



Certificate No.

**IECRE.WE.TC.18.0006-R0**

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

## PROVISIONAL 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 V117-3.45 MW / V117-3.60 MW

wind turbine class (class, standard, year)

S (IEC IB)\*, 61400-1:2005

\*S (IEC IB) - IEC wind turbine class IB expect for the temperature range.

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-0074-00821-2 (DB-DNV-DSS-904-00821-2)  
2017.02.28

Design evaluation conformity statement  
Dated

DE-DNVGL-SE-0074-00822-2 (DE-DNV-DSS-904-00822-2)  
2017.02.28

Type test conformity statement  
Dated

TT-DNVGL-SE-0074-00823-2 (TT-DNV-DSS-904-00823-2)  
2017.02.28

Manufacturing conformity statement  
Dated

ME-DNVGL-SE-0074-00824-2 (ME-DNV-DSS-904-00824-2)  
2017.02.28

Type Characteristic Measurements conformity statement  
Dated

TCM-DNVGL-SE-0074-00826-2 (TCM-DNV-DSS-904-00826-2)  
2017.11.17

Final evaluation report  
Dated

FER-TC-DNVGL-SE-0074-00820-3  
2017.11.17

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.

Outstanding issues are listed on page 8 of this certificate.

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

This certificate is valid until:  
2019.02.05

Approved for issue on behalf of the IECRE Certification Body:

  
Parasarampuram,  
Ramakrishna  
2018.02.06 16:57:21  
+01'00'

  
Eriksson, Christer  
2018.02.06  
17:38:25 +01'00'

R Parasarampuram /Christer Eriksson  
Project Manager /Service Line Leader, TC  
Hellerup 2018.02.06



Renewables Certification  
Brooktorkai 18  
20457 Hamburg, Germany



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### **Wind Turbine**

#### **Machine parameters:**

Power regulation:	pitch-controlled
Rotor orientation:	upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	4°
Rated power:	3450 kW / 3600 kW
Rated wind speed $V_r$ :	10.90 m/s / 11.20 m/s
Rotor diameter:	117 m
Hub height(s):	91 m
Hub height operating wind speed range $V_{in} - V_{out}$ :	3 m/s – 30 m/s
Design life time:	20 years
Software version:	VMP Global, Build: 2016.07

#### **Wind conditions:**

Characteristic turbulence intensity $I_{ref}$ at $V_{hub} = 15$ m/s:	0.16
Annual average wind speed at hub height $V_{ave}$ :	10 m/s
Reference wind speed $V_{ref}$ :	50 m/s
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):

Normal and extreme temperature ranges:

\*de-rating strategy:

\*de-rating strategy above +30 °C for V117-3.45 MW

\*de-rating strategy above +20 °C for V117-3.60 MW

Relative humidity of the air:

Air density:

Solar radiation:

Lightning protection system (standard and protection class):

Normal: -20 °C to +45 °C\*

Extreme: -30 °C to +50 °C

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

1.225 / 1.325<sup>i</sup> kg/m<sup>3</sup>

<sup>i</sup>To 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

1000 W/m<sup>2</sup>

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:	57.15 m
Number of blades:	3
Manufacturer:	Vestas
Drawing / Data sheet / Part No.:	0037-6856, Rev.0 – V117 Blade 0054-9342, Rev.1 – V117 STE kit 0043-3896, Rev.2 – V117 Root Vortex Generator 0056-7084, Rev.1 – V117 Gurney Flap Assembly

#### **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:**

Type	Hydraulic power unit
Pitch Actuation Module	29080632, Rev. 0
Hydraulic Cylinder (140/90X922)	29080628, Rev. 0

#### **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
Manufacturer	ZF
Gear ratio	104.9
Drawing / Data sheet / Part no.	EH921A

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

#### Yaw System:

Drive type	Nacelle mounted electrical driven plain bearing with external tothing
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 voltage	750 V
Rated power factor (VFD) – Cos phi	0.87
Insulation class stator	H
Protection class (acc. to IEC 529)	IP54
Rated speed	1520 rpm

#### **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
Length:	91.5 m
Drawing / Data sheet / Part No.:	0057-6835.R00

#### **Manuals:**

Operation & maintenance manual:	0006-6955, Rev. 25
Transport manual:	0040-6996, Rev. 10
Installation & commissioning. manual:	0040-6996, Rev. 10



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**Outstanding issues:**

All additional IECRE requirements as compared to IEC 61400-22 certification scheme shall be considered.