



Certificate No.

IECRE.WE.TC.19.0021-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 V112-3.45 MW / V112-3.60 MW
Vestas V112-3.3 MW / V112-3.45 MW (BWC)

wind turbine class (class, standard, year)

IEC S (specified in Annex 1), IEC 61400-1 incl. Amd.1, 2010

This certificate is transferred from IEC 61400-22 to IECRE and 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-0074-00871-4
2018-12-10

Design evaluation conformity statement
Dated

DE-DNVGL-SE-0074-00872-4
2018-12-10

Type test conformity statement
Dated

TT-DNVGL-SE-0074-00874-4
2018-12-10

Manufacturing conformity statement
Dated

ME-DNVGL-SE-0074-00873-4
2018-12-10

Type characteristics conformity statement
Dated

TCM-DNVGL-SE-0074-00875-4
2018-12-10

Final evaluation report
Dated

FER-TC-DNVGL-SE-0074-00870-5
2018-12-10

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:
2022-02-16

Approved for issue on behalf of the IECRE
Certification Body:



Renewables Certification
Brooktorkai 18
20457 Hamburg, Germany

Ramakrishna Parasarampuram /
Christer Eriksson
Project Manager / Service Line Leader,
Type Certification
Hamburg 2019-01-31



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Machine parameters:

Power regulation:	See Annex 1
Rotor orientation:	pitch-controlled
Number of rotor blades:	upwind
Rotor tilt:	6°
Cone angle:	4°
Rated power:	See Annex 1
Rated wind speed V_r :	See Annex 1
Rotor diameter:	112 m
Hub height(s):	See Annex 1
Hub height operating wind speed range $V_{in} - V_{out}$: V112-3.3 MW / V112-3.45 MW (BWC)	3 – 25 m/s
Hub height operating wind speed range $V_{in} - V_{out}$: V112-3.45 MW / V112-3.60 MW	3 – 30 m/s (including HWO)
Design life time:	20 years
Software version:	See Annex 1

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°

Electrical network conditions:

Normal supply voltage and range:	3 x 650 V 10.5-36 kV \pm 10 %
Normal supply frequency and range:	50 or 60 Hz \pm 6 % Hz
Voltage imbalance:	IEC 61000-3-6 TR max 2 %
Maximum duration of electrical power network outages:	Two 3 months periods
Number of electrical network outages	Max 52 per year



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Other environmental conditions (where taken into account):

Standard temperature ranges

Normal: -20 °C to +45 °C*

Extreme: -30 °C to +50 °C

Low temperature range

Normal: -30 °C to +45 °C*

Extreme: -40 °C to +50 °C

*de-rating strategy

See Annex 1

Relative humidity of the air:

100% (max 40% of time) and 90%
(rest of life time)

Air density:

1.225 / 1.325ⁱ kg/m³

ⁱTo account for low temperature
operation, Vestas has applied higher
air density for the following load
cases: 1.2, 2.1, 3.1, 4.1 and 5.1

Solar radiation:

1000 W/m²

Lightning protection system (standard and protection
class):

Designed acc. to IEC 61400-24,
Protection Level 1 and IEC 61312-1



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Major components:

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

Blade:

Type:	Airfoil shells bonded to supporting beam
Material:	Fibreglass reinforced epoxy, carbon fibres and Solid Metal Tip (SMT)
Blade length:	54.65 m
Number of blades:	3
Manufacturer:	Vestas
Drawing / Data sheet / Part No.:	V112 blade : 78000020 Aero add-ons : 0054-8857, Rev. 1 - STE kit 0055-4456, Rev. 1 – RVG 0056-7085, Rev. 0 - GF

Blade bearing:

Type:	Double row four-point contact ball bearing
Manufacturer:	LGN/RLX/LBC/TMB
Drawing / Data sheet / Part No.:	29049732, Rev. 3

Pitch System:

Motor / Actuator Type:	Hydraulic power unit
Pitch Controller Type:	Pitch Actuation Module 29084357, Rev. 1
Hydraulic Cylinder (125/80x922)	29084354, Rev. 1

Main shaft:

Type:	Cast hollow shaft
Material:	EN GJS-500-14
Drawing / Data sheet / Part No.:	29085300, Rev. 1



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Type: Cast hollow shaft
Material: EN GJS-400-18U-LT
Drawing / Data sheet / Part No.: 29024367, Rev. 2

Main bearing:

Type: Double-row spherical roller bearing
Manufacturer: SKF/FAG
Drawing / Data sheet / Part No.: SKF - 240/950 CA/C3LW 33VQ113
FAG - F-582562.PRL-WPO

Gearbox:

Type: 2 Planetary stages and one helical stage
Gear Ratio: 104.8
Manufacturer: ZF
Drawing / Data sheet / Part No.: EH921A

Type: 2 Planetary stages and one helical stage
Gear Ratio: Winergy
Manufacturer: 104.9
Drawing / Data sheet / Part No.: PZAB 3530.1

Yaw System:

Drive Type: Nacelle mounted electrical driven plain bearing with external toothing
Yaw Bearing Type: Friction bearing, permanently pre-tensioned
Yaw Drive Type: Comer type PG 1903
Yaw Brake Type: Electrical disc brake in yaw motors
Yaw Speed: 0.45 °/s for 50 Hz
0.55 °/s for 60 Hz



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Generator:

Type	VND SFIG V2 - DASG 560/6M (Three phase induction generator with squirrel cage rotor)
Rated Power:	3450 kW, 3650 kW, 3800 kW
Rated Speed:	1450 rpm / 1470 rpm
Rated Voltage:	750 V
Rated Power Factor (VFD) – Cos phi	0.87
Insulation Class:	H
Degree of Protection:	IP54

Converter:

Type:	Full-scale converter - cube power
Manufacturer:	Vestas
Line side voltage level	650 Vac
Machine side voltage level	750 Vac
Nominal apparent power	4.4 MVA
Line side AC Frequency	50 / 60 Hz
DC-Link voltage	1150 Vdc

Transformer:

Type	Dry-type transformer (ECO)
Manufacturer	SGB
Nominal power	4000 kVA
Nominal voltages (HV)	33 kV
Nominal voltage (LV)	650 V
Frequency	50 Hz
Vector group	Dyn5
Environmental Tests	E2
Climatic Tests	C2
Fire class	F1



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Type	Dry-type transformer 3-Phase GEAFOL – Transformer (ECO)
Manufacturer	Siemens
Nominal power	4000 kVA
Nominal voltages (HV)	33 kV / 34.5 kV
Nominal voltage (LV)	650 V
Frequency	50 Hz / 60 Hz
Vector group	Dyn5
Environmental Tests	E2
Climatic Tests	C2
Fire class	F1
Tower:	
Type:	Tubular steel tower
Hub height	See Annex 1
Drawing / Data sheet / Part No.:	See Annex 1
Manuals:	
Operation & maintenance manual:	See list of manuals 0006-6955, Rev. 25
Transport manual:	See list of manuals 0040-6996, Rev. 10
Installation & commissioning. manual:	See list of manuals 0040-6996, Rev. 10
Control System	
Manufacturer	Vestas
Type	Vestas Multi Processor VMP Global – System 8000
Service lift (optional)	
Manufacturer	Avanti
Type	Avanti Shark or Power Lift Sherpa-SD



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Crane (optional)

Manufacturer

Star 071/95 Liftket

Maximum lifting capacity

max 800 kg



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Annex 1 - Configurations covered by this Type Certificate

Variants	IEC WT class**	Power*	Rated wind speed V_r	De-rating temperature	Mean wind speed V_{ave}
V112-3.3 MW/ V112-3.45 MW (BWC)	S (IIA)	3.3 MW /3.45 MW	11.40 m/s	*de-rating strategy above +30 °C for V112-3.3 MW *de-rating strategy above +25 °C for V112-3.45 MW	8.5 m/s
V112-3.3 MW/ V112-3.45 MW (BWC)	S (IIIA)	3.3 MW /3.45 MW	11.40 m/s	*de-rating strategy above +30 °C for V112-3.3 MW *de-rating strategy above +25 °C for V112-3.45 MW	7.5 m/s
V112-3.3 MW/ V112-3.45 MW (BWC)	S (IIB)	3.3 MW /3.45 MW	11.40 m/s	*de-rating strategy above +30 °C for V112-3.3 MW *de-rating strategy above +25 °C for V112-3.45 MW	8.5 m/s
V112-3.3 MW/ V112-3.45 MW (BWC)	S (IB) / S***	3.3 MW /3.45 MW	11.20 m/s	*de-rating strategy above +30 °C for V112-3.3 MW *de-rating strategy above +25 °C for V112-3.45 MW	10 m/s / 9.3 m/s
V112-3.45 MW/ V112-3.60 MW	S (IA)	3.45 MW / 3.60 MW	11.3 m/s /11.5 m/s	*de-rating strategy above +30 °C for V112-3.45 MW *de-rating strategy above +20 °C for V112-3.60 MW	10 m/s

Notes:

Power* - see De-rating temperature defined in the table.

IEC WT class**:

- S (IIA) – IEC Wind turbine class IIA except for the temperature range
- S (IIIA) - IEC Wind turbine class IIIA except for the temperature range
- S (IIB) - IEC Wind turbine class IIB except for the temperature range
- S (IB) - IEC Wind turbine class IB except for the temperature range
- S (IA) - IEC Wind turbine class IA except for the temperature range
- S*** – The mean wind speed (V_{ave}) is lowered to 9.3 m/s for V112-3.45 MW power mode



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Variants	Hub Height (HH)	Tower (drawing no)	Turbulence Intensity I_{ref}	Software version
V112-3.3 MW/ V112-3.45 MW (BwC)	84 m 94 m 84 m (US) 94 m (US) 84 m (Mk 2C)	84 m - 0036-9936.V00 94 m - 0036-9935.V00 84 m (US) - 0038-7704.V00 94 m (US) - 0039-5891.V00 84 m (Mk 2C) - 0049-9636.V00	0.16	VMP Global, Build: 2016.07 (BwC)
V112-3.3 MW/ V112-3.45 MW (BwC)	119 m	119 m - 0041-0468.V00	0.16	VMP Global, Build: 2016.07 (BwC)
V112-3.3 MW/ V112-3.45 MW (BwC)	94 m (Mk 2C)	94 m (Mk 2C) - 0049-9637.V00	0.14	VMP Global, Build: 2016.07 (BwC)
V112-3.3 MW/ V112-3.45 MW (BwC)	84 m	84 m - 0040-4239.V00	0.14	VMP Global, Build: 2016.07 (BwC)
V112-3.45 MW/ V112-3.60 MW	69 m 94 m	69 m - 0060-5707.V00 94 m - 0065-1302.V00	0.16	VMP Global, Build: 2016.07