



Certificate No.

IECRE.WE.TC.18.0014-R2

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 V110-2 MW 60 Hz VCSS 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 and later renewed according to IECRE OD-501 Ed.2. It is based on the following reference documents:

Design basis evaluation conformity statement
Dated

DB-DNVGL-SE-0074-02061-3
2017-10-06

Design evaluation conformity statement
Dated

DE-B-DNVGL-SE-0074-02062-4
2020-01-16

Type test conformity statement
Dated

TT-B-DNVGL-SE-0074-02063-4
2020-01-16

Manufacturing conformity statement
Dated

ME-B-DNVGL-SE-0074-02064-5
2020-01-16

Final evaluation report
Dated

FER-TC-B-DNVGL-SE-0074-02060-6
2020-01-16

The conformity evaluation was carried out in accordance with the rules and procedures of the IECRE System www.iecre.org

The wind turbine type specification begins on page 2 of this certificate. Outstanding issues are listed in the last page 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:
2021-01-15

Approved for issue on behalf of the IECRE
Certification Body:



Florian Willers Bente Vestergaard

Florian Willers / Bente Vestergaard
Project Manager / Service Line Leader,
Type Certification
Hamburg / Hellerup 2020-01-16

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:	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, T2X123, T2X222, T2X320, T2X321 110 m, T2X330 120 m, T2X331 (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 - 36000 V
Normal supply frequency and range:	60 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/m³
Low temperature turbine
1.325 kg/m³

The -30 °C minimum operating temperature has been verified for loads and structural integrity by considering an air density of 1.325 kg/m³

Solar radiation:

The turbine shall resist solar radiation (including UV) with 1000 W/m² and 8000 MJ/m² 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 Wind System A/S, TPI China,
Aries Brazil, Aelon 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: 1:89.75
Drawing / Data sheet / Part No.: PEAB 4440

Gearbox:

Type: 3 stage gearbox (1 planetary stage)
Manufacturer: ZF
Gear Ratio: 1:89.8
Drawing / Data sheet / Part No.: Atlas 1.0, 1.1, 1.2, 1.21

Yaw System:

Drive Type: Electrical motor
Manufacturer: ABB or Lafert
Drawing / Data sheet / Part No.: 29005013

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.: 29005013

Generator:

Type: DVSG 500/6M (Asynchronous generator
with wound rotor)
Manufacturer: Vestas Wind System A/S
Rated Power: 2060 kW or 2260 kW
Rated Frequency: 60 Hz



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Rated Speed:	1344 rpm
Rated Voltage:	690 VAC
Rated Current:	1558 A or 1708 A
Insulation Class:	H/H
Degree of Protection:	IP54
Drawing / Data sheet / Part No.:	0046-9904.V0 (2060 kW) 0054-3041.V0 (2260 kW)

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: 10500-36000 V LV side: 690 V +/-2% & 480 V +/-2%

Transformer:

Type:	Dry type
Manufacturer:	SGB
Rated Voltage:	HV side: 10500-36000 V LV side: 690 V +/-2% & 480 V +/-2%

Transformer:

Type:	Dry type
Manufacturer:	JST



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Rated Voltage: HV side: 10500-36000 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.V01 (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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Tower:

Type: Tubular steel
Sections: 4
Hub height: 95 m
Drawing / Data sheet / Part No.: 0051-4179.V00 (T2X123)

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



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Hub height: 120 m
Drawing / Data sheet / Part No.: 0056-9140.V02 (T2X331)

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

ID ¹	Wind turbine class	Tower	Rated power (kW)	V _{ave} (m/s)	I _{ref}
1.1	S (3A*)	T2X103	2000	7.5	0.16
6.1	S (3A*)	T2X300	2000	7.5	0.16
2.1	S (3A*)	T2X122	2000	7.5	0.16
3.1	S (3A*)	T2X123	2000	7.5	0.16
8.1	S (3A*)	T2X320	2000	7.5	0.16
7.1	S (3B*)	T2X302	2000	7.5	0.14
5.1	S (3B*)	T2X222	2000	7.5	0.14
9.1	S (3B*)	T2X321	2000	7.5	0.14
10.1	S (3B*)	T2X330	2000	7.5	0.14
11.1	S (3B*)	T2X331	2000	7.5	0.14
4.1	S (3C*)	T2X203	2000	7.5	0.12
1.2	S	T2X103	2200	6.5	0.16
6.2	S	T2X300	2200	6.5	0.16
2.2	S	T2X122	2200	6.5	0.16
3.2	S	T2X123	2200	6.5	0.16
8.2	S	T2X320	2200	6.5	0.16
7.2	S	T2X302	2200	6.5	0.14
5.2	S	T2X222	2200	6.5	0.14
9.2	S	T2X321	2200	6.5	0.14
10.2	S	T2X330	2200	6.5	0.14
11.2	S	T2X331	2200	6.5	0.14
4.2	S	T2X203	2200	6.5	0.12

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

¹ The ID follows the tower with its first digit, the second digit is only consecutive to identify the different configurations within one tower.



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Outstanding issues:

The following are the outstanding issues in order to achieve the full Type Certificate:

- Gap analysis between the IEC 61400-22:2010 and IECRE OD-501, Ed.2 shall be submitted for review and needs to be accepted by DNV GL.
- The manufacturing evaluation for the following components are pending for full Type Certificate.

Component	Manufacturer / Workshop	DNV GL Inspection date
Gearbox (Winergy PEAB 4440)	Winergy facilities in Voerde, Germany	2015-01-09
Gearbox (ZF Atlas 1.0/1.2)	ZF facilities in Gainesville, GA USA	2012-11-28
Nacelle and hub assembly	Vestas, Colorado	2014-11-10
V110 Blade	Vestas, Smed Hansenevej 23 Lem, Denmark	2014-03-19
V110 Blade	Vestas, Smed Hansenevej 23 Lem, Denmark	2015-02-25
V110 Blade	Vestas, Smed Hansenevej 23 Lem, Denmark	2015-06-03
V110 Blade	TPI, Dafeng, China	2015-05-07
Tower	GWS Galicia, O Carballiño Ourense, Spain	2015-07-22