



Certificate No.

**IECRE.WE.CC.20.0038-R0**

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

## PROVISIONAL COMPONENT CERTIFICATE

### Wind Turbine

This certificate is issued to

General Electric Renovables España, S.L.  
C/ Roc Boronat, 78  
08005 Barcelona  
Spain

for the component

HALIADE-X

wind turbine class (class, standard, year)

Class IB, adapted to offshore wind conditions; IEC 61400-1:2019-02

This certificate attests compliance with the operational documents of the IECRE system and applicable technical standards such as the 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-0074-03480-0  
2018-06-29

Design evaluation conformity statement  
Dated

IECRE.WE.CS.20.0049-R0  
2020-06-05

Type test conformity statement  
Dated

TT-B-DNVGL-SE-0074-03483-0  
2020-06-09

Manufacturing conformity statement  
Dated

ME-DNVGL-SE-0074-03482-0  
2019-08-30

Final evaluation report  
Dated

FER-TCO-B-DNVGL-SE-0074-03484-0  
2020-06-09

Provisional component certificate issued by  
Dated

IECRE.WE.CC.20.0018-R0 issued by TÜV NORD CERT GmbH  
2020-03-24  
*(DNV GL takes no responsibility for the work covered by this certificate)*

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 component specification begins on page 2 of this component certificate. Outstanding issues in the case of a provisional component certificate 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 DNV GL. Without approval, the certificate loses its validity.

This certificate is valid until:  
2021-03-23

Approved for issue on behalf of the IECRE  
Certification Body:

Gema Parro / Bente Vestergaard  
Project Manager / Service Line Leader, Type  
Certification  
Hellerup 2020-06-09



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:	12000 kW
Rated wind speed $V_r$ :	10.5 m/s
Rotor diameter:	220 m
Hub height(s):	138 m
Hub height operating wind speed range $V_{in} - V_{out}$ :	3.5-28 m/s
Design life time:	25 years
Wind turbine control system, software release:	GEWindOffshore_V01.01.01
Wind turbine safety PLC, software version:	V01.01.01
Pitch Safety PLC, software version:	HaliadeX_Proto_v00_00

#### Wind conditions:

Characteristic turbulence intensity at $V_{hub}$ :	0.14
Annual average wind speed at hub height $V_{ave}$ :	10.0 m/s
Weibull shape factor $k$ :	2.0
Mean flow inclination:	0°
50 Year mean wind speed (10min avg.), $V_{50}$ :	50.0 m/s
1 Year mean wind speed (10min avg.), $V_1$ :	40.0 m/s



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#### **Electrical network conditions:**

Normal supply voltage and range:	66 kV $\pm$ 10%
Normal supply frequency and range:	50 Hz -6% / +4%
Voltage imbalance:	2.5% V
Maximum duration of electrical power network outages:	As per IEC 61400-1 Ed.4 requirements, section 6.5
Number of electrical network outages	As per IEC 61400-1 Ed.4 requirements, section 6.5



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

Design conditions in case of offshore WT (water depth, wave conditions, salinity, etc.):	Marine environment for atmospheric zone, ref. IEC 61400-3 ed.1 Hydrodynamic loading not included
	Corrosion class acc. IDO-12944-2 External surfaces: C5 Internal surfaces: C-4
Normal and extreme temperature ranges: Extreme temperature range: Maximum operation temperature without derating:	-10 °C to +40 °C (operating) -20 °C to +50 °C (survival) +25 °C
Relative humidity of the air:	10% to 100%
Air density:	1.24 kg/m <sup>3</sup>
Solar radiation:	1000 W/m <sup>2</sup>
Lightning protection system (standard and protection class):	Designed acc. to IEC 61400-24, Protection Level I
Earthquake model and parameters (standard and key parameters e.g. spectrum, model, seismic zone, soil class, etc.):	Not applicable
Other design conditions :	Not applicable

#### **Interfaces:**

Tower, tower top flange to upper section bolted connection, tower internals and diesel generator are not covered Load calculations are valid for tower frequency range:	0.18 Hz to 0.26 Hz
Interface to other components or systems and design loads	See Final Evaluation Report: FER-TCO-B-DNVGL-SE-0074-03484-0 dated 2020-06-09



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## **PROVISIONAL COMPONENT CERTIFICATE**

### **Wind Turbine**

#### **Major components:**

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

#### **Blade:**

Type: LM107P

Material: glass fibre reinforced polyester material in  
a sandwich construction; spar cap  
consists of glass and carbon fibre  
reinforced polyester material and hybrid  
reinforced vinyl ester material; core  
material is end grain balsa wood for the  
blade shell and PVC-foam for the shear  
webs

Blade length: 107 m

Number of blades: 3

Manufacturer: LM Wind Power

Drawing / Data sheet / Part No.: DR-08898/A2, Rev. A2

#### **Blade bearing:**

Type: Double row four contact ball slewing  
bearing

Manufacturer: Rollix

Drawing / Data sheet / Part No.: 12-5580-00, Rev. B

#### **Pitch System:**

Type: Three stages planetary gearbox with  
pinion shaft

Manufacturer: Liebherr Components Biberach GmbH

Drawing / Data sheet / Part No.: 368 451 4000 99 0, Rev. 00.13

#### **Main shaft:**

Type: Cast Component

Material: EN-GJS-400-18-LT

Drawing / Data sheet / Part No.: 448W6388, Rev. A



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#### **Main bearing:**

Type: Two taper roller bearings  
Manufacturer: Timken Company  
Drawing / Data sheet / Part No.: E-57384, Rev. F (front bearing)  
E-57383, Rev. F (rear bearing)

#### **Yaw System:**

*Gear/Drive Type:* Four stages planetary gearbox with pinion shaft and electric motor with electrobrakes  
Manufacturer: Liebherr Components Biberach GmbH  
Drawing / Data sheet / Part No.: 368 452 5000 99 0, rev. 01.5

*Bearing Type:* Friction bearing with 24 upper pads, four front calipers and eight rear calipers  
Manufacturer: GE Renewable Energy  
Drawing / Data sheet / Part No.: 447W6166, rev. -

#### **Generator:**

Type: Permanent magnet synchronous generator (PMSG)  
DD12-3MV-120P-9600-1150  
Manufacturer: GE Renewable Energy  
Drawing / Data sheet / Part No.: WE-47700, Rev. A  
Rated Power: 12798 kW  
Rated Frequency: 7.81 Hz  
Rated Speed: 7.81 rpm  
Rated Voltage: 3220 V  
Rated Current: 2 x 1455 A  
Insulation Class: F  
Degree of Protection: IP54

#### **Converter:**

Type: PCS6000 Wind  
Manufacturer: ABB Switzerland Ltd.



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Drawing / Data sheet / Part No.: 3BHE054727\_E01, Rev. B  
Rated Voltage (machine side/grid side): 3.3 kV / 3.1 kV  
Rated Current (machine side/grid side): 2 x 1600 A / 2 x 1600 A  
Degree of Protection: IP54

#### **Transformer:**

Type: KTAU/M 72 NM 15250 – Ester-immersed  
Manufacturer: ABB  
Drawing / Data sheet / Part No.: YKLZE 2168, dated 17.09.2018  
Rated Voltage: 66 kV  
Degree of protection: n/s  
Location (e.g. tower bottom): Nacelle

#### **Manuals:**

Operation & maintenance manual: 17\_054 Gxxx\_BDC101.R3  
17\_054 Gxxx\_BDC200.R2

Installation & commissioning. manual: WOS-TI\_IDI-025\_HALX.R02  
WOS-T&I\_IDI-024\_HALX.R02  
HAL-X Commissioning Manual.RevA



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#### **Outstanding issues**

The following outstanding items are pending before the issue of Component Certificate:

- Deviations between GE and DNV GL fatigue calculation methods on some structural components are to be clarified, and corresponding documentation for fatigue and ultimate strength of these components and connections shall be finalized.
- The ILC model will be updated after the type testing is completed in order to account for the updated controller settings, design load model and also according to the measured frequencies and damping of components such as Blade for Type Certification.
- The proof of the reliability of the pitch frequency converter KEB P6 shall be submitted.
- Final manuals are to be evaluated in Final Evaluation.
- The documentation of the BMS calibration (Blade Monitoring System) shall be finalized.
- The evaluation of controller parameter settings needs to be finalized because the controller settings are preliminary at this stage and will be modified to obtain the most optimal ratio between loads and power.
- GE to submit document to finalization of Safety and Function Tests Evaluation.
- Load measurements to be completed
- Power performance measurements to be carried out.
- Type Inspection needs to be performed according to OD-501 section 7.4.2.
- The reduced partial safety factor of  $\gamma_M=1.07$  for blade to tower clearance will have to be confirmed by TUV NORD CERT GmbH.
- According to Provisional Component certificate IECRE.WE.CC.20.0018-R0:
  - Evaluation of fatigue blade test and post fatigue static test
  - The mass and the deflection of the blade with the serial number #0002 shall be measured after the fatigue test