



Certificate. No.

**IECRE.WE.TC.18.0016-R4**

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 V136-3.45 MW / V136-3.60 MW

wind turbine class (class, standard, year)

See Annex 1, IEC 61400-1: 2005+Amd1: 2010

This certificate is transferred from IEC 61400-22 to IECRE and attests compliance with IEC 61400 Series as specified in subsequent pages and later updated according to IECRE OD-501, ed. 2. It is based on the following reference documents:

Design basis evaluation conformity statement  
Dated

DB-DNVGL-SE-0074-02943-1  
2017-11-15

Design evaluation conformity statement  
Dated

DE-DNVGL-SE-0074-02745-9  
2020-06-05

Type test conformity statement  
Dated

TT-DNVGL-SE-0074-02944-8  
2020-06-05

Manufacturing conformity statement  
Dated

ME-DNVGL-SE-0074-04229-7  
2020-06-05

Final evaluation report  
Dated

FER-TC-DNVGL-SE-0074-03880-7  
2020-06-05

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:  
2022-05-28

Approved for issue on behalf of the IECRE  
Certification Body:

Nils Kreidelmeyer / Bente Vestergaard  
Senior Project Manager / Service Line Leader,  
Type Certification  
Hellerup 2020-06-05



Renewables Certification  
Brooktorkai 18  
20457 Hamburg, Germany



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#### 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 $V_r$ :	See Annex 1
Rotor diameter:	136 m
Hub height(s):	See Annex 1
Hub height operating wind speed range $V_{in} - V_{out}$ :	See Annex 1
Design life time:	20 years
Software version:	VMP Global version/build 2017.01

#### 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):**

Normal and extreme temperature ranges:	Normal: -20°C to +45°C* Extreme: -30°C to +50°C (*de-rating strategy: see Annex 1)
Low temperature turbine	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 kg/m <sup>3</sup> (for normal operation) 1.325 kg/m <sup>3</sup> (for low temperature operation)
Solar radiation:	1000 W/m <sup>2</sup>
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: Hybrid/Infused  
Material: Hybrid: Glass fibre pre-preg / dry glass  
"hybrid" and pvc core with Carbon and T  
pultrusions  
Infused: dry glass together with Carbon  
and T pultrusions  
Blade length: 66.65 m  
Number of blades: 3  
Manufacturer: Vestas  
Drawing / Data sheet / Part No.: 0055-0068, Rev. 10  
0060-1773, Rev. 6 (retrofit)

#### **Blade Aero Addons:**

Type: STE's and RVG's  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part no.: STE Kit: 0059-6671, Rev. 0  
RVG: 0056-5767, Rev. 1

#### **Blade bearing:**

Type: Double row four-point contact ball bearing  
Manufacturer: LGN  
Drawing / Data sheet / Part No.: 29058368, Rev.0

#### **Blade bearing:**

Type: Double row four-point contact ball bearing  
Manufacturer: RLX  
Drawing / Data sheet / Part No.: 29058368, Rev.0



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## **TYPE CERTIFICATE**

### **Wind Turbine**

#### **Blade bearing:**

Type: Double row four-point contact ball bearing  
Manufacturer: LBC

Drawing / Data sheet / Part No.: 29058368, Rev.0

#### **Blade bearing:**

Type: Double row four-point contact ball bearing  
Manufacturer: TMB

Drawing / Data sheet / Part No.: 29058368, Rev.0

#### **Pitch System:**

Motor / Actuator Type: Hydraulic power unit

Drawing / Data sheet / Part No.: 29059706, Rev. 3

Hydraulic Cylinder (160/110X922): 29060554, Rev. 1

Hydraulic Cylinder (160/110X922): FCE002458, Rev. B

#### **Main shaft:**

Type: Cast hollow shaft

Material: EN GJS-500-14

Drawing / Data sheet / Part No.: 29085300, Rev. 1

#### **Main bearing:**

Type: Double-row spherical roller bearing

Manufacturer: SKF

Drawing / Data sheet / Part No.: 240/950 CA/C3LW 33VQ113

#### **Main bearing:**

Type: Double-row spherical roller bearing

Manufacturer: FAG

Drawing / Data sheet / Part No.: F-582562.PRL-WPO



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#### **Gearbox:**

Type: 2 Planetary stages and one helical stage  
Gear Ratio: 1:125.163  
Manufacturer: ZF  
Drawing / Data sheet / Part No.: EH922A

#### **Gearbox:**

Type: 2 Planetary stages and one helical stage  
Gear Ratio: 1:125.883  
Manufacturer: Winergy  
Drawing / Data sheet / Part No.: PZAB 3530.2

#### **Gearbox:**

Type: 2 Planetary stages and one helical stage  
Gear Ratio: 1:125.883  
Manufacturer: Winergy  
Drawing / Data sheet / Part No.: PZAB 3530.3

#### **Yaw System:**

Drive Type: Nacelle mounted electrical driven plain bearing with external tothing

Bearing Type: Friction bearing, permanently pre-tensioned

Gear Type: Multiple stage gearbox  
Manufacturer: Comer/Bonfiglioli/Liebherr  
Drawing / Data sheet / Part No.: PG 1903/709T4R/DAT350

Brake Type: Electrical disc brake in yaw motors



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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	1470 rpm

#### Converter:

Type	Full-scale converter - cube power
Manufacturer	Vestas Wind Systems A/S
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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#### Transformer:

Type	Dry-type transformer 3-Phase GEAFOL – Transformer (ECO)
Manufacturer	Siemens
Nominal power	4000 kVA
Nominal voltages (HV)	34.5 kV
Nominal voltage (LV)	650 V
Frequency	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 0040-6996, Rev. 14
Transport manual:	See list of manuals 0040-6996, Rev. 14
Installation & commissioning. manual:	See list of manuals 0040-6996, Rev. 14

#### Service lift:

Manufacturer	Avanti
Type	Avanti Shark or Power Lift Sherpa-SD

#### Crane:

Manufacturer	Star 071/95 Liftket
Type	max 800 kg





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**Annex 1 - Configurations covered by this Type Certificate**

ID <sup>10</sup>	Variants	HH (m)	IEC WT class	V <sub>r</sub> (m/s)	V <sub>in</sub> - V <sub>out</sub> (m/s)	V <sub>ave</sub> (m/s)	I <sub>ref</sub> (%)	V <sub>ref</sub> (m/s)	Tower drawing
1.1	V136-3.45 MW <sup>1</sup>	82	S (III A) <sup>3</sup>	10.0	3 - 27.5	7.5	16	37.5	0060-8092.V00
1.2	V136-3.45 MW <sup>1</sup>	82	S <sup>4</sup>	10.0	3 - 27.5	8.6	14	44	0060-8092.V00
1.3	V136-3.45 MW <sup>1</sup>	82	S (III A) <sup>3</sup>	10.0	3 - 27.5	7.5	16	37.5	0065-7850.V01
1.4	V136-3.60 MW <sup>2</sup>	82	S (III A) <sup>3</sup>	10.2	3 - 27.5	7.5	16	37.5	0065-7850.V01
1.5	V136-3.45 MW <sup>1</sup>	82	S (II B) <sup>5</sup>	10.0	3 - 30	8.5	14	42.5	0065-7850.V01
1.6	V136-3.60 MW <sup>2</sup>	82	S <sup>6</sup>	10.2	3 - 30	8.0	14	42.5	0065-7850.V01
2.1	V136-3.45 MW <sup>1</sup>	105	S (III A) <sup>3</sup>	10.0	3 - 27.5	7.5	16	37.5	0060-6080.V00
2.2	V136-3.60 MW <sup>2</sup>	105	S (III A) <sup>3</sup>	10.2	3 - 27.5	7.5	16	37.5	0060-6080.V00
2.3	V136-3.45 MW <sup>1</sup>	105	S (IEC III B) <sup>7</sup>	10.0	3 - 30	7.5	14	37.5	0067-3835.V00
2.4	V136-3.60 MW <sup>2</sup>	105	S (IEC III B) <sup>7</sup>	10.2	3 - 30	7.5	14	37.5	0067-3835.V00
3.1	V136-3.45 MW <sup>1</sup>	112	S (III A) <sup>3</sup>	10.0	3 - 27.5	7.5	16	37.5	0064-9758.V00
3.2	V136-3.60 MW <sup>2</sup>	112	S (III A) <sup>3</sup>	10.2	3 - 27.5	7.5	16	37.5	0064-9758.V00
4.1	V136-3.60 MW	120	S <sup>8</sup>	10.2	3 - 22.5	8.0	I <sub>ref</sub> <sup>9</sup>	35.5	A006-4259.V00
5.1	V136-3.45 MW <sup>1</sup>	142	S (III A) <sup>3</sup>	10.0	3 - 27.5	7.5	16	37.5	0056-3963.V00
5.2	V136-3.60 MW <sup>2</sup>	142	S (III A) <sup>3</sup>	10.2	3 - 27.5	7.5	16	37.5	0056-3963.V00
6.1	V136-3.45 MW <sup>1</sup>	132	S (III A) <sup>3</sup>	10.0	3 - 27.5	7.5	16	37.5	0064-8000.V00
6.2	V136-3.60 MW <sup>2</sup>	132	S (III A) <sup>3</sup>	10.2	3 - 27.5	7.5	16	37.5	0064-8000.V00
6.3	V136-3.45 MW <sup>1</sup>	132	S (II B) <sup>5</sup>	10.0	3 - 30	8.5	14	42.5	0064-8000.V00
6.4	V136-3.60 MW <sup>2</sup>	132	S <sup>6</sup>	10.2	3 - 30	8.0	14	42.5	0064-8000.V00



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#### Notes:

- 1 De-rating strategy above +30°C for V136-3.45MW
- 2 De-rating strategy above +20°C for V136-3.60MW
- 3 Wind turbine class IEC III A except for the temperature ranges
- 4 The following are the deviations from standard Wind turbine class IEC IIB:
  - Deviation in the standard and operating temperature ranges as compared to the IEC II B wind turbine class.
  - Air density ( $1.11 \text{ kg/m}^3$ ) has been used except for following DLCs - 12LT, 12Ic, 21RPY, 21PSBB, 21GRF, 31PR, 41RP, 41RC, 51RE ( $1.325 \text{ kg/m}^3$ ).
  - Mean wind speed  $V_{\text{ave}} - 8.6 \text{ m/s}$
  - Reference wind speed  $V_{\text{ref}} - 44 \text{ m/s}$
- 5 Wind turbine class IEC II B except for the temperature ranges
- 6 Wind turbine class IEC II B except for the temperature ranges and with reduced mean wind speed (8 m/s).
- 7 Wind turbine class IEC III B except for the temperature ranges
- 8 Wind turbine class S, as the following parameters have been set by Vestas: The air density for this load set has been set to  $1.029 \text{ kg/m}^3$ , the mean flow inclination is set to  $0.2^\circ$  and the normal and extreme temperature ranges are  $-12.1^\circ\text{C}$  to  $+36^\circ\text{C}$
- 9 The turbulence intensity is set according to table 2.3 in loads appendix of the evaluation report ER-DE-DNVGL-SE-0074-02745-7
- 10 The ID follows the hub height with its first digit, the second digit is only consecutive to identify the different configurations within one hub height