



Certificate No.

**IECRE.WE.TC.20.0081-R0**

IECRE - IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications

## TYPE CERTIFICATE Wind Turbine

This certificate is issued to

Vestas Wind Systems A/S  
Hedeager 42  
8200 Aarhus N  
Denmark

for the wind turbine

Vestas V120 2.2 MW 50 Hz VCS Mk11

wind turbine class (class, standard, year)

WT class S, IEC 61400-1:2005+Amd1: 2010

This certificate attests compliance with IEC 61400 Series as specified in subsequent pages . It is based on the following reference documents:

Design basis evaluation conformity statement  
Dated

DB-DNVGL-SE-0074-05971-0  
2020-04-20

Design evaluation conformity statement  
Dated

IECRE.WE.CS.20.0044-R0  
2020-04-20

Type test conformity statement  
Dated

TT-DNVGL-SE-0074-05973-0  
2020-04-20

Manufacturing conformity statement  
Dated

ME-DNVGL-SE-0074-05974-0  
2020-04-20

Final evaluation report  
Dated

FER-TC-DNVGL-SE-0074-05970-0  
2020-04-20

The conformity evaluation was carried out in accordance with the rules and procedures of the IECRE System [www.iecre.org](http://www.iecre.org)

The wind turbine type specification begins on page 2 of this certificate.

Changes in the system design or the manufacturer's quality system are to be approved by the Certification Body. Without approval, the certificate loses its validity.

This certificate is valid until:  
2024-06-25

Approved for issue on behalf of the IECRE  
Certification Body:



Renewables Certification  
Brooktorkai 18  
20457 Hamburg, Germany

Maria Olsen/Bente Vestergaard:  
Project Manager/Service Line Leader:  
Hellerup 2020-04-20



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#### Machine parameters:

Power regulation:	Pitch-controlled
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	-3°
Rated power:	See Annex 1
Rated wind speed $V_r$ :	See Annex 1
Rotor diameter:	120 m
Hub height(s):	122 m
Hub height operating wind speed range $V_{in} - V_{out}$ :	3 m/s – 20 m/s
Design life time:	20 years
Software version:	VMP Global 2019.05

#### Wind conditions:

Characteristic turbulence intensity $I_{ref}$ at $V_{hub} = 15$ m/s:	See Annex 1
Annual average wind speed at hub height $V_{ave}$ :	See Annex 1
Reference wind speed $V_{ref}$ :	See Annex 1
Mean flow inclination:	8°
Hub height 50-year extreme wind speed $V_{e50}$ :	See Annex 1

#### Electrical network conditions:

Normal supply voltage and range:	10.5 kV, 35 kV
Normal supply frequency and range:	50 Hz
Voltage imbalance:	< 3%
Maximum duration of electrical power network outages:	Not design driving
Number of electrical network outages	Max 120 times per year



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#### Other environmental conditions (where taken into account):

Design conditions in case of offshore WT (water depth, wave conditions, salinity, etc.):

N.A.

Normal and extreme temperature ranges:

Normal temperature turbine

Normal temperature:

-20°C to +45°C

Extreme temperature:

-30°C to +50°C

Low temperature turbine (LT)

Normal temperature:

-30°C to +45°C

Extreme temperature:

-40°C to +50°C

Relative humidity of the air:

100% (max. 10% of the lifetime)

Air density:

See Annex 1

Solar radiation:

The turbine shall resist solar radiation (including UV) with 1000 W/m<sup>2</sup> throughout the design lifetime

Lightning protection system (standard and protection class):

Designed acc. to IEC 61400-24, Protection Level I

Earthquake model and parameters (standard and key parameters e.g. spectrum, model, seismic zone, soil class, etc.):

N.A.

Other design conditions (such as sand-storm):

N.A.



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**Wind Turbine**

**Major components:**

\*\*If not otherwise stated, the certificate holder  
is the manufacturer.

**Blade:**

Type: V120 Infused blade  
Material: Carbon fibre and dry glass reinforced with epoxy resin  
Blade length: 59 m  
Number of blades: 3  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No.: 0073-9710 V06

Type: V120 Hybrid blade  
Material: Pultruded carbon fibre and hybrid pre-preg with dry glass reinforced with epoxy resin  
Blade length: 59 m  
Number of blades: 3  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No.: 0065-9125 V03

**Blade bearing:**

Type: 3 row roller bearing  
Manufacturer: TMB  
Drawing / Data sheet / Part No.: 29099950.V01

**Pitch System:**

Motor / Actuator Type: Hydraulic  
Pitch Controller Type: Hydraulic  
Manufacturer: LJM, Glual and Hengli



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#### Main shaft:

Type: Forged hollow trumpet shaft  
Manufacturer: Taewoong  
Material: 42CrMo4  
Drawing / Data sheet / Part No.: 29085835

#### Main bearing:

Type: Two double row spherical roller bearing  
Manufacturer: SKF  
Drawing / Data sheet / Part No.: 230/630 CA/HM2W33 (front)  
24188 ECA/HM2W33 (rear)

Type: Two double row spherical roller bearing  
Manufacturer: KOYO  
Drawing / Data sheet / Part No.: 230/630 RHAW33T (front)  
24188 RHAW33 (rear)

Type: Two double row spherical roller bearing  
Manufacturer: FAG  
Drawing / Data sheet / Part No.: F-582558.PRL-WPO (front)  
F-582559.PRL-WPO (rear)

#### Gearbox:

Type: 3 stage planetary gearbox  
Gear Ratio: 1:112.2  
Manufacturer: Winergy  
Drawing / Data sheet / Part No.: PEAB 4440, 29099324

Type: 3 stage planetary gearbox  
Gear Ratio: 1:112.4  
Manufacturer: ZF  
Drawing / Data sheet / Part No.: Atlas 1.21, 29099326



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#### Yaw System:

*Drive Type:* Electrical motor  
*Manufacturer:* ABB or Lafert  
*Drawing / Data sheet / Part No.:* 29094938

*Bearing Type:* Friction Bearing (PETP slide plate)  
*Manufacturer:* Vestas Wind Systems A/S  
*Drawing / Data sheet / Part No.:* 29095702.V00

*Gear Type:* Planetary-/worm gear combination,  
3 step planetary / 1 step worm gear  
*Manufacturer:* Bonfiglioli or Comer  
*Drawing / Data sheet / Part No.:* 29014048(left) / 29014049(right)

*Brake Type:* Friction brake, motor brake included in  
the motor unit  
*Manufacturer:* ABB or Lafert (motor brake)  
*Drawing / Data sheet / Part No.:* 29094938

#### Generator:

*Type* Asynchronous generator with wound rotor  
*Manufacturer:* Vestas Wind Systems A/S  
*Drawing / Data sheet / Part No.:* DVSG 500/4M sp  
0057-1280.V06  
*Rated Power:* 2260 kW  
*Rated Frequency:* 50 Hz  
*Rated Speed:* 1510 rpm  
*Max. speed:* 2900 rpm  
*Rated Voltage:* 690 V  
*Rated Current:* Stator 1839 A  
*Insulation Class:* H/H  
*Degree of Protection:* IP 54



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**Converter:**

Type: Full-quadrant IGBT converter  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No: 0042-3461.V06  
Rated Voltage (grid side): 480 V  
Rated Current (grid side): 300A  
Degree of Protection: IP 54

**Transformer:**

Type: Dry-type transformer  
Manufacturer: SGB  
Drawing / Data sheet / Part No.: DTTH1N 1600/10  
0070-0676.V00  
Rated Voltage: 10.5 kV  
Rated Power: 2300 kVA  
Degree of Protection: IP00  
Location: Nacelle rear

Type: Dry-type transformer  
Manufacturer: Siemens  
Drawing / Data sheet / Part No.: 4GT6443-8EY  
0070-0642.V00  
Rated Voltage: 10.5 kV  
Rated Power: 2300 kVA  
Degree of Protection: IP00  
Location: Nacelle rear

Type: Dry-type transformer  
Manufacturer: JST  
Drawing / Data sheet / Part No.: SCLB10-2300/35  
0063-7426.V01  
Rated Voltage: 35 kV  
Rated Power: 2300 kVA



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**Wind Turbine**

Degree of Protection:	IP00
Location:	Nacelle rear
<b>Tower:</b>	
Type:	Tubular steel
Manufacturer:	Vestas Wind Systems A/S
Sections:	5
Length:	120.1 m
Drawing / Data sheet / Part No.:	A005-2922.V03 (T787A00)
<b>Foundation:</b>	
Type:	N.A.
Manufacturer:	N.A.
Drawing / Data sheet / Part No:	N.A.
<b>Foundation Adaptor:</b>	
Type:	N.A.
Manufacturer:	N.A.
Drawing / Data sheet / Part No.:	N.A.
<b>Manuals:</b>	
List of manuals	0081-4913.V3
Operation & maintenance manual:	0001-1995.V27 and 0076-9981.V2
Transport manual:	0076-9984.V4
Installation & commissioning. manual:	0076-9976.V0 and 0076-9901.V1





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Annex 1 – Configuration matrix

<b>Turbine ID</b>	<b>Rated power [MW]</b>	<b>Rated wind speed <math>V_r</math> [m/s]</b>	<b>Annual average wind speed at hub height <math>V_{ave}</math> [m/s]</b>	<b>Characteristic turbulence intensity <math>I_{ref}</math> at <math>V_{hub} = 15</math> m/s:</b>	<b>Reference wind speed <math>V_{ref}</math> [m/s]</b>	<b>Hub height extreme wind speed <math>V_{650}</math> [m/s]</b>	<b>Normal air density [kg/m<sup>3</sup>]</b>	<b>Low temperature air density [kg/m<sup>3</sup>]</b>
1	2.2	9.0	8.0	0.135	36.2	50.7	1.200	1.298*

\* Note for LT: The -30°C minimum operating temperature has been verified for loads and structural integrity by considering an air density of 1.298 kg/m<sup>3</sup>

<b>Turbine ID</b>	<b>Tower No.</b>	<b>Tower Sections</b>	<b>Tower Drawing</b>	<b>Tower length [m]</b>	<b>Foundation Loads document</b>
1	T787A00	5	A005-2922.V03	120.1	0082-4366.V04 0082-6536.V02*

\* Up to 3m above ground due to raised foundations