



Certificate No.

**IECRE.WE.TC.18.0015-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 V110 2.0-2.2 MW 50 Hz VCS Mk 10

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-0074-02383-2  
2017-11-24

Design evaluation conformity statement  
Dated

DE-DNVGL-SE-0074-02384-2  
2017-11-24

Type test conformity statement  
Dated

TT-DNVGL-SE-0074-02385-2  
2017-11-24

Manufacturing conformity statement  
Dated

ME-DNVGL-SE-0074-02386-3  
2017-11-24

Type characteristics conformity statement  
Dated

TCM-DNVGL-SE-0074-02387-1  
2017-11-24

Final evaluation report  
Dated

FER-TC-DNVGL-SE-0074-02382-3  
2017-11-24

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:  
2020-01-16

Approved for issue on behalf of the IECRE  
Certification Body:



Renewables Certification  
Brooktorkai 18  
20457 Hamburg, Germany

Mark Wollenberg / Christer Eriksson  
Project Manager / Service Line Leader,  
Type Certification  
Hellerup 2018-11-30



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#### Machine parameters:

Power regulation:	pitch-controlled
Rotor orientation:	upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	3°
Rated power:	2000 kW 2200 kW (refer to annex 1 for details)
2000 kW: derating strategy for cooler top 30 at ambient temperature above 35°C	
2000 kW: derating strategy for cooler top 40 at ambient temperature above 40°C	
2200 kW: derating strategies for ambient temperature above 30°C	
Rated wind speed $V_r$ :	9.6 m/s (2000 kW) 10.0 m/s (2200 kW)
Rotor diameter:	110 m
Hub height(s):	75 m, T2X302 80 m, T2X103, T2X203, T2X300 95 m, T2X122, T2X222, T2X320, T2X321 110 m, T2X330 120 m, T2X331 125 m, T2X133 (refer to annex 1 for details)
Hub height operating wind speed range $V_{in} - V_{out}$ :	3 - 22 m/s (2000 kW) 3 - 20 m/s (2200 kW)
Design life time:	20 years
Software version:	VMP Global 17.06.44

#### 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 $V_{ref}$ :	37.5 m/s
Mean flow inclination:	8°
Hub height 50-year extreme wind speed $V_{e50}$ :	52.5 m/s

#### Electrical network conditions:

Normal supply voltage and range:	10500 V - 35000 V
Normal supply frequency and range:	50 Hz
Voltage imbalance:	<3 %
Maximum duration of electrical power network outages:	Not dimensioning
Number of electrical network outages	50 / year



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

Normal and extreme temperature ranges:

Standard turbine  
-20 °C to +45 °C  
-30 °C to +50 °C  
Low temperature turbine (LT)  
-30 °C to +45 °C  
-40 °C to +50 °C

Low temperature turbine (LT), turbine components and operating strategy are identical to the standard temperature turbine, but additional heating elements are installed for low temperature usage

Relative humidity of the air:

100 % (max 10 % of lifetime)

Air density:

Standard turbine  
1.225 kg/m<sup>3</sup>  
Low temperature turbine  
1.325 kg/m<sup>3</sup>

The -30 °C minimum operating temperature has been verified for loads and structural integrity by considering an air density of 1.325 kg/m<sup>3</sup>

Solar radiation:

The turbine shall resist solar radiation (including UV) with 1000 W/m<sup>2</sup> and 8000 MJ/m<sup>2</sup> per year throughout the design lifetime

Lightning protection system (standard and protection class):

IEC 61400-24:2010, Protection Level 1



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#### Major components:

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

##### Blade:

Type: 54m Structural shell  
Manufacturer: Vestas, TPI China  
Material: Glass fibre and carbon fibre reinforced epoxy  
Blade length: 54m  
Number of blades: 3  
Drawing / Data sheet / Part No.: 29061061 or 29083499 (2000 kW)  
29061061 (2200 kW)

##### Blade bearing:

Type: 2 row 4-point contact ball bearing  
Manufacturer: Rollix  
Drawing / Data sheet / Part No.: 13-1920-02-DD0-5

##### Blade bearing:

Type: 2 row 4-point contact ball bearing  
Manufacturer: Liebherr  
Drawing / Data sheet / Part No.: 648 VO 802-000

##### Blade bearing:

Type: 2 row 4-point contact ball bearing  
Manufacturer: TMB  
Drawing / Data sheet / Part No.: B030.65.1920K

##### Pitch System:

Motor / Actuator Type: One hydraulic cylinder per blade  
Pitch Controller Type: Hydraulic  
Manufacturer: LJM



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#### Pitch System:

Motor / Actuator Type: One hydraulic cylinder per blade  
Pitch Controller Type: Hydraulic  
Manufacturer: Glual

#### Pitch System:

Motor / Actuator Type: One hydraulic cylinder per blade  
Pitch Controller Type: Hydraulic  
Manufacturer: Hine

#### Main shaft:

Type: Forged hollow trumpet shaft  
Material: 42CrMo4  
Drawing / Data sheet / Part No.: 29085836

#### Main bearing:

Type: Two double row spherical roller bearing  
Manufacturer: SKF  
Drawing / Data sheet / Part No.: 230/630 CA/HM2 W33  
24188 ECA/HM2 W33

#### Main bearing:

Type: Two double row spherical roller bearing  
Manufacturer: KOYO  
Drawing / Data sheet / Part No.: 230/630 RHAW33T  
24188 RHAW33

#### Main bearing:

Type: Two double row spherical roller bearing  
Manufacturer: FAG  
Drawing / Data sheet / Part No.: F-582558.PRL-WPO  
F-582559.PRL-WPO

#### Gearbox:

Type: 3 stage gearbox (1 planetary stage)



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Manufacturer: Winergy  
Gear Ratio: 1:112.2  
Drawing / Data sheet / Part No.: PEAB 4440

#### **Gearbox:**

Type: 3 stage gearbox (1 planetary stage)  
Manufacturer: ZF  
Gear Ratio: 1:112.36  
Drawing / Data sheet / Part No.: Atlas 1.2, 1.21

#### **Yaw System:**

Drive Type: Electrical motor  
Manufacturer: ABB or Lafert  
Drawing / Data sheet / Part No.: 29005012

Bearing Type: Friction Bearing (PETP slide plate)  
Manufacturer: Vestas Wind System A/S  
Drawing / Data sheet / Part No.: 29011239.V01

Gear Type: Planetary-/worm gear combination  
Manufacturer: Bonfiglioli, Comer  
Drawing / Data sheet / Part No.: 29014048 (left) /29014049 (right)

Brake Type: Friction brake, motor brake included in  
the drive unit  
Manufacturer: ABB or Lafert  
Drawing / Data sheet / Part No.: 29005012

#### **Generator:**

Type: DVSG 500/4M SP.  
(Asynchronous generator with wound  
rotor)  
Manufacturer: Vestas Wind System A/S  
Rated Power: 2060 kW or 2260 kW



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Rated Frequency:	50 Hz
Rated Speed:	1680 rpm
Rated Voltage:	690 VAC
Rated Current:	1573 A or 1713 A
Insulation Class:	H/H
Degree of Protection:	IP54
Drawing / Data sheet / Part No.:	0007-0081.V09 (2060 kW) 0057-1280.V02 (2260kW)

#### Converter:

Type:	Full quadrant IGBT
Manufacturer:	Vestas Wind System A/S
Rated Voltage (grid side):	480 V
Nominal current (at 2.0 MW)	
Grid	240 A
Rotor	592 A
Nominal current (at 2.2 MW)	
Grid	256 A
Rotor	655 A
Degree of Protection:	IP 54

#### Transformer:

Type:	Dry type
Manufacturer:	Siemens
Rated Voltage:	HV side: 10500-35000 V LV side: 690 V +/-2% & 480 V +/-2%

#### Transformer:

Type:	Dry type
Manufacturer:	SGB
Rated Voltage:	HV side: 10500-35000 V LV side: 690 V +/-2% & 480 V +/-2%

#### Transformer:

Type:	Dry type
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**TYPE CERTIFICATE**  
**Wind Turbine**

Manufacturer: JST  
Rated Voltage: HV side: 10500-35000 V  
LV side: 690 V +/-2% & 480 V +/-2%

**Tower:**

Type: Tubular steel  
Sections: 3  
Hub height: 75 m  
Drawing / Data sheet / Part No.: 0059-1124.V00 (T2X302)

**Tower:**

Type: Tubular steel  
Sections: 4  
Hub height: 80 m  
Drawing / Data sheet / Part No.: 0043-5737.V00 (T2X103)

**Tower:**

Type: Tubular steel  
Sections: 3  
Hub height: 80 m  
Drawing / Data sheet / Part No.: 0044-7632.V1 (T2X203)

**Tower:**

Type: Tubular steel  
Sections: 3  
Hub height: 80 m  
Drawing / Data sheet / Part No.: 0056-9134.V00 (T2X300)

**Tower:**

Type: Tubular steel  
Sections: 4  
Hub height: 95 m  
Drawing / Data sheet / Part No.: 0039-6458.V00 (T2X122)





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### Wind Turbine

#### **Tower:**

Type: Tubular steel  
Sections: 4  
Hub height: 95 m  
Drawing / Data sheet / Part No.: 0044-7654.V01 (T2X222)

#### **Tower:**

Type: Tubular steel  
Sections: 4  
Hub height: 95 m  
Drawing / Data sheet / Part No.: 0056-8544.V01 (T2X320)

#### **Tower:**

Type: Tubular steel  
Sections: 4  
Hub height: 95 m  
Drawing / Data sheet / Part No.: 0056-9137.V01 (T2X321)

#### **Tower:**

Type: Tubular steel  
Sections: 4  
Hub height: 110 m  
Drawing / Data sheet / Part No.: 0056-9139.V02 (T2X330)

#### **Tower:**

Type: Tubular steel  
Sections: 5  
Hub height: 120 m  
Drawing / Data sheet / Part No.: 0056-9140.V02 (T2X331)

#### **Tower:**

Type: Tubular steel



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### **Wind Turbine**

Sections: 5  
Hub height: 125 m  
Drawing / Data sheet / Part No.: 0048-4332.V00 (T2X133)

#### **Manuals:**

Operation & maintenance manual: See list of manuals  
0068-9605.V01  
Transport manual: See list of manuals  
0068-9605.V01  
Installation & commissioning manual: See list of manuals  
0068-9605.V01



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#### Annex 1 – Configuration matrix

Wind turbine class	Tower	Rated power (kW)	$V_{ave}$ (m/s)	$I_{ref}$
S (3A*)	T2X103	2000	7.5	0.16
S (3A*)	T2X122	2000	7.5	0.16
S (3A*)	T2X320	2000	7.5	0.16
S (3A*)	T2X300	2000	7.5	0.16
S (3B*)	T2X302	2000	7.5	0.14
S (3B*)	T2X222	2000	7.5	0.14
S (3B*)	T2X321	2000	7.5	0.14
S (3B*)	T2X330	2000	7.5	0.14
S (3B*)	T2X331	2000	7.5	0.14
S (3B*)	T2X133	2000	7.5	0.14
S (3C*)	T2X203	2000	7.5	0.12
S	T2X103	2200	6.5	0.16
S	T2X122	2200	6.5	0.16
S	T2X320	2200	6.5	0.16
S	T2X300	2200	6.5	0.16
S	T2X302	2200	6.5	0.14
S	T2X222	2200	6.5	0.14
S	T2X321	2200	6.5	0.14
S	T2X330	2200	6.5	0.14
S	T2X331	2200	6.5	0.14
S	T2X133	2200	6.5	0.14
S	T2X203	2200	6.5	0.12

\* Only temperature levels (LT) deviate from this turbine class