



Certificate No.

**IECRE.WE.TC.18.0016-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 V136-3.45 MW / V136-3.60 MW

wind turbine class (class, standard, year)

WT class S, 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. 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-0074-02745-2  
2017-11-15

Type test conformity statement  
Dated

TT-DNVGL-SE-0074-02944-1  
2017-11-15

Manufacturing conformity statement  
Dated

ME-DNVGL-SE-0074-02945-2  
2018-09-19

Final evaluation report  
Dated

FER-TC-DNVGL-SE-0074-02942-2  
2018-09-19

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:



Ramakrishna Parasarampuram / Christer Eriksson  
Project Manager / Service Line Leader, Type  
Certification  
Hellerup 2018-12-14

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: Infused structural airfoil shell  
Material: Fibreglass reinforced epoxy, carbon  
fibres and Solid Metal  
Tip (SMT).  
Blade length: 66.65 m  
Number of blades: 3  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No.: 0055-0068 Rev.2 - V136 blade  
Aero add-ons:  
0059-6671, Rev.0 - V136 STE kit  
0056-5767, Rev.1 - V136 Vortex  
Generator Assembly

**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

**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



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

**Pitch System:**

Motor / Actuator Type: One hydraulic cylinder (160/100x922) per  
blade

Drawing / Data sheet / Part No.: 29060554, Rev. 1

FCE002458, Rev. B

Pitch Controller Type: Hydraulic actuation module

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

**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

**Gearbox:**

Type: 2 Planetary stages and one helical stage

Gear Ratio: 125.163

Manufacturer: ZF

Drawing / Data sheet / Part No.: EH922A



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#### Yaw System:

Drive Type:	Nacelle mounted electrical driven plain bearing with external toothing
Bearing Type:	Friction bearing, permanently pre-tensioned
Gear Type:	Multiple stage gearbox
Manufacturer:	Comer
Drawing / Data sheet / Part No.:	PG 1903
Brake Type:	Electrical disc brake in yaw motors

#### 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)
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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

#### 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



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**Wind Turbine**

**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**

Variants	HH (m)	IEC WT class	$V_r$ (m/s)	$V_{in} - V_{out}$ (m/s)	$V_{ave}$ (m/s)	$I_{ref}$ (%)	$V_{ref}$ (m/s)	Tower drawing
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
V136-3.45 MW <sup>1</sup>	82	S <sup>4</sup>	10.0	3 - 27.5	8.6	14	44	0060-8092.V00
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
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
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
V136-3.60 MW <sup>2</sup>	82	S <sup>6</sup>	10.2	3 - 30	8.0	14	42.5	0065-7850.V01
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
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
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
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
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
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
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
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
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
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
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
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