1617	0.1570	0.1526	0.1484	0.1445	0.1408	0.1373	0.1340	0.1308	0.1279
17	0.1104	0.1428	0.1384	0.1344	0.1305	0.1269	0.1235	0.1203	0.1173	0.1145	0.1117	0.1092	0.1067
18	0.0933	0.1201	0.1165	0.1131	0.1100	0.1070	0.1042	0.1015	0.0990	0.0967	0.0944	0.0923	0.0902
19	0.0797	0.1022	0.0992	0.0963	0.0937	0.0912	0.0888	0.0866	0.0845	0.0825	0.0806	0.0788	0.0771
20	0.0686	0.0876	0.0851	0.0827	0.0804	0.0783	0.0763	0.0744	0.0726	0.0710	0.0694	0.0678	0.0664
21	0.0592	0.0754	0.0732	0.0712	0.0693	0.0675	0.0658	0.0642	0.0627	0.0612	0.0599	0.0586	0.0574
22	0.0511	0.0648	0.0630	0.0613	0.0597	0.0581	0.0567	0.0553	0.0540	0.0528	0.0517	0.0506	0.0495
23	0.0440	0.0556	0.0541	0.0526	0.0513	0.0500	0.0488	0.0476	0.0465	0.0455	0.0445	0.0436	0.0427
24	0.0379	0.0478	0.0465	0.0452	0.0441	0.0430	0.0419	0.0410	0.0400	0.0392	0.0383	0.0375	0.0368
25	0.0329	0.0413	0.0401	0.0391	0.0381	0.0372	0.0363	0.0355	0.0347	0.0339	0.0332	0.0325	0.0319
26	0.0287	0.0360	0.0350	0.0341	0.0332	0.0324	0.0317	0.0310	0.0303	0.0296	0.0290	0.0284	0.0279
27	0.0255	0.0318	0.0310	0.0302	0.0294	0.0287	0.0280	0.0274	0.0268	0.0263	0.0257	0.0252	0.0247

Table 20 C_T curves of the SG 4.5-145 WT AM-1 (@4.4 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.5.5 Noise Levels

Table 21 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

Ws [m/s]	LWA [dB(A)]
3	95.1
4	95.1
5	95.1
6	95.1
7	95.5
8	97.6
9	99.7
10	101.5
11	103.2
12	104.7
13	106.2
14	107.5
15	107.5
16	107.5
17	107.5
18	107.5
19	107.5
20	107.5
21	107.5
22	107.5
23	107.5
24	107.5
25	107.5
26	107.5
27	107.5

Table 21: Noise levels of the SG 4.5-145 WT AM-1 (@4.4 MW rated power) calculated as a function of W_S [m/s]. (ref: *SG145OF_R00_29052018*)

6.6 SG 4.5-145 AM+1 (@4.6 MW RATED POWER) PERFORMANCE

6.6.1 Standard Power Curve

Table 22 shows the electrical power [kW] as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

P [kW]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2459	1873	1935	1997	2059	2121	2182	2244	2306	2367	2429	2490	2551
9	3383	2602	2687	2771	2855	2939	3022	3105	3186	3266	3345	3421	3495
10	4143	3334	3437	3537	3634	3727	3815	3898	3975	4047	4113	4172	4226
11	4522	3975	4069	4155	4231	4298	4357	4407	4450	4484	4512	4531	4547
12	4589	4404	4459	4502	4532	4553	4566	4575	4581	4585	4588	4590	4591
13	4597	4570	4579	4585	4589	4591	4593	4594	4596	4596	4597	4598	4598
14	4599	4593	4595	4596	4597	4598	4598	4599	4599	4599	4599	4599	4600
15	4600	4598	4599	4599	4599	4599	4600	4600	4600	4600	4600	4600	4600
16	4600	4599	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600
17	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600
18	4599	4599	4599	4599	4599	4599	4599	4599	4599	4599	4599	4599	4599
19	4594	4594	4594	4594	4594	4594	4594	4594	4594	4594	4594	4594	4594
20	4571	4571	4571	4571	4571	4571	4571	4571	4571	4571	4571	4571	4571
21	4512	4512	4512	4512	4512	4512	4512	4512	4512	4512	4512	4512	4512
22	4401	4401	4401	4401	4401	4401	4401	4401	4401	4401	4401	4401	4401
23	4245	4245	4245	4245	4245	4245	4245	4245	4245	4245	4245	4245	4245
24	4063	4063	4063	4063	4063	4063	4063	4063	4063	4063	4063	4063	4063
25	3884	3884	3884	3884	3884	3884	3884	3884	3884	3884	3884	3884	3884
26	3726	3726	3726	3726	3726	3726	3726	3726	3726	3726	3726	3726	3726
27	3604	3604	3604	3604	3604	3604	3604	3604	3604	3604	3604	3604	3604

Table 23 Electric power [kW] of the SG 4.5-145 WT AM+1 (@4.6 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.6.2 Annual Energy Production

Table 24 shows the annual output [MWh] for the SG 4.5-145 WT AM+1 (@4.6 MW rated power) for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. The values are calculated for 1.225 kg/m^3 standard air density and 10% turbulence intensity.

AEP [MWh]		Wave [m/s]										
		5	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**
Weibull K	**1.5**	9324	11094	12789	14382	15856	17201	18413	19489	20434	21251	21946
	2	8483	10595	12698	14734	16662	18460	20116	21625	22985	24197	25264
	2.5	7625	9892	12254	14611	16886	19029	21009	22815	24447	25908	27209

Table 24: Annual energy production [MWh] of the SG 4.5-145 WT AM+1 (@4.6 MW rated power) calculated as a function of W_{ave} [m/s]. (ref: *SG145OF_R00_29052018*)

6.6.3 C_P Curves

Table 25 shows the C_P values for the SG 4.5-145 WT AM+1 (@4.6 MW rated power).

Ws [m/s]	C_P [-]
3	0.2091
4	0.3755
5	0.4400
6	0.4623
7	0.4726
8	0.4749
9	0.4588
10	0.4096
11	0.3359
12	0.2626
13	0.2069
14	0.1657
15	0.1348
16	0.1110
17	0.0926
18	0.0780
19	0.0662
20	0.0565
21	0.0482
22	0.0409
23	0.0345
24	0.0291
25	0.0246
26	0.0210
27	0.0181

Table 25: C_P values for the SG 4.5-145 WT AM+1 (@4.6 MW rated power). (ref: *SG145OF_R00_29052018*)

6.6.4 C_T Curves

Table 26 shows the C_T curves as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

C_T [-]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914
4	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422
5	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214
6	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191
7	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184
8	0.8024	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8025	0.8025	0.8023	0.8022
9	0.7323	0.7398	0.7398	0.7397	0.7395	0.7391	0.7386	0.7379	0.7368	0.7354	0.7334	0.7310	0.7280
10	0.6040	0.6458	0.6446	0.6427	0.6402	0.6369	0.6327	0.6278	0.6219	0.6154	0.6080	0.5999	0.5913
11	0.4613	0.5440	0.5384	0.5317	0.5242	0.5158	0.5067	0.4971	0.4871	0.4769	0.4665	0.4561	0.4458
12	0.3465	0.4407	0.4311	0.4210	0.4108	0.4004	0.3900	0.3799	0.3700	0.3603	0.3510	0.3420	0.3334
13	0.2655	0.3482	0.3380	0.3280	0.3184	0.3092	0.3003	0.2919	0.2839	0.2762	0.2690	0.2621	0.2556
14	0.2090	0.2751	0.2663	0.2580	0.2502	0.2428	0.2359	0.2293	0.2231	0.2172	0.2116	0.2064	0.2014
15	0.1683	0.2205	0.2135	0.2069	0.2007	0.1949	0.1894	0.1842	0.1794	0.1748	0.1704	0.1663	0.1624
16	0.1382	0.1799	0.1743	0.1690	0.1640	0.1594	0.1550	0.1509	0.1470	0.1433	0.1398	0.1365	0.1334
17	0.1152	0.1492	0.1446	0.1403	0.1363	0.1325	0.1289	0.1255	0.1224	0.1194	0.1165	0.1138	0.1113
18	0.0972	0.1254	0.1216	0.1180	0.1147	0.1116	0.1086	0.1059	0.1032	0.1007	0.0984	0.0961	0.0940
19	0.0830	0.1066	0.1034	0.1004	0.0976	0.0950	0.0925	0.0902	0.0880	0.0859	0.0839	0.0820	0.0803
20	0.0713	0.0912	0.0886	0.0861	0.0837	0.0815	0.0794	0.0774	0.0755	0.0738	0.0721	0.0705	0.0690
21	0.0614	0.0783	0.0760	0.0739	0.0719	0.0700	0.0683	0.0666	0.0650	0.0635	0.0621	0.0607	0.0594
22	0.0528	0.0670	0.0651	0.0633	0.0616	0.0600	0.0585	0.0571	0.0558	0.0545	0.0533	0.0522	0.0511
23	0.0452	0.0572	0.0556	0.0541	0.0526	0.0513	0.0501	0.0489	0.0477	0.0467	0.0457	0.0447	0.0438
24	0.0387	0.0488	0.0474	0.0462	0.0450	0.0438	0.0428	0.0418	0.0408	0.0399	0.0391	0.0383	0.0375
25	0.0333	0.0419	0.0407	0.0396	0.0386	0.0377	0.0368	0.0359	0.0351	0.0344	0.0337	0.0330	0.0323
26	0.0290	0.0363	0.0353	0.0344	0.0335	0.0327	0.0320	0.0312	0.0306	0.0299	0.0293	0.0287	0.0281
27	0.0256	0.0320	0.0311	0.0303	0.0296	0.0289	0.0282	0.0276	0.0270	0.0264	0.0259	0.0253	0.0249

Table 26 C_T curves of the SG 4.5-145 WT AM+1 (@4.6 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.6.5 Noise Levels

Table 27 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

Ws [m/s]	LWA [dB(A)]
3	95.1
4	95.1
5	95.1
6	95.1
7	95.5
8	97.6
9	99.7
10	101.5
11	103.2
12	104.7
13	106.2
14	107.6
15	108.1
16	108.1
17	108.1
18	108.1
19	108.1
20	108.1
21	108.1
22	108.1
23	108.1
24	108.1
25	108.1
26	108.1
27	108.1

Table 27: Noise levels of the SG 4.5-145 WT AM+1 (@4.6 MW rated power) calculated as a function of W_S [m/s]. (ref: *SG145OF_R00_29052018*)

6.7 SG 4.5-145 AM+2 (@4.7 MW RATED POWER) PERFORMANCE

6.7.1 Standard Power Curve

Table 28 shows the electrical power [kW] in function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

P [kW]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2459	1873	1935	1997	2059	2121	2182	2244	2306	2367	2429	2490	2551
9	3389	2602	2687	2771	2856	2940	3023	3106	3189	3270	3349	3427	3503
10	4178	3336	3441	3543	3642	3738	3829	3916	3998	4074	4145	4209	4268
11	4599	3992	4092	4184	4266	4340	4405	4462	4510	4551	4585	4611	4631
12	4686	4454	4518	4569	4609	4636	4655	4667	4675	4681	4685	4688	4690
13	4697	4659	4673	4680	4686	4689	4691	4693	4694	4696	4696	4697	4698
14	4699	4691	4693	4695	4696	4697	4698	4698	4699	4699	4699	4699	4699
15	4700	4697	4698	4699	4699	4699	4699	4700	4700	4700	4700	4700	4700
16	4700	4699	4699	4700	4700	4700	4700	4700	4700	4700	4700	4700	4700
17	4700	4700	4700	4700	4700	4700	4700	4700	4700	4700	4700	4700	4700
18	4699	4699	4699	4699	4699	4699	4699	4699	4699	4699	4699	4699	4699
19	4693	4693	4693	4693	4693	4693	4693	4693	4693	4693	4693	4693	4693
20	4667	4667	4667	4667	4667	4667	4667	4667	4667	4667	4667	4667	4667
21	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600
22	4477	4477	4477	4477	4477	4477	4477	4477	4477	4477	4477	4477	4477
23	4304	4304	4304	4304	4304	4304	4304	4304	4304	4304	4304	4304	4304
24	4105	4105	4105	4105	4105	4105	4105	4105	4105	4105	4105	4105	4105
25	3912	3912	3912	3912	3912	3912	3912	3912	3912	3912	3912	3912	3912
26	3744	3744	3744	3744	3744	3744	3744	3744	3744	3744	3744	3744	3744
27	3614	3614	3614	3614	3614	3614	3614	3614	3614	3614	3614	3614	3614

Table 28 Electric power [kW] of the SG 4.5-145 WT AM+2 (@4.7 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.7.2 Annual Energy Production

Table 29 shows the annual output [MWh] for the SG 4.5-145 WT AM+2 (@4.7 MW rated power) for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. The values are calculated for 1.225 kg/m^3 standard density and 10% turbulence intensity.

AEP [MWh]		Wave [m/s]										
		5	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**
Weibull K	**1.5**	9395	11192	12915	14538	16040	17412	18649	19749	20714	21549	22260
	2	8517	10653	12787	14858	16823	18659	20352	21897	23291	24534	25628
	2.5	7638	9922	12309	14700	17015	19200	21226	23078	24754	26257	27597

Table 29: Annual energy production [MWh] of the SG 4.5-145 WT AM+2 (@4.7 MW rated power) calculated as a function of W_{ave} [m/s]. (ref: *SG145OF_R00_29052018*)

6.7.3 C_P Curves

Table 30 shows the C_P values for the SG 4.5-145 WT AM+2 (@4.7 MW rated power).

Ws [m/s]	C_P [-]
3	0.2091
4	0.3755
5	0.4400
6	0.4623
7	0.4726
8	0.4749
9	0.4596
10	0.4130
11	0.3416
12	0.2681
13	0.2114
14	0.1693
15	0.1377
16	0.1134
17	0.0946
18	0.0797
19	0.0676
20	0.0577
21	0.0491
22	0.0416
23	0.0350
24	0.0294
25	0.0248
26	0.0211
27	0.0182

Table 30: C_P values for the SG 4.5-145 WT AM+2 (@4.7 MW rated power). (ref: *SG145OF_R00_29052018*)

6.7.4 C_T Curves

Table 31 shows the C_T curves as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

C_T [-]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914
4	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422
5	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214
6	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191
7	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184
8	0.8025	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8025	0.8024	0.8023
9	0.7342	0.7398	0.7398	0.7397	0.7396	0.7394	0.7390	0.7385	0.7377	0.7366	0.7351	0.7331	0.7307
10	0.6107	0.6464	0.6455	0.6441	0.6421	0.6394	0.6360	0.6317	0.6267	0.6208	0.6143	0.6069	0.5990
11	0.4702	0.5471	0.5423	0.5365	0.5297	0.5220	0.5137	0.5047	0.4952	0.4853	0.4753	0.4651	0.4550
12	0.3543	0.4467	0.4377	0.4281	0.4182	0.4080	0.3979	0.3878	0.3779	0.3683	0.3589	0.3498	0.3411
13	0.2715	0.3549	0.3449	0.3350	0.3253	0.3160	0.3070	0.2985	0.2903	0.2825	0.2751	0.2680	0.2613
14	0.2136	0.2811	0.2722	0.2638	0.2558	0.2483	0.2411	0.2344	0.2280	0.2220	0.2163	0.2109	0.2058
15	0.1719	0.2254	0.2182	0.2114	0.2051	0.1991	0.1935	0.1882	0.1833	0.1785	0.1741	0.1699	0.1659
16	0.1411	0.1838	0.1780	0.1726	0.1676	0.1628	0.1583	0.1541	0.1501	0.1463	0.1428	0.1394	0.1362
17	0.1175	0.1524	0.1477	0.1433	0.1391	0.1353	0.1316	0.1282	0.1249	0.1218	0.1189	0.1162	0.1135
18	0.0992	0.1280	0.1241	0.1205	0.1171	0.1139	0.1109	0.1080	0.1053	0.1028	0.1004	0.0981	0.0959
19	0.0846	0.1088	0.1055	0.1025	0.0996	0.0969	0.0944	0.0920	0.0898	0.0876	0.0856	0.0837	0.0818
20	0.0727	0.0930	0.0903	0.0877	0.0853	0.0831	0.0809	0.0789	0.0770	0.0752	0.0735	0.0719	0.0703
21	0.0625	0.0797	0.0774	0.0752	0.0732	0.0713	0.0695	0.0678	0.0662	0.0646	0.0632	0.0618	0.0605
22	0.0536	0.0681	0.0661	0.0643	0.0626	0.0610	0.0595	0.0580	0.0567	0.0554	0.0542	0.0530	0.0519
23	0.0458	0.0579	0.0563	0.0548	0.0533	0.0520	0.0507	0.0495	0.0484	0.0473	0.0462	0.0453	0.0443
24	0.0391	0.0493	0.0479	0.0466	0.0454	0.0443	0.0432	0.0422	0.0412	0.0403	0.0395	0.0387	0.0379
25	0.0335	0.0422	0.0410	0.0399	0.0389	0.0380	0.0370	0.0362	0.0354	0.0346	0.0339	0.0332	0.0325
26	0.0291	0.0365	0.0355	0.0346	0.0337	0.0329	0.0321	0.0314	0.0307	0.0300	0.0294	0.0288	0.0283
27	0.0257	0.0321	0.0312	0.0304	0.0297	0.0290	0.0283	0.0276	0.0270	0.0265	0.0259	0.0254	0.0249

Table 31 C_T curves of the SG 4.5-145 WT AM+2 (@4.7 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.7.5 Noise Levels

Table 32 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

Ws [m/s]	LWA [dB(A)]
3	95.1
4	95.1
5	95.1
6	95.1
7	95.5
8	97.6
9	99.7
10	101.5
11	103.2
12	104.7
13	106.2
14	107.6
15	108.4
16	108.4
17	108.4
18	108.4
19	108.4
20	108.4
21	108.4
22	108.4
23	108.4
24	108.4
25	108.4
26	108.4
27	108.4

Table 32: Noise levels of the SG 4.5-145 WT AM+2 (@4.7 MW rated power) calculated as a function of W_S [m/s]. (ref: *SG145OF_R00_29052018*)

6.8 SG 4.5-145 AM+3 (@4.8 MW RATED POWER) PERFORMANCE

6.8.1 Standard Power Curve

Table 28 shows the electrical power [kW] in function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

P [kW]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2460	1873	1935	1997	2059	2121	2182	2244	2306	2367	2429	2490	2552
9	3393	2602	2687	2771	2856	2940	3024	3107	3190	3272	3353	3432	3510
10	4208	3338	3443	3546	3648	3746	3841	3931	4017	4097	4173	4242	4306
11	4670	4006	4111	4209	4298	4378	4449	4511	4566	4613	4653	4685	4711
12	4783	4499	4570	4630	4678	4714	4739	4757	4768	4776	4781	4785	4788
13	4796	4743	4763	4775	4782	4786	4789	4792	4793	4795	4796	4796	4797
14	4799	4789	4792	4794	4795	4796	4797	4798	4798	4799	4799	4799	4799
15	4800	4797	4798	4798	4799	4799	4799	4799	4800	4800	4800	4800	4800
16	4800	4799	4799	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
17	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
18	4799	4799	4799	4799	4799	4799	4799	4799	4799	4799	4799	4799	4799
19	4792	4792	4792	4792	4792	4792	4792	4792	4792	4792	4792	4792	4792
20	4763	4763	4763	4763	4763	4763	4763	4763	4763	4763	4763	4763	4763
21	4689	4689	4689	4689	4689	4689	4689	4689	4689	4689	4689	4689	4689
22	4553	4553	4553	4553	4553	4553	4553	4553	4553	4553	4553	4553	4553
23	4363	4363	4363	4363	4363	4363	4363	4363	4363	4363	4363	4363	4363
24	4148	4148	4148	4148	4148	4148	4148	4148	4148	4148	4148	4148	4148
25	3941	3941	3941	3941	3941	3941	3941	3941	3941	3941	3941	3941	3941
26	3761	3761	3761	3761	3761	3761	3761	3761	3761	3761	3761	3761	3761
27	3624	3624	3624	3624	3624	3624	3624	3624	3624	3624	3624	3624	3624

Table 28 Electric power [kW] of the SG 4.5-145 WT AM+3 (@4.8 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.8.2 Annual Energy Production

Table 29 shows the annual output [MWh] for the SG 4.5-145 WT AM+3 (@4.8 MW rated power) for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. The values are calculated for 1.225 kg/m^3 standard air density and 10% turbulence intensity.

AEP [MWh]		**Wave [m/s]**										
		5	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**
Weibull K	**1.5**	9463	11286	13038	14689	16220	17619	18880	20003	20989	21842	22569
	2	8549	10709	12872	14976	16978	18852	20582	22162	23590	24864	25986
	2.5	7649	9948	12360	14783	17137	19365	21436	23333	25053	26598	27976

Table 29: Annual energy production [MWh] of the SG 4.5-145 WT AM+3 (@4.8 MW rated power) calculated as a function of W_{ave} [m/s]. (ref: *SG145OF_R00_29052018*)

6.8.3 C_P Curves

Table 30 shows the C_P values for the SG 4.5-145 WT AM+3 (@4.8 MW rated power).

Ws [m/s]	**C_P [-]**
3	0.2091
4	0.3755
5	0.4400
6	0.4623
7	0.4726
8	0.4749
9	0.4602
10	0.4160
11	0.3469
12	0.2737
13	0.2158
14	0.1729
15	0.1406
16	0.1159
17	0.0966
18	0.0814
19	0.0691
20	0.0589
21	0.0501
22	0.0423
23	0.0355
24	0.0297
25	0.0249
26	0.0212
27	0.0182

Table 30: C_P values for the SG 4.5-145 WT AM+3 (@4.8 MW rated power). (ref: *SG145OF_R00_29052018*)

6.8.4 C_T Curves

Table 31 shows the C_T curves as a function of the horizontal wind speed at hub height W_S [m/s] for different air densities [kg/m^3].

C_T [-]	Air Density [kg/m3]												
Ws [m/s]	**1.225**	**0.94**	**0.97**	**1**	**1.03**	**1.06**	**1.09**	**1.12**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**
3	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914	0.8914
4	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422	0.8422
5	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214	0.8214
6	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191	0.8191
7	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184	0.8184
8	0.8025	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8026	0.8025	0.8025	0.8024
9	0.7356	0.7398	0.7398	0.7398	0.7397	0.7396	0.7393	0.7389	0.7384	0.7375	0.7364	0.7348	0.7328
10	0.6165	0.6469	0.6462	0.6451	0.6435	0.6414	0.6386	0.6350	0.6308	0.6256	0.6198	0.6132	0.6059
11	0.4787	0.5497	0.5456	0.5406	0.5346	0.5277	0.5200	0.5116	0.5027	0.4933	0.4837	0.4738	0.4638
12	0.3620	0.4521	0.4437	0.4347	0.4252	0.4154	0.4055	0.3955	0.3857	0.3761	0.3666	0.3575	0.3486
13	0.2776	0.3614	0.3515	0.3417	0.3321	0.3227	0.3137	0.3050	0.2967	0.2888	0.2812	0.2740	0.2672
14	0.2182	0.2870	0.2780	0.2695	0.2614	0.2537	0.2464	0.2395	0.2330	0.2269	0.2210	0.2155	0.2102
15	0.1756	0.2303	0.2229	0.2160	0.2095	0.2034	0.1977	0.1923	0.1872	0.1823	0.1778	0.1734	0.1693
16	0.1440	0.1878	0.1818	0.1763	0.1711	0.1662	0.1616	0.1573	0.1532	0.1494	0.1457	0.1423	0.1390
17	0.1199	0.1556	0.1507	0.1462	0.1420	0.1380	0.1343	0.1308	0.1275	0.1243	0.1213	0.1185	0.1158
18	0.1012	0.1307	0.1267	0.1230	0.1195	0.1162	0.1131	0.1102	0.1074	0.1048	0.1024	0.1000	0.0978
19	0.0863	0.1109	0.1076	0.1045	0.1016	0.0989	0.0963	0.0938	0.0915	0.0893	0.0873	0.0853	0.0834
20	0.0740	0.0948	0.0921	0.0894	0.0870	0.0847	0.0825	0.0804	0.0785	0.0766	0.0749	0.0732	0.0716
21	0.0636	0.0812	0.0788	0.0766	0.0745	0.0726	0.0707	0.0690	0.0673	0.0658	0.0643	0.0629	0.0615
22	0.0544	0.0692	0.0672	0.0653	0.0636	0.0620	0.0604	0.0589	0.0576	0.0562	0.0550	0.0538	0.0527
23	0.0463	0.0587	0.0570	0.0555	0.0540	0.0527	0.0514	0.0501	0.0490	0.0479	0.0468	0.0458	0.0449
24	0.0394	0.0498	0.0484	0.0471	0.0459	0.0447	0.0436	0.0426	0.0416	0.0407	0.0399	0.0390	0.0382
25	0.0338	0.0425	0.0413	0.0402	0.0392	0.0382	0.0373	0.0364	0.0356	0.0349	0.0341	0.0334	0.0328
26	0.0292	0.0367	0.0357	0.0347	0.0339	0.0330	0.0323	0.0315	0.0308	0.0302	0.0295	0.0289	0.0284
27	0.0257	0.0322	0.0313	0.0305	0.0297	0.0290	0.0284	0.0277	0.0271	0.0265	0.0260	0.0255	0.0250

Table 31 C_T curves of the SG 4.5-145 WT AM+3 (@4.8 MW rated power) calculated as a function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (ref: *SG145OF_R00_29052018*)

6.8.5 Noise Levels

Table 32 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

Ws [m/s]	LWA [dB(A)]
3	95.1
4	95.1
5	95.1
6	95.1
7	95.5
8	97.6
9	99.7
10	101.5
11	103.2
12	104.7
13	106.2
14	107.6
15	108.7
16	108.7
17	108.7
18	108.7
19	108.7
20	108.7
21	108.7
22	108.7
23	108.7
24	108.7
25	108.7
26	108.7
27	108.7

Table 32: Noise levels of the SG 4.5-145 WT AM+3 (@4.8 MW rated power) calculated as a function of W_S [m/s]. (ref: *SG145OF_R00_29052018*)

7 LOW NOISE MODES

SG 4.5-145 wind turbine NRS (Noise Reduction System) low noise modes data are the same for all the FLEXIBLE RATING Application Modes. Please, refer to the information included in [1] and [4] for details.

8 REFERENCES

[1] GD372187_SG 4.5-145 DEVELOPER PACKAGE
[2] GD372367_SG 4.5-145 POWER CURVE
[3] GD372368_SG 4.5-145 POWER CURVE & NOISE
[4] GD372369_SG 4.5-145 LOW NOISE MODES

SIEMENS Gamesa RENEWABLE ENERGY	**GENERAL CHARACTERISTICS MANUAL**	*Code:* **GD365035-en** *Rev:* **1**
		Date: **13/04/2018** *Pg.* **1** *of* **8**
Approval process: **PDTD - Product**	*Title:*	*Approval process:* **Electronic: PDM Flow**
		Prepared: **JSANMARTIN / SNOVO**
Deliverable: **S12**	**SG 4.2-145 POWER CURVE AND NOISE**	*Verified:* **JEJGUERRERO**
		Approved: **RRS**

© Siemens Gamesa Renewable Energy, S.A., 2018, All Rights Reserved

INDEX

INDEX 1
1 AIM 2
2 SCOPE 2
3 ABBREVIATIONS, DEFINITIONS 2
4 DESCRIPTION 3
5 RESULTS 4
5.1 STANDARD POWER CURVES 4
5.2 ANNUAL ENERGY PRODUCTION 5
5.3 CP AND CT CURVES 6
5.4 NOISE LEVELS 8

RECORD OF CHANGES

Rev.	Date	Author	Description
0	12/03/2018	SNOVO	Initial Version
1	13/04/2018	JSANMARTIN / SNOVO	Updated Safe Mode.

1 AIM

This document presents the power curves and noise emission levels for the wind turbine SG 4.2-145.

2 SCOPE

The values shown in this document are applicable to all the existing configurations for the wind turbine SG 4.2-145, for standard operation mode and according to tower height. Tonality is not considered.

3 ABBREVIATIONS, DEFINITIONS

- **WT**: Wind turbine.
- **Power (P):** Expressed in kW, this is the electric power obtained at the generator terminals without considering the losses in the transformer or high voltage cables of the wind turbine, or the occasional power consumption which may exist in the same to supply a component. Averaged every 10 minutes.
- **Wind speed (W_S):** Expressed in m/s, it is the horizontal wind component value at the height of the hub averaged every 10 minutes.
- **Power curve (CdP):** Represents the change in the P in accordance with the W_S for the different WT operating modes.
- **Annual Output / Annual Energy Production (AEP)**: Expressed in [MWh], it is the total electrical energy produced in a WT during a one-year period, in accordance with a given CdP and a given wind distribution.
- **Wind distribution:** The Weibull distribution is used for different K-distribution parameters and for annual average wind speed values (W_{ave}).
- **Wind speed W_{10} [m/s]:** The wind speed value, measured at 10m above ground level.
- **Tower height (H):** Expressed in meters, is the height of the rotor center above ground level.
- **Power coefficient:** C_P
- **Thrust coefficient:** C_T
- **Noise level:** The expected sound power level values, expressed in dB(A), represent the sound power that the WT emits at the height of the hub for a given wind speed. In accordance with the IEC standard, the wind speed value (W_{10}) 10 m from the ground is used.

  The noise levels shown in this document are average expected values, called Lw in IEC-61400-14. To obtain the Lwd value, as defined in IEC-61400-14, an increase of 2 dB(A) shall be considered over said Lw values.
- **dB(A):** An A type frequency filter is applied, in accordance with the IEC standard.

4 DESCRIPTION

When not specified otherwise, data in following sections is calculated using the parameters from Table 1. All power curve and annual energy production values in this document are subject to the validity ranges presented in Table 2.

Rated power	4.2 MW
Frequency	50Hz/60Hz
Rotor Diameter	145 m
Angle of blade tip	Pitch control regulation
Air density reference	1.225 kg/m3

Table 1 Calculation parameter values for the SG 4.2-145 wind turbine power curve.

Wind Shear (10min average)	≤ 0.3
Turbulence intensity TI [%] for bin i	$5\%\frac{(0.75v_i+5.6)}{v_i} < TI_i < 12\%\frac{(0.75v_i+5.6)}{v_i}$
Terrain	Not complex according to IEC 61400-12-1
Upflow β [º]	-2º ≤ β ≤ +2º
Grid frequency [Hz]	± 0.5 Hz

Table 2 Validity ranges for the SG 4.2-145 wind turbine power curve.

Noise values included in the present document correspond to the wind turbine configuration with noise reduction add-ons attached to the blade.

5 RESULTS

5.1 STANDARD POWER CURVES

Table 3 shows the electrical power [kW] in accordance with the horizontal wind speed [m/s] in relation to the height of the hub W_S [m/s] for different air densities [kg/m^3].

P [kW]	***Density [kg/m^3]***												
WS [m/s]	***1.225***	***0.94***	***0.97***	***1.00***	***1.03***	***1.06***	***1.09***	***1.12***	***1.15***	***1.18***	***1.21***	***1.24***	***1.27***
3	57	31	34	37	39	42	45	48	50	53	56	58	61
4	243	172	179	187	194	202	209	217	224	232	239	247	254
5	556	411	427	442	457	472	488	503	518	533	549	564	579
6	1010	760	786	813	839	865	891	918	944	970	997	1023	1049
7	1640	1243	1285	1327	1368	1410	1452	1494	1535	1577	1619	1661	1702
8	2458	1873	1935	1997	2059	2120	2182	2244	2305	2367	2428	2488	2549
9	3342	2602	2686	2769	2851	2933	3012	3090	3165	3238	3308	3375	3439
10	3963	3315	3408	3496	3579	3655	3725	3788	3845	3896	3942	3982	4018
11	4173	3864	3932	3991	4040	4080	4111	4133	4150	4162	4170	4176	4180
12	4195	4141	4160	4172	4180	4184	4188	4190	4192	4193	4194	4195	4196
13	4199	4190	4192	4194	4195	4196	4197	4198	4198	4199	4199	4199	4199
14	4200	4197	4198	4199	4199	4199	4199	4199	4200	4200	4200	4200	4200
15	4200	4199	4199	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
16	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
17	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
18	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
19	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197	4197
20	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187	4187
21	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158	4158
22	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098	4098
23	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007	4007
24	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892	3892
25	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770	3770
26	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656	3656
27	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562	3562

Table 3 Electric power [KW] of the wind turbine SG 4.2-145 calculated in function of wind speed at hub height Ws [m/s], for different air densities [kg/m^3]. (*ref: SG145AERPC4200KW_R01_13042018*)

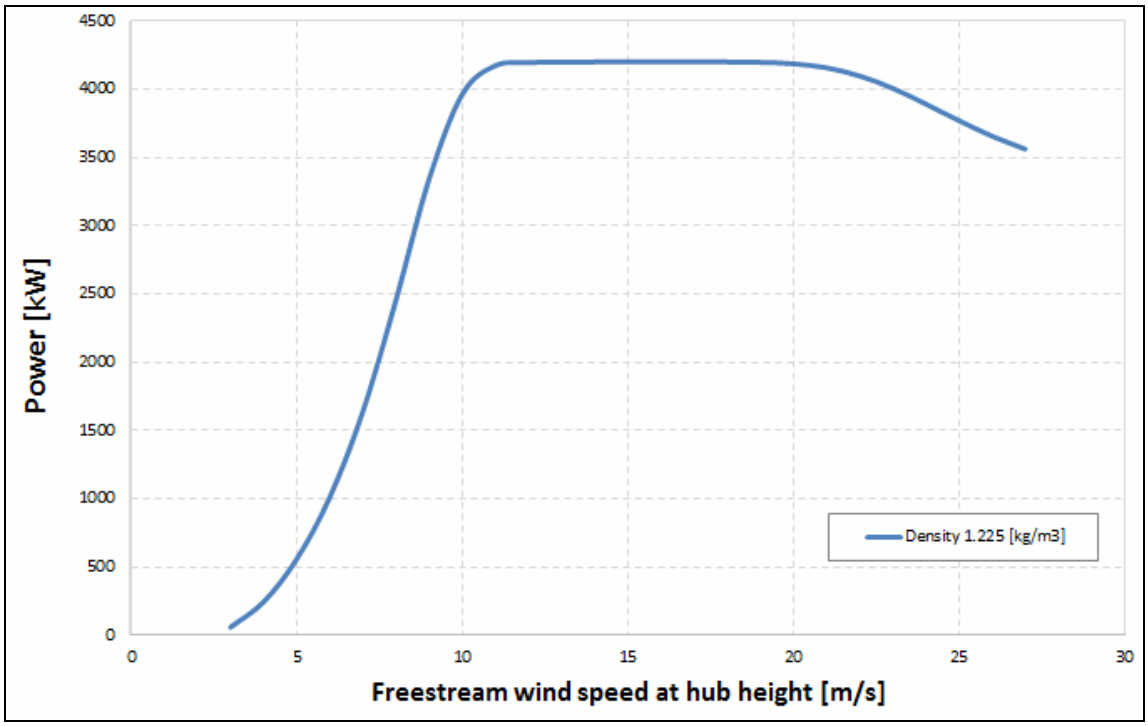


Figure 1 Power curve of the wind turbine SG 4.2-145 for an air density equal to 1.225 [kg/m3].

5.2 ANNUAL ENERGY PRODUCTION

Table 4 shows the annual output [MWh] for the wind turbine SG145 4.2-145 for different Weibull K-distribution parameter values and annual average wind speeds W_{ave} [m/s]. Values calculated for 1.225 kg/m^3 standard density and 10% turbulence intensity.

AEP [MWh]		***Wave [m/s]***										
		5.0	***5.5***	***6.0***	***6.5***	***7.0***	***7.5***	***8.0***	***8.5***	***9.0***	***9.5***	***10.0***
Weibull K	***1.5***	9014	10669	12244	13717	15074	16308	17418	18402	19264	20008	20641
	2.0	8323	10326	12299	14188	15962	17604	19107	20470	21695	22785	23742
	2.5	7560	9749	11995	14205	16309	18268	20060	21681	23134	24430	25578

Table 4 Annual energy production [MWh] of the wind turbine SG 4.2-145 calculated in function of W_{ave}[m/s].
(*ref: SG145AERPC4200KW_R01_13042018*)

5.3 CP AND CT CURVES

Table 5 shows the CP and CT values for the SG 4.2-145 wind turbine.

WS [m/s]	CP	CT
3	0.2091	0.8914
4	0.3755	0.8422
5	0.4400	0.8214
6	0.4623	0.8191
7	0.4726	0.8184
8	0.4747	0.8015
9	0.4533	0.7188
10	0.3918	0.5694
11	0.3100	0.4222
12	0.2400	0.3145
13	0.1890	0.2413
14	0.1513	0.1905
15	0.1230	0.1539
16	0.1014	0.1265
17	0.0845	0.1057
18	0.0712	0.0893
19	0.0605	0.0764
20	0.0517	0.0658
21	0.0444	0.0570
22	0.0381	0.0494
23	0.0326	0.0429
24	0.0278	0.0372
25	0.0239	0.0324
26	0.0206	0.0285
27	0.0179	0.0253

Table 5 CP and CT values for the wind turbine SG 4.2-145.
(*ref: SG145AERPC4200KW_R01_13042018*)

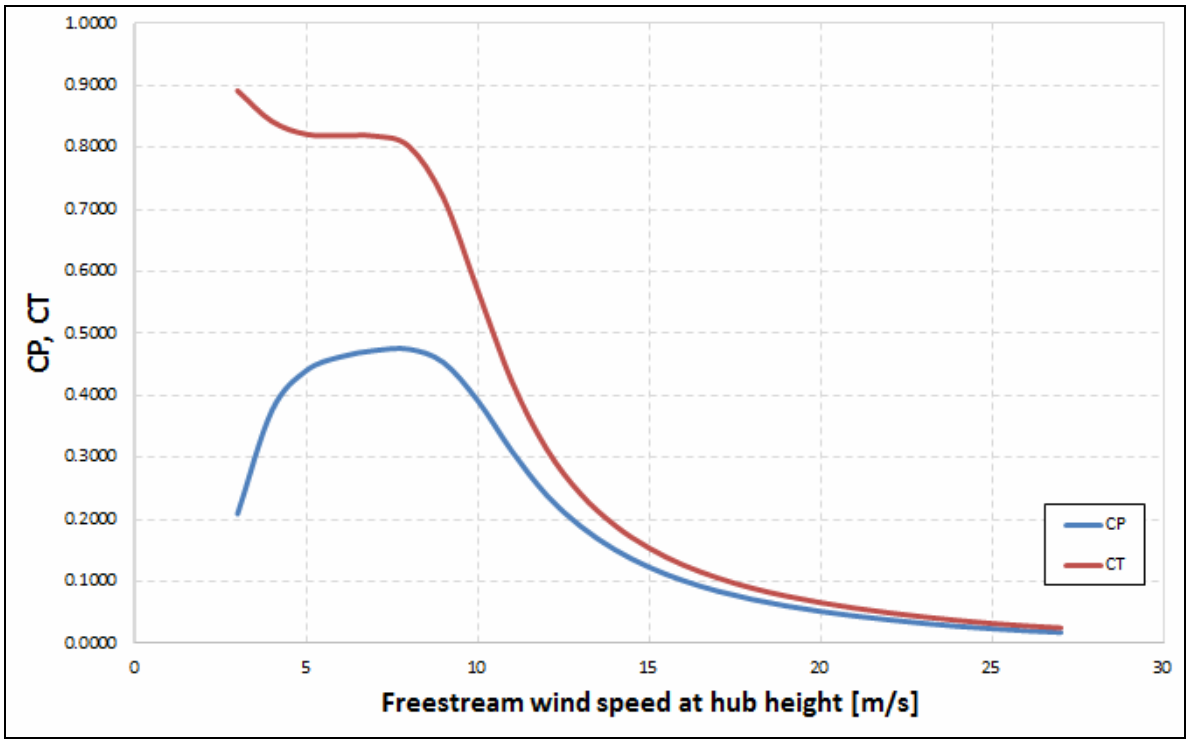


Figure 2 C_P and C_T curves of the wind turbine SG 4.2-145.

5.4 NOISE LEVELS

Estimate of aero-acoustic noise emitted by the rotor of the SG 4.2-145 wind turbine, simulated for different wind speeds at hub height (W_S).

Table 6 includes the numerical values for the estimated L_{WA} noise level in dB(A) for the different wind speeds, from the start-up speed, 3m/s.

W_S	L_{WA}
[m/s]	[dB(A)]
3	95.1
3.5	95.1
4	95.1
4.5	95.1
5	95.5
5.5	97.6
6	99.7
6.5	101.5
7	103.2
7.5	104.7
8	106.2
8.5	106.9
9	106.9
9.5	106.9
10	106.9
10.5	106.9
11	106.9
11.5	106.9
12	106.9
12.5	106.9
13	106.9
13.5	106.9
14	106.9
14.5	106.9
15	106.9

Table 6: Noise levels of the SG 4.2-145 wind turbine calculated in function of W_S [m/s].
(*ref: SG145AERPCNLEV4200KW_R00_12032018*)

Restricted
Document no.: 0067-7067 V09
2018-09-25

Performance Specification

V150-4.0/4.2 MW 50/60 Hz

Vestas Wind Systems A/S · Hedeager 42 · 8200 Aarhus N · Denmark · www.vestas.com

VESTAS PROPRIETARY NOTICE: This document contains valuable confidential information of Vestas Wind Systems A/S. It is protected by copyright law as an unpublished work. Vestas reserves all patent, copyright, trade secret, and other proprietary rights to it. The information in this document may not be used, reproduced, or disclosed except if and to the extent rights are expressly granted by Vestas in writing and subject to applicable conditions. Vestas disclaims all warranties except as expressly granted by written agreement and is not responsible for unauthorized uses, for which it may pursue legal remedies against responsible parties.

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

Original Instruction: T05 0067-7067 VER 09

Table of contents

1 GENERAL DESCRIPTION 5

2 TYPE APPROVALS AND AVAILABLE HUB HEIGHTS 5

3 OPERATIONAL ENVELOPE AND PERFORMANCE GUIDELINES 5

3.1 Climate and Site Conditions 5
3.1.1 Complex Terrain 6
3.1.2 Altitude 6
3.1.3 Wind Power Plant Layout 7
3.2 Operational Envelope – Wind 7
3.3 Operational Envelope – Conditions for Power Curve and Ct Values (at Hub Height) 8
3.4 Sound Modes 8
3.5 Load Modes 9

4 DRAWINGS 10

4.1 Structural Design – Illustration of Outer Dimensions 10

5 GENERAL RESERVATIONS, NOTES AND DISCLAIMERS 11

6 POWER CURVES, CT VALUES AND SOUND CURVES, MODE 0/0-0S 12

6.1 Power Curves, Mode 0/0-0S 12
6.2 Ct Values, Mode 0/0-0S 13
6.3 Sound Curves, Mode 0/0-0S 14

7 POWER CURVES, CT VALUES AND SOUND CURVES, POWER OPTIMIZED MODE PO1/PO1-0S 15

7.1 Power Curves, Power Optimized Mode PO1/PO1-0S 15
7.2 Ct Values, Power Optimized Mode PO1/PO1-0S 16
7.3 Sound Curves, Power Optimized Mode PO1/PO1-0S 17

8 POWER CURVES, CT VALUES AND SOUND CURVES, LOAD MODE LO1 18

8.1 Power Curves, Load Mode LO1 18
8.2 Ct Values, Load Mode LO1 19
8.3 Sound Curves, Load Mode LO1 20

9 POWER CURVES, CT VALUES AND SOUND CURVES, LOAD MODE LO2 21

9.1 Power Curves, Load Mode LO2 21
9.2 Ct Values, Load Mode LO2 22
9.3 Sound Curves, Load Mode LO2 23

10 POWER CURVES, CT VALUES AND SOUND CURVES, SOUND OPTIMIZED MODE SO1 24

10.1 Power Curves, Sound Optimized Mode SO1 24
10.2 Ct Values, Sound Optimized Mode SO1 25
10.3 Sound Curves, Sound Optimized Mode SO1 26

11 POWER CURVES, CT VALUES AND SOUND CURVES, SOUND OPTIMIZED MODE SO2 27

11.1 Power Curves, Sound Optimized Mode SO2 27
11.2 Ct Values, Sound Optimized Mode SO2 28
11.3 Sound Curves, Sound Optimized Mode SO2 29

12 POWER CURVES, CT VALUES AND SOUND CURVES, SOUND OPTIMIZED MODE SO3 30

12.1 Power Curves, Sound Optimized Mode SO3 30
12.2 Ct Values, Sound Optimized Mode SO3 31
12.3 Sound Curves, Sound Optimized Mode SO3 32

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

13 POWER CURVES, CT VALUES AND SOUND CURVES, SOUND OPTIMIZED MODE SO11 33

13.1 POWER CURVES, SOUND OPTIMIZED MODE SO11 33
13.2 CT VALUES, SOUND OPTIMIZED MODE SO11 34
13.3 SOUND CURVES, SOUND OPTIMIZED MODE SO11 35

14 POWER CURVES, CT VALUES AND SOUND CURVES, SOUND OPTIMIZED MODE SO12 36

14.1 POWER CURVES, SOUND OPTIMIZED MODE SO12 36
14.2 CT VALUES, SOUND OPTIMIZED MODE SO12 37
14.3 SOUND CURVES, SOUND OPTIMIZED MODE SO12 38

15 POWER CURVES, CT VALUES AND SOUND CURVES, SOUND OPTIMIZED MODE SO13 39

15.1 POWER CURVES, SOUND OPTIMIZED MODE SO13 39
15.2 CT VALUES, SOUND OPTIMIZED MODE SO13 40
15.3 SOUND CURVES, SOUND OPTIMIZED MODE SO13 41

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Recipient acknowledges that (i) this Performance Specification is provided for recipient's information only, and, does not create or constitute a warranty, guarantee, promise, commitment, or other representation (Commitment) by Vestas Wind Systems or any of its affiliated or subsidiary companies (Vestas), all of which are disclaimed by Vestas and (ii) any and all Commitments by Vestas to recipient as to this Performance Specification (or any of the contents herein) are to be contained exclusively in signed written contracts between recipient and Vestas, and not within this document.

See general reservations, notes and disclaimers (including, Section 5, p. 11) to this Performance Specification.

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

1 General Description

The Vestas V150-4.0/4.2 MW wind turbine is a pitch regulated upwind turbine with active yaw and a three-blade rotor. The Vestas V150-4.0/4.2 MW turbine has a rotor diameter of 150 m and a rated power of 4.0 MW.

Vestas offers an optional Power Optimized (PO) mode at 4.2 MW for the V150-4.0 MW variant.

2 Type Approvals and Available Hub Heights

The standard turbine is type certified according to the certification standards and available hub heights listed below:

Certification	Wind Class	Hub Height		
Tower type		**Standard**	**Large diameter (split)**	**Large diameter (non-split) (1)**
IEC61400-22	IEC IIIB/IEC S	105 m		155 m
DIBt 2012	WZ2(S), GK2	123 m	145 / 166 m	

Table 2-1: Type approval data and available hub heights

(1): These towers require special transport conditions as the bottom diameter is above 5 m and are not available as standard to the US/Canadian market, but can be evaluated on a case-by-case basis.

The hub height can be increased by up to 3 m by use of raised foundation. Use of raised foundation is subject to site-specific evaluation and is not available for all soil conditions.

3 Operational Envelope and Performance Guidelines

Actual climate and site conditions have many variables and should be considered in evaluating actual turbine performance. The design and operating parameters set forth in this section do not constitute warranties, guarantees, or representations as to turbine performance at actual sites.

3.1 Climate and Site Conditions

The standard turbine is designed for the wind climate conditions listed below. Values refer to hub height.

Wind Climate	IEC IIIB	IEC S
Hub Height	**105/155m**	**105/155m**
Power Rating	**4.0MW**	**4.2MW**
Extr Wind Speed (10 min average), V_{50}	37.5 m/s	37.5 m/s
Survival Wind Speed (3 s gust), V_{e50}	52.5 m/s	52.5 m/s
Turbulence Intensity, I_{V50}	11%	11%

Table 3-1: Extreme design parameters – IEC

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

Wind Climate	IEC IIIB	IEC S
Hub Height	**105/155m**	**105/155m**
Power Rating	**4.0MW**	**4.2MW**
Wind Speed (10 min average), V_{ave}	7.5 m/s	7.0 m/s
Weibull Scale Factor, *C*	8.5 m/s	7.9 m/s
Weibull Shape Factor, *k*	2.0	2.0
I_{ref} acc. to IEC 61400-1	0.14	0.14
Turbulence Intensity acc. to IEC 61400-1, Including Wind Farm Turbulence (@15 m/s) I_{90} (90% quantile)	15.7%	15.7%
Wind Shear, α	0.20	0.20
Inflow Angle (vertical)	8°	8°

Table 3-2: Average design parameters – IEC

Wind Climate	WZ2(S)	WZ2(S)	WZ2(S)	WZ2(S)	WZ2(S)	WZ2(S)
Hub Height	**123 m**	**123 m**	**145 m**	**145 m**	**166 m**	**166 m**
Power Rating	**4.0MW**	**4.2MW**	**4.0MW**	**4.2MW**	**4.0MW**	**4.2MW**
Extr Wind Speed (10 min average), V_{50}	37.45 m/s	37.45 m/s	37.50 m/s	37.50 m/s	37.50 m/s	37.50 m/s
Survival Wind Speed (3 s gust), V_{e50}	52.43 m/s	52.43 m/s	52.50 m/s	52.50 m/s	52.50 m/s	52.50 m/s
Turbulence intensity, $I_{v(z)}$	12.7%	12.7%	12.4%	12.4%	12.1%	12.1%

Table 3-3: Extreme design parameters – DIBt

Wind Climate	WZ2(S)	WZ2(S)	WZ2(S)	WZ2(S)	WZ2(S)	WZ2(S)
Hub Height	**123 m**	**123 m**	**145 m**	**145 m**	**166 m**	**166 m**
Power Rating	**4.0MW**	**4.2MW**	**4.0MW**	**4.2MW**	**4.0MW**	**4.2MW**
Wind Speed (10 min average), V_{ave}	7.4 m/s	7.0 m/s	7.5 m/s	7.0 m/s	7.05 m/s	7.0 m/s
I_{ref} acc. to IEC 61400-1	0.14	0.14	0.14	0.14	0.14	0.14
Turbulence Intensity, I_{90} (90% quant.)	15.7%	15.7%	15.7%	15.7%	15.7%	15.7%

Table 3-4: Average design parameters – DIBt

3.1.1 Complex Terrain

Classification of complex terrain according to IEC 61400-1:2005 Chapter 11.2. For sites classified as complex, appropriate measures are to be included in site assessment. Positioning of each turbine must be verified via Vestas Site Check.

3.1.2 Altitude

The turbine is designed for use at altitudes up to 1000 m above sea level as standard and optional up to 2000 m above sea level.

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

3.1.3 Wind Power Plant Layout

Turbine spacing is to be evaluated site-specifically. Spacing below two rotor diameters (2D) may require sector-wise curtailment.

NOTE

As evaluation of climate and site conditions is complex, consult Vestas for every project. If conditions exceed the above parameters, Vestas must be consulted.

3.2 Operational Envelope – Wind

Values refer to hub height and are determined by the sensors and control system of the turbine.

Wind Climate	**IEC IIIB/ IEC S**
Hub Height	**105 / 155 m**
Cut-In, V_{in}	3 m/s
Cut-Out (10 min exponential avg.), V_{out}	24.5 m/s
Re-Cut In (10 min exponential avg.)	22.5 m/s

Table 3-5: Operational envelope – wind – IEC

Wind climate	**WZ2(S)**
Hub height	**123 / 145 / 166 m**
Cut-In, V_{in}	3 m/s
Cut-Out (10 min exponential avg.), V_{out}	24.5 m/s
Re-Cut In (10 min exponential avg.)	22.5 m/s

Table 3-6: Operational envelope – wind – DIBt

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

3.3 Operational Envelope – Conditions for Power Curve and Ct Values (at Hub Height)

Consult Section 6 and following sections, p. 12 for power curves and C_t values.

Conditions for Power Curve and C_t Values (at Hub Height)	
Wind Shear, *α*	0.00-0.30 (10 minute average)
Turbulence Intensity, *I*	6-12% (10 minute average)
Blades	Clean
Rain	No
Ice/Snow on Blades	No
Leading Edge	No damage
Terrain	IEC 61400-12-1
Inflow Angle (Vertical)	0 ±2°
Grid Voltage	Nominal Voltage ±2.5%
Grid Frequency	Nominal Frequency ±0.5 Hz
Grid Active Power (LV-side)	Per tabulated values in Section 6 and following sections
Grid Reactive Power (LV-side)	Power Factor 1.0

Table 3-7: Conditions for power curve and Ct values

3.4 Sound Modes

The sound modes listed below are available for the turbine.

Sound modes			
Mode No.	**Maximum Sound Level**	**Serrated trailing edges**	**Available hub heights**
0	104.9 dBA	Yes (standard)	105 / 123 / 145 / 155 / 166 m
0-0S	108.0 dBA	No (option)	105 / 123 / 145 / 155 / 166 m
PO1	104.9 dBA	Yes (standard)	105 / 123 / 145 / 155 / 166 m
PO1-0S	108.0 dBA	No (option)	105 / 123 / 145 / 155 / 166 m

Table 3-8: Available sound performance

NOTE The turbine is as standard equipped with serrated trailing edges on the blades. Optionally, Mode 0-0S can be offered without serrated trailing edges mounted on the blades.

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

In addition, Sound Optimized (SO) modes as listed below are available as options for the turbine.

Sound Optimized (SO) modes			
Mode No.	**Maximum Sound Level**	**Serrated trailing edges**	**Available hub heights**
SO1	103.4 dBA	Yes	105 / 123 / 155 / 166 m
SO2	102.0 dBA	Yes	105 / 123 / 166 m
SO3	99.5 dBA	Yes	105 / 123 / 145 / 155 / 166 m
SO11	99.2 dBA	Yes	105 m
SO12	99.9 dBA	Yes	105 m
SO13	97.0 dBA	Yes	105 m

Table 3-9: Available Sound Optimized modes

NOTE Sound Optimized (SO) modes are only available with serrated trailing edges on the blades. For further details on sound performance and in case of specific requests for sound modes per tower, please contact Vestas Wind Systems A/S.

3.5 Load Modes

The Load Optimized (LO) modes listed below are available for the turbine.

Load Optimized (LO) modes				
Mode No.	**Power**	**Maximum Sound Level**	**Serrated trailing edges**	**Available hub heights**
LO1	3.8 MW	104.9 dBA	Yes	105 / 123 / 145 / 155 / 166 m
LO2	3.6 MW	104.9 dBA	Yes	105 / 123 / 155 / 166 m

Table 3-10: Available Load Optimized modes

NOTE Load Optimized (LO) modes are only available with serrated trailing edges mounted on the blades.

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

4 Drawings

4.1 Structural Design – Illustration of Outer Dimensions

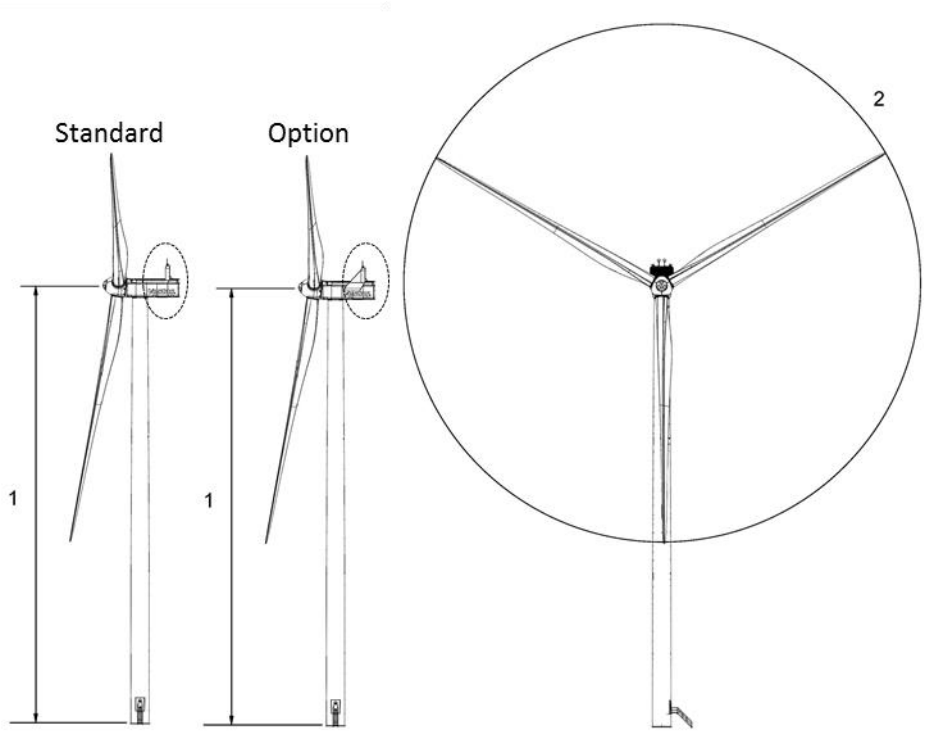


Figure 4-1: Illustration of outer dimensions – structure.

1 Hub height:
105/123/145/155/166 m

2 Diameter:
150 m

NOTE The turbine to the right is shown with side panels on the cooler top (Option).

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

5 General Reservations, Notes and Disclaimers

- © 2017 Vestas Wind Systems A/S. This document is created by Vestas Wind Systems A/S and/or its affiliates and contains copyrighted material, trademarks, and other proprietary information. All rights reserved. No part of the document may be reproduced or copied in any form or by any means – such as graphic, electronic, or mechanical, including photocopying, taping, or information storage and retrieval systems – without the prior written permission of Vestas Wind Systems A/S. The use of this document is prohibited unless specifically permitted by Vestas Wind Systems A/S. Trademarks, copyright or other notices may not be altered or removed from the document.
- The performance specifications described in this document apply to the current version of the V150-4.0/4.2 MW wind turbine. Updated versions of the V150-4.0/4.2 MW wind turbine, which may be manufactured in the future, may differ from these performance specifications. In the event that Vestas supplies an updated version of the V150-4.0/4.2 MW wind, Vestas will provide an updated performance specification applicable to the updated version.
- All listed start/stop parameters (e.g. wind speeds) are equipped with hysteresis control. This can, in certain borderline situations, result in turbine stops even though the ambient conditions are within the listed operation parameters.
- This document, Performance Specification, is not an offer for sale, and does not contain any guarantee, warranty and/or verification of the power curve and sound (including, without limitation, the power curve and sound verification method). Any guarantee, warranty and/or verification of the power curve and sound (including, without limitation, the power curve and sound verification method) must be agreed to separately in writing.

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

6 Power Curves, Ct Values and Sound Curves, Mode 0/0-0S

6.1 Power Curves, Mode 0/0-0S

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	415	434	443
5.0	**597**	452	465	478	491	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	756	774	792	827	844
6.0	**1062**	813	835	858	881	904	926	949	972	994	1017	1040	1085	1108
6.5	**1361**	1045	1074	1103	1131	1160	1189	1218	1246	1275	1304	1332	1389	1418
7.0	**1709**	1317	1353	1389	1425	1460	1496	1532	1568	1603	1638	1674	1744	1779
7.5	**2101**	1628	1671	1715	1759	1802	1845	1888	1931	1974	2016	2058	2143	2185
8.0	**2545**	1982	2034	2085	2137	2189	2240	2292	2343	2394	2444	2495	2594	2644
8.5	**3014**	2375	2435	2496	2556	2617	2675	2733	2791	2848	2904	2959	3067	3120
9.0	**3458**	2791	2856	2921	2986	3052	3112	3172	3232	3292	3348	3403	3510	3561
9.5	**3778**	3181	3246	3312	3378	3444	3498	3552	3606	3660	3699	3739	3807	3836
10.0	**3934**	3543	3596	3650	3704	3758	3789	3821	3852	3884	3901	3917	3944	3953
10.5	**3981**	3807	3835	3864	3892	3921	3932	3943	3954	3965	3971	3976	3984	3987
11.0	**3999**	3953	3962	3970	3979	3987	3990	3992	3995	3997	3998	3998	4000	4000
11.5	**4000**	3990	3992	3994	3996	3998	3999	3999	3999	4000	4000	4000	4000	4000
12.0	**4000**	3998	3999	3999	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
12.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
13.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
13.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
14.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
14.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
15.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
15.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
16.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
16.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
17.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
17.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
18.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
18.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
19.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
19.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
20.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
20.5	**3995**	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995
21.0	**3742**	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742
21.5	**3309**	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309
22.0	**2730**	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730
22.5	**2154**	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154
23.0	**1805**	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805
23.5	**1526**	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526
24.0	**1284**	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1283	1283
24.5	**1116**	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116

Table 6-1: Power curve, Mode 0/0-0S

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

6.2 Ct Values, Mode 0/0-0S

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.849	0.848	0.848	0.847	0.847	0.846	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.826	0.826	0.826	0.825	0.825	0.824	0.824	0.824	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.821	0.821	0.821	0.820	0.819	0.819
6.0	**0.815**	0.821	0.820	0.820	0.819	0.819	0.818	0.818	0.817	0.816	0.816	0.815	0.814	0.813
6.5	**0.809**	0.817	0.816	0.815	0.815	0.814	0.813	0.813	0.812	0.811	0.810	0.810	0.808	0.807
7.0	**0.803**	0.812	0.811	0.810	0.809	0.809	0.808	0.807	0.806	0.806	0.805	0.804	0.802	0.801
7.5	**0.794**	0.807	0.805	0.804	0.803	0.802	0.801	0.800	0.799	0.798	0.797	0.796	0.793	0.792
8.0	**0.786**	0.801	0.800	0.799	0.798	0.796	0.795	0.793	0.792	0.790	0.789	0.787	0.784	0.782
8.5	**0.758**	0.797	0.794	0.792	0.789	0.786	0.783	0.779	0.775	0.772	0.767	0.763	0.754	0.749
9.0	**0.697**	0.767	0.761	0.755	0.749	0.743	0.737	0.730	0.724	0.717	0.711	0.704	0.691	0.684
9.5	**0.615**	0.707	0.700	0.693	0.685	0.678	0.669	0.661	0.653	0.644	0.634	0.625	0.604	0.594
10.0	**0.523**	0.645	0.635	0.625	0.615	0.605	0.593	0.582	0.570	0.559	0.547	0.535	0.511	0.500
10.5	**0.439**	0.574	0.561	0.548	0.535	0.522	0.510	0.497	0.485	0.472	0.461	0.450	0.429	0.419
11.0	**0.372**	0.499	0.486	0.472	0.458	0.445	0.434	0.422	0.411	0.400	0.391	0.381	0.364	0.356
11.5	**0.319**	0.426	0.414	0.402	0.391	0.379	0.370	0.360	0.351	0.342	0.334	0.327	0.312	0.306
12.0	**0.277**	0.366	0.356	0.346	0.337	0.327	0.319	0.311	0.304	0.296	0.290	0.283	0.271	0.266
12.5	**0.243**	0.318	0.310	0.301	0.293	0.285	0.278	0.272	0.265	0.259	0.253	0.248	0.238	0.233
13.0	**0.214**	0.279	0.272	0.265	0.258	0.251	0.245	0.239	0.234	0.228	0.224	0.219	0.210	0.206
13.5	**0.191**	0.247	0.240	0.234	0.228	0.222	0.217	0.213	0.208	0.203	0.199	0.195	0.187	0.184
14.0	**0.171**	0.219	0.214	0.209	0.204	0.198	0.194	0.190	0.186	0.181	0.178	0.174	0.167	0.164
14.5	**0.153**	0.197	0.192	0.187	0.183	0.178	0.174	0.170	0.167	0.163	0.160	0.157	0.151	0.148
15.0	**0.139**	0.177	0.173	0.169	0.165	0.160	0.157	0.154	0.150	0.147	0.144	0.141	0.136	0.134
15.5	**0.126**	0.160	0.156	0.153	0.149	0.145	0.142	0.139	0.136	0.133	0.131	0.128	0.124	0.121
16.0	**0.115**	0.145	0.142	0.139	0.135	0.132	0.129	0.127	0.124	0.121	0.119	0.117	0.113	0.111
16.5	**0.105**	0.133	0.130	0.127	0.124	0.121	0.118	0.116	0.113	0.111	0.109	0.107	0.103	0.101
17.0	**0.096**	0.121	0.119	0.116	0.113	0.111	0.108	0.106	0.104	0.102	0.100	0.098	0.095	0.093
17.5	**0.089**	0.112	0.110	0.107	0.105	0.102	0.100	0.098	0.096	0.094	0.092	0.091	0.088	0.086
18.0	**0.082**	0.103	0.101	0.099	0.096	0.094	0.092	0.091	0.089	0.087	0.085	0.084	0.081	0.080
18.5	**0.076**	0.095	0.093	0.091	0.089	0.087	0.085	0.084	0.082	0.080	0.079	0.078	0.075	0.074
19.0	**0.071**	0.088	0.086	0.084	0.082	0.081	0.079	0.077	0.076	0.074	0.073	0.072	0.069	0.068
19.5	**0.066**	0.082	0.080	0.078	0.077	0.075	0.073	0.072	0.071	0.069	0.068	0.067	0.065	0.064
20.0	**0.061**	0.076	0.075	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.064	0.063	0.060	0.059
20.5	**0.057**	0.071	0.070	0.068	0.067	0.065	0.064	0.063	0.062	0.060	0.059	0.058	0.057	0.056
21.0	**0.051**	0.063	0.061	0.060	0.059	0.058	0.057	0.056	0.055	0.053	0.053	0.052	0.050	0.049
21.5	**0.043**	0.052	0.051	0.050	0.049	0.048	0.047	0.047	0.046	0.045	0.044	0.043	0.042	0.041
22.0	**0.034**	0.041	0.040	0.040	0.039	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.033	0.033
22.5	**0.025**	0.031	0.031	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.025	0.025
23.0	**0.021**	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.020
23.5	**0.018**	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017
24.0	**0.015**	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.013

Table 6-2: C_t values, Mode 0/0-0S

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

6.3 Sound Curves, Mode 0/0-0S

Sound Power Level at Hub Height		
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3 Maximum turbulence at hub height: 30% Inflow angle (vertical): 0 ±2° Air density: 1.225 kg/m^3**	
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA] Mode 0 (Blades with serrated trailing edge)**	**Sound Power Level at Hub Height [dBA] Mode 0-0S (Blades without serrated trailing edge)**
3	91.1	93.4
4	91.3	94.0
5	93.2	97.1
6	96.4	100.5
7	99.9	103.8
8	103.3	106.6
9	104.9	108.0
10	104.9	108.0
11	104.9	108.0
12	104.9	108.0
13	104.9	108.0
14	104.9	108.0
15	104.9	108.0
16	104.9	108.0
17	104.9	108.0
18	104.9	108.0
19	104.9	108.0
20	104.9	108.0

Table 6-3: Sound curves, Mode 0/0-0S

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

7 Power Curves, Ct Values and Sound Curves, Power Optimized Mode PO1/PO1-0S

7.1 Power Curves, Power Optimized Mode PO1/PO1-0S

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	415	434	444
5.0	**597**	452	465	478	492	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	757	774	792	827	844
6.0	**1062**	813	835	858	881	904	926	949	972	995	1017	1040	1085	1108
6.5	**1361**	1045	1074	1103	1131	1160	1189	1218	1247	1275	1304	1332	1389	1418
7.0	**1709**	1317	1353	1389	1425	1461	1496	1532	1568	1603	1639	1674	1744	1779
7.5	**2101**	1628	1671	1715	1758	1802	1845	1888	1931	1974	2016	2058	2143	2185
8.0	**2545**	1982	2034	2086	2137	2189	2240	2292	2343	2394	2444	2494	2594	2644
8.5	**3014**	2375	2435	2496	2556	2616	2674	2732	2790	2848	2904	2959	3067	3120
9.0	**3458**	2791	2856	2921	2986	3052	3112	3172	3232	3292	3348	3403	3510	3562
9.5	**3807**	3180	3246	3312	3377	3443	3499	3556	3613	3669	3715	3761	3845	3884
10.0	**4038**	3543	3602	3662	3722	3781	3824	3866	3909	3951	3980	4009	4059	4079
10.5	**4143**	3842	3884	3926	3969	4012	4035	4059	4083	4107	4119	4131	4150	4158
11.0	**4191**	4055	4078	4100	4122	4145	4154	4162	4171	4180	4184	4187	4193	4195
11.5	**4199**	4152	4160	4168	4176	4185	4188	4190	4193	4196	4197	4198	4199	4200
12.0	**4200**	4185	4188	4191	4194	4198	4198	4199	4199	4200	4200	4200	4200	4200
12.5	**4200**	4197	4197	4198	4199	4200	4200	4200	4200	4200	4200	4200	4200	4200
13.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
13.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
14.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
14.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
15.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
15.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
16.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
16.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
17.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
17.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
18.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
18.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
19.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
19.5	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
20.0	**4200**	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
20.5	**4186**	4186	4186	4186	4186	4186	4186	4186	4186	4186	4186	4186	4186	4186
21.0	**3870**	3870	3870	3870	3870	3870	3870	3870	3870	3870	3870	3870	3870	3870
21.5	**3373**	3373	3373	3373	3373	3373	3373	3373	3373	3373	3373	3373	3373	3373
22.0	**2745**	2745	2745	2745	2745	2745	2745	2745	2745	2745	2745	2745	2745	2744
22.5	**2154**	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154
23.0	**1805**	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805
23.5	**1526**	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526
24.0	**1283**	1283	1283	1283	1283	1283	1283	1283	1283	1283	1283	1283	1283	1283
24.5	**1116**	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116

Table 7-1: Power curve, Power Optimized Mode PO1/PO1-0S

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

7.2 Ct Values, Power Optimized Mode PO1/PO1-0S

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.847**	0.853	0.852	0.851	0.850	0.850	0.849	0.849	0.848	0.847	0.847	0.847	0.847	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.827	0.826	0.826	0.825	0.825	0.824	0.824	0.824	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.822	0.821	0.821	0.820	0.819	0.819
6.0	**0.815**	0.821	0.820	0.820	0.819	0.819	0.818	0.817	0.817	0.816	0.816	0.815	0.814	0.813
6.5	**0.809**	0.817	0.816	0.815	0.815	0.814	0.813	0.813	0.812	0.811	0.810	0.810	0.808	0.807
7.0	**0.803**	0.812	0.811	0.810	0.810	0.809	0.808	0.807	0.806	0.806	0.805	0.804	0.802	0.801
7.5	**0.795**	0.806	0.805	0.804	0.803	0.802	0.801	0.800	0.799	0.798	0.797	0.796	0.793	0.792
8.0	**0.785**	0.802	0.800	0.799	0.798	0.797	0.795	0.794	0.792	0.791	0.789	0.787	0.783	0.781
8.5	**0.759**	0.797	0.794	0.792	0.789	0.786	0.783	0.779	0.775	0.772	0.767	0.763	0.754	0.749
9.0	**0.698**	0.767	0.761	0.755	0.749	0.743	0.737	0.730	0.724	0.718	0.711	0.704	0.691	0.684
9.5	**0.621**	0.707	0.700	0.692	0.685	0.678	0.670	0.662	0.654	0.646	0.638	0.629	0.612	0.603
10.0	**0.540**	0.645	0.636	0.627	0.619	0.610	0.600	0.590	0.580	0.570	0.560	0.550	0.530	0.520
10.5	**0.460**	0.581	0.570	0.559	0.548	0.537	0.526	0.515	0.504	0.493	0.482	0.471	0.450	0.441
11.0	**0.393**	0.515	0.503	0.491	0.479	0.466	0.455	0.444	0.433	0.422	0.412	0.402	0.384	0.376
11.5	**0.337**	0.447	0.435	0.424	0.412	0.400	0.390	0.380	0.371	0.361	0.353	0.345	0.330	0.322
12.0	**0.292**	0.386	0.376	0.366	0.355	0.345	0.337	0.329	0.320	0.312	0.305	0.299	0.286	0.280
12.5	**0.255**	0.336	0.327	0.318	0.309	0.300	0.293	0.287	0.280	0.273	0.267	0.261	0.250	0.245
13.0	**0.225**	0.294	0.286	0.279	0.271	0.264	0.258	0.252	0.246	0.240	0.235	0.230	0.221	0.216
13.5	**0.200**	0.260	0.253	0.247	0.240	0.234	0.229	0.224	0.218	0.213	0.209	0.205	0.196	0.193
14.0	**0.179**	0.231	0.225	0.220	0.214	0.208	0.204	0.199	0.195	0.190	0.187	0.183	0.176	0.172
14.5	**0.161**	0.207	0.202	0.197	0.192	0.187	0.183	0.179	0.175	0.171	0.168	0.164	0.158	0.155
15.0	**0.145**	0.186	0.182	0.177	0.173	0.168	0.165	0.161	0.158	0.154	0.151	0.148	0.143	0.140
15.5	**0.132**	0.168	0.164	0.160	0.156	0.152	0.149	0.146	0.143	0.140	0.137	0.134	0.129	0.127
16.0	**0.120**	0.153	0.149	0.146	0.142	0.139	0.136	0.133	0.130	0.127	0.125	0.122	0.118	0.116
16.5	**0.110**	0.139	0.136	0.133	0.130	0.126	0.124	0.121	0.119	0.116	0.114	0.112	0.108	0.106
17.0	**0.101**	0.127	0.124	0.122	0.119	0.116	0.114	0.111	0.109	0.107	0.105	0.103	0.099	0.097
17.5	**0.093**	0.117	0.115	0.112	0.110	0.107	0.105	0.103	0.101	0.098	0.097	0.095	0.091	0.090
18.0	**0.086**	0.108	0.106	0.103	0.101	0.099	0.097	0.095	0.093	0.091	0.089	0.088	0.085	0.083
18.5	**0.080**	0.100	0.098	0.096	0.093	0.091	0.089	0.088	0.086	0.084	0.083	0.081	0.078	0.077
19.0	**0.074**	0.092	0.090	0.088	0.086	0.084	0.083	0.081	0.079	0.078	0.076	0.075	0.072	0.071
19.5	**0.069**	0.086	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.070	0.067	0.066
20.0	**0.064**	0.080	0.078	0.076	0.075	0.073	0.072	0.070	0.069	0.067	0.066	0.065	0.063	0.062
20.5	**0.060**	0.074	0.073	0.071	0.069	0.068	0.067	0.065	0.064	0.063	0.062	0.061	0.059	0.058
21.0	**0.052**	0.065	0.063	0.062	0.061	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051
21.5	**0.043**	0.053	0.052	0.051	0.050	0.049	0.048	0.047	0.046	0.046	0.045	0.044	0.043	0.042
22.0	**0.034**	0.041	0.041	0.040	0.039	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.033	0.033
22.5	**0.026**	0.031	0.031	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.025	0.025
23.0	**0.021**	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.020
23.5	**0.018**	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017
24.0	**0.015**	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.012

Table 7-2: C_t values, Power Optimized Mode PO1/PO1-0S

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

7.3 Sound Curves, Power Optimized Mode PO1/PO1-0S

Sound Power Level at Hub Height		
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**	
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Power Optimized Mode PO1 (Blades with serrated trailing edge)**	**Sound Power Level at Hub Height [dBA]** **Power Optimized Mode PO1-0S (Blades without serrated trailing edge)**
3	91.1	93.4
4	91.3	94.0
5	93.2	97.1
6	96.4	100.5
7	99.9	103.8
8	103.3	106.6
9	104.9	108.0
10	104.9	108.0
11	104.9	108.0
12	104.9	108.0
13	104.9	108.0
14	104.9	108.0
15	104.9	108.0
16	104.9	108.0
17	104.9	108.0
18	104.9	108.0
19	104.9	108.0
20	104.9	108.0

Table 7-3: Sound curves, Power Optimized Mode PO1/PO1-0S

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

8 Power Curves, Ct Values and Sound Curves, Load Mode LO1

8.1 Power Curves, Load Mode LO1

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	415	434	443
5.0	**597**	452	465	478	491	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	756	774	792	827	844
6.0	**1062**	813	835	858	881	904	926	949	972	994	1017	1040	1085	1108
6.5	**1361**	1045	1074	1103	1131	1160	1189	1218	1246	1275	1304	1332	1389	1418
7.0	**1709**	1317	1353	1389	1425	1460	1496	1532	1568	1603	1638	1674	1744	1779
7.5	**2101**	1628	1671	1715	1759	1802	1845	1888	1931	1974	2016	2058	2143	2185
8.0	**2545**	1982	2034	2085	2137	2189	2240	2292	2343	2394	2444	2495	2594	2644
8.5	**3012**	2375	2435	2496	2556	2617	2675	2732	2790	2848	2903	2958	3065	3117
9.0	**3428**	2791	2855	2920	2985	3050	3108	3166	3224	3282	3331	3380	3468	3508
9.5	**3648**	3174	3231	3289	3346	3404	3444	3485	3526	3566	3593	3621	3668	3689
10.0	**3750**	3482	3521	3559	3597	3635	3656	3678	3699	3720	3730	3740	3757	3764
10.5	**3786**	3670	3688	3706	3724	3742	3750	3758	3765	3773	3777	3781	3788	3791
11.0	**3800**	3766	3772	3778	3784	3790	3792	3794	3796	3798	3798	3799	3800	3800
11.5	**3800**	3791	3793	3795	3797	3798	3799	3799	3800	3800	3800	3800	3800	3800
12.0	**3800**	3799	3799	3799	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
12.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
13.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
13.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
14.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
14.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
15.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
15.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
16.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
16.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
17.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
17.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
18.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
18.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
19.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
19.5	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
20.0	**3800**	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800	3800
20.5	**3797**	3797	3797	3797	3797	3797	3797	3797	3797	3797	3797	3797	3797	3797
21.0	**3598**	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598
21.5	**3226**	3225	3225	3225	3225	3226	3226	3226	3226	3226	3226	3226	3226	3226
22.0	**2697**	2697	2697	2697	2697	2697	2697	2697	2697	2697	2697	2697	2697	2697
22.5	**2152**	2152	2152	2152	2152	2152	2152	2152	2152	2152	2152	2152	2152	2152
23.0	**1805**	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805
23.5	**1526**	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526
24.0	**1284**	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1283	1283
24.5	**1116**	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116

Table 8-1: Power curve, Load Mode LO1

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

8.2 Ct Values, Load Mode LO1

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.849	0.848	0.848	0.847	0.847	0.846	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.826	0.826	0.826	0.825	0.825	0.824	0.824	0.824	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.821	0.821	0.821	0.820	0.819	0.819
6.0	**0.815**	0.821	0.820	0.820	0.819	0.819	0.818	0.818	0.817	0.816	0.816	0.815	0.814	0.813
6.5	**0.809**	0.817	0.816	0.815	0.815	0.814	0.813	0.813	0.812	0.811	0.810	0.810	0.808	0.807
7.0	**0.803**	0.812	0.811	0.810	0.809	0.809	0.808	0.807	0.806	0.806	0.805	0.804	0.802	0.801
7.5	**0.794**	0.807	0.805	0.804	0.803	0.802	0.801	0.800	0.799	0.798	0.797	0.796	0.793	0.792
8.0	**0.786**	0.801	0.800	0.799	0.798	0.796	0.795	0.793	0.792	0.790	0.789	0.787	0.784	0.782
8.5	**0.758**	0.797	0.794	0.792	0.789	0.786	0.783	0.779	0.775	0.771	0.767	0.762	0.753	0.748
9.0	**0.689**	0.767	0.761	0.755	0.749	0.743	0.736	0.729	0.722	0.715	0.706	0.698	0.679	0.669
9.5	**0.588**	0.705	0.696	0.686	0.677	0.667	0.656	0.645	0.634	0.623	0.611	0.599	0.576	0.565
10.0	**0.492**	0.631	0.618	0.605	0.592	0.580	0.567	0.554	0.541	0.528	0.516	0.504	0.481	0.470
10.5	**0.413**	0.548	0.534	0.520	0.506	0.492	0.480	0.468	0.456	0.444	0.434	0.424	0.404	0.395
11.0	**0.351**	0.469	0.456	0.443	0.431	0.418	0.407	0.397	0.387	0.377	0.368	0.360	0.343	0.336
11.5	**0.302**	0.400	0.389	0.379	0.368	0.357	0.348	0.340	0.331	0.323	0.316	0.309	0.295	0.289
12.0	**0.262**	0.345	0.336	0.327	0.318	0.309	0.301	0.294	0.287	0.280	0.274	0.268	0.257	0.252
12.5	**0.230**	0.300	0.292	0.285	0.277	0.270	0.263	0.257	0.251	0.245	0.240	0.235	0.226	0.221
13.0	**0.204**	0.264	0.257	0.251	0.244	0.237	0.232	0.227	0.222	0.217	0.212	0.208	0.200	0.196
13.5	**0.181**	0.234	0.228	0.222	0.217	0.211	0.206	0.202	0.197	0.193	0.189	0.185	0.178	0.175
14.0	**0.162**	0.208	0.203	0.198	0.193	0.188	0.184	0.180	0.176	0.172	0.169	0.166	0.159	0.156
14.5	**0.146**	0.187	0.182	0.178	0.174	0.169	0.166	0.162	0.159	0.155	0.152	0.149	0.143	0.141
15.0	**0.132**	0.168	0.164	0.160	0.157	0.153	0.149	0.146	0.143	0.140	0.137	0.135	0.130	0.127
15.5	**0.120**	0.152	0.149	0.145	0.142	0.138	0.136	0.133	0.130	0.127	0.125	0.122	0.118	0.116
16.0	**0.109**	0.138	0.135	0.132	0.129	0.126	0.123	0.121	0.118	0.116	0.114	0.111	0.107	0.106
16.5	**0.100**	0.126	0.123	0.121	0.118	0.115	0.113	0.110	0.108	0.106	0.104	0.102	0.098	0.097
17.0	**0.092**	0.116	0.113	0.111	0.108	0.105	0.103	0.101	0.099	0.097	0.095	0.094	0.090	0.089
17.5	**0.085**	0.107	0.104	0.102	0.100	0.097	0.096	0.094	0.092	0.090	0.088	0.087	0.084	0.082
18.0	**0.079**	0.098	0.096	0.094	0.092	0.090	0.088	0.086	0.085	0.083	0.082	0.080	0.077	0.076
18.5	**0.073**	0.091	0.089	0.087	0.085	0.083	0.082	0.080	0.078	0.077	0.076	0.074	0.072	0.071
19.0	**0.068**	0.084	0.082	0.080	0.079	0.077	0.075	0.074	0.073	0.071	0.070	0.069	0.066	0.065
19.5	**0.063**	0.078	0.076	0.075	0.073	0.072	0.070	0.069	0.068	0.066	0.065	0.064	0.062	0.061
20.0	**0.059**	0.073	0.071	0.070	0.068	0.067	0.066	0.064	0.063	0.062	0.061	0.060	0.058	0.057
20.5	**0.055**	0.068	0.067	0.065	0.064	0.062	0.061	0.060	0.059	0.058	0.057	0.056	0.054	0.053
21.0	**0.049**	0.061	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051	0.050	0.049	0.048
21.5	**0.042**	0.051	0.050	0.049	0.048	0.047	0.046	0.046	0.045	0.044	0.043	0.043	0.041	0.041
22.0	**0.033**	0.041	0.040	0.039	0.038	0.038	0.037	0.036	0.036	0.035	0.034	0.034	0.033	0.032
22.5	**0.025**	0.031	0.031	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.025	0.025
23.0	**0.021**	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.020
23.5	**0.018**	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017
24.0	**0.015**	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.013

Table 8-2: C_t values, Load Mode LO1

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

8.3 Sound Curves, Load Mode LO1

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Load Mode LO1 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.2
6	96.4
7	99.9
8	103.3
9	104.9
10	104.9
11	104.9
12	104.9
13	104.9
14	104.9
15	104.9
16	104.9
17	104.9
18	104.9
19	104.9
20	104.9

Table 8-3: Sound curves, Load Mode LO1

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

9 Power Curves, Ct Values and Sound Curves, Load Mode LO2

9.1 Power Curves, Load Mode LO2

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	415	434	443
5.0	**597**	452	465	478	491	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	756	774	792	827	844
6.0	**1062**	813	835	858	881	904	926	949	972	994	1017	1040	1085	1108
6.5	**1361**	1045	1074	1103	1131	1160	1189	1218	1246	1275	1304	1332	1389	1418
7.0	**1709**	1317	1353	1389	1425	1460	1496	1532	1568	1603	1638	1674	1744	1779
7.5	**2101**	1628	1672	1715	1759	1802	1845	1888	1931	1974	2016	2058	2143	2185
8.0	**2548**	1983	2035	2087	2139	2191	2243	2294	2345	2397	2447	2497	2597	2647
8.5	**3015**	2375	2435	2496	2557	2618	2676	2734	2793	2851	2906	2960	3065	3115
9.0	**3380**	2783	2848	2913	2978	3043	3097	3152	3206	3260	3300	3340	3409	3438
9.5	**3521**	3145	3195	3244	3294	3343	3374	3406	3437	3468	3486	3504	3532	3542
10.0	**3576**	3399	3427	3455	3483	3511	3523	3535	3546	3558	3564	3570	3580	3584
10.5	**3595**	3528	3539	3549	3560	3570	3575	3579	3584	3589	3591	3593	3597	3598
11.0	**3600**	3584	3587	3590	3594	3597	3598	3598	3599	3600	3600	3600	3600	3600
11.5	**3600**	3596	3597	3598	3599	3600	3600	3600	3600	3600	3600	3600	3600	3600
12.0	**3600**	3599	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
12.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
13.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
13.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
14.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
14.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
15.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
15.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
16.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
16.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
17.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
17.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
18.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
18.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
19.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
19.5	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
20.0	**3600**	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
20.5	**3598**	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598	3598
21.0	**3448**	3448	3448	3448	3448	3448	3448	3448	3448	3448	3448	3448	3448	3448
21.5	**3132**	3132	3132	3132	3132	3132	3132	3132	3132	3132	3132	3132	3132	3132
22.0	**2657**	2657	2657	2657	2657	2657	2657	2657	2657	2657	2657	2657	2657	2657
22.5	**2150**	2150	2150	2150	2150	2150	2150	2150	2150	2150	2150	2150	2150	2150
23.0	**1805**	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805
23.5	**1526**	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526
24.0	**1284**	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1283	1283
24.5	**1116**	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116

Table 9-1: Power curve, Load Mode LO2

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

9.2 Ct Values, Load Mode LO2

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.849	0.848	0.848	0.847	0.847	0.846	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.826	0.826	0.826	0.825	0.825	0.824	0.824	0.824	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.821	0.821	0.821	0.820	0.819	0.819
6.0	**0.815**	0.821	0.820	0.820	0.819	0.819	0.818	0.818	0.817	0.816	0.816	0.815	0.814	0.813
6.5	**0.809**	0.817	0.816	0.815	0.815	0.814	0.813	0.813	0.812	0.811	0.810	0.810	0.808	0.807
7.0	**0.803**	0.812	0.811	0.810	0.809	0.809	0.808	0.807	0.806	0.806	0.805	0.804	0.802	0.801
7.5	**0.795**	0.807	0.806	0.805	0.804	0.803	0.801	0.800	0.799	0.798	0.797	0.796	0.793	0.792
8.0	**0.790**	0.805	0.804	0.803	0.801	0.800	0.799	0.797	0.796	0.795	0.793	0.791	0.788	0.786
8.5	**0.761**	0.800	0.798	0.795	0.793	0.790	0.786	0.783	0.779	0.776	0.771	0.766	0.755	0.748
9.0	**0.675**	0.769	0.763	0.757	0.751	0.745	0.736	0.727	0.718	0.709	0.698	0.686	0.662	0.649
9.5	**0.559**	0.701	0.689	0.677	0.665	0.654	0.640	0.627	0.613	0.600	0.586	0.573	0.546	0.533
10.0	**0.462**	0.614	0.599	0.584	0.569	0.554	0.540	0.526	0.512	0.498	0.486	0.474	0.451	0.441
10.5	**0.387**	0.522	0.507	0.493	0.478	0.463	0.452	0.440	0.428	0.417	0.407	0.397	0.379	0.370
11.0	**0.328**	0.441	0.429	0.416	0.404	0.392	0.382	0.372	0.362	0.353	0.345	0.336	0.321	0.314
11.5	**0.283**	0.376	0.365	0.355	0.345	0.335	0.327	0.319	0.311	0.303	0.296	0.290	0.277	0.271
12.0	**0.246**	0.324	0.315	0.307	0.298	0.290	0.283	0.276	0.270	0.263	0.258	0.252	0.242	0.237
12.5	**0.216**	0.282	0.275	0.268	0.261	0.253	0.248	0.242	0.236	0.231	0.226	0.221	0.212	0.208
13.0	**0.192**	0.248	0.242	0.236	0.230	0.224	0.219	0.214	0.209	0.204	0.200	0.196	0.188	0.184
13.5	**0.171**	0.220	0.215	0.209	0.204	0.199	0.194	0.190	0.186	0.182	0.178	0.174	0.168	0.164
14.0	**0.153**	0.196	0.192	0.187	0.182	0.178	0.174	0.170	0.166	0.163	0.159	0.156	0.150	0.147
14.5	**0.138**	0.176	0.172	0.168	0.164	0.160	0.156	0.153	0.150	0.146	0.143	0.141	0.135	0.133
15.0	**0.125**	0.159	0.155	0.151	0.148	0.144	0.141	0.138	0.135	0.132	0.130	0.127	0.122	0.120
15.5	**0.113**	0.144	0.140	0.137	0.134	0.131	0.128	0.125	0.123	0.120	0.118	0.115	0.111	0.109
16.0	**0.103**	0.131	0.128	0.125	0.122	0.119	0.116	0.114	0.112	0.109	0.107	0.105	0.101	0.100
16.5	**0.094**	0.119	0.117	0.114	0.111	0.109	0.106	0.104	0.102	0.100	0.098	0.096	0.093	0.091
17.0	**0.087**	0.109	0.107	0.104	0.102	0.100	0.098	0.096	0.094	0.092	0.090	0.088	0.085	0.084
17.5	**0.080**	0.101	0.099	0.097	0.094	0.092	0.090	0.088	0.087	0.085	0.083	0.082	0.079	0.078
18.0	**0.074**	0.093	0.091	0.089	0.087	0.085	0.083	0.082	0.080	0.078	0.077	0.076	0.073	0.072
18.5	**0.069**	0.086	0.084	0.082	0.081	0.079	0.077	0.076	0.074	0.073	0.071	0.070	0.068	0.067
19.0	**0.064**	0.079	0.078	0.076	0.074	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.063	0.062
19.5	**0.059**	0.074	0.072	0.071	0.069	0.068	0.066	0.065	0.064	0.063	0.062	0.061	0.058	0.058
20.0	**0.056**	0.069	0.067	0.066	0.065	0.063	0.062	0.061	0.060	0.059	0.058	0.057	0.055	0.054
20.5	**0.052**	0.064	0.063	0.062	0.060	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.051	0.050
21.0	**0.047**	0.058	0.057	0.056	0.054	0.053	0.052	0.051	0.050	0.050	0.049	0.048	0.046	0.046
21.5	**0.041**	0.050	0.049	0.048	0.047	0.046	0.045	0.044	0.043	0.043	0.042	0.041	0.040	0.039
22.0	**0.033**	0.040	0.039	0.039	0.038	0.037	0.036	0.036	0.035	0.034	0.034	0.033	0.032	0.032
22.5	**0.025**	0.031	0.031	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.025	0.025
23.0	**0.021**	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.020
23.5	**0.018**	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017
24.0	**0.015**	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.013

Table 9-2: C_t values, Load Mode LO2

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

9.3 Sound Curves, Load Mode LO2

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA] Load Mode LO2 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.2
6	96.4
7	99.9
8	103.1
9	103.7
10	103.7
11	103.7
12	103.7
13	103.7
14	103.7
15	103.7
16	103.7
17	103.7
18	103.7
19	103.7
20	103.7

Table 9-3: Sound curves, Load Mode LO2

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

10 Power Curves, Ct Values and Sound Curves, Sound Optimized Mode SO1

10.1 Power Curves, Sound Optimized Mode SO1

Air density [kg/m^3]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	414	434	443
5.0	**597**	452	465	478	491	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	756	774	791	826	844
6.0	**1062**	812	835	858	881	904	926	949	972	994	1017	1039	1085	1107
6.5	**1361**	1045	1074	1102	1131	1160	1189	1217	1246	1275	1303	1332	1389	1418
7.0	**1706**	1316	1351	1387	1423	1458	1494	1530	1565	1601	1636	1671	1742	1776
7.5	**2076**	1610	1653	1696	1739	1782	1824	1866	1909	1951	1993	2035	2118	2159
8.0	**2461**	1920	1970	2019	2069	2119	2168	2217	2266	2316	2364	2412	2509	2557
8.5	**2862**	2243	2300	2357	2415	2472	2528	2584	2640	2697	2752	2807	2915	2968
9.0	**3257**	2587	2652	2716	2781	2846	2907	2968	3030	3091	3146	3202	3308	3358
9.5	**3540**	2968	3032	3096	3159	3223	3273	3323	3373	3423	3462	3501	3570	3599
10.0	**3712**	3352	3398	3444	3490	3536	3566	3597	3628	3658	3676	3694	3724	3735
10.5	**3793**	3634	3658	3680	3704	3726	3738	3749	3760	3771	3778	3786	3797	3802
11.0	**3842**	3798	3805	3813	3821	3828	3831	3834	3837	3839	3840	3841	3843	3843
11.5	**3866**	3851	3854	3857	3860	3863	3864	3864	3865	3866	3866	3866	3866	3866
12.0	**3888**	3884	3884	3885	3886	3887	3887	3888	3888	3888	3888	3888	3887	3887
12.5	**3905**	3904	3904	3905	3905	3905	3905	3905	3905	3905	3905	3905	3905	3905
13.0	**3916**	3916	3916	3916	3916	3916	3916	3916	3916	3916	3916	3916	3915	3915
13.5	**3924**	3925	3925	3925	3925	3925	3925	3924	3924	3924	3924	3924	3923	3923
14.0	**3934**	3937	3937	3936	3936	3936	3936	3935	3935	3935	3934	3934	3934	3933
14.5	**3946**	3949	3949	3949	3949	3948	3948	3948	3948	3947	3947	3946	3946	3946
15.0	**3955**	3958	3957	3957	3957	3957	3956	3956	3956	3956	3956	3955	3955	3955
15.5	**3964**	3967	3967	3966	3966	3966	3966	3965	3965	3965	3964	3964	3964	3963
16.0	**3975**	3979	3978	3978	3978	3978	3977	3977	3976	3976	3976	3975	3974	3974
16.5	**3986**	3989	3988	3988	3988	3988	3988	3987	3987	3987	3986	3986	3985	3985
17.0	**3993**	3995	3995	3995	3994	3994	3994	3994	3994	3994	3994	3993	3993	3992
17.5	**3998**	3999	3999	3998	3998	3998	3998	3998	3998	3998	3998	3998	3998	3998
18.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	3999
18.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
19.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
19.5	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
20.0	**4000**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
20.5	**3995**	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995	3995
21.0	**3742**	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742	3742
21.5	**3309**	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309	3309
22.0	**2730**	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730	2730
22.5	**2154**	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154	2154
23.0	**1805**	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805	1805
23.5	**1526**	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526
24.0	**1284**	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1283	1283
24.5	**1116**	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116

Table 10-1: Power curve, Sound Optimized Mode SO1

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

10.2 Ct Values, Sound Optimized Mode SO1

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.848	0.848	0.847	0.847	0.847	0.846	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.826	0.826	0.826	0.825	0.825	0.824	0.824	0.823	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.821	0.821	0.820	0.820	0.819	0.819
6.0	**0.814**	0.821	0.820	0.820	0.819	0.819	0.818	0.817	0.817	0.816	0.816	0.815	0.814	0.813
6.5	**0.808**	0.816	0.815	0.815	0.814	0.813	0.813	0.812	0.811	0.811	0.810	0.809	0.808	0.807
7.0	**0.796**	0.805	0.804	0.803	0.802	0.802	0.801	0.800	0.799	0.798	0.797	0.797	0.795	0.794
7.5	**0.758**	0.768	0.767	0.766	0.766	0.765	0.764	0.763	0.762	0.761	0.760	0.759	0.757	0.756
8.0	**0.706**	0.716	0.715	0.715	0.714	0.713	0.712	0.711	0.710	0.709	0.708	0.707	0.705	0.704
8.5	**0.659**	0.670	0.669	0.668	0.667	0.666	0.665	0.664	0.663	0.662	0.661	0.660	0.658	0.656
9.0	**0.613**	0.632	0.631	0.630	0.629	0.628	0.626	0.625	0.623	0.621	0.619	0.616	0.609	0.605
9.5	**0.550**	0.608	0.604	0.601	0.597	0.594	0.588	0.582	0.576	0.570	0.564	0.557	0.542	0.534
10.0	**0.479**	0.583	0.574	0.565	0.556	0.547	0.537	0.528	0.518	0.508	0.498	0.489	0.469	0.459
10.5	**0.411**	0.536	0.523	0.511	0.498	0.485	0.474	0.462	0.451	0.440	0.430	0.420	0.402	0.393
11.0	**0.354**	0.475	0.462	0.448	0.435	0.422	0.412	0.401	0.391	0.380	0.371	0.363	0.346	0.338
11.5	**0.306**	0.408	0.397	0.386	0.374	0.363	0.355	0.346	0.337	0.328	0.321	0.313	0.300	0.293
12.0	**0.268**	0.354	0.344	0.335	0.325	0.316	0.308	0.301	0.293	0.286	0.280	0.274	0.262	0.257
12.5	**0.236**	0.309	0.301	0.293	0.285	0.277	0.271	0.264	0.258	0.252	0.246	0.241	0.231	0.227
13.0	**0.209**	0.272	0.265	0.258	0.251	0.245	0.239	0.234	0.228	0.223	0.218	0.214	0.205	0.201
13.5	**0.187**	0.241	0.235	0.229	0.224	0.218	0.213	0.208	0.203	0.199	0.195	0.191	0.183	0.180
14.0	**0.167**	0.216	0.210	0.205	0.200	0.195	0.191	0.186	0.182	0.178	0.175	0.171	0.164	0.161
14.5	**0.151**	0.194	0.189	0.185	0.180	0.175	0.172	0.168	0.164	0.161	0.157	0.154	0.148	0.146
15.0	**0.137**	0.175	0.171	0.167	0.163	0.159	0.155	0.152	0.149	0.145	0.143	0.140	0.134	0.132
15.5	**0.125**	0.159	0.155	0.151	0.148	0.144	0.141	0.138	0.135	0.132	0.130	0.127	0.122	0.120
16.0	**0.114**	0.145	0.141	0.138	0.135	0.131	0.129	0.126	0.123	0.121	0.118	0.116	0.112	0.110
16.5	**0.104**	0.132	0.129	0.126	0.123	0.120	0.118	0.115	0.113	0.111	0.109	0.106	0.103	0.101
17.0	**0.096**	0.121	0.119	0.116	0.113	0.110	0.108	0.106	0.104	0.102	0.100	0.098	0.094	0.093
17.5	**0.089**	0.112	0.110	0.107	0.105	0.102	0.100	0.098	0.096	0.094	0.092	0.091	0.087	0.086
18.0	**0.082**	0.103	0.101	0.099	0.096	0.094	0.092	0.091	0.089	0.087	0.085	0.084	0.081	0.080
18.5	**0.076**	0.095	0.093	0.091	0.089	0.087	0.085	0.084	0.082	0.080	0.079	0.078	0.075	0.074
19.0	**0.071**	0.088	0.086	0.084	0.082	0.081	0.079	0.077	0.076	0.074	0.073	0.072	0.069	0.068
19.5	**0.066**	0.082	0.080	0.078	0.077	0.075	0.073	0.072	0.071	0.069	0.068	0.067	0.065	0.064
20.0	**0.061**	0.076	0.075	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.064	0.063	0.060	0.059
20.5	**0.057**	0.071	0.070	0.068	0.067	0.065	0.064	0.063	0.062	0.060	0.059	0.058	0.057	0.056
21.0	**0.051**	0.063	0.061	0.060	0.059	0.058	0.057	0.056	0.055	0.053	0.053	0.052	0.050	0.049
21.5	**0.043**	0.052	0.051	0.050	0.049	0.048	0.047	0.047	0.046	0.045	0.044	0.043	0.042	0.041
22.0	**0.034**	0.041	0.040	0.040	0.039	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.033	0.033
22.5	**0.025**	0.031	0.031	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.025	0.025
23.0	**0.021**	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.020
23.5	**0.018**	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017
24.0	**0.015**	0.018	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.013

Table 10-2: C_t values, Sound Optimized Mode SO1

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

10.3 Sound Curves, Sound Optimized Mode SO1

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Sound Optimized Mode SO1 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.2
6	96.4
7	99.9
8	102.7
9	103.3
10	103.3
11	103.3
12	103.3
13	103.4
14	103.4
15	103.4
16	103.4
17	103.4
18	103.4
19	103.4
20	103.4

Table 10-3: Sound curves, Sound Optimized Mode SO1

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

11 Power Curves, Ct Values and Sound Curves, Sound Optimized Mode SO2

11.1 Power Curves, Sound Optimized Mode SO2

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	414	434	443
5.0	**597**	452	465	478	491	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	756	774	791	826	844
6.0	**1062**	812	835	858	881	904	926	949	972	994	1017	1039	1085	1107
6.5	**1360**	1045	1074	1103	1131	1160	1189	1218	1246	1275	1303	1332	1388	1417
7.0	**1699**	1317	1353	1389	1424	1460	1495	1530	1566	1601	1633	1666	1730	1760
7.5	**2034**	1627	1670	1712	1754	1796	1834	1872	1909	1946	1976	2005	2055	2076
8.0	**2241**	1969	2008	2046	2085	2124	2145	2167	2188	2210	2220	2231	2248	2256
8.5	**2303**	2220	2234	2249	2263	2278	2283	2289	2294	2300	2301	2302	2303	2303
9.0	**2336**	2326	2328	2330	2332	2335	2335	2335	2335	2336	2336	2336	2335	2335
9.5	**2383**	2380	2381	2382	2383	2384	2384	2384	2384	2384	2383	2383	2383	2382
10.0	**2418**	2422	2422	2422	2421	2421	2420	2420	2420	2419	2419	2418	2417	2417
10.5	**2442**	2454	2453	2452	2451	2450	2449	2447	2446	2445	2444	2443	2441	2440
11.0	**2506**	2552	2547	2542	2537	2532	2528	2524	2520	2516	2512	2509	2502	2499
11.5	**2578**	2693	2675	2658	2640	2622	2615	2608	2601	2593	2588	2583	2574	2570
12.0	**2644**	2754	2742	2730	2717	2705	2696	2687	2678	2668	2660	2652	2640	2635
12.5	**2674**	2767	2756	2746	2736	2726	2717	2709	2701	2692	2686	2680	2670	2666
13.0	**2683**	2764	2754	2745	2735	2725	2718	2710	2702	2695	2691	2687	2681	2678
13.5	**2753**	2860	2847	2833	2819	2806	2797	2789	2780	2772	2765	2759	2748	2743
14.0	**2854**	2970	2956	2941	2926	2912	2903	2895	2886	2878	2870	2862	2847	2840
14.5	**2987**	3082	3070	3058	3047	3035	3027	3020	3012	3005	2999	2993	2982	2977
15.0	**3123**	3166	3163	3159	3155	3151	3147	3144	3140	3136	3132	3128	3119	3115
15.5	**3215**	3255	3252	3248	3245	3242	3238	3235	3231	3228	3224	3219	3210	3206
16.0	**3334**	3365	3363	3360	3358	3356	3353	3350	3348	3345	3341	3338	3329	3325
16.5	**3415**	3431	3430	3429	3429	3428	3426	3425	3423	3421	3419	3417	3412	3410
17.0	**3461**	3468	3468	3468	3468	3468	3468	3467	3466	3465	3464	3462	3459	3458
17.5	**3470**	3478	3477	3477	3476	3476	3475	3474	3474	3473	3472	3471	3469	3468
18.0	**3484**	3494	3494	3492	3492	3490	3490	3489	3488	3487	3486	3485	3483	3482
18.5	**3507**	3517	3516	3516	3515	3514	3513	3512	3511	3510	3509	3508	3506	3504
19.0	**3532**	3534	3535	3535	3535	3535	3535	3534	3534	3534	3533	3532	3530	3529
19.5	**3555**	3556	3556	3556	3557	3557	3557	3557	3557	3556	3556	3556	3554	3554
20.0	**3573**	3570	3570	3571	3572	3573	3574	3574	3574	3574	3574	3574	3573	3573
20.5	**3583**	3575	3577	3578	3579	3580	3581	3582	3582	3583	3583	3583	3583	3583
21.0	**3297**	3296	3297	3297	3297	3297	3297	3297	3297	3297	3297	3297	3297	3297
21.5	**2623**	2630	2628	2627	2626	2625	2624	2624	2624	2623	2623	2623	2623	2623
22.0	**2011**	2019	2019	2018	2018	2018	2016	2015	2014	2012	2012	2011	2010	2010
22.5	**1594**	1596	1596	1596	1596	1596	1596	1596	1596	1596	1595	1595	1594	1594
23.0	**1502**	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502
23.5	**1400**	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
24.0	**1252**	1252	1252	1252	1252	1252	1252	1252	1252	1252	1252	1252	1252	1252
24.5	**1112**	1112	1112	1112	1112	1112	1112	1112	1112	1112	1112	1112	1112	1112

Table 11-1: Power curve, Sound Optimized Mode SO2

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

11.2 Ct Values, Sound Optimized Mode SO2

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.848	0.848	0.847	0.847	0.847	0.846	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.826	0.826	0.826	0.825	0.825	0.824	0.824	0.823	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.821	0.821	0.820	0.820	0.819	0.819
6.0	**0.814**	0.821	0.820	0.820	0.819	0.819	0.818	0.817	0.817	0.816	0.816	0.815	0.814	0.813
6.5	**0.808**	0.816	0.816	0.815	0.815	0.814	0.813	0.812	0.812	0.811	0.810	0.809	0.807	0.805
7.0	**0.789**	0.812	0.811	0.810	0.809	0.808	0.806	0.804	0.803	0.801	0.797	0.793	0.783	0.778
7.5	**0.736**	0.806	0.803	0.800	0.797	0.795	0.788	0.782	0.776	0.770	0.758	0.747	0.722	0.708
8.0	**0.616**	0.790	0.777	0.765	0.752	0.739	0.721	0.704	0.686	0.668	0.651	0.633	0.601	0.585
8.5	**0.490**	0.686	0.665	0.644	0.623	0.602	0.585	0.568	0.551	0.533	0.519	0.505	0.478	0.466
9.0	**0.401**	0.554	0.536	0.519	0.501	0.483	0.470	0.457	0.444	0.431	0.421	0.411	0.392	0.383
9.5	**0.342**	0.460	0.447	0.433	0.420	0.407	0.397	0.387	0.377	0.367	0.358	0.350	0.335	0.328
10.0	**0.293**	0.387	0.377	0.366	0.356	0.345	0.337	0.329	0.321	0.313	0.306	0.299	0.287	0.281
10.5	**0.253**	0.331	0.322	0.314	0.305	0.297	0.290	0.283	0.276	0.270	0.264	0.258	0.248	0.243
11.0	**0.223**	0.294	0.287	0.279	0.271	0.263	0.257	0.251	0.245	0.239	0.234	0.229	0.219	0.214
11.5	**0.200**	0.269	0.261	0.253	0.245	0.237	0.231	0.225	0.219	0.214	0.209	0.205	0.196	0.192
12.0	**0.180**	0.240	0.234	0.227	0.220	0.214	0.208	0.203	0.198	0.193	0.188	0.184	0.176	0.173
12.5	**0.161**	0.212	0.207	0.201	0.195	0.190	0.185	0.181	0.176	0.172	0.168	0.164	0.158	0.154
13.0	**0.143**	0.188	0.183	0.178	0.173	0.168	0.164	0.160	0.156	0.153	0.150	0.146	0.141	0.138
13.5	**0.131**	0.173	0.168	0.164	0.159	0.154	0.151	0.147	0.144	0.140	0.137	0.134	0.129	0.126
14.0	**0.122**	0.161	0.156	0.152	0.148	0.143	0.140	0.137	0.133	0.130	0.127	0.125	0.120	0.117
14.5	**0.115**	0.150	0.146	0.142	0.138	0.134	0.131	0.128	0.125	0.122	0.120	0.117	0.113	0.110
15.0	**0.108**	0.139	0.136	0.133	0.129	0.126	0.123	0.121	0.118	0.115	0.113	0.111	0.106	0.104
15.5	**0.101**	0.130	0.127	0.124	0.121	0.118	0.115	0.113	0.110	0.108	0.106	0.103	0.099	0.098
16.0	**0.096**	0.122	0.119	0.116	0.113	0.111	0.108	0.106	0.104	0.101	0.100	0.098	0.094	0.092
16.5	**0.090**	0.113	0.111	0.108	0.106	0.103	0.101	0.099	0.097	0.095	0.093	0.091	0.088	0.086
17.0	**0.083**	0.105	0.103	0.100	0.098	0.096	0.094	0.092	0.090	0.088	0.087	0.085	0.082	0.081
17.5	**0.077**	0.097	0.095	0.093	0.091	0.089	0.087	0.085	0.084	0.082	0.080	0.079	0.076	0.075
18.0	**0.072**	0.090	0.088	0.086	0.084	0.082	0.081	0.079	0.078	0.076	0.075	0.073	0.071	0.070
18.5	**0.067**	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.070	0.068	0.066	0.065
19.0	**0.063**	0.078	0.076	0.075	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.064	0.062	0.061
19.5	**0.059**	0.073	0.071	0.070	0.068	0.067	0.066	0.064	0.063	0.062	0.061	0.060	0.058	0.057
20.0	**0.055**	0.068	0.067	0.065	0.064	0.063	0.061	0.060	0.059	0.058	0.057	0.056	0.054	0.053
20.5	**0.052**	0.064	0.062	0.061	0.060	0.059	0.058	0.057	0.056	0.054	0.054	0.053	0.051	0.050
21.0	**0.045**	0.056	0.054	0.053	0.052	0.051	0.050	0.049	0.049	0.048	0.047	0.046	0.045	0.044
21.5	**0.035**	0.043	0.042	0.041	0.040	0.040	0.039	0.038	0.038	0.037	0.036	0.036	0.035	0.034
22.0	**0.027**	0.032	0.031	0.031	0.030	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026
22.5	**0.020**	0.024	0.024	0.024	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.021	0.020	0.020
23.0	**0.018**	0.022	0.022	0.021	0.021	0.020	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018
23.5	**0.017**	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.018	0.017	0.017	0.017	0.016	0.016
24.0	**0.015**	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.012

Table 11-2: C_t values, Sound Optimized Mode SO2

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

11.3 Sound Curves, Sound Optimized Mode SO2

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Sound Optimized Mode SO2 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.2
6	96.4
7	99.9
8	102.0
9	102.0
10	102.0
11	102.0
12	102.0
13	102.0
14	102.0
15	102.0
16	102.0
17	102.0
18	102.0
19	102.0
20	102.0

Table 11-3: Sound curves, Sound Optimized Mode SO2

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

12 Power Curves, Ct Values and Sound Curves, Sound Optimized Mode SO3

12.1 Power Curves, Sound Optimized Mode SO3

Air density [kg/m^3]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**285**	210	217	224	231	238	244	251	258	265	272	278	292	299
4.5	**424**	318	328	337	347	357	366	376	386	395	405	415	434	443
5.0	**597**	452	465	478	491	505	518	531	544	557	571	584	610	623
5.5	**809**	616	633	651	669	686	704	721	739	756	774	792	827	844
6.0	**1062**	813	835	858	881	904	926	949	972	994	1017	1040	1084	1107
6.5	**1338**	1045	1073	1101	1130	1158	1185	1212	1239	1266	1290	1314	1359	1379
7.0	**1517**	1305	1334	1362	1391	1419	1436	1454	1471	1488	1498	1507	1523	1528
7.5	**1546**	1493	1502	1512	1521	1531	1534	1537	1541	1544	1544	1545	1546	1546
8.0	**1546**	1543	1544	1545	1545	1546	1546	1546	1546	1546	1546	1546	1546	1546
8.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
9.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
9.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
10.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
10.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
11.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
11.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
12.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
12.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
13.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
13.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
14.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
14.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
15.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
15.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
16.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
16.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
17.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
17.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
18.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
18.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
19.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
19.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
20.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
20.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
21.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
21.5	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
22.0	**1546**	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546	1546
22.5	**1545**	1545	1545	1545	1545	1545	1545	1545	1545	1545	1545	1545	1545	1545
23.0	**1511**	1511	1511	1511	1511	1510	1511	1511	1511	1511	1511	1511	1511	1511
23.5	**1414**	1415	1415	1415	1415	1415	1415	1415	1415	1414	1414	1414	1414	1414
24.0	**1264**	1264	1264	1264	1264	1264	1264	1264	1264	1264	1264	1264	1264	1264
24.5	**1115**	1115	1115	1115	1115	1115	1115	1115	1115	1115	1115	1115	1115	1115

Table 12-1: Power curve, Sound Optimized Mode SO3

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

12.2 Ct Values, Sound Optimized Mode SO3

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.849	0.848	0.848	0.847	0.847	0.846	0.847
4.0	**0.830**	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.831	0.830	0.830	0.830	0.830
4.5	**0.828**	0.831	0.831	0.830	0.830	0.830	0.830	0.830	0.830	0.829	0.829	0.829	0.828	0.828
5.0	**0.823**	0.828	0.827	0.827	0.826	0.826	0.826	0.825	0.825	0.824	0.824	0.824	0.823	0.822
5.5	**0.820**	0.824	0.824	0.823	0.823	0.823	0.822	0.822	0.821	0.821	0.821	0.820	0.819	0.819
6.0	**0.814**	0.821	0.820	0.820	0.819	0.819	0.818	0.818	0.817	0.816	0.815	0.815	0.813	0.812
6.5	**0.778**	0.818	0.817	0.815	0.814	0.812	0.809	0.805	0.801	0.798	0.791	0.784	0.768	0.759
7.0	**0.633**	0.799	0.788	0.776	0.765	0.754	0.737	0.719	0.702	0.685	0.668	0.651	0.617	0.601
7.5	**0.476**	0.672	0.651	0.630	0.609	0.588	0.571	0.553	0.536	0.519	0.505	0.490	0.464	0.452
8.0	**0.373**	0.515	0.499	0.482	0.466	0.449	0.437	0.426	0.414	0.402	0.392	0.383	0.365	0.357
8.5	**0.303**	0.404	0.393	0.382	0.370	0.359	0.351	0.342	0.333	0.325	0.318	0.310	0.297	0.291
9.0	**0.252**	0.330	0.321	0.313	0.304	0.296	0.289	0.282	0.275	0.269	0.263	0.257	0.247	0.242
9.5	**0.213**	0.277	0.270	0.263	0.256	0.250	0.244	0.238	0.233	0.227	0.223	0.218	0.209	0.205
10.0	**0.182**	0.235	0.229	0.223	0.218	0.212	0.207	0.203	0.198	0.194	0.190	0.186	0.179	0.175
10.5	**0.157**	0.201	0.197	0.192	0.187	0.182	0.178	0.175	0.171	0.167	0.164	0.160	0.154	0.151
11.0	**0.137**	0.174	0.170	0.166	0.162	0.158	0.155	0.151	0.148	0.145	0.142	0.139	0.134	0.132
11.5	**0.120**	0.152	0.149	0.145	0.142	0.138	0.135	0.133	0.130	0.127	0.124	0.122	0.118	0.115
12.0	**0.106**	0.134	0.131	0.128	0.125	0.122	0.119	0.117	0.114	0.112	0.110	0.108	0.104	0.102
12.5	**0.094**	0.119	0.116	0.113	0.111	0.108	0.106	0.104	0.102	0.099	0.098	0.096	0.092	0.091
13.0	**0.084**	0.106	0.103	0.101	0.099	0.096	0.095	0.093	0.091	0.089	0.087	0.086	0.083	0.081
13.5	**0.076**	0.095	0.093	0.091	0.089	0.087	0.085	0.083	0.082	0.080	0.078	0.077	0.074	0.073
14.0	**0.068**	0.085	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.070	0.067	0.066
14.5	**0.062**	0.077	0.076	0.074	0.072	0.071	0.069	0.068	0.067	0.065	0.064	0.063	0.061	0.060
15.0	**0.057**	0.070	0.069	0.067	0.066	0.064	0.063	0.062	0.061	0.060	0.059	0.058	0.056	0.055
15.5	**0.052**	0.064	0.063	0.061	0.060	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.051	0.050
16.0	**0.048**	0.059	0.058	0.056	0.055	0.054	0.053	0.052	0.051	0.050	0.049	0.048	0.047	0.046
16.5	**0.044**	0.054	0.053	0.052	0.051	0.050	0.049	0.048	0.047	0.046	0.045	0.045	0.043	0.043
17.0	**0.041**	0.050	0.049	0.048	0.047	0.046	0.045	0.044	0.044	0.043	0.042	0.041	0.040	0.040
17.5	**0.038**	0.046	0.046	0.045	0.044	0.043	0.042	0.041	0.041	0.040	0.039	0.039	0.038	0.037
18.0	**0.036**	0.043	0.042	0.042	0.041	0.040	0.039	0.039	0.038	0.037	0.037	0.036	0.035	0.035
18.5	**0.033**	0.040	0.039	0.039	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.034	0.033	0.032
19.0	**0.031**	0.037	0.037	0.036	0.035	0.035	0.034	0.034	0.033	0.032	0.032	0.032	0.031	0.030
19.5	**0.029**	0.035	0.034	0.034	0.033	0.033	0.032	0.032	0.031	0.031	0.030	0.030	0.029	0.028
20.0	**0.028**	0.033	0.032	0.032	0.031	0.031	0.030	0.030	0.029	0.029	0.028	0.028	0.027	0.027
20.5	**0.026**	0.031	0.030	0.030	0.029	0.029	0.028	0.028	0.028	0.027	0.027	0.026	0.026	0.025
21.0	**0.025**	0.029	0.029	0.028	0.028	0.027	0.027	0.026	0.026	0.026	0.025	0.025	0.024	0.024
21.5	**0.023**	0.028	0.027	0.027	0.026	0.026	0.025	0.025	0.025	0.024	0.024	0.024	0.023	0.023
22.0	**0.022**	0.026	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.023	0.022	0.022	0.021	0.021
22.5	**0.020**	0.024	0.023	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.021	0.020	0.020	0.019
23.0	**0.018**	0.022	0.022	0.021	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.018	0.018
23.5	**0.017**	0.020	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017	0.017	0.017	0.016
24.0	**0.015**	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014	0.014
24.5	**0.013**	0.015	0.015	0.015	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.012

Table 12-2: C_t values, Sound Optimized Mode SO3

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

12.3 Sound Curves, Sound Optimized Mode SO3

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Sound Optimized Mode SO3 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.2
6	96.3
7	99.5
8	99.5
9	99.5
10	99.5
11	99.5
12	99.5
13	99.5
14	99.5
15	99.5
16	99.5
17	99.5
18	99.5
19	99.5
20	99.5

Table 12-3: Sound curves, Sound Optimized Mode SO3

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

13 Power Curves, Ct Values and Sound Curves, Sound Optimized Mode SO11

13.1 Power Curves, Sound Optimized Mode SO11

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**277**	210	217	224	231	237	243	250	256	262	267	272	282	286
4.5	**403**	318	327	337	346	356	363	371	379	387	392	398	406	409
5.0	**579**	452	465	478	491	504	516	528	540	552	561	570	585	590
5.5	**740**	615	632	648	664	681	692	703	713	724	730	735	743	745
6.0	**861**	800	811	822	833	845	848	851	855	858	859	860	861	862
6.5	**982**	966	969	973	976	979	980	980	981	982	982	982	982	982
7.0	**1103**	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103
7.5	**1218**	1218	1218	1218	1218	1218	1218	1218	1218	1218	1218	1218	1218	1218
8.0	**1334**	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334
8.5	**1458**	1458	1458	1458	1458	1458	1458	1458	1458	1458	1458	1458	1458	1458
9.0	**1584**	1584	1584	1584	1584	1584	1584	1584	1584	1584	1584	1584	1584	1584
9.5	**1690**	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690
10.0	**1769**	1769	1769	1769	1769	1769	1769	1769	1769	1769	1769	1769	1769	1769
10.5	**1811**	1811	1811	1811	1811	1811	1811	1811	1811	1811	1811	1811	1811	1811
11.0	**1841**	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
11.5	**1873**	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873
12.0	**1902**	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902
12.5	**1921**	1921	1921	1921	1921	1921	1921	1921	1921	1921	1921	1921	1921	1921
13.0	**1933**	1933	1933	1933	1933	1933	1933	1933	1933	1933	1933	1933	1933	1933
13.5	**1944**	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944
14.0	**1952**	1952	1952	1952	1952	1952	1952	1952	1952	1952	1952	1952	1952	1952
14.5	**1960**	1960	1960	1960	1960	1960	1960	1960	1960	1960	1960	1960	1960	1960
15.0	**1972**	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972
15.5	**1984**	1984	1984	1984	1984	1984	1984	1984	1984	1984	1984	1984	1984	1984
16.0	**1995**	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995
16.5	**2005**	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
17.0	**2013**	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013
17.5	**2022**	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022
18.0	**2031**	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031
18.5	**2039**	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039
19.0	**2047**	2047	2047	2047	2047	2047	2047	2047	2047	2047	2047	2047	2047	2047
19.5	**2054**	2054	2054	2054	2054	2054	2054	2054	2054	2054	2054	2054	2054	2054
20.0	**2061**	2061	2061	2061	2061	2061	2061	2061	2061	2061	2061	2061	2061	2061
20.5	**2068**	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068
21.0	**2049**	2049	2049	2049	2049	2049	2049	2049	2049	2049	2049	2049	2049	2049
21.5	**1853**	1853	1853	1853	1853	1853	1853	1853	1853	1853	1853	1853	1853	1853
22.0	**1421**	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421
22.5	**950**	950	950	950	950	950	950	950	950	950	950	950	950	950
23.0	**816**	816	816	816	816	816	816	816	816	816	816	816	816	816
23.5	**758**	758	758	758	758	758	758	758	758	758	758	758	758	758
24.0	**683**	683	683	683	683	683	683	683	683	683	683	683	683	683
24.5	**614**	614	614	614	614	614	614	614	614	614	614	614	614	614

Table 13-1: Power curve, Sound Optimized Mode SO11

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

13.2 Ct Values, Sound Optimized Mode SO11

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.89	0.89	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.85	0.85	0.849	0.848	0.848	0.847	0.847	0.846	0.845	0.845
4.0	**0.774**	0.83	0.829	0.828	0.827	0.826	0.82	0.814	0.808	0.802	0.793	0.784	0.76	0.746
4.5	**0.723**	0.831	0.828	0.825	0.822	0.819	0.808	0.797	0.786	0.775	0.758	0.74	0.704	0.686
5.0	**0.755**	0.829	0.827	0.825	0.823	0.822	0.815	0.808	0.802	0.795	0.782	0.768	0.736	0.717
5.5	**0.669**	0.824	0.818	0.811	0.805	0.799	0.782	0.765	0.748	0.731	0.711	0.69	0.649	0.628
6.0	**0.549**	0.782	0.76	0.737	0.715	0.692	0.67	0.647	0.624	0.602	0.584	0.566	0.534	0.519
6.5	**0.468**	0.677	0.652	0.627	0.603	0.578	0.56	0.543	0.525	0.507	0.494	0.481	0.457	0.445
7.0	**0.406**	0.564	0.545	0.527	0.508	0.489	0.476	0.463	0.45	0.437	0.426	0.416	0.397	0.388
7.5	**0.356**	0.481	0.467	0.452	0.438	0.424	0.414	0.403	0.392	0.382	0.373	0.365	0.348	0.341
8.0	**0.316**	0.42	0.409	0.397	0.386	0.374	0.365	0.356	0.347	0.338	0.331	0.323	0.31	0.303
8.5	**0.285**	0.375	0.365	0.355	0.345	0.335	0.327	0.32	0.312	0.304	0.298	0.291	0.279	0.273
9.0	**0.258**	0.337	0.329	0.32	0.311	0.303	0.296	0.289	0.282	0.275	0.269	0.264	0.253	0.248
9.5	**0.234**	0.304	0.296	0.289	0.281	0.273	0.267	0.261	0.255	0.249	0.244	0.239	0.229	0.225
10.0	**0.209**	0.27	0.264	0.257	0.25	0.244	0.238	0.233	0.228	0.222	0.218	0.214	0.205	0.201
10.5	**0.185**	0.237	0.231	0.226	0.22	0.214	0.21	0.205	0.201	0.196	0.192	0.188	0.181	0.178
11.0	**0.163**	0.208	0.204	0.199	0.194	0.189	0.185	0.181	0.177	0.173	0.17	0.166	0.16	0.157
11.5	**0.145**	0.185	0.18	0.176	0.172	0.168	0.164	0.161	0.157	0.154	0.151	0.148	0.142	0.14
12.0	**0.13**	0.165	0.161	0.157	0.153	0.15	0.147	0.144	0.141	0.138	0.135	0.132	0.127	0.125
12.5	**0.116**	0.147	0.144	0.141	0.137	0.134	0.131	0.128	0.126	0.123	0.121	0.119	0.114	0.112
13.0	**0.104**	0.132	0.129	0.126	0.123	0.12	0.118	0.115	0.113	0.11	0.108	0.106	0.103	0.101
13.5	**0.094**	0.119	0.116	0.113	0.111	0.108	0.106	0.104	0.102	0.1	0.098	0.096	0.093	0.091
14.0	**0.085**	0.107	0.105	0.102	0.1	0.098	0.096	0.094	0.092	0.09	0.089	0.087	0.084	0.082
14.5	**0.078**	0.097	0.095	0.093	0.091	0.089	0.087	0.085	0.084	0.082	0.08	0.079	0.076	0.075
15.0	**0.071**	0.088	0.087	0.085	0.083	0.081	0.079	0.078	0.076	0.075	0.074	0.072	0.07	0.069
15.5	**0.065**	0.081	0.079	0.078	0.076	0.074	0.073	0.072	0.07	0.069	0.068	0.066	0.064	0.063
16.0	**0.06**	0.074	0.073	0.071	0.07	0.068	0.067	0.066	0.065	0.063	0.062	0.061	0.059	0.058
16.5	**0.056**	0.069	0.067	0.066	0.064	0.063	0.062	0.061	0.06	0.059	0.058	0.057	0.055	0.054
17.0	**0.052**	0.063	0.062	0.061	0.06	0.058	0.057	0.056	0.055	0.054	0.053	0.053	0.051	0.05
17.5	**0.048**	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051	0.05	0.049	0.048	0.047
18.0	**0.045**	0.055	0.054	0.053	0.052	0.051	0.05	0.049	0.048	0.047	0.047	0.046	0.044	0.044
18.5	**0.042**	0.051	0.05	0.049	0.048	0.047	0.047	0.046	0.045	0.044	0.044	0.043	0.042	0.041
19.0	**0.04**	0.048	0.047	0.046	0.045	0.044	0.044	0.043	0.042	0.041	0.041	0.04	0.039	0.038
19.5	**0.037**	0.045	0.044	0.043	0.042	0.042	0.041	0.04	0.04	0.039	0.038	0.038	0.037	0.036
20.0	**0.035**	0.042	0.041	0.041	0.04	0.039	0.039	0.038	0.037	0.037	0.036	0.036	0.035	0.034
20.5	**0.033**	0.04	0.039	0.038	0.038	0.037	0.036	0.036	0.035	0.035	0.034	0.034	0.033	0.032
21.0	**0.031**	0.037	0.037	0.036	0.035	0.035	0.034	0.034	0.033	0.032	0.032	0.032	0.031	0.03
21.5	**0.027**	0.032	0.032	0.031	0.031	0.03	0.03	0.029	0.029	0.028	0.028	0.028	0.027	0.026
22.0	**0.021**	0.025	0.024	0.024	0.023	0.023	0.023	0.022	0.022	0.022	0.022	0.021	0.021	0.02
22.5	**0.015**	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015
23.0	**0.013**	0.015	0.015	0.014	0.014	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013
23.5	**0.012**	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012
24.0	**0.011**	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.01	0.01
24.5	**0.009**	0.011	0.011	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.009	0.009

Table 13-2: C_t values, Sound Optimized Mode SO11

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

13.3 Sound Curves, Sound Optimized Mode SO11

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Sound Optimized Mode SO11 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.0
6	94.4
7	95.6
8	96.8
9	98.0
10	98.8
11	99.0
12	99.2
13	99.2
14	99.2
15	99.2
16	99.2
17	99.2
18	99.2
19	99.2
20	99.2

Table 13-3: Sound curves, Sound Optimized Mode SO11

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

14 Power Curves, Ct Values and Sound Curves, Sound Optimized Mode SO12

14.1 Power Curves, Sound Optimized Mode SO12

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	81	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	172	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	278	210	217	224	231	237	243	250	256	262	267	272	282	286
4.5	405	318	327	337	347	356	364	373	381	389	394	400	409	413
5.0	580	452	465	478	491	504	516	528	540	552	562	571	586	592
5.5	766	616	633	650	667	684	698	713	727	741	749	758	771	775
6.0	934	810	829	848	867	886	896	906	916	926	929	931	935	936
6.5	1108	1029	1044	1059	1074	1090	1093	1097	1101	1105	1106	1107	1108	1108
7.0	1301	1270	1278	1285	1293	1300	1300	1301	1301	1301	1301	1301	1301	1301
7.5	1516	1508	1510	1512	1514	1516	1516	1516	1516	1516	1516	1516	1516	1516
8.0	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695
8.5	1810	1810	1810	1810	1810	1810	1810	1810	1810	1810	1810	1810	1809	1809
9.0	1884	1884	1884	1884	1884	1884	1884	1884	1884	1884	1884	1884	1884	1884
9.5	1936	1936	1936	1936	1936	1936	1936	1936	1936	1936	1936	1936	1936	1936
10.0	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976
10.5	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
11.0	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
11.5	2035	2035	2035	2035	2035	2035	2035	2035	2035	2035	2035	2035	2035	2035
12.0	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048
12.5	2057	2057	2057	2057	2057	2057	2057	2057	2057	2057	2057	2057	2057	2057
13.0	2066	2066	2066	2066	2066	2066	2066	2066	2066	2066	2066	2066	2066	2066
13.5	2078	2078	2078	2078	2078	2078	2078	2078	2078	2078	2078	2078	2078	2078
14.0	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092
14.5	2108	2108	2108	2108	2108	2108	2108	2108	2108	2108	2108	2108	2108	2108
15.0	2123	2123	2123	2123	2123	2123	2123	2123	2123	2123	2123	2123	2123	2123
15.5	2132	2132	2132	2132	2132	2132	2132	2132	2132	2132	2132	2132	2132	2132
16.0	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140
16.5	2148	2148	2148	2148	2148	2148	2148	2148	2148	2148	2148	2148	2148	2148
17.0	2158	2158	2158	2158	2158	2158	2158	2158	2158	2158	2158	2158	2158	2158
17.5	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168	2168
18.0	2179	2179	2179	2179	2179	2179	2179	2179	2179	2179	2179	2179	2179	2179
18.5	2188	2188	2188	2188	2188	2188	2188	2188	2188	2188	2188	2188	2188	2188
19.0	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197
19.5	2205	2205	2205	2205	2205	2205	2205	2205	2205	2205	2205	2205	2205	2205
20.0	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212
20.5	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220
21.0	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
21.5	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951	1951
22.0	1460	1460	1460	1460	1460	1460	1460	1460	1460	1460	1460	1460	1460	1460
22.5	951	951	951	951	951	951	951	951	951	951	951	951	951	951
23.0	816	816	816	816	816	816	816	816	816	816	816	816	816	816
23.5	758	758	758	758	758	758	758	758	758	758	758	758	758	758
24.0	683	683	683	683	683	683	683	683	683	683	683	683	683	683
24.5	614	614	614	614	614	614	614	614	614	614	614	614	614	614

Table 14-1: Power curve, Sound Optimized Mode SO12

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

14.2 Ct Values, Sound Optimized Mode SO12

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.848	0.848	0.847	0.847	0.846	0.845	0.845
4.0	**0.776**	0.830	0.829	0.828	0.827	0.826	0.820	0.814	0.809	0.803	0.794	0.785	0.762	0.747
4.5	**0.732**	0.831	0.829	0.827	0.825	0.823	0.813	0.803	0.793	0.783	0.766	0.749	0.713	0.695
5.0	**0.760**	0.829	0.827	0.826	0.824	0.823	0.816	0.810	0.804	0.798	0.785	0.772	0.741	0.722
5.5	**0.712**	0.825	0.822	0.819	0.816	0.813	0.802	0.792	0.782	0.771	0.751	0.732	0.691	0.670
6.0	**0.618**	0.815	0.805	0.794	0.783	0.773	0.751	0.729	0.707	0.685	0.663	0.640	0.600	0.583
6.5	**0.548**	0.785	0.762	0.740	0.717	0.695	0.671	0.648	0.624	0.601	0.583	0.565	0.533	0.518
7.0	**0.495**	0.738	0.709	0.679	0.650	0.620	0.600	0.579	0.559	0.538	0.524	0.509	0.483	0.471
7.5	**0.459**	0.669	0.643	0.616	0.590	0.564	0.547	0.530	0.514	0.497	0.484	0.472	0.448	0.438
8.0	**0.414**	0.580	0.560	0.540	0.520	0.500	0.487	0.473	0.460	0.446	0.436	0.425	0.405	0.396
8.5	**0.362**	0.489	0.475	0.460	0.446	0.431	0.420	0.409	0.399	0.388	0.379	0.370	0.354	0.346
9.0	**0.312**	0.414	0.403	0.391	0.380	0.369	0.360	0.351	0.342	0.334	0.326	0.319	0.306	0.299
9.5	**0.271**	0.355	0.346	0.337	0.327	0.318	0.311	0.304	0.296	0.289	0.283	0.277	0.266	0.260
10.0	**0.235**	0.305	0.298	0.290	0.282	0.275	0.269	0.263	0.256	0.250	0.245	0.240	0.231	0.226
10.5	**0.205**	0.264	0.257	0.251	0.245	0.238	0.233	0.228	0.223	0.217	0.213	0.209	0.201	0.197
11.0	**0.179**	0.230	0.224	0.219	0.213	0.208	0.203	0.199	0.194	0.190	0.186	0.183	0.176	0.172
11.5	**0.158**	0.201	0.196	0.192	0.187	0.182	0.179	0.175	0.171	0.167	0.164	0.161	0.155	0.152
12.0	**0.140**	0.178	0.173	0.169	0.165	0.161	0.158	0.155	0.151	0.148	0.145	0.142	0.137	0.135
12.5	**0.124**	0.158	0.154	0.150	0.147	0.143	0.140	0.138	0.135	0.132	0.129	0.127	0.122	0.120
13.0	**0.111**	0.141	0.138	0.134	0.131	0.128	0.126	0.123	0.120	0.118	0.116	0.114	0.109	0.107
13.5	**0.100**	0.126	0.124	0.121	0.118	0.115	0.113	0.111	0.108	0.106	0.104	0.102	0.099	0.097
14.0	**0.091**	0.114	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096	0.095	0.093	0.090	0.088
14.5	**0.083**	0.104	0.102	0.100	0.097	0.095	0.093	0.091	0.090	0.088	0.086	0.085	0.082	0.080
15.0	**0.076**	0.095	0.093	0.091	0.089	0.087	0.085	0.084	0.082	0.080	0.079	0.077	0.075	0.074
15.5	**0.070**	0.087	0.085	0.083	0.081	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.069	0.068
16.0	**0.064**	0.080	0.078	0.076	0.075	0.073	0.072	0.070	0.069	0.068	0.066	0.065	0.063	0.062
16.5	**0.059**	0.073	0.072	0.070	0.069	0.067	0.066	0.065	0.064	0.062	0.061	0.060	0.058	0.057
17.0	**0.055**	0.068	0.066	0.065	0.064	0.062	0.061	0.060	0.059	0.058	0.057	0.056	0.054	0.053
17.5	**0.051**	0.063	0.062	0.061	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051	0.050
18.0	**0.048**	0.059	0.058	0.056	0.055	0.054	0.053	0.052	0.051	0.050	0.050	0.049	0.047	0.047
18.5	**0.045**	0.055	0.054	0.053	0.052	0.051	0.050	0.049	0.048	0.047	0.046	0.046	0.044	0.044
19.0	**0.042**	0.051	0.050	0.049	0.048	0.047	0.046	0.046	0.045	0.044	0.043	0.043	0.041	0.041
19.5	**0.040**	0.048	0.047	0.046	0.045	0.044	0.044	0.043	0.042	0.041	0.041	0.040	0.039	0.038
20.0	**0.037**	0.045	0.044	0.043	0.042	0.042	0.041	0.040	0.040	0.039	0.038	0.038	0.037	0.036
20.5	**0.035**	0.042	0.042	0.041	0.040	0.039	0.039	0.038	0.037	0.037	0.036	0.036	0.035	0.034
21.0	**0.033**	0.039	0.039	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.034	0.033	0.032	0.032
21.5	**0.028**	0.034	0.033	0.033	0.032	0.031	0.031	0.030	0.030	0.029	0.029	0.029	0.028	0.028
22.0	**0.021**	0.025	0.025	0.024	0.024	0.024	0.023	0.023	0.023	0.022	0.022	0.022	0.021	0.021
22.5	**0.015**	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015
23.0	**0.013**	0.015	0.015	0.014	0.014	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013
23.5	**0.012**	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012
24.0	**0.011**	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.010
24.5	**0.009**	0.011	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.009	0.009

Table 14-2: C_t values, Sound Optimized Mode SO12

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

14.3 Sound Curves, Sound Optimized Mode SO12

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Sound Optimized Mode SO12 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	93.0
6	94.9
7	96.9
8	98.9
9	99.6
10	99.9
11	99.9
12	99.9
13	99.9
14	99.9
15	99.9
16	99.9
17	99.9
18	99.9
19	99.9
20	99.9

Table 14-3: Sound curves, Sound Optimized Mode SO12

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

15 Power Curves, Ct Values and Sound Curves, Sound Optimized Mode SO13

15.1 Power Curves, Sound Optimized Mode SO13

Air density [kg/m³]														
Wind speed [m/s]	**1.225**	**0.95**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**81**	51	54	57	60	62	65	68	70	73	76	79	84	87
3.5	**172**	123	127	132	136	141	145	150	154	159	163	168	177	181
4.0	**277**	210	217	224	231	237	244	250	256	262	267	272	281	286
4.5	**378**	317	326	334	342	351	356	362	367	373	374	376	378	379
5.0	**440**	426	429	432	436	439	439	439	439	440	440	440	440	440
5.5	**465**	464	464	464	465	465	465	465	465	465	465	465	465	465
6.0	**506**	506	506	506	506	506	506	506	506	506	506	506	506	506
6.5	**597**	597	597	597	597	597	597	597	597	597	597	597	597	597
7.0	**705**	705	705	705	705	705	705	705	705	705	705	705	705	705
7.5	**804**	804	804	804	804	804	804	804	804	804	804	804	804	804
8.0	**923**	923	923	923	923	923	923	923	923	923	923	923	923	923
8.5	**1069**	1069	1069	1069	1069	1069	1069	1069	1069	1069	1069	1069	1069	1069
9.0	**1200**	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
9.5	**1290**	1290	1290	1290	1290	1290	1290	1290	1290	1290	1290	1290	1290	1290
10.0	**1355**	1355	1355	1355	1355	1355	1355	1355	1355	1355	1355	1355	1355	1355
10.5	**1409**	1409	1409	1409	1409	1409	1409	1409	1409	1409	1409	1409	1409	1409
11.0	**1455**	1455	1455	1455	1455	1455	1455	1455	1455	1455	1455	1455	1455	1455
11.5	**1480**	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480
12.0	**1492**	1492	1492	1492	1492	1492	1492	1492	1492	1492	1492	1492	1492	1492
12.5	**1499**	1499	1499	1499	1499	1499	1499	1499	1499	1499	1499	1499	1499	1499
13.0	**1505**	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505	1505
13.5	**1512**	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512
14.0	**1522**	1522	1522	1522	1522	1522	1522	1522	1522	1522	1522	1522	1522	1522
14.5	**1535**	1535	1535	1535	1535	1535	1535	1535	1535	1535	1535	1535	1535	1535
15.0	**1547**	1547	1547	1547	1547	1547	1547	1547	1547	1547	1547	1547	1547	1547
15.5	**1555**	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555
16.0	**1560**	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560
16.5	**1568**	1568	1568	1568	1568	1568	1568	1568	1568	1568	1568	1568	1568	1568
17.0	**1577**	1577	1577	1577	1577	1577	1577	1577	1577	1577	1577	1577	1577	1577
17.5	**1587**	1587	1587	1587	1587	1587	1587	1587	1587	1587	1587	1587	1587	1587
18.0	**1595**	1595	1595	1595	1595	1595	1595	1595	1595	1595	1595	1595	1595	1595
18.5	**1599**	1599	1599	1599	1599	1599	1599	1599	1599	1599	1599	1599	1599	1599
19.0	**1603**	1603	1603	1603	1603	1603	1603	1603	1603	1603	1603	1603	1603	1603
19.5	**1610**	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610
20.0	**1618**	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618
20.5	**1629**	1629	1629	1629	1629	1629	1629	1629	1629	1629	1629	1629	1629	1629
21.0	**1636**	1636	1636	1636	1636	1636	1636	1636	1636	1636	1636	1636	1636	1636
21.5	**1550**	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
22.0	**1276**	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276
22.5	**941**	941	941	941	941	941	941	941	941	941	941	941	941	941
23.0	**816**	816	816	816	816	816	816	816	816	816	816	816	816	816
23.5	**758**	758	758	758	758	758	758	758	758	758	758	758	758	758
24.0	**683**	683	683	683	683	683	683	683	683	683	683	683	683	683
24.5	**614**	614	614	614	614	614	614	614	614	614	614	614	614	614

Table 15-1: Power curve, Sound Optimized Mode SO13

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

15.2 Ct Values, Sound Optimized Mode SO13

Air density kg/m³														
Wind speed [m/s]	**1.225**	**0.950**	**0.975**	**1.0**	**1.025**	**1.05**	**1.075**	**1.1**	**1.125**	**1.15**	**1.175**	**1.2**	**1.25**	**1.275**
3.0	**0.888**	0.893	0.893	0.892	0.892	0.891	0.891	0.891	0.890	0.890	0.889	0.889	0.888	0.888
3.5	**0.846**	0.853	0.852	0.851	0.850	0.850	0.849	0.848	0.848	0.847	0.847	0.846	0.845	0.845
4.0	**0.774**	0.830	0.829	0.828	0.827	0.826	0.820	0.814	0.809	0.803	0.793	0.783	0.759	0.745
4.5	**0.642**	0.825	0.816	0.808	0.799	0.791	0.772	0.753	0.734	0.715	0.690	0.666	0.622	0.602
5.0	**0.490**	0.724	0.698	0.671	0.644	0.618	0.597	0.576	0.555	0.534	0.519	0.505	0.479	0.467
5.5	**0.369**	0.505	0.490	0.474	0.458	0.442	0.431	0.419	0.408	0.396	0.387	0.378	0.361	0.353
6.0	**0.298**	0.395	0.384	0.373	0.363	0.352	0.344	0.336	0.327	0.319	0.312	0.305	0.292	0.286
6.5	**0.270**	0.355	0.345	0.336	0.327	0.317	0.310	0.303	0.296	0.288	0.282	0.276	0.265	0.259
7.0	**0.251**	0.328	0.319	0.311	0.303	0.294	0.288	0.281	0.274	0.268	0.262	0.256	0.246	0.241
7.5	**0.230**	0.299	0.291	0.284	0.276	0.269	0.263	0.257	0.251	0.245	0.240	0.235	0.225	0.221
8.0	**0.215**	0.279	0.272	0.265	0.258	0.251	0.246	0.240	0.235	0.229	0.224	0.220	0.211	0.207
8.5	**0.206**	0.267	0.260	0.254	0.247	0.240	0.235	0.230	0.225	0.219	0.215	0.211	0.202	0.198
9.0	**0.194**	0.250	0.244	0.238	0.232	0.226	0.221	0.216	0.211	0.206	0.202	0.198	0.190	0.187
9.5	**0.178**	0.229	0.223	0.218	0.212	0.207	0.202	0.198	0.194	0.189	0.185	0.182	0.175	0.171
10.0	**0.160**	0.205	0.200	0.195	0.190	0.186	0.182	0.178	0.174	0.170	0.167	0.163	0.157	0.154
10.5	**0.144**	0.183	0.179	0.175	0.171	0.166	0.163	0.159	0.156	0.152	0.150	0.147	0.141	0.139
11.0	**0.129**	0.164	0.161	0.157	0.153	0.149	0.146	0.143	0.140	0.137	0.134	0.132	0.127	0.125
11.5	**0.115**	0.146	0.143	0.140	0.136	0.133	0.130	0.128	0.125	0.122	0.120	0.118	0.113	0.111
12.0	**0.103**	0.130	0.127	0.124	0.121	0.118	0.116	0.113	0.111	0.109	0.107	0.105	0.101	0.099
12.5	**0.092**	0.116	0.113	0.111	0.108	0.105	0.103	0.101	0.099	0.097	0.095	0.094	0.090	0.089
13.0	**0.082**	0.103	0.101	0.099	0.097	0.094	0.093	0.091	0.089	0.087	0.085	0.084	0.081	0.080
13.5	**0.074**	0.093	0.091	0.089	0.087	0.085	0.084	0.082	0.080	0.079	0.077	0.076	0.073	0.072
14.0	**0.068**	0.084	0.083	0.081	0.079	0.077	0.076	0.074	0.073	0.071	0.070	0.069	0.067	0.066
14.5	**0.062**	0.077	0.075	0.074	0.072	0.071	0.069	0.068	0.067	0.065	0.064	0.063	0.061	0.060
15.0	**0.057**	0.071	0.069	0.068	0.066	0.065	0.064	0.062	0.061	0.060	0.059	0.058	0.056	0.055
15.5	**0.052**	0.065	0.063	0.062	0.061	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051
16.0	**0.048**	0.059	0.058	0.057	0.056	0.055	0.054	0.053	0.052	0.051	0.050	0.049	0.048	0.047
16.5	**0.045**	0.055	0.054	0.053	0.052	0.051	0.050	0.049	0.048	0.047	0.046	0.046	0.044	0.044
17.0	**0.042**	0.051	0.050	0.049	0.048	0.047	0.046	0.045	0.045	0.044	0.043	0.042	0.041	0.041
17.5	**0.039**	0.048	0.047	0.046	0.045	0.044	0.043	0.043	0.042	0.041	0.041	0.040	0.039	0.038
18.0	**0.037**	0.045	0.044	0.043	0.042	0.041	0.041	0.040	0.039	0.038	0.038	0.037	0.036	0.036
18.5	**0.034**	0.042	0.041	0.040	0.039	0.039	0.038	0.037	0.037	0.036	0.036	0.035	0.034	0.034
19.0	**0.032**	0.039	0.038	0.037	0.037	0.036	0.035	0.035	0.034	0.034	0.033	0.033	0.032	0.031
19.5	**0.030**	0.037	0.036	0.035	0.035	0.034	0.033	0.033	0.032	0.032	0.031	0.031	0.030	0.030
20.0	**0.029**	0.034	0.034	0.033	0.033	0.032	0.032	0.031	0.031	0.030	0.030	0.029	0.028	0.028
20.5	**0.027**	0.033	0.032	0.031	0.031	0.030	0.030	0.029	0.029	0.029	0.028	0.028	0.027	0.027
21.0	**0.026**	0.031	0.030	0.030	0.029	0.029	0.028	0.028	0.027	0.027	0.027	0.026	0.026	0.025
21.5	**0.024**	0.028	0.027	0.027	0.027	0.026	0.026	0.025	0.025	0.025	0.024	0.024	0.023	0.023
22.0	**0.019**	0.023	0.022	0.022	0.022	0.021	0.021	0.021	0.020	0.020	0.020	0.020	0.019	0.019
22.5	**0.015**	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.015
23.0	**0.013**	0.015	0.015	0.014	0.014	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013
23.5	**0.012**	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012
24.0	**0.011**	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.010
24.5	**0.009**	0.011	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.009	0.009

Table 15-2: C_t values, Sound Optimized Mode SO13

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

15.3 Sound Curves, Sound Optimized Mode SO13

Sound Power Level at Hub Height	
Conditions for Sound Power Level:	**Measurement standard IEC 61400-11 ed. 3** **Maximum turbulence at hub height: 30%** **Inflow angle (vertical): 0 ±2°** **Air density: 1.225 kg/m^3**
Wind speed at hub height [m/s]	**Sound Power Level at Hub Height [dBA]** **Sound Optimized Mode SO13 (Blades with serrated trailing edge)**
3	91.1
4	91.3
5	91.9
6	92.1
7	93.1
8	94.2
9	95.8
10	96.5
11	96.9
12	97.0
13	97.0
14	97.0
15	97.0
16	97.0
17	97.0
18	97.0
19	97.0
20	97.0

Table 15-3: Sound curves, Sound Optimized Mode SO13

Original Instruction: T05 0067-7067 VER 09

T05 0067-7067 Ver 09 - Approved - Exported from DMS: 2018-10-07 by NELAN

VESTAS PROPRIETARY NOTICE

DMS 0067-4767 V05

V150-4.0/4.2 MW
Third octave
noise emission

Original Instruction: T05 0067-4767 VER 05

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE: This document contains valuable confidential information of Vestas Wind Systems A/S. It is protected by copyright law as an unpublished work. Vestas reserves all patent, copyright, trade secret, and other proprietary rights to it. The information in this document may not be used, reproduced, or disclosed except if and to the extent rights are expressly granted by Vestas in writing and subject to applicable conditions. Vestas disclaims all warranties except as expressly granted by written agreement and is not responsible for unauthorized uses, for which it may pursue legal remedies against responsible parties.

Original Instruction: T05 0067-4767 VER 05

Abstract

This document serves as a paper behind the General Specification.

The document describes the measured/estimated third octave spectra for noise levels according to the General Specification.

The document is a living document and will be updated regularly.

When new measurements exist, the document might be updated.

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

Contents

1. Introduction 4
2. Method 4
   2.1 Procedure 4
   2.2 Physical environment 4
3. Results 5
   3.1 Mode 0 5
   3.2 Mode PO1 7
   3.3 Mode SO1 9
   3.4 Mode SO2 10
   3.5 Mode SO3 11
   3.6 Mode SO11 12
   3.7 Mode SO12 13
   3.8 Mode SO13 14
4. Limitations 15
5. Recalculation to 10 m wind speeds 15

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

1. Introduction

The purpose of this document is to present the expected third octave noise spectra for the V150-4.0/4.2 MW turbine. Test results for this turbine are not yet available, so data are based on test results from turbines with rotors that are as close as possible in size the V150.

Results for the turbine with Serrated Trailing Edges are based upon internal measurement results obtained on the V136 prototype turbine located at the Østerild test site in Denmark during January and February 2017.

There are no results for V136 without Serrated Trailing Edges available, so results for the turbine without Serrated Trailing Edges are based on internal measurement results on a V126-3.3 MW located at the Østerild test site in Denmark during April to June 2014.

2. Method

2.1 Procedure

During measurements, a very large number of correlated values for noise emission spectra and turbine operating parameters are identified.

From these a relation between noise emission within each 1/3 octave band, wind speed and operational conditions are extracted. By combination of these extracted values and the actual turbine operation and rotor size, an estimate of the actual 1/3 octave performance is obtained.

In order to secure that measurement system limitations are not influencing the findings, the frequency content is limited to the frequency range 6.3 Hz to 10 kHz. The stated spectral values are thus representative for the expected noise emission from the turbine at each wind speed.

The method is verified as giving results corresponding to direct measured values.

The reported wind speed range cover hub height wind speeds from 3 to 20 m/s. Extrapolations outside this wind speed range is not possible due to limitations in the measured input data.

The stated values represent the expected turbine performance, but do not in any way enable issuing guarantees on the values.

2.2 Physical environment

The results are valid for the downwind reference position as defined according to IEC 61400-11 Ed.3.

Applicable environmental conditions are thus corresponding to the standardized requirements as described directly and indirectly in IEC 61400-11.

These can be interpreted as air density 1.225 kg/m^3, yaw errors below +/- 15 deg. and vertical inflow angles below +/- 10 deg. Blade condition is clean and undamaged.

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

3. Results

3.1 Mode 0

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	15.8	17.7	21.3	25.7	29.4	31.6	32.2	33.2	34.0	34.7	35.2	35.6	36.0	36.4	36.7	36.9	37.3
8 Hz	24.0	22.7	24.6	28.1	32.4	36.1	38.3	38.8	39.7	40.4	41.0	41.4	41.8	42.1	42.5	42.8	43.0	43.3
10 Hz	29.9	28.7	30.7	34.2	38.4	42.1	44.2	44.6	45.4	46.1	46.6	47.0	47.3	47.6	47.9	48.2	48.3	48.6
12.5 Hz	35.5	34.5	36.4	39.9	44.0	47.7	49.7	50.2	50.9	51.4	51.9	52.2	52.5	52.7	53.0	53.2	53.4	53.6
16 Hz	41.3	40.5	42.4	45.9	49.9	53.5	55.5	55.9	56.5	57.0	57.3	57.6	57.9	58.1	58.4	58.5	58.7	58.9
20 Hz	46.3	45.5	47.5	50.9	54.9	58.5	60.4	60.7	61.2	61.6	62.0	62.2	62.4	62.6	62.9	63.0	63.1	63.3
25 Hz	50.8	50.3	52.2	55.6	59.5	63.1	65.0	65.2	65.7	66.0	66.3	66.5	66.7	66.9	67.1	67.2	67.3	67.4
31.5 Hz	55.3	54.8	56.8	60.1	64.0	67.5	69.4	69.6	70.0	70.2	70.5	70.7	70.8	70.9	71.1	71.2	71.3	71.4
40 Hz	59.5	59.2	61.1	64.4	68.2	71.8	73.6	73.7	74.0	74.3	74.5	74.6	74.7	74.8	75.0	75.0	75.1	75.2
50 Hz	63.1	62.9	64.8	68.1	71.9	75.4	77.1	77.3	77.5	77.7	77.9	78.0	78.1	78.1	78.3	78.3	78.4	78.5
63 Hz	66.5	66.3	68.3	71.6	75.3	78.8	80.5	80.6	80.8	80.9	81.0	81.1	81.2	81.3	81.4	81.4	81.4	81.5
80 Hz	69.6	69.6	71.5	74.8	78.5	81.9	83.6	83.7	83.8	83.9	84.0	84.1	84.1	84.2	84.2	84.3	84.3	84.3
100 Hz	72.2	72.3	74.2	77.5	81.1	84.5	86.2	86.3	86.3	86.4	86.5	86.5	86.5	86.6	86.6	86.6	86.7	86.7
125 Hz	74.5	74.6	76.5	79.8	83.4	86.8	88.5	88.5	88.5	88.6	88.6	88.7	88.7	88.7	88.7	88.7	88.7	88.8
160 Hz	76.7	76.8	78.8	82.0	85.5	89.0	90.6	90.6	90.6	90.6	90.7	90.7	90.7	90.7	90.7	90.7	90.7	90.7
200 Hz	78.3	78.5	80.4	83.6	87.2	90.6	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2
250 Hz	79.6	79.8	81.7	84.9	88.5	91.9	93.5	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.3	93.3	93.3	93.3
315 Hz	80.6	80.8	82.8	86.0	89.4	92.8	94.4	94.4	94.4	94.4	94.3	94.3	94.3	94.3	94.3	94.3	94.2	94.2
400 Hz	81.3	81.5	83.4	86.6	90.1	93.5	95.1	95.1	95.0	95.0	95.0	94.9	94.9	94.9	94.9	94.9	94.9	94.8
500 Hz	81.6	81.8	83.7	86.9	90.4	93.8	95.4	95.3	95.3	95.3	95.2	95.2	95.2	95.2	95.2	95.1	95.1	95.1
630 Hz	81.5	81.8	83.7	86.9	90.3	93.7	95.3	95.3	95.3	95.2	95.2	95.2	95.2	95.2	95.1	95.1	95.1	95.1
800 Hz	81.1	81.4	83.3	86.5	89.9	93.3	94.9	94.9	94.9	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
1 kHz	80.4	80.7	82.5	85.7	89.2	92.6	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.1	94.1	94.1
1.25 kHz	79.4	79.6	81.5	84.7	88.2	91.5	93.1	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2
1.6 kHz	77.9	78.0	79.9	83.1	86.6	90.0	91.6	91.7	91.7	91.7	91.8	91.8	91.8	91.8	91.9	91.9	91.9	91.9
2 kHz	76.3	76.3	78.1	81.3	84.9	88.3	89.9	90.0	90.1	90.1	90.2	90.2	90.2	90.3	90.3	90.3	90.4	90.4
2.5 kHz	74.2	74.2	76.1	79.3	82.8	86.2	87.9	88.0	88.1	88.2	88.3	88.3	88.4	88.4	88.5	88.5	88.5	88.6
3.15 kHz	71.8	71.7	73.5	76.7	80.3	83.8	85.4	85.6	85.7	85.9	86.0	86.1	86.1	86.2	86.3	86.3	86.4	86.4
4 kHz	69.0	68.8	70.6	73.8	77.4	80.9	82.6	82.7	82.9	83.1	83.3	83.4	83.5	83.6	83.7	83.7	83.8	83.9
5 kHz	66.0	65.6	67.5	70.7	74.4	77.8	79.5	79.7	80.0	80.2	80.4	80.6	80.7	80.8	80.9	81.0	81.1	81.2
6.3 kHz	62.5	62.1	63.9	67.1	70.8	74.3	76.1	76.3	76.6	76.9	77.2	77.3	77.5	77.6	77.8	77.9	77.9	78.1
8 kHz	58.6	58.0	59.8	63.1	66.8	70.3	72.1	72.4	72.8	73.2	73.4	73.7	73.8	74.0	74.2	74.3	74.4	74.5
10 kHz	54.6	53.9	55.7	58.9	62.8	66.2	68.1	68.4	68.9	69.3	69.7	69.9	70.1	70.3	70.5	70.7	70.8	71.0
A-wgt	91.1	91.3	93.2	96.4	99.9	103.3	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9

Table 1: V150-4.0MW Mode 0, expected 1/3 octave band performance, (Blades with serrated trailing edge)

Original Instruction: T05 0067-4767 VER 05

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	24.3	21.9	24.8	28.8	33.4	36.6	38.8	39.7	41.0	41.8	42.4	42.7	42.9	43.1	43.2	43.3	43.3	43.3
8 Hz	30.0	28.2	31.1	34.9	39.2	42.3	44.4	45.0	45.9	46.5	46.8	47.0	47.1	47.2	47.1	47.1	47.0	46.9
10 Hz	35.0	33.8	36.7	40.4	44.4	47.4	49.3	49.7	50.4	50.7	50.9	50.9	50.9	50.8	50.7	50.5	50.4	50.2
12.5 Hz	39.8	39.0	42.0	45.6	49.3	52.3	53.9	54.2	54.6	54.7	54.7	54.6	54.5	54.3	54.0	53.8	53.6	53.3
16 Hz	44.9	44.6	47.5	50.9	54.5	57.3	58.8	59.0	59.0	59.0	58.8	58.5	58.3	58.0	57.6	57.3	57.1	56.7
20 Hz	49.1	49.2	52.2	55.5	58.9	61.6	63.0	63.0	62.9	62.6	62.3	61.9	61.6	61.2	60.7	60.4	60.1	59.6
25 Hz	53.2	53.6	56.5	59.8	63.0	65.7	66.9	66.8	66.5	66.1	65.6	65.1	64.8	64.3	63.7	63.3	63.0	62.4
31.5 Hz	57.1	57.8	60.8	64.0	67.0	69.6	70.8	70.5	70.0	69.4	68.9	68.3	67.9	67.3	66.7	66.2	65.8	65.2
40 Hz	60.8	61.9	64.8	68.0	70.9	73.4	74.5	74.1	73.4	72.7	72.0	71.4	70.9	70.3	69.6	69.1	68.7	68.0
50 Hz	64.1	65.4	68.3	71.4	74.2	76.7	77.7	77.3	76.4	75.6	74.9	74.2	73.6	73.0	72.2	71.7	71.2	70.5
63 Hz	67.2	68.7	71.6	74.7	77.4	79.8	80.7	80.3	79.3	78.4	77.6	76.9	76.3	75.6	74.7	74.2	73.7	72.9
80 Hz	70.1	71.7	74.7	77.7	80.3	82.8	83.6	83.1	82.1	81.1	80.2	79.5	78.8	78.1	77.2	76.7	76.1	75.4
100 Hz	72.5	74.3	77.2	80.3	82.9	85.3	86.1	85.6	84.5	83.5	82.5	81.7	81.1	80.3	79.4	78.8	78.3	77.5
125 Hz	74.8	76.6	79.5	82.5	85.1	87.5	88.4	87.8	86.7	85.6	84.7	83.8	83.2	82.4	81.5	80.9	80.4	79.5
160 Hz	76.9	78.7	81.7	84.7	87.3	89.7	90.5	90.0	88.8	87.8	86.8	86.0	85.3	84.5	83.6	83.0	82.5	81.7
200 Hz	78.6	80.4	83.4	86.4	89.0	91.5	92.3	91.7	90.6	89.6	88.6	87.8	87.1	86.3	85.4	84.8	84.3	83.5
250 Hz	80.0	81.8	84.8	87.8	90.5	92.9	93.8	93.2	92.2	91.2	90.2	89.4	88.7	88.0	87.1	86.5	86.0	85.2
315 Hz	81.2	82.9	85.9	89.0	91.7	94.2	95.1	94.6	93.6	92.6	91.7	90.9	90.3	89.6	88.7	88.1	87.6	86.8
400 Hz	82.2	83.7	86.7	89.9	92.7	95.2	96.2	95.7	94.8	93.9	93.1	92.3	91.7	91.0	90.2	89.7	89.2	88.4
500 Hz	82.8	84.1	87.2	90.4	93.3	95.9	96.9	96.5	95.7	94.9	94.2	93.5	92.9	92.3	91.5	91.0	90.5	89.8
630 Hz	83.2	84.3	87.4	90.7	93.7	96.4	97.5	97.2	96.5	95.8	95.1	94.5	94.0	93.4	92.7	92.2	91.8	91.1
800 Hz	83.4	84.1	87.2	90.6	93.8	96.6	97.8	97.6	97.1	96.5	95.9	95.4	95.0	94.4	93.8	93.3	93.0	92.3
1 kHz	83.2	83.7	86.8	90.3	93.7	96.5	97.8	97.7	97.4	97.0	96.5	96.1	95.7	95.2	94.7	94.3	93.9	93.4
1.25 kHz	82.8	82.9	86.1	89.7	93.2	96.1	97.6	97.6	97.5	97.2	96.9	96.6	96.3	95.9	95.4	95.1	94.8	94.3
1.6 kHz	82.1	81.8	85.0	88.7	92.5	95.5	97.1	97.3	97.4	97.3	97.2	97.0	96.8	96.5	96.1	95.9	95.6	95.2
2 kHz	81.2	80.4	83.6	87.5	91.5	94.6	96.4	96.7	97.1	97.2	97.2	97.2	97.0	96.9	96.6	96.4	96.2	95.9
2.5 kHz	80.0	78.7	82.0	86.0	90.3	93.5	95.5	96.0	96.6	97.0	97.1	97.2	97.2	97.1	97.0	96.9	96.7	96.5
3.15 kHz	78.5	76.7	80.0	84.2	88.7	92.1	94.3	94.9	95.9	96.5	96.9	97.1	97.2	97.2	97.2	97.2	97.1	97.0
4 kHz	76.7	74.3	77.6	81.9	86.9	90.3	92.7	93.6	94.9	95.8	96.4	96.7	97.0	97.2	97.3	97.4	97.4	97.4
5 kHz	74.8	71.7	75.1	79.6	84.8	88.5	91.1	92.1	93.8	94.9	95.8	96.3	96.7	97.0	97.3	97.4	97.6	97.7
6.3 kHz	72.5	68.8	72.2	76.9	82.4	86.2	89.1	90.4	92.4	93.9	94.9	95.7	96.2	96.7	97.1	97.4	97.6	97.8
8 kHz	69.8	65.4	68.8	73.7	79.7	83.7	86.8	88.3	90.8	92.6	93.9	94.8	95.5	96.2	96.8	97.2	97.5	97.9
10 kHz	67.1	61.9	65.4	70.5	76.9	81.0	84.4	86.2	89.0	91.2	92.8	93.9	94.7	95.5	96.4	96.9	97.3	97.8
A-wgt	93.4	94.0	97.1	100.5	103.8	106.6	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0

Table 2: V150-4.0MW Mode 0-0S, expected 1/3 octave band performance (Blades without serrated trailing edge)

Original Instruction: T05 0067-4767 VER 05

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.2 Mode PO1

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	15.8	17.7	21.3	25.7	29.4	31.6	32.1	33.1	34.0	34.6	35.1	35.5	35.9	36.3	36.6	37.0	37.3
8 Hz	24.0	22.7	24.6	28.1	32.4	36.1	38.3	38.7	39.6	40.4	40.9	41.3	41.7	42.1	42.5	42.7	43.0	43.3
10 Hz	29.9	28.7	30.7	34.2	38.4	42.1	44.2	44.5	45.4	46.0	46.5	46.9	47.2	47.5	47.9	48.1	48.4	48.6
12.5 Hz	35.5	34.5	36.4	39.9	44.0	47.7	49.7	50.0	50.8	51.4	51.8	52.1	52.4	52.7	53.0	53.2	53.4	53.6
16 Hz	41.3	40.5	42.4	45.9	49.9	53.5	55.5	55.8	56.4	56.9	57.3	57.6	57.8	58.1	58.3	58.5	58.7	58.9
20 Hz	46.3	45.5	47.5	50.9	54.9	58.5	60.4	60.6	61.2	61.6	61.9	62.2	62.4	62.6	62.8	63.0	63.2	63.3
25 Hz	50.8	50.3	52.2	55.6	59.5	63.1	65.0	65.2	65.6	66.0	66.3	66.5	66.7	66.8	67.0	67.2	67.3	67.4
31.5 Hz	55.3	54.8	56.8	60.1	64.0	67.5	69.4	69.5	69.9	70.2	70.4	70.6	70.8	70.9	71.1	71.2	71.3	71.4
40 Hz	59.5	59.2	61.1	64.4	68.2	71.8	73.6	73.7	74.0	74.2	74.4	74.6	74.7	74.8	74.9	75.0	75.1	75.2
50 Hz	63.1	62.9	64.8	68.1	71.9	75.4	77.1	77.2	77.5	77.7	77.8	77.9	78.0	78.1	78.2	78.3	78.4	78.4
63 Hz	66.5	66.3	68.3	71.6	75.3	78.8	80.5	80.6	80.8	80.9	81.0	81.1	81.2	81.3	81.3	81.4	81.5	81.5
80 Hz	69.6	69.6	71.5	74.8	78.5	81.9	83.6	83.7	83.8	83.9	84.0	84.1	84.1	84.2	84.2	84.3	84.3	84.3
100 Hz	72.2	72.3	74.2	77.5	81.1	84.5	86.2	86.2	86.3	86.4	86.5	86.5	86.5	86.6	86.6	86.6	86.7	86.7
125 Hz	74.5	74.6	76.5	79.8	83.4	86.8	88.5	88.5	88.5	88.6	88.6	88.6	88.7	88.7	88.7	88.7	88.7	88.8
160 Hz	76.7	76.8	78.8	82.0	85.5	89.0	90.6	90.6	90.6	90.6	90.7	90.7	90.7	90.7	90.7	90.7	90.7	90.7
200 Hz	78.3	78.5	80.4	83.6	87.2	90.6	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2
250 Hz	79.6	79.8	81.7	84.9	88.5	91.9	93.5	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.3	93.3	93.3	93.3
315 Hz	80.6	80.8	82.8	86.0	89.4	92.8	94.4	94.4	94.4	94.4	94.3	94.3	94.3	94.3	94.3	94.3	94.2	94.2
400 Hz	81.3	81.5	83.4	86.6	90.1	93.5	95.1	95.1	95.0	95.0	95.0	94.9	94.9	94.9	94.9	94.9	94.9	94.8
500 Hz	81.6	81.8	83.7	86.9	90.4	93.8	95.4	95.3	95.3	95.3	95.2	95.2	95.2	95.2	95.2	95.2	95.1	95.1
630 Hz	81.5	81.8	83.7	86.9	90.3	93.7	95.3	95.3	95.3	95.2	95.2	95.2	95.2	95.2	95.1	95.1	95.1	95.1
800 Hz	81.1	81.4	83.3	86.5	89.9	93.3	94.9	94.9	94.9	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
1 kHz	80.4	80.7	82.5	85.7	89.2	92.6	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.1	94.1	94.1
1.25 kHz	79.4	79.6	81.5	84.7	88.2	91.5	93.1	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2
1.6 kHz	77.9	78.0	79.9	83.1	86.6	90.0	91.6	91.6	91.7	91.7	91.8	91.8	91.8	91.8	91.9	91.9	91.9	91.9
2 kHz	76.3	76.3	78.1	81.3	84.9	88.3	89.9	90.0	90.0	90.1	90.2	90.2	90.2	90.3	90.3	90.3	90.4	90.4
2.5 kHz	74.2	74.2	76.1	79.3	82.8	86.2	87.9	87.9	88.1	88.2	88.3	88.3	88.4	88.4	88.5	88.5	88.6	88.6
3.15 kHz	71.8	71.7	73.5	76.7	80.3	83.8	85.4	85.5	85.7	85.9	86.0	86.0	86.1	86.2	86.3	86.3	86.4	86.4
4 kHz	69.0	68.8	70.6	73.8	77.4	80.9	82.6	82.7	82.9	83.1	83.2	83.4	83.4	83.5	83.6	83.7	83.8	83.8
5 kHz	66.0	65.6	67.5	70.7	74.4	77.8	79.5	79.7	80.0	80.2	80.4	80.5	80.6	80.8	80.9	81.0	81.1	81.2
6.3 kHz	62.5	62.1	63.9	67.1	70.8	74.3	76.1	76.2	76.6	76.9	77.1	77.3	77.4	77.6	77.7	77.8	78.0	78.1
8 kHz	58.6	58.0	59.8	63.1	66.8	70.3	72.1	72.3	72.8	73.1	73.4	73.6	73.8	74.0	74.1	74.3	74.4	74.5
10 kHz	54.6	53.9	55.7	58.9	62.8	66.2	68.1	68.3	68.9	69.3	69.6	69.8	70.1	70.3	70.5	70.6	70.8	70.9
A-wgt	91.1	91.3	93.2	96.4	99.9	103.3	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9

Table 3: V150-4.2MW PO1, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	24.3	21.9	24.8	28.8	33.3	36.6	38.8	39.5	40.8	41.7	42.3	42.6	42.9	43.1	43.2	43.3	43.3	43.3
8 Hz	30.0	28.2	31.1	34.9	39.1	42.3	44.4	44.8	45.8	46.5	46.8	47.0	47.1	47.2	47.2	47.1	47.0	46.9
10 Hz	35.0	33.8	36.7	40.4	44.3	47.4	49.3	49.6	50.3	50.7	50.8	50.9	50.9	50.8	50.7	50.6	50.4	50.2
12.5 Hz	39.8	39.0	42.0	45.6	49.2	52.3	53.9	54.2	54.6	54.7	54.7	54.6	54.5	54.3	54.1	53.9	53.6	53.3
16 Hz	44.9	44.6	47.5	50.9	54.4	57.3	58.8	58.9	59.0	59.0	58.8	58.6	58.4	58.1	57.7	57.4	57.0	56.7
20 Hz	49.1	49.2	52.2	55.5	58.8	61.6	63.0	63.0	62.9	62.6	62.3	62.0	61.7	61.3	60.8	60.5	60.0	59.6
25 Hz	53.2	53.6	56.5	59.8	62.9	65.7	66.9	66.9	66.5	66.1	65.7	65.3	64.9	64.4	63.8	63.4	62.9	62.5
31.5 Hz	57.1	57.8	60.8	64.0	66.9	69.6	70.8	70.6	70.1	69.5	69.0	68.5	68.0	67.4	66.8	66.3	65.7	65.3
40 Hz	60.8	61.9	64.8	68.0	70.8	73.4	74.5	74.2	73.5	72.8	72.2	71.6	71.1	70.4	69.7	69.2	68.6	68.0
50 Hz	64.1	65.4	68.3	71.4	74.1	76.7	77.7	77.4	76.5	75.7	75.0	74.4	73.8	73.1	72.4	71.8	71.1	70.5
63 Hz	67.2	68.7	71.6	74.7	77.3	79.8	80.7	80.4	79.5	78.5	77.8	77.1	76.4	75.7	74.9	74.3	73.6	73.0
80 Hz	70.1	71.7	74.7	77.7	80.2	82.8	83.6	83.3	82.2	81.2	80.4	79.7	79.0	78.2	77.4	76.8	76.0	75.4
100 Hz	72.5	74.3	77.2	80.3	82.8	85.3	86.1	85.7	84.6	83.6	82.7	82.0	81.2	80.4	79.6	79.0	78.2	77.6
125 Hz	74.8	76.6	79.5	82.5	85.0	87.5	88.4	87.9	86.8	85.7	84.8	84.1	83.3	82.5	81.7	81.0	80.2	79.6
160 Hz	76.9	78.7	81.7	84.7	87.2	89.7	90.5	90.1	89.0	87.9	87.0	86.2	85.5	84.7	83.8	83.2	82.4	81.7
200 Hz	78.6	80.4	83.4	86.4	88.9	91.5	92.3	91.9	90.7	89.7	88.8	88.0	87.3	86.5	85.6	85.0	84.2	83.5
250 Hz	80.0	81.8	84.8	87.8	90.4	92.9	93.8	93.4	92.3	91.2	90.4	89.6	88.9	88.1	87.3	86.7	85.9	85.3
315 Hz	81.2	82.9	85.9	89.0	91.6	94.2	95.1	94.7	93.7	92.7	91.9	91.2	90.5	89.7	88.9	88.3	87.5	86.9
400 Hz	82.2	83.7	86.7	89.9	92.6	95.2	96.2	95.8	94.9	94.0	93.2	92.5	91.9	91.2	90.4	89.8	89.1	88.5
500 Hz	82.8	84.1	87.2	90.4	93.2	95.9	96.9	96.7	95.8	95.0	94.3	93.7	93.1	92.4	91.7	91.1	90.4	89.9
630 Hz	83.2	84.3	87.4	90.7	93.6	96.4	97.5	97.3	96.6	95.9	95.2	94.7	94.1	93.5	92.8	92.3	91.7	91.2
800 Hz	83.4	84.1	87.2	90.6	93.7	96.6	97.8	97.6	97.1	96.5	96.0	95.5	95.1	94.5	93.9	93.4	92.8	92.4
1 kHz	83.2	83.7	86.8	90.3	93.6	96.5	97.8	97.7	97.4	97.0	96.6	96.2	95.8	95.3	94.8	94.4	93.8	93.4
1.25 kHz	82.8	82.9	86.1	89.7	93.1	96.1	97.6	97.6	97.5	97.3	97.0	96.7	96.4	96.0	95.5	95.2	94.7	94.3
1.6 kHz	82.1	81.8	85.0	88.7	92.4	95.5	97.1	97.2	97.4	97.4	97.2	97.0	96.8	96.5	96.2	95.9	95.5	95.2
2 kHz	81.2	80.4	83.6	87.5	91.4	94.6	96.4	96.7	97.1	97.2	97.2	97.2	97.1	96.9	96.7	96.5	96.2	95.9
2.5 kHz	80.0	78.7	82.0	86.0	90.2	93.5	95.5	95.8	96.5	96.9	97.1	97.2	97.2	97.1	97.0	96.9	96.7	96.5
3.15 kHz	78.5	76.7	80.0	84.2	88.6	92.1	94.3	94.8	95.8	96.4	96.8	97.0	97.1	97.2	97.2	97.2	97.1	97.0
4 kHz	76.7	74.3	77.6	81.9	86.7	90.3	92.7	93.4	94.8	95.7	96.3	96.7	96.9	97.1	97.3	97.4	97.4	97.4
5 kHz	74.8	71.7	75.1	79.6	84.7	88.5	91.1	91.9	93.6	94.9	95.6	96.2	96.6	96.9	97.2	97.4	97.6	97.7
6.3 kHz	72.5	68.8	72.2	76.9	82.3	86.2	89.1	90.1	92.2	93.8	94.8	95.5	96.0	96.6	97.0	97.3	97.6	97.8
8 kHz	69.8	65.4	68.8	73.7	79.6	83.7	86.8	87.9	90.5	92.4	93.7	94.6	95.3	96.1	96.7	97.1	97.6	97.8
10 kHz	67.1	61.9	65.4	70.5	76.7	81.0	84.4	85.7	88.7	91.0	92.5	93.6	94.5	95.4	96.2	96.8	97.4	97.8
A-wgt	93.4	94.0	97.1	100.5	103.7	106.6	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0	108.0

Table 4: V150-4.2MW PO1-0S, expected 1/3 octave band performance (Blades without serrated trailing edge)

Original Instruction: T05 0067-4767 VER 05

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.3 Mode SO1

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	15.8	17.7	21.3	25.7	28.8	29.8	30.5	31.5	32.3	33.1	33.6	34.0	34.5	34.9	35.2	35.4	35.8
8 Hz	24.0	22.7	24.6	28.1	32.5	35.5	36.4	37.1	37.9	38.7	39.4	39.9	40.2	40.6	41.0	41.3	41.5	41.8
10 Hz	29.9	28.7	30.7	34.2	38.4	41.4	42.4	42.9	43.7	44.3	45.0	45.4	45.7	46.1	46.4	46.7	46.8	47.1
12.5 Hz	35.5	34.5	36.4	39.9	44.1	47.1	47.9	48.4	49.1	49.7	50.3	50.6	50.9	51.2	51.5	51.7	51.9	52.1
16 Hz	41.3	40.5	42.4	45.9	49.9	52.9	53.7	54.2	54.8	55.2	55.8	56.1	56.3	56.6	56.9	57.0	57.2	57.4
20 Hz	46.3	45.5	47.5	50.9	54.9	57.9	58.7	59.0	59.5	59.9	60.4	60.7	60.9	61.1	61.4	61.5	61.6	61.8
25 Hz	50.8	50.3	52.2	55.6	59.5	62.5	63.2	63.6	64.0	64.3	64.8	65.0	65.2	65.4	65.6	65.7	65.8	65.9
31.5 Hz	55.3	54.8	56.8	60.1	64.0	66.9	67.7	67.9	68.3	68.6	68.9	69.1	69.3	69.4	69.6	69.7	69.8	69.9
40 Hz	59.5	59.2	61.1	64.4	68.2	71.1	71.9	72.1	72.4	72.6	72.9	73.1	73.2	73.3	73.5	73.5	73.6	73.7
50 Hz	63.1	62.9	64.8	68.1	71.9	74.8	75.5	75.6	75.9	76.0	76.3	76.4	76.5	76.6	76.8	76.8	76.9	77.0
63 Hz	66.5	66.3	68.3	71.6	75.3	78.2	78.8	79.0	79.1	79.3	79.5	79.6	79.7	79.8	79.9	79.9	79.9	80.0
80 Hz	69.6	69.6	71.5	74.8	78.5	81.3	82.0	82.1	82.2	82.3	82.5	82.6	82.6	82.7	82.7	82.8	82.8	82.8
100 Hz	72.2	72.3	74.2	77.5	81.1	83.9	84.6	84.6	84.7	84.8	85.0	85.0	85.0	85.1	85.1	85.1	85.2	85.2
125 Hz	74.5	74.6	76.5	79.8	83.4	86.2	86.8	86.9	86.9	87.0	87.1	87.1	87.2	87.2	87.2	87.2	87.2	87.3
160 Hz	76.7	76.8	78.8	82.0	85.5	88.4	89.0	89.0	89.0	89.0	89.2	89.2	89.2	89.2	89.2	89.2	89.2	89.2
200 Hz	78.3	78.5	80.4	83.6	87.2	90.0	90.6	90.6	90.6	90.6	90.7	90.7	90.7	90.7	90.7	90.7	90.7	90.7
250 Hz	79.6	79.8	81.7	84.9	88.4	91.3	91.9	91.8	91.8	91.8	91.9	91.9	91.9	91.9	91.8	91.8	91.8	91.8
315 Hz	80.6	80.8	82.8	86.0	89.4	92.2	92.8	92.8	92.8	92.8	92.8	92.8	92.8	92.8	92.8	92.8	92.7	92.7
400 Hz	81.3	81.5	83.4	86.6	90.1	92.9	93.5	93.5	93.4	93.4	93.5	93.4	93.4	93.4	93.4	93.4	93.4	93.3
500 Hz	81.6	81.8	83.7	86.9	90.4	93.2	93.8	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.6	93.6	93.6
630 Hz	81.5	81.8	83.7	86.9	90.3	93.1	93.7	93.7	93.7	93.6	93.7	93.7	93.7	93.7	93.6	93.6	93.6	93.6
800 Hz	81.1	81.4	83.3	86.5	89.9	92.7	93.3	93.3	93.3	93.2	93.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3
1 kHz	80.4	80.7	82.5	85.7	89.2	92.0	92.6	92.6	92.6	92.6	92.7	92.7	92.7	92.7	92.7	92.6	92.6	92.6
1.25 kHz	79.4	79.6	81.5	84.7	88.2	90.9	91.5	91.6	91.6	91.6	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7
1.6 kHz	77.9	78.0	79.9	83.1	86.6	89.4	90.0	90.1	90.1	90.1	90.3	90.3	90.3	90.3	90.4	90.4	90.4	90.4
2 kHz	76.3	76.3	78.1	81.3	84.9	87.7	88.3	88.4	88.4	88.5	88.7	88.7	88.7	88.8	88.8	88.8	88.9	88.9
2.5 kHz	74.2	74.2	76.1	79.3	82.8	85.6	86.3	86.4	86.5	86.6	86.8	86.8	86.9	86.9	87.0	87.0	87.0	87.1
3.15 kHz	71.8	71.7	73.5	76.7	80.4	83.2	83.8	83.9	84.1	84.2	84.5	84.6	84.6	84.7	84.8	84.8	84.9	84.9
4 kHz	69.0	68.8	70.6	73.8	77.4	80.2	80.9	81.1	81.3	81.5	81.7	81.9	82.0	82.1	82.2	82.2	82.3	82.4
5 kHz	66.0	65.6	67.5	70.7	74.4	77.2	77.9	78.1	78.4	78.6	78.9	79.1	79.2	79.3	79.4	79.5	79.6	79.7
6.3 kHz	62.5	62.1	63.9	67.1	70.9	73.7	74.4	74.7	75.0	75.3	75.6	75.8	76.0	76.1	76.3	76.4	76.4	76.6
8 kHz	58.6	58.0	59.8	63.1	66.9	69.7	70.4	70.7	71.2	71.5	71.9	72.1	72.3	72.5	72.7	72.8	72.9	73.0
10 kHz	54.6	53.9	55.7	58.9	62.8	65.6	66.4	66.8	67.3	67.7	68.1	68.4	68.6	68.8	69.0	69.2	69.3	69.5
A-wgt	91.1	91.3	93.2	96.4	99.9	102.7	103.3	103.3	103.3	103.3	103.4	103.4	103.4	103.4	103.4	103.4	103.4	103.4

Table 5: V150-4.0MW SO1, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.4 Mode SO2

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	19.4	17.8	18.7	21.2	24.7	26.6	28.0	28.6	29.4	29.7	30.1	30.6	30.8	31.3	31.6	31.9	32.1	32.5
8 Hz	20.5	19.9	22.5	26.4	30.8	33.4	34.3	34.8	35.2	35.5	35.7	35.9	36.1	36.4	36.6	36.8	36.9	37.1
10 Hz	26.8	26.2	28.7	32.6	37.0	39.6	40.5	41.0	41.5	41.7	41.9	42.2	42.4	42.7	42.8	43.0	43.1	43.4
12.5 Hz	35.2	34.4	36.7	40.4	44.7	47.1	48.1	48.6	49.2	49.4	49.6	50.0	50.2	50.5	50.7	50.9	51.0	51.3
16 Hz	42.0	41.4	43.5	46.9	50.9	53.2	54.0	54.4	54.9	55.1	55.2	55.5	55.6	55.9	56.0	56.2	56.3	56.5
20 Hz	46.5	46.0	48.4	52.1	56.3	58.8	59.5	60.0	60.4	60.6	60.8	61.0	61.2	61.4	61.5	61.7	61.8	62.0
25 Hz	53.5	53.0	55.1	58.5	62.5	64.8	65.5	65.9	66.3	66.4	66.6	66.8	67.0	67.2	67.3	67.5	67.6	67.8
31.5 Hz	56.7	55.5	57.5	61.0	65.2	67.6	68.8	69.5	70.2	70.5	70.8	71.2	71.4	71.9	72.1	72.4	72.6	72.9
40 Hz	59.6	59.9	62.3	66.0	69.8	72.1	72.3	72.4	72.5	72.5	72.5	72.6	72.6	72.6	72.6	72.6	72.6	72.6
50 Hz	65.0	65.0	67.1	70.4	74.2	76.4	76.8	77.0	77.2	77.3	77.3	77.4	77.5	77.6	77.6	77.7	77.7	77.8
63 Hz	73.6	72.9	73.4	75.3	78.0	79.6	80.2	80.5	80.8	81.0	81.1	81.3	81.4	81.6	81.7	81.8	81.9	82.1
80 Hz	76.2	76.9	77.6	79.5	81.7	83.0	82.7	82.5	82.3	82.2	82.1	81.9	81.8	81.6	81.5	81.3	81.3	81.1
100 Hz	74.4	74.1	75.6	78.5	81.9	83.8	84.4	84.6	84.8	85.0	85.1	85.2	85.3	85.4	85.5	85.6	85.6	85.7
125 Hz	80.0	78.6	78.8	80.6	83.4	84.9	85.9	86.5	87.1	87.3	87.6	88.0	88.2	88.6	88.7	89.0	89.2	89.5
160 Hz	77.3	78.7	80.4	83.1	85.8	87.4	86.7	86.3	85.8	85.6	85.4	85.1	84.9	84.5	84.3	84.0	83.9	83.6
200 Hz	76.9	77.6	79.7	82.9	86.2	88.2	88.1	88.0	87.9	87.9	87.8	87.7	87.7	87.6	87.5	87.4	87.3	87.2
250 Hz	80.2	79.4	81.0	84.0	87.7	89.8	90.7	91.2	91.6	91.9	92.1	92.4	92.6	92.8	93.0	93.2	93.3	93.6
315 Hz	83.0	82.2	82.9	85.1	88.0	89.6	90.4	90.7	91.1	91.2	91.4	91.7	91.8	92.0	92.1	92.3	92.4	92.5
400 Hz	75.2	76.5	79.5	83.4	87.2	89.6	89.1	88.9	88.6	88.5	88.3	88.1	88.0	87.8	87.7	87.5	87.4	87.1
500 Hz	75.0	76.2	79.6	83.9	88.1	90.6	90.3	90.1	89.8	89.7	89.6	89.4	89.3	89.1	89.0	88.8	88.7	88.5
630 Hz	77.8	78.0	80.6	84.3	88.3	90.6	90.8	90.9	91.0	91.1	91.1	91.1	91.2	91.2	91.2	91.2	91.2	91.2
800 Hz	77.4	78.6	81.3	84.9	88.5	90.6	90.2	90.0	89.7	89.6	89.4	89.2	89.1	88.9	88.7	88.6	88.4	88.2
1 kHz	83.5	83.5	84.7	87.2	90.3	92.0	92.4	92.5	92.6	92.7	92.8	92.8	92.9	92.9	93.0	93.0	93.0	93.1
1.25 kHz	79.2	80.5	83.2	86.9	90.4	92.6	92.1	91.8	91.4	91.3	91.1	90.9	90.7	90.4	90.3	90.1	89.9	89.7
1.6 kHz	78.4	79.4	82.2	85.9	89.6	91.9	91.6	91.4	91.1	91.0	90.9	90.7	90.6	90.4	90.3	90.2	90.1	89.9
2 kHz	77.2	78.0	80.7	84.4	88.3	90.6	90.4	90.4	90.3	90.2	90.1	90.1	90.0	89.9	89.8	89.7	89.7	89.5
2.5 kHz	75.3	76.1	79.0	82.9	86.8	89.1	89.0	88.9	88.8	88.7	88.6	88.5	88.5	88.3	88.3	88.2	88.1	88.0
3.15 kHz	73.2	73.7	76.3	79.9	83.8	86.0	86.1	86.2	86.2	86.2	86.1	86.1	86.1	86.1	86.1	86.0	86.0	85.9
4 kHz	71.6	71.3	73.0	76.1	79.6	81.7	82.2	82.5	82.8	82.9	83.0	83.2	83.3	83.4	83.5	83.6	83.7	83.8
5 kHz	63.2	63.0	65.4	69.1	73.1	75.4	75.9	76.2	76.4	76.5	76.6	76.8	76.9	77.0	77.1	77.2	77.2	77.3
6.3 kHz	61.3	59.5	60.1	62.5	65.9	67.7	69.2	69.9	70.8	71.1	71.5	72.0	72.3	72.9	73.1	73.5	73.8	74.2
8 kHz	60.8	59.8	58.2	58.4	59.6	60.2	60.8	61.0	61.4	61.5	61.7	61.9	62.0	62.2	62.3	62.4	62.5	62.7
10 kHz	58.4	58.9	56.9	56.3	56.4	56.4	55.8	55.4	55.0	54.8	54.7	54.4	54.2	53.9	53.7	53.5	53.4	53.2
A-wgt	91.1	91.3	93.2	96.4	99.9	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0

Table 6: V150-4.0MW SO2, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.5 Mode SO3

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	15.8	17.7	21.2	25.1	26.8	27.8	28.2	29.2	30.0	30.2	31.2	31.6	31.9	32.3	32.7	32.5	32.8
8 Hz	24.0	22.7	24.6	28.0	31.9	33.4	34.3	34.6	35.5	36.2	36.4	37.3	37.6	37.9	38.3	38.6	38.5	38.7
10 Hz	29.9	28.7	30.7	34.1	37.9	39.2	40.0	40.3	41.1	41.7	41.9	42.7	43.0	43.2	43.5	43.9	43.7	43.9
12.5 Hz	35.5	34.5	36.4	39.8	43.5	44.7	45.4	45.7	46.4	46.9	47.1	47.8	48.0	48.3	48.5	48.8	48.7	48.9
16 Hz	41.3	40.5	42.4	45.8	49.4	50.4	51.0	51.2	51.9	52.3	52.5	53.1	53.3	53.5	53.7	53.9	53.8	54.0
20 Hz	46.3	45.5	47.5	50.8	54.4	55.3	55.8	56.0	56.5	56.9	57.0	57.5	57.7	57.9	58.1	58.3	58.2	58.3
25 Hz	50.8	50.3	52.2	55.5	59.0	59.8	60.2	60.4	60.8	61.2	61.3	61.7	61.9	62.0	62.2	62.4	62.3	62.4
31.5 Hz	55.3	54.8	56.8	60.0	63.5	64.1	64.5	64.6	65.0	65.3	65.4	65.7	65.9	66.0	66.1	66.3	66.2	66.3
40 Hz	59.5	59.2	61.1	64.3	67.8	68.3	68.6	68.7	69.0	69.2	69.3	69.6	69.7	69.8	69.9	70.0	69.9	70.0
50 Hz	63.1	62.9	64.8	68.0	71.4	71.8	72.0	72.1	72.4	72.6	72.6	72.9	72.9	73.0	73.1	73.2	73.2	73.2
63 Hz	66.5	66.3	68.3	71.5	74.8	75.2	75.3	75.4	75.6	75.7	75.8	75.9	76.0	76.1	76.1	76.2	76.2	76.2
80 Hz	69.6	69.6	71.5	74.7	78.0	78.2	78.4	78.4	78.6	78.7	78.7	78.8	78.9	78.9	78.9	79.0	79.0	79.0
100 Hz	72.2	72.3	74.2	77.4	80.7	80.8	80.9	80.9	81.0	81.1	81.1	81.2	81.2	81.2	81.3	81.3	81.3	81.3
125 Hz	74.5	74.6	76.5	79.7	83.0	83.0	83.1	83.1	83.2	83.2	83.2	83.3	83.3	83.3	83.3	83.3	83.3	83.4
160 Hz	76.7	76.8	78.8	81.9	85.1	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.3	85.3	85.3	85.3	85.3	85.3
200 Hz	78.3	78.5	80.4	83.5	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7
250 Hz	79.6	79.8	81.7	84.8	88.0	88.0	88.0	88.0	88.0	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
315 Hz	80.6	80.8	82.8	85.9	89.0	89.0	89.0	88.9	88.9	88.9	88.9	88.8	88.8	88.8	88.8	88.8	88.8	88.8
400 Hz	81.3	81.5	83.4	86.5	89.7	89.6	89.6	89.6	89.5	89.5	89.5	89.5	89.4	89.4	89.4	89.4	89.4	89.4
500 Hz	81.6	81.8	83.7	86.8	90.0	89.9	89.9	89.9	89.8	89.8	89.8	89.7	89.7	89.7	89.7	89.7	89.7	89.7
630 Hz	81.5	81.8	83.7	86.8	89.9	89.9	89.9	89.8	89.8	89.8	89.8	89.7	89.7	89.7	89.7	89.7	89.7	89.7
800 Hz	81.1	81.4	83.3	86.4	89.5	89.5	89.5	89.5	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.3	89.4	89.3
1 kHz	80.4	80.7	82.5	85.6	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8
1.25 kHz	79.4	79.6	81.5	84.6	87.8	87.8	87.8	87.8	87.8	87.8	87.8	87.9	87.9	87.9	87.9	87.9	87.9	87.9
1.6 kHz	77.9	78.0	79.9	83.0	86.2	86.3	86.4	86.4	86.4	86.5	86.5	86.5	86.5	86.5	86.6	86.6	86.6	86.6
2 kHz	76.3	76.3	78.1	81.2	84.5	84.6	84.7	84.7	84.8	84.9	84.9	85.0	85.0	85.1	85.1	85.1	85.1	85.1
2.5 kHz	74.2	74.2	76.1	79.2	82.4	82.6	82.8	82.8	82.9	83.0	83.1	83.2	83.2	83.3	83.3	83.4	83.3	83.4
3.15 kHz	71.8	71.7	73.5	76.6	79.9	80.2	80.4	80.5	80.7	80.8	80.8	81.0	81.1	81.1	81.2	81.3	81.2	81.3
4 kHz	69.0	68.8	70.6	73.7	77.0	77.4	77.6	77.7	78.0	78.1	78.2	78.4	78.5	78.6	78.7	78.8	78.7	78.8
5 kHz	66.0	65.6	67.5	70.6	74.0	74.4	74.7	74.8	75.1	75.4	75.4	75.7	75.8	75.9	76.0	76.1	76.1	76.2
6.3 kHz	62.5	62.1	63.9	67.0	70.4	71.0	71.4	71.5	71.9	72.2	72.2	72.6	72.7	72.8	73.0	73.1	73.1	73.2
8 kHz	58.6	58.0	59.8	63.0	66.4	67.1	67.6	67.7	68.2	68.5	68.6	69.0	69.2	69.3	69.5	69.7	69.6	69.7
10 kHz	54.6	53.9	55.7	58.8	62.3	63.2	63.7	63.9	64.4	64.8	64.9	65.4	65.6	65.8	66.0	66.2	66.1	66.2
A-wgt	91.1	91.3	93.2	96.3	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5	99.5

Table 7: V150-4.0MW SO3, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.6 Mode SO11

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	16.1	18.1	21.1	23.4	25.5	27.3	28.7	29.5	30.1	30.6	31.0	31.3	31.6	32.0	32.2	32.5	32.7
8 Hz	24.1	22.9	25.0	27.7	29.9	31.9	33.7	35.0	35.7	36.3	36.7	37.1	37.4	37.6	37.9	38.1	38.4	38.6
10 Hz	30.0	29.0	31.0	33.6	35.7	37.6	39.3	40.6	41.2	41.8	42.2	42.4	42.7	42.9	43.2	43.4	43.6	43.8
12.5 Hz	35.6	34.7	36.7	39.2	41.2	42.9	44.6	45.8	46.4	46.9	47.3	47.5	47.8	48.0	48.2	48.4	48.5	48.7
16 Hz	41.4	40.7	42.6	44.9	46.8	48.5	50.1	51.3	51.8	52.3	52.6	52.8	53.0	53.2	53.4	53.5	53.7	53.8
20 Hz	46.3	45.7	47.6	49.8	51.6	53.3	54.8	55.9	56.4	56.8	57.1	57.3	57.5	57.6	57.8	57.9	58.0	58.1
25 Hz	50.9	50.4	52.3	54.4	56.1	57.7	59.2	60.2	60.7	61.1	61.3	61.5	61.6	61.7	61.9	62.0	62.1	62.2
31.5 Hz	55.3	54.9	56.8	58.8	60.4	61.9	63.4	64.4	64.8	65.2	65.3	65.5	65.6	65.7	65.8	65.9	66.0	66.1
40 Hz	59.5	59.2	61.1	63.0	64.5	66.0	67.4	68.4	68.7	69.1	69.2	69.3	69.4	69.5	69.6	69.7	69.7	69.8
50 Hz	63.1	62.9	64.8	66.5	68.0	69.4	70.8	71.7	72.1	72.4	72.5	72.6	72.7	72.7	72.8	72.9	72.9	73.0
63 Hz	66.5	66.4	68.2	69.9	71.3	72.7	74.0	74.9	75.2	75.5	75.6	75.7	75.7	75.8	75.8	75.9	75.9	76.0
80 Hz	69.6	69.6	71.4	73.0	74.4	75.7	77.0	77.9	78.2	78.4	78.5	78.5	78.6	78.6	78.7	78.7	78.7	78.8
100 Hz	72.2	72.3	74.1	75.6	76.9	78.2	79.5	80.3	80.6	80.8	80.9	80.9	80.9	81.0	81.0	81.0	81.0	81.1
125 Hz	74.5	74.6	76.4	77.9	79.2	80.4	81.7	82.5	82.7	83.0	83.0	83.0	83.0	83.0	83.0	83.1	83.1	83.1
160 Hz	76.7	76.8	78.6	80.0	81.3	82.5	83.7	84.5	84.7	84.9	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
200 Hz	78.3	78.5	80.2	81.6	82.8	84.0	85.2	86.0	86.2	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4
250 Hz	79.6	79.8	81.5	82.9	84.1	85.3	86.5	87.3	87.4	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6
315 Hz	80.6	80.8	82.5	83.9	85.1	86.2	87.4	88.2	88.4	88.6	88.6	88.5	88.5	88.5	88.5	88.5	88.5	88.5
400 Hz	81.2	81.5	83.2	84.6	85.7	86.9	88.1	88.8	89.0	89.2	89.2	89.2	89.1	89.1	89.1	89.1	89.1	89.1
500 Hz	81.5	81.8	83.5	84.8	86.0	87.2	88.3	89.1	89.3	89.5	89.5	89.4	89.4	89.4	89.4	89.4	89.4	89.4
630 Hz	81.5	81.8	83.5	84.8	86.0	87.1	88.3	89.1	89.3	89.5	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4
800 Hz	81.1	81.4	83.1	84.4	85.6	86.8	87.9	88.7	88.9	89.1	89.1	89.1	89.1	89.1	89.1	89.0	89.0	89.0
1 kHz	80.4	80.6	82.3	83.7	84.9	86.1	87.3	88.1	88.3	88.5	88.5	88.5	88.5	88.5	88.4	88.4	88.4	88.4
1.25 kHz	79.4	79.6	81.3	82.7	83.9	85.1	86.3	87.1	87.3	87.5	87.5	87.5	87.6	87.6	87.6	87.6	87.6	87.6
1.6 kHz	77.9	78.1	79.7	81.2	82.4	83.7	84.9	85.7	85.9	86.2	86.2	86.2	86.2	86.2	86.2	86.3	86.3	86.3
2 kHz	76.3	76.3	78.0	79.5	80.8	82.0	83.3	84.1	84.4	84.6	84.6	84.7	84.7	84.7	84.8	84.8	84.8	84.8
2.5 kHz	74.3	74.3	75.9	77.5	78.8	80.1	81.4	82.2	82.5	82.8	82.8	82.9	82.9	82.9	83.0	83.0	83.0	83.1
3.15 kHz	71.8	71.8	73.5	75.1	76.5	77.8	79.1	80.0	80.3	80.5	80.6	80.7	80.7	80.8	80.8	80.9	80.9	81.0
4 kHz	69.0	68.8	70.5	72.2	73.7	75.0	76.4	77.3	77.6	77.9	78.0	78.1	78.2	78.2	78.3	78.4	78.4	78.5
5 kHz	66.0	65.7	67.4	69.2	70.7	72.1	73.5	74.5	74.8	75.1	75.3	75.4	75.5	75.5	75.6	75.7	75.8	75.8
6.3 kHz	62.6	62.2	63.9	65.8	67.4	68.8	70.2	71.2	71.6	72.0	72.1	72.2	72.4	72.5	72.6	72.7	72.8	72.8
8 kHz	58.6	58.2	59.9	61.9	63.5	65.0	66.5	67.5	68.0	68.3	68.5	68.7	68.8	69.0	69.1	69.2	69.3	69.4
10 kHz	54.7	54.1	55.8	57.9	59.6	61.2	62.7	63.8	64.2	64.7	64.9	65.1	65.3	65.4	65.6	65.7	65.8	65.9
A-wgt	91.1	91.3	93.0	94.4	95.6	96.8	98.0	98.8	99.0	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2

Table 8: V150-4.0MW SO11, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.7 Mode SO12

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	16.1	18.1	21.2	24.3	27.1	28.7	29.7	30.3	30.8	31.2	31.6	31.9	32.2	32.5	32.8	33.1	33.3
8 Hz	24.1	22.9	25.0	27.9	30.9	33.6	35.1	36.0	36.5	36.9	37.3	37.7	37.9	38.3	38.5	38.8	39.0	39.2
10 Hz	30.0	29.0	31.0	33.8	36.7	39.3	40.7	41.6	42.0	42.4	42.7	43.1	43.3	43.6	43.8	44.0	44.2	44.4
12.5 Hz	35.6	34.7	36.7	39.4	42.2	44.7	46.1	46.8	47.2	47.6	47.9	48.2	48.4	48.6	48.8	49.0	49.2	49.3
16 Hz	41.4	40.7	42.6	45.2	47.9	50.4	51.6	52.3	52.7	53.0	53.2	53.5	53.6	53.8	54.0	54.2	54.3	54.5
20 Hz	46.3	45.7	47.6	50.1	52.7	55.1	56.3	57.0	57.2	57.5	57.7	57.9	58.1	58.3	58.4	58.6	58.7	58.8
25 Hz	50.9	50.4	52.3	54.7	57.2	59.6	60.7	61.3	61.5	61.8	61.9	62.1	62.2	62.4	62.5	62.6	62.8	62.9
31.5 Hz	55.3	54.9	56.8	59.1	61.6	63.9	64.9	65.5	65.7	65.8	66.0	66.2	66.3	66.4	66.5	66.6	66.7	66.8
40 Hz	59.5	59.2	61.1	63.3	65.7	68.0	68.9	69.4	69.6	69.7	69.9	70.0	70.1	70.2	70.3	70.3	70.4	70.5
50 Hz	63.1	62.9	64.8	66.9	69.2	71.4	72.4	72.8	73.0	73.1	73.2	73.3	73.3	73.4	73.5	73.6	73.6	73.7
63 Hz	66.5	66.4	68.2	70.3	72.6	74.7	75.6	76.0	76.1	76.2	76.3	76.4	76.4	76.5	76.5	76.6	76.6	76.7
80 Hz	69.6	69.6	71.4	73.5	75.6	77.8	78.6	79.0	79.1	79.1	79.2	79.2	79.3	79.3	79.4	79.4	79.4	79.4
100 Hz	72.2	72.3	74.1	76.1	78.2	80.3	81.1	81.4	81.5	81.5	81.6	81.6	81.6	81.7	81.7	81.7	81.7	81.8
125 Hz	74.5	74.6	76.4	78.4	80.4	82.5	83.3	83.6	83.6	83.7	83.7	83.7	83.7	83.7	83.7	83.8	83.8	83.8
160 Hz	76.7	76.8	78.6	80.5	82.6	84.6	85.3	85.6	85.6	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7
200 Hz	78.3	78.5	80.2	82.1	84.1	86.2	86.9	87.2	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1
250 Hz	79.6	79.8	81.5	83.4	85.4	87.4	88.1	88.4	88.4	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3
315 Hz	80.6	80.8	82.5	84.4	86.4	88.4	89.0	89.3	89.3	89.3	89.3	89.2	89.2	89.2	89.2	89.2	89.2	89.2
400 Hz	81.2	81.5	83.2	85.1	87.0	89.0	89.7	89.9	89.9	89.9	89.9	89.9	89.9	89.8	89.8	89.8	89.8	89.8
500 Hz	81.5	81.8	83.5	85.4	87.3	89.3	90.0	90.2	90.2	90.2	90.2	90.1	90.1	90.1	90.1	90.1	90.1	90.1
630 Hz	81.5	81.8	83.5	85.3	87.3	89.3	89.9	90.2	90.2	90.2	90.1	90.1	90.1	90.1	90.1	90.1	90.1	90.1
800 Hz	81.1	81.4	83.1	84.9	86.9	88.9	89.5	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.7	89.7
1 kHz	80.4	80.6	82.3	84.2	86.2	88.2	88.9	89.2	89.2	89.2	89.2	89.2	89.2	89.2	89.1	89.1	89.1	89.1
1.25 kHz	79.4	79.6	81.3	83.2	85.2	87.2	87.9	88.2	88.2	88.2	88.2	88.2	88.2	88.3	88.3	88.3	88.3	88.3
1.6 kHz	77.9	78.1	79.7	81.7	83.7	85.7	86.5	86.8	86.8	86.9	86.9	86.9	86.9	86.9	86.9	86.9	87.0	87.0
2 kHz	76.3	76.3	78.0	80.0	82.0	84.1	84.9	85.2	85.3	85.3	85.3	85.4	85.4	85.4	85.4	85.5	85.5	85.5
2.5 kHz	74.3	74.3	75.9	77.9	80.1	82.1	82.9	83.3	83.4	83.4	83.5	83.5	83.6	83.6	83.7	83.7	83.7	83.7
3.15 kHz	71.8	71.8	73.5	75.5	77.7	79.8	80.6	81.0	81.1	81.2	81.3	81.4	81.4	81.5	81.5	81.6	81.6	81.6
4 kHz	69.0	68.8	70.5	72.6	74.8	77.0	77.9	78.3	78.5	78.6	78.7	78.8	78.8	78.9	79.0	79.0	79.1	79.1
5 kHz	66.0	65.7	67.4	69.6	71.9	74.1	75.0	75.5	75.7	75.8	75.9	76.0	76.1	76.2	76.3	76.4	76.4	76.5
6.3 kHz	62.6	62.2	63.9	66.1	68.5	70.7	71.7	72.2	72.4	72.6	72.8	72.9	73.0	73.1	73.2	73.3	73.4	73.5
8 kHz	58.6	58.2	59.9	62.2	64.6	66.9	68.0	68.5	68.8	69.0	69.2	69.3	69.5	69.6	69.7	69.8	70.0	70.1
10 kHz	54.7	54.1	55.8	58.2	60.7	63.0	64.1	64.8	65.1	65.3	65.5	65.7	65.9	66.0	66.2	66.3	66.5	66.6
A-wgt	91.1	91.3	93.0	94.9	96.9	98.9	99.6	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9

Table 9: V150-4.0MW SO12, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

3.8 Mode SO13

Frequency	Hub height wind speeds [m/s]																	
	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	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
6.3 Hz	17.4	16.1	18.6	20.2	21.7	23.4	25.5	26.7	27.6	28.1	28.6	28.9	29.3	29.6	29.9	30.1	30.4	30.6
8 Hz	24.1	22.9	25.2	26.7	28.2	29.8	31.8	32.9	33.8	34.2	34.7	35.0	35.3	35.6	35.8	36.1	36.2	36.5
10 Hz	30.0	29.0	31.1	32.4	33.8	35.4	37.4	38.5	39.2	39.7	40.1	40.3	40.6	40.8	41.1	41.3	41.5	41.7
12.5 Hz	35.6	34.7	36.6	37.8	39.2	40.7	42.6	43.7	44.4	44.8	45.2	45.4	45.7	45.9	46.0	46.2	46.4	46.6
16 Hz	41.4	40.7	42.4	43.5	44.8	46.2	48.1	49.1	49.8	50.2	50.5	50.7	50.9	51.1	51.2	51.4	51.5	51.7
20 Hz	46.3	45.7	47.3	48.2	49.5	50.9	52.8	53.7	54.4	54.7	55.0	55.1	55.3	55.5	55.6	55.8	55.9	56.0
25 Hz	50.9	50.4	51.9	52.7	53.9	55.3	57.1	58.0	58.6	58.9	59.1	59.3	59.5	59.6	59.7	59.8	59.9	60.0
31.5 Hz	55.3	54.9	56.2	57.0	58.2	59.5	61.3	62.2	62.7	63.0	63.2	63.3	63.4	63.5	63.6	63.8	63.8	63.9
40 Hz	59.5	59.2	60.4	61.0	62.2	63.5	65.3	66.1	66.7	66.9	67.0	67.1	67.2	67.3	67.4	67.5	67.5	67.6
50 Hz	63.1	62.9	64.0	64.5	65.7	66.9	68.7	69.5	70.0	70.2	70.3	70.4	70.5	70.6	70.6	70.7	70.7	70.8
63 Hz	66.5	66.4	67.4	67.8	68.9	70.2	71.9	72.7	73.2	73.3	73.4	73.5	73.5	73.6	73.6	73.7	73.7	73.8
80 Hz	69.6	69.6	70.5	70.9	72.0	73.2	74.8	75.6	76.1	76.2	76.3	76.3	76.4	76.4	76.5	76.5	76.5	76.6
100 Hz	72.2	72.3	73.1	73.4	74.5	75.6	77.3	78.1	78.5	78.6	78.7	78.7	78.7	78.8	78.8	78.8	78.8	78.9
125 Hz	74.5	74.6	75.4	75.6	76.7	77.8	79.5	80.2	80.6	80.7	80.8	80.8	80.8	80.8	80.8	80.9	80.9	80.9
160 Hz	76.7	76.8	77.5	77.7	78.8	79.9	81.5	82.2	82.6	82.7	82.7	82.8	82.8	82.8	82.8	82.8	82.8	82.8
200 Hz	78.3	78.5	79.1	79.3	80.3	81.4	83.0	83.7	84.1	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
250 Hz	79.6	79.8	80.4	80.6	81.6	82.6	84.3	84.9	85.3	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4
315 Hz	80.6	80.8	81.4	81.5	82.5	83.6	85.2	85.9	86.3	86.4	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3
400 Hz	81.2	81.5	82.0	82.2	83.2	84.3	85.8	86.5	86.9	87.0	87.0	86.9	86.9	86.9	86.9	86.9	86.9	86.9
500 Hz	81.5	81.8	82.3	82.5	83.5	84.5	86.1	86.8	87.2	87.3	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2
630 Hz	81.5	81.8	82.3	82.5	83.4	84.5	86.1	86.8	87.2	87.3	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2
800 Hz	81.1	81.4	81.9	82.1	83.1	84.2	85.7	86.4	86.8	86.9	86.9	86.9	86.9	86.9	86.9	86.8	86.8	86.8
1 kHz	80.4	80.6	81.2	81.4	82.4	83.5	85.1	85.8	86.2	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.2
1.25 kHz	79.4	79.6	80.2	80.4	81.4	82.5	84.1	84.8	85.2	85.3	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4
1.6 kHz	77.9	78.1	78.7	79.0	80.0	81.1	82.7	83.4	83.9	84.0	84.0	84.0	84.0	84.0	84.1	84.1	84.1	84.1
2 kHz	76.3	76.3	77.1	77.4	78.4	79.5	81.1	81.9	82.3	82.4	82.5	82.5	82.5	82.6	82.6	82.6	82.6	82.6
2.5 kHz	74.3	74.3	75.1	75.4	76.5	77.6	79.3	80.0	80.5	80.6	80.7	80.7	80.7	80.8	80.8	80.8	80.9	80.9
3.15 kHz	71.8	71.8	72.7	73.1	74.2	75.3	77.0	77.7	78.2	78.4	78.5	78.5	78.6	78.6	78.7	78.7	78.8	78.8
4 kHz	69.0	68.8	69.8	70.3	71.4	72.6	74.3	75.1	75.6	75.8	75.9	76.0	76.0	76.1	76.2	76.2	76.3	76.3
5 kHz	66.0	65.7	66.8	67.4	68.5	69.8	71.5	72.3	72.8	73.0	73.2	73.3	73.4	73.4	73.5	73.6	73.7	73.7
6.3 kHz	62.6	62.2	63.4	64.1	65.2	66.5	68.2	69.1	69.6	69.9	70.0	70.2	70.3	70.4	70.5	70.6	70.6	70.7
8 kHz	58.6	58.2	59.5	60.3	61.5	62.8	64.5	65.4	66.0	66.3	66.5	66.6	66.8	66.9	67.0	67.1	67.2	67.3
10 kHz	54.7	54.1	55.5	56.4	57.6	59.0	60.7	61.7	62.3	62.6	62.8	63.0	63.2	63.3	63.5	63.6	63.7	63.9
A-wgt	91.1	91.3	91.9	92.1	93.1	94.2	95.8	96.5	96.9	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0

Table 10: V150-4.0MW SO13, expected 1/3 octave band performance, (Blades with serrated trailing edge)

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE

Original Instruction: T05 0067-4767 VER 05

4. Limitations

The values as stated in the present document are to be regarded as “best estimates” for the octave band performance for the turbine. The values are to be regarded as informative and cannot in any way be used as guaranteed for any projects.

The complete document can be handed out as pdf and must always be referred to using the complete document DMS number.

5. Recalculation to 10 m wind speeds

In case 10 m height wind speed references are required, recalculation of the stated values can be made using the following procedure:

1. The stated hub height wind speeds are recalculated to 10 m reference height.
2. Integer 10 m height wind speed related sound power levels are calculated using linear interpolation between the nearest non- integer values.

Recalculation is made using procedures as defined in IEC 61400-11 ed.3. Appendix D.

T05 0067-4767 Ver 05 - Approved - Exported from DMS: 2018-08-01 by NELAN

VESTAS PROPRIETARY NOTICE