



Certificate No.

**IECRE.WE.TC.19.0050-R6**

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 V117-4.0 MW / V117-4.2 MW

wind turbine class (class, standard, year)

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

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-0074-04861-4  
2020-12-18

Design evaluation conformity statement  
Dated

DE-DNVGL-SE-0074-04461-6  
2020-12-18

Manufacturing evaluation conformity statement  
Dated

ME-DNVGL-SE-0074-04862-4  
2020-12-18

Type test conformity statement  
Dated

TT-DNVGL-SE-0074-04863-5  
2020-12-18

Final evaluation report  
Dated

FER-TC-DNVGL-SE-0074-04860-5  
2020-12-18

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.

Changes in the system design or the manufacturer's quality system are to be approved by DNV GL. Without approval, the certificate loses its validity.

This certificate is valid until:  
2024-11-28

Approved for issue on behalf of the IECRE  
Certification Body:

*P. Ramakrishna* *Bente Vestergaard*

Ramakrishna Parasarampuram / Bente Vestergaard  
Project Manager / Service Line Leader, Type  
Certification  
Hamburg/Hellerup 2020-12-18



Renewables Certification  
Brooktorkai 18  
20457 Hamburg, Germany



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## TYPE CERTIFICATE

### Wind Turbine

#### Machine parameters:

|  |   |
|--|---|
| Power regulation:  | pitch-controlled  |
| Rotor orientation:   | Upwind  |
| Number of rotor blades:                                    | 3   |
| Rotor tilt:  | 6.0°  |
| Cone angle:  | -4.0°   |
| Rated power:   | 4000 kW / 4200 kW<br>(HH 84m & HH 91.5 m)                     |
|  | 4200 kW<br>(HH 94 m & HH 114 m)                               |
| Rated wind speed $V_r$ :                                   | Annex 1   |
| Rotor diameter:  | 117 m   |
| Hub height(s):   | 84 m, 91.5 m, 94 m, 114 m                                     |
| Hub height operating wind speed range $V_{in} - V_{out}$ : | 3.0 – 27.0 m/s (HWO disabled)<br>3.0 – 32.0 m/s (HWO enabled) |
| Design life time:  | 20 years  |
| Software version:  | 2019.06   |

#### Wind conditions:

|  |         |
|--|---------|
| Characteristic turbulence intensity $I_{ref}$ at $V_{hub} = 15$ m/s: | Annex 1 |
| Annual average wind speed at hub height $V_{ave}$ :                  | Annex 1 |
| Reference wind speed $V_{ref}$ :                                     | Annex 1 |
| Mean flow inclination:   | Annex 1 |

#### Electrical network conditions:

|   |                          |
|---|--------------------------|
| Normal supply voltage and range:                      | 720 V                    |
| 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          |



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## TYPE CERTIFICATE

### Wind Turbine

#### Other environmental conditions (where taken into account): HH 84 m & HH 91.5 m

|  |   |
|--|---|
| Normal and extreme temperature ranges:                       | Normal: -20°C to +45°C*<br>Extreme: -30°C to +50°C  |
| Low temperature turbine                                      | Normal: -30°C to +45°C*<br>Extreme: -40°C to +50°C  |
| Relative humidity of the air:                                | 100% (max 40% of time) and<br>90% (rest of life time)   |
| Air density:   | 1.225 kg/m <sup>3</sup> (for normal<br>operation)<br>1.325 kg/m <sup>3</sup> (for low<br>temperature operation) |
| Solar radiation:   | 1000 W/m <sup>2</sup>   |
| Lightning protection system (standard and protection class): | Designed acc. to IEC 61400-24,<br>Protection Level 1 and IEC<br>61312-1   |

\*de-rating strategy above +30°C for 4.0 MW and above +20°C for 4.2 MW

#### Other environmental conditions (where taken into account): HH 94m & HH 114 m

|  |   |
|--|---|
| Normal and extreme temperature ranges:                       | -8.4°C to +23.5°C   |
| Relative humidity of the air:                                | 100% (max 40% of time) and<br>90% (rest of life time)                   |
| Air density:   | 1.140 kg/m <sup>3</sup> (HH 94 m)<br>1.135 kg/m <sup>3</sup> (HH 114 m) |
| Solar radiation:   | 1000 W/m <sup>2</sup>   |
| Lightning protection system (standard and protection class): | Designed acc. to IEC 61400-24,<br>Protection Level 1 and IEC<br>61312-1 |



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## **TYPE CERTIFICATE**

### **Wind Turbine**

#### **Major components:**

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

#### **Blade:**

Type: Air foil shells bonded to supporting beam  
Material: Fibreglass reinforced epoxy, carbon fibres and Solid Metal Tip (SMT)  
Blade length: 57.15 m  
Number of blades: 3  
Manufacturer: Vestas  
Drawing / Data sheet / Part No.: 0037-6856, Rev. 6

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

Type: Serrated Trailing Edge (STE), Root Vortex Generator (RVG), Gurney Flap Assembly  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part no.: STE: 0054-9342, Rev.1  
RVG: 0043-3896, Rev.2  
Gurney Flap Assembly: 0056-7084, Rev.1

#### **Blade bearing:**

Type: Double row four-point contact ball bearing  
Manufacturer: Laulagun/Rollix/Liebherr/TMB  
Drawing / Data sheet / Part No.: 29058368, Rev.1

#### **Pitch System:**

Type: Hydraulic power unit  
Manufacturer: LJM/Glual/Hine/Liebherr  
Hydraulic Cylinder (140/90x922): 29080628, Rev.1

Type: Pitch Actuation Module  
Manufacturer: Vestas Wind Systems A/S  
Drawing / Data sheet / Part no.: 29113716, Rev.1



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## TYPE CERTIFICATE

### Wind Turbine

#### Main shaft:

Type: Cast iron  
Material: EN-GJS-500-14  
Drawing / Data sheet / Part no.: 29085300, Rev. 4

#### Main bearing:

Type: Spherical Roller Bearing  
Manufacturer: SKF/FAG/JTKET-Koyo  
Drawing / Data sheet / Part no.: SKF - 240/950 CA/C3LW 33VQ113  
FAG - F-582562.PRL-WPO 000  
JTKET-Koyo - 240/950 RHAW33TS1CS

#### Gearbox:

Type: 2 stage planetary and 1 helical stage gearbox  
Manufacturer: Winergy (PZAB 3530.3)  
Gear ratio: 1:112.630  
Drawing / Data sheet / Part no.: A5E43498362A, Rev. 001-AA

#### Yaw System:

Drive type: 8 x 2.7 kW, 400 V, 50 Hz asynchronous motors  
Drive manufacturer: Lafert  
Drawing / Data sheet / Part no.: MZ10/A4A-55337

Drive type: 8 x 3.2 kW, 400 V, 60 Hz asynchronous motors  
Drive manufacturer: Lafert  
Drawing / Data sheet / Part no.: MZ10/A4A-55338

Drive type: 8 x 2.7 kW, 400 V, 50 Hz asynchronous motors  
Drive manufacturer: ABB  
Drawing / Data sheet / Part no.: 3GZF500810-23 A 14 AA 100 A



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## TYPE CERTIFICATE

### Wind Turbine

|                                  |   |
|----------------------------------|---|
| Drive type:                      | 8 x 3.2 kW, 400 V, 60 Hz asynchronous motors        |
| Drive manufacturer:              | ABB   |
| Drawing / Data sheet / Part no.: | 3GZF500810-23 A 14 AA 100 A                         |
| Drive type:                      | 8 x 2.7 kW, 400 V, 50 Hz asynchronous motors        |
| Drive manufacturer:              | Bonfiglioli   |
| Drawing / Data sheet / Part no.: | CD00006614-02                                       |
| Drive type:                      | 8 x 3.2 kW, 400 V, 60 Hz asynchronous motors        |
| Drive manufacturer:              | Bonfiglioli   |
| Drawing / Data sheet / Part no.: | CD00007013-01                                       |
| Gear type:                       | Bevel stage and three planetary stages, $i = 952.3$ |
| Gear manufacturer:               | Bonfiglioli   |
| Drawing / Data sheet / Part no.: | I7090T010300  |
| Gear type:                       | Bevel stage and three planetary stages, $i = 935$   |
| Gear manufacturer:               | Comer   |
| Drawing / Data sheet / Part no.: | N07297_01   |
| Bearing type:                    | Preloaded sliding bearing, PETP pads                |
| Bearing manufacturer:            | Vestas Wind Systems A/S                             |
| Drawing / Data sheet / Part no.: | 29104726, Rev. 0                                    |



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## TYPE CERTIFICATE

### Wind Turbine

#### Generator:

Type: DASG 560/6M, Induction generator  
Manufacturer: Vestas Nacelles Deutschland (VND)  
Rated power: 4450 kW  
Rated frequency: 74 Hz  
Rated speed: 1485 rpm  
Rated voltage: 800 V  
Rated current: 3650 A  
Insulation class: H  
Degree of protection: IP54  
Drawing / Data sheet / Part no.: 0071-4454, Rev. 0

#### Converter:

Type: Full quadrant IGBT  
Manufacturer: Vestas Wind Systems A/S  
Rated voltage machine/grid: 800 Vrms / 720 Vrms  
Rated current: 4500 A  
Degree of protection: IP54  
Drawing / Data sheet / Part no.: 0069-2805, Rev. 0

#### Transformer:

Type: Cast-Resin transformer  
4GY6781-1EY  
Manufacturer: Siemens  
Rated voltage: 33 / 0.72 V  
Degree of protection: IP00  
Drawing / Data sheet / Part no.: 0073-7914, Rev. 0

Type: Cast-Resin transformer  
DTTH1N 5000/30  
Manufacturer: SGB  
Rated voltage: 33 / 0.72 V  
Degree of protection: IP00  
Drawing / Data sheet / Part no.: 0073-7915, Rev. 02



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## TYPE CERTIFICATE

### Wind Turbine

#### **Tower:**

Type: Conical steel  
Number of sections: 4  
Length: 81.4 m (HH 84 m)  
Drawing / Data sheet / Part no.: 0078-1303 Rev. 0 (T755401)

Type: Conical steel  
Number of sections: 4  
Length: 89.3 m (HH 91.5 m)  
Drawing / Data sheet / Part no.: 0075-2831, Rev. 0 (T755B01)

Type: Tubular / Conical steel  
Number of sections: 4  
Length: 91.6 m (HH 94 m)  
Drawing / Data sheet / Part no.: A009-4180, Rev. 1 (T755E02)

Type: Tubular / Conical steel  
Number of sections: 5  
Length: 111.6 m (HH 114 m)  
Drawing / Data sheet / Part no.: A008-9339, Rev. 2 (T757200)

#### **Manuals:**

Operating manual: 0079-9811, Rev. 1  
Transportation and handling manual: 0079-9801, Rev. 2  
Installation manual: 0079-9663, Rev. 2  
Commissioning manual: 0079-9665, Rev. 0

#### **Service lift:**

Manufacturer: Avanti  
Type: Avanti Shark / Avanti Dolphin / Avanti  
Beluga





Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

## **TYPE CERTIFICATE**

### **Wind Turbine**

Manufacturer: Power climber  
Type: Sherpa-SD4

#### **Crane:**

Manufacturer: Star 071/95 Liftket  
Maximum lifting capacity: max 800 kg



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

**TYPE CERTIFICATE**  
**Wind Turbine**

**Annex 1**

**Configurations covered by this Type Certificate**

| ID* | Variants    | Hub Height | IEC WT class   | Turbulence Intensity I <sub>ref</sub> | Inflow angle | Rated wind speed V <sub>r</sub> | Mean wind speed V <sub>ave</sub> | Reference wind speed V <sub>ref</sub> |
|-----|-------------|------------|--|---------------------------------------|--------------|---------------------------------|----------------------------------|---------------------------------------|
| 1.1 | V117-4.0 MW | 84         | S (IEC 1B except temperature ranges, V <sub>ref</sub> and inflow angle)                    | 0.14                                  | 0°           | 11.7 m/s                        | 10.0 m/s                         | 57.0 m/s                              |
| 1.2 | V117-4.2 MW | 84         | S (IEC 1B except temperature ranges, V <sub>ave</sub> , V <sub>ref</sub> and inflow angle) | 0.14                                  | 0°           | 12.0 m/s                        | 9.5 m/s                          | 57.0 m/s                              |
| 1.3 | V117-4.0 MW | 84         | S (IEC 1A except temperature ranges, V <sub>ave</sub> , V <sub>ref</sub> and inflow angle) | 0.16                                  | 0°           | 11.7 m/s                        | 8.5 m/s                          | 57.0 m/s                              |
| 1.4 | V117-4.2 MW | 84         | S (IEC 1A except temperature ranges, V <sub>ave</sub> , V <sub>ref</sub> and inflow angle) | 0.16                                  | 0°           | 12.0 m/s                        | 8.5 m/s                          | 57.0 m/s                              |
| 2.1 | V117-4.0 MW | 91.5       | S (IEC 2A except temperature ranges)   | 0.16                                  | 8°           | 11.7 m/s                        | 8.5 m/s                          | 42.5 m/s                              |
| 2.2 | V117-4.2 MW | 91.5       | S (IEC 2A except temperature ranges)   | 0.16                                  | 8°           | 12.0 m/s                        | 8.5 m/s                          | 42.5 m/s                              |
| 2.3 | V117-4.0 MW | 91.5       | S (IEC 1B except temperature ranges)   | 0.14                                  | 8°           | 11.7 m/s                        | 10.0 m/s                         | 50.0 m/s                              |
| 2.4 | V117-4.2 MW | 91.5       | S (IEC 1B except temperature ranges and V <sub>ave</sub> )                                 | 0.14                                  | 8°           | 12.0 m/s                        | 9.5 m/s                          | 50.0 m/s                              |
| 3.1 | V117-4.2 MW | 94         | S  | Annex 2                               | -0.6°        | 12.0 m/s                        | 6.65 m/s                         | 41.9 m/s                              |
| 4.1 | V117-4.2 MW | 114        | S  | Annex 2                               | 0.2°         | 12.0 m/s                        | 6.05 m/s                         | 47.0 m/s                              |

\* 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



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

**TYPE CERTIFICATE**  
**Wind Turbine**

**Annex 2**

**HH 94 m (VSC Table):**

| SiteTurb | DETwind | NTM_Fat | NTM_Ext | ETM    |
|----------|---------|---------|---------|--------|
| 1 3      | 0.4593  | 0.4316  | 0.5425  | 1.6102 |
| 3 5      | 0.327   | 0.318   | 0.39    | 0.8476 |
| 5 7      | 0.264   | 0.268   | 0.328   | 0.6199 |
| 7 9      | 0.244   | 0.255   | 0.31    | 0.5345 |
| 9 11     | 0.235   | 0.248   | 0.299   | 0.4803 |
| 11 13    | 0.224   | 0.233   | 0.28    | 0.4236 |
| 13 15    | 0.214   | 0.218   | 0.261   | 0.375  |
| 15 17    | 0.205   | 0.204   | 0.245   | 0.3365 |
| 17 19    | 0.202   | 0.194   | 0.226   | 0.2984 |
| 19 21    | 0.204   | 0.177   | 0.214   | 0.2728 |
| 21 23    | 0.186   | 0.165   | 0.194   | 0.2397 |
| 23 25    | 0.186   | 0.156   | 0.188   | 0.2259 |
| 25 27    | 0.183   | 0.1486  | 0.1779  | 0.2083 |
| 27 29    | 0.18    | 0.1419  | 0.1701  | 0.1947 |
| 29 31    | 0.1774  | 0.1361  | 0.1634  | 0.1866 |
| 31 33    | 0.1751  | 0.131   | 0.1575  | 0.1803 |
| 33 35    | 0.1732  | 0.1265  | 0.1523  | 0.1747 |
| 35 37    | 0.1714  | 0.1226  | 0.1477  | 0.1697 |
| 37 45    | 0.19    | 0.19    | 0.19    | 0.1987 |



Certificate. No.

**IECRE.WE.TC.19.0050-R6**

IECRE - IEC System for Certification  
to Standards Relating to Equipment  
for Use in Renewable Energy  
Applications

**TYPE CERTIFICATE**  
**Wind Turbine**

**HH 114 m (VSC Table):**

| SiteTurb | DETwind | NTM_Fat | NTM_Ext | ETM    |
|----------|---------|---------|---------|--------|
| 1 3      | 0.5519  | 0.5172  | 0.5538  | 1.7694 |
| 3 5      | 0.378   | 0.363   | 0.383   | 0.9288 |
| 5 7      | 0.301   | 0.296   | 0.31    | 0.6486 |
| 7 9      | 0.281   | 0.28    | 0.294   | 0.5085 |
| 9 11     | 0.268   | 0.268   | 0.28    | 0.4498 |
| 11 13    | 0.248   | 0.249   | 0.258   | 0.3903 |
| 13 15    | 0.235   | 0.233   | 0.241   | 0.3463 |
| 15 17    | 0.222   | 0.219   | 0.227   | 0.3118 |
| 17 19    | 0.205   | 0.201   | 0.21    | 0.2773 |
| 19 21    | 0.197   | 0.155   | 0.193   | 0.2564 |
| 21 23    | 0.185   | 0.145   | 0.171   | 0.2411 |
| 23 25    | 0.183   | 0.138   | 0.167   | 0.2283 |
| 25 27    | 0.1749  | 0.1286  | 0.1549  | 0.2176 |
| 27 29    | 0.1697  | 0.1195  | 0.1465  | 0.2083 |
| 29 31    | 0.1653  | 0.1115  | 0.1392  | 0.2003 |
| 31 33    | 0.1614  | 0.1045  | 0.1328  | 0.1933 |
| 33 35    | 0.158   | 0.0984  | 0.1271  | 0.1871 |
| 35 37    | 0.1549  | 0.0929  | 0.1221  | 0.1816 |
| 37 50    | 0.149   | 0.149   | 0.149   | 0.1767 |