



Certificate No.

IECRE.WE.TC.20.0078-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 60 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-0074-04208-0
2020-01-31

Design evaluation conformity statement
Dated

IECRE.WE.CS.19.0030-R1
2020-01-31

Type test conformity statement
Dated

TT-DNVGL-SE-0074-04211-0
2020-01-31

Manufacturing conformity statement
Dated

ME-DNVGL-SE-0074-04210-0
2020-01-31

Final evaluation report
Dated

FER-TC-DNVGL-SE-0074-04207-0
2020-01-31

The conformity evaluation was carried out in accordance with the rules and procedures of the IECRE System 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 2020-01-31



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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):	80m – See Annex 1
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:	34.5 kV
Normal supply frequency and range:	60 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.):

NA

Normal and extreme temperature ranges:

Normal temperature turbine

Normal temperature:

-20°C to +45°C

Extreme temperature:

-30°C to +50°C

Relative humidity of the air:

Low temperature turbine (LT)

Normal temperature:

-30°C to +45°C

Extreme temperature:

-40°C to +50°C

100% (max. 10% of the lifetime)

Air density:

See Annex 1

Solar radiation:

The turbine shall resist solar
radiation (including UV) with
1000 W/m² 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.):

NA

Other design conditions (such as sand-storm):

NA



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Major components:

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

Blade:

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

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

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)



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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: 1:89.748
Manufacturer: Winergy
Drawing / Data sheet / Part No.: PEAB 4440, 29099324

Type: 3 stage planetary gearbox
Gear Ratio: 1:89.804
Manufacturer: ZF
Drawing / Data sheet / Part No.: Atlas 1.21, 29099326

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



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<i>Gear Type:</i>	Planetary-/worm gear combination, 3 step planetary / 1 step worm gear
Manufacturer:	Bonfiglioli or Comer
Drawing / Data sheet / Part No.:	29014048(left) / 29014049(right)
<i>Brake Type:</i>	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 500/6M/V2 0069-4743.V01
Rated Power:	2260 kW
Rated Frequency:	60 Hz
Rated Speed:	1208 rpm
Max. speed:	2600
Rated Voltage:	690 V
Rated Current:	Stator 1954 A
Insulation Class:	H/H
Degree of Protection:	IP 54
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



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Transformer:

Type: Dry-type transformer
Manufacturer: SGB
Drawing / Data sheet / Part No.: DTTH1N 1600/30
0056-7859.V00

Rated Voltage: 34.5 kV
Rated Power: 2300 kVA
Degree of Protection: IP00
Location: Nacelle rear

Type: Dry-type transformer
Manufacturer: Siemens
Drawing / Data sheet / Part No.: 4GT6499-8ZY, Basic+
0056-7859 V00

Rated Voltage: 34.5 kV
Rated Power: 2300 kVA
Degree of Protection: IP00
Location: Nacelle rear

Type: Dry-type transformer
Manufacturer: JST
Drawing / Data sheet / Part No.: SCLB10-2300/34.5
0056-7859.V00

Rated Voltage: 34.5 kV
Rated Power: 2300 kVA
Degree of Protection: IP00
Location: Nacelle rear



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Tower:

Type: Tubular steel
Manufacturer: Vestas Wind Systems A/S
Sections: 3
Length: 78.1 m
Drawing / Data sheet / Part No.: 0043-5737.V00 (T2X103)

Type: Tubular steel
Manufacturer: Vestas Wind Systems A/S
Sections: 3
Length: 78.1 m
Drawing / Data sheet / Part No.: 0075-5764.V00 (T785002)

Foundation:

Type: NA
Manufacturer: NA
Drawing / Data sheet / Part No: NA

Foundation Adaptor:

Type: NA
Manufacturer: NA
Drawing / Data sheet / Part No.: NA

Manuals:

List of manuals 0081-4913.V3
Operation & maintenance manual: 0001-1995.V27 and 0076-9981.V2
Transport manual: 0076-9984.V2
Installation & commissioning. manual: 0076-9976.V0 and 0076-9901.V1



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Annex 1 – Configuration matrix

Turbine ID	Rated power [MW]	Rated wind speed V_r [m/s]	Annual average wind speed at hub height V_{ave} [m/s]	Characteristic turbulence intensity I_{ref} at $V_{hub} = 15$ m/s:	Reference wind speed V_{ref} [m/s]	Hub height extreme wind speed V_{e50} [m/s]	Normal air density [kg/m ³]	Low temperature air density [kg/m ³]
1	2.2	9.0	6.5	0.135	36.2	50.7	1.200	1.298*
2	2.2	9.0	8.0	0.125	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/m³

Turbine ID	Tower No.	Tower Sections	Tower Drawing	Tower length [m]	Foundation Loads document
1	T2X103	3	0043-5737.V00*	78.1	0083-8211.V01 0083-8207.V01**
2	T785002	3	0075-5764.V00*	78.1	0081-8321.V01 0081-8322.V00**

* The optional oscillation damper has not been assessed by DNV GL

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