



Certificate No.

**IECRE.WE.TC.20.0088-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

EnVentus V150-5.6 MW

wind turbine class (class, standard, year)

Class S, IEC 61400-1:2019-02

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-0074-05355-0  
2020-09-18

Design evaluation conformity statement  
Dated

IECRE.WE.CS.19.0028-R1  
2020-09-18

Type test conformity statement  
Dated

TT-B-DNVGL-SE-0074-05356-0  
2020-09-18

Final evaluation report  
Dated

FER-TC-B-DNVGL-SE-0074-05354-0  
2020-09-18

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 in the case of a provisional type certificate are listed in the last page(s) 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:  
2021-09-17

Approved for issue on behalf of the IECRE  
Certification Body:



*Mark Wollenberg* *Bente Vestergaard*

Renewables Certification  
Brooktorkai 18  
20457 Hamburg, Germany

Mark Wollenberg/Bente Vestergaard:  
Project Manager/Service Line Leader:  
Hellerup 2020-09-18



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#### Machine parameters:

Power regulation:	Pitch-controlled
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	-6°
Rated power:	5600 kW
Rated wind speed $V_r$ :	11.2 m/s
Rotor diameter:	150 m
Hub height(s):	105 m
Hub height operating wind speed range $V_{in} - V_{out}$ :	3-25 m/s
Design life time:	20 years
Software version:	2018-11

#### Wind conditions:

Characteristic turbulence intensity at $V_{hub}$ :	0.14
Annual average wind speed at hub height $V_{ave}$ :	8.5 m/s
Weibull shape factor k:	2.3
Mean flow inclination:	8°
50 Year mean wind speed (10min avg.), $V_{50}$ :	37.5 m/s
1 Year mean wind speed (10min avg.), $V_1$ :	32.9 m/s

#### Electrical network conditions:

Normal supply voltage (LV side) and range:	720 V $\pm$ 10 %
Normal supply frequency and range:	50 / 60 Hz $\pm$ 6 %
Voltage imbalance:	< 2%
Maximum duration of electrical power network outages:	Two 3 months periods
Number of electrical network outages	Max. 50 times per year



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#### **Other environmental conditions (where taken into account):**

Normal and extreme temperature ranges:	-20 °C to +45 °C (operating) -30 °C to +50 °C (survival)
Relative humidity of the air:	Up to 95%
Air density:	1.134 kg/m <sup>3</sup> (normal) 1.325 kg/m <sup>3</sup> (low temperature)
Solar radiation:	1000 W/m <sup>2</sup>
Lightning protection system (standard and protection class):	Designed acc. to IEC 61400-24 ed. 2, Protection Level I
Other design conditions :	Max installation height 1000m (2000 m optional)



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#### **Major components:**

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

#### **Blade:**

Type: V150 P2  
Material: Blade shell: fibre-reinforced plastic (Epoxy / Glass) and PET foam.  
Webs: fibre-reinforced plastic (Epoxy / Glass), PET foam and pultruded T-Sections.  
Spar Cap and TE cap: pultruded carbon stacks.  
Blade length: 73.65 m  
Number of blades: 3  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No.: 0078-5376, Rev. 3

#### **Blade bearing:**

Type: Three row roller bearing  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No.: DWG: 29131217, Rev. 0  
TPS: 0023-3088, Rev. 7

#### **Pitch System:**

Motor / Actuator Type: Double acting hydraulic cylinder  
Pitch Controller Type: Hydraulic  
Manufacturer: HINE S.A.  
Drawing / Data sheet / Part No.: Z-200.043, Rev. A

#### **Main shaft:**

Type: Cast Iron  
Manufacturer: Vestas Wind Systems A/S  
Material: EN-GJS-500-14  
Drawing / Data sheet / Part No.: 29203608, Rev. 0



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#### **Main bearing:**

Type: Two single row tapered roller bearings  
Manufacturer: Schaeffler Technologies AG & Co. KG  
Drawing / Data sheet / Part No.: EDD F-636693.TR1-WPOS 000, Rev. AD  
EDD F-636694.TR1-WPOS 000, Rev. AC

Type: Two single row tapered roller bearings  
Manufacturer: Thyssenkrupp, Rothe Erde Germany GmbH  
Drawing / Data sheet / Part No.: PSL612-436, Rev. 1  
PSL612-437, Rev. 2

#### **Gearbox:**

Type: 2 stage planetary gearbox, EF 1205  
Gear Ratio: 1:43,875  
Manufacturer: ZF Wind Power  
Drawing / Data sheet / Part No.: 096-EF1205A001, Rev. A

#### **Yaw System:**

*Drive Type:* 9 x 2.2 kW, 400 V, 50 Hz asynchronous motors  
Manufacturer: Lafert  
Drawing / Data sheet / Part No.: MY10AA4A-56087

*Drive Type:* 9 x 2.5 kW, 400 V, 60 Hz asynchronous motors  
Manufacturer: Lafert  
Drawing / Data sheet / Part No.: MY10AA4A-56088

*Bearing Type:* Preloaded sliding bearing, PETP pads  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part No.: 29190520, Rev. 0

*Gear Type:* 4 planetary stages,  $i = 945,3$   
Manufacturer: Bonfiglioli  
Drawing / Data sheet / Part No.: I7090T014900, Rev. E



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<i>Gear Type:</i>	4 planetary stages, $i = 948$
Manufacturer:	Comer
Drawing / Data sheet / Part No.:	N07388_05, Rev. 5
<i>Brake Type:</i>	9 x 2.2 kW, 400 V, 50 Hz asynchronous motors
Manufacturer:	Lafert
Drawing / Data sheet / Part No.:	MY10AA4A-56087
<i>Brake Type:</i>	9 x 2.5 kW, 400 V, 60 Hz asynchronous motors
Manufacturer:	Lafert
Drawing / Data sheet / Part No.:	MY10AA4A-56088
<b>Generator:</b>	
Type	PMG, ID V14-14
Manufacturer:	Vestas Wind Systems A/S
Drawing / Data sheet / Part No.:	0085-6986, Rev. 1
Rated Power:	5600 kW
Rated Frequency:	131.7 Hz
Rated Speed:	439 RPM
Rated Voltage:	800 V
Rated Current:	5315 A
Insulation Class:	H
Degree of Protection:	IP54
<b>Converter:</b>	
Type:	CubePower 4415 Full quadrant IGBT
Manufacturer:	Vestas Wind Systems A/S
Drawing / Data sheet / Part No.:	0077-0958, Rev. 1
Rated Voltage (grid side):	720 V
Rated Current (grid side):	4 x 1500 A
Degree of Protection:	IP54



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#### Transformer:

Type: MINERA MP  
Manufacturer: Schneider Electric  
Drawing / Data sheet / Part No.: A006-0649, Rev. 0  
Rated Voltage: 33 / 0.72 kV  
Rated Power: 7000 kVA  
Rated grid frequency: 50 Hz  
Location (e.g. tower bottom): Nacelle

Type: TDU-703A03W1N-TU  
Manufacturer: Siemens  
Drawing / Data sheet / Part No.: A006-0648, Rev. 0  
Rated Voltage: 33 / 0.72 kV  
Rated Power: 7000 kVA  
Rated grid frequency: 50 Hz  
Location (e.g. tower bottom): Nacelle

Type: MINERA MP  
Manufacturer: Schneider Electric  
Drawing / Data sheet / Part No.: A008-6903, Rev. 0  
Rated Voltage: 34.5 / 0.72 kV  
Rated Power: 7000 kVA  
Rated grid frequency: 60 Hz  
Location (e.g. tower bottom): Nacelle

#### Tower:

Type: Conical and cylindrical steel  
Manufacturer: Vestas Wind Systems A/S  
Sections: 4  
Length: 102.31 m (HH105)  
Drawing / Data sheet / Part No.: A008-4579, Rev. 1 (T966909)



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#### **Manuals:**

Operation & maintenance manual:	0079-9811, Rev. 1
Transport manual:	0079-9801, Rev. 2
Installation & commissioning. manual:	0079-9663, Rev. 2 0079-9665, Rev. 0

Outstanding issues for Type Certification:

Final manuals are to be submitted to DNV GL and assessed.

The Manufacturing Evaluation for the components listed in section 7.5.3 of IECRE OD-501, Ed.2 is pending.

Type Testing:

S&F test incl. Type Inspection

- Final Safety Manual 0087-9452 needs to be submitted to and evaluated by DNV GL.
- Type Inspection need to be evaluated and finalized by DNV GL.

Blade tests

- Full scale blade tests need to be finalized, reported and verified by DNV GL.

Power performance measurements

- Power performance measurements need to be completed, reported and verified by DNV GL.

Load measurements

- Load measurements need to need to be completed, reported and verified by DNV GL.
  - Type Test results will need to include validation of the tower top acceleration sensing system and rotational speed sensing system.

Gearbox testing

- Gearbox final reporting on the robustness testing is to be submitted to DNV GL and verified

Others

- Tests on the main shaft connection (Schaaf Gripcon bolts) needs to be carried out and reported to DNV GL.