



Certificate No.

IECRE.WE.TC.16.0002-R0

IEC SYSTEM FOR CERTIFICATION TO STANDARDS RELATING TO EQUIPMENT FOR USE IN RENEWABLE ENERGY APPLICATIONS

TYPE CERTIFICATE

Wind Turbine

This certificate is issued to

GE Energy GmbH
Holsterfeld 16
48499 Salzbergen
GERMANY

for the wind turbine

GE 2.3-116, GE56.9, LM56.9P, HH 80m & 94 m, 50 Hz & 60 Hz

wind turbine class (class, standard, year)

S, IEC 61400-1 Ed.3:2005-08 incl. Amendment:2010-10

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

44 220 16193611-TBD-IEC
Rev.0, 2016-12-23

Design evaluation conformity statement
Dated

44 220 16806080-D-IEC
Rev.1, 2016-07-22

Type test conformity statement
Dated

44 220 16672205-T-IEC
Rev.1, 2016-07-22

Manufacturing conformity statement
Dated

44 220 16806080-M-IEC
Rev.0, 2016-07-22

Final evaluation report
Dated

8114193611-20 E
Rev.0, 2016-12-23

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.

Changes in the system design or the manufacturer's quality system are to be approved by the TÜV NORD CERT GmbH. Without approval, the certificate loses its validity.

This type certificate is valid until:
2021-12-22

Approved for issue on behalf of the IECRE
Certification Body:

Essen, 2016-12-23

Dipl.-Ing. C. Hering / Specialist Manager





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Machine parameters:

Power regulation:

Independent electromechanical pitch system for each blade

Rotor orientation:

Upwind

Number of rotor blades:

3

Rotor tilt:

5°

Cone angle:

4°

Rated power:

Variable Power Rating

from 2300kW to 2100 kW

for 2330 kW (derated to 1830 kW @ -30 °C for CWE operation)

Rated wind speed V_r (for 2.3MW)

10.4 m/s (STW); 9.2 m/s (CWE)

Rated rotational speed (for 2.3MW)

14.0 rpm (STW); 12.7 rpm (CWE)

Rated wind speed V_r (for 2.1MW)

9.75 m/s (STW); reduced in CWE mode

Rated rotational speed (for 2.1MW)

13.1 rpm (STW); 12.7 rpm (CWE)

Rotor diameter:

116 m

Hub height(s):

80 m & 94 m

Hub height operating wind speed range

3 – 22 m/s

$V_{in} - V_{out}$:

Design life time:

20y

Software version:

V3.01.0015B

Control Document:

2.0-116_2.3-

107_SC_allComp_xxxxxxxx.15.ENxx, Rev. 15

Wind conditions:

Characteristic turbulence intensity I_{ref} at $V_{hub} = 15$ m/s:

0.129

Annual average wind speed at hub height

V_{ave} :

7 m/s

Reference wind speed V_{ref} :

38 m/s

Mean flow inclination:

8°

Hub height 50-year extreme wind speed

53,2 m/s

V_{e50} :

Electrical network conditions:

(transformer out of scope, therefore converter properties are given)

Normal supply voltage and range:

690 V (90% up to 110%)

Normal supply frequency and range:

50 ± 5 Hz & 60 ± 5 Hz

Voltage imbalance:

4%

Maximum duration of electrical power network outages:

not dimensioning

Number of electrical network outages:

20



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Other environmental conditions (where taken into account):

Design conditions in case of offshore WT : Normal and extreme temperature ranges:

Relative humidity of the air: Air density:

Solar radiation: Lightning protection class : Earthquake model and parameters : Other design conditions :

Major components:

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

Blade LM56.9P (VG without LNTE):

Type: Material: Blade length: Number of blades: Manufacturer:

Max. Rotor imbalance: Main Drawing No.: GE Part No.: Alternative GE Part No.:

Blade GE56.9 (VG without LNTE):

Type: Material: Blade length: Number of blades: Manufacturer:

Max. Rotor imbalance: Main Drawing No. (finished):

GE Part No. (VG):

N/A Standard weather (STW): Normal temperature range -15 °C – +40 °C Extreme temperature range -20 °C – +50 °C Cold weather (CWE): Normal temperature range -30 °C – +40 °C Extreme temperature range -40 °C – +50 °C up to 95% Annual mean air density 1.18 kg/m³ Air density maximum operation 1.35 kg/m³ Air density maximum survival 1.408 kg/m³ 1000 W/m² 1 N/A N/A

Vacuum infusion E-glass fibre reinforced epoxy 56.993 m 3 LM Wind Power, all manufacturing sites covered by LM ISO 9001 Certificate 600 kgm DR-07059/A2 109W9397G001 109W8143P001

Vacuum infusion E-glass fibre reinforced epoxy 56.9 m 3 TPI Composites (Taicang) Co., Ltd., Taicang, P.R. China 600 kgm 444W3154, Rev.- 109W7485, Rev. A (alternative) 444W4627, Rev. A



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Major components cont.:

Blade bearing :

Type:

Manufacturer:

GE Part No.:

GE Drawing No.:

Ring Stiffener for Pitch Bearing

Type:

Design:

Main Drawing No.:

Pitch Drive :

Type:

Manufacturer:

Designation:

GE Part No.:

GE Vendor Part No.:

Gear ratio:

Main drawing No.:

Sectional drawing No.:

Sectional drawing shaft No.:

alternative:

Manufacturer:

Designation:

GE Part No.:

GE Vendor Part No.:

Gear ratio:

Main Drawing No.:

Sectional Drawing No.:

Sectional Drawing shaft No.:

alternative:

Manufacturer:

Designation:

GE Part No.:

GE Vendor Part No.:

Gear ratio:

Main drawing No.:

Sectional drawing No.:

Sectional drawing shaft No.:

Ball bearing slewing ring

- ILJIN USA SC Plant, Greer, USA

- Tianma Chengdu Railway Bearing, P.R. China

- Shilla, Korea

- Sumitomo, Korea

200W1709G001-003, G007-009, G013-015

200W1709, Rev. A

Forged ring

GE Power & Water

200W1847, Rev. A

3-stage planetary gearbox

Bonfiglioli Riduttori S.p.A., Italy

Bonfiglioli USA Inc., Hebron, Kentucky, US

707T3N

109W1175P001

109W3528P001

136.1

56120831, Rev. D

A7070T004200, Rev. E

6630070681, Rev. –

Liebherr Components AG, Germany

DAT 300/484

109W1175P001

109W1176P001

138.75

68 484 3000 99 2, Index 1.1

68 484 3000 00 1, Index 5.1

68 484 3000 10 0, Index 3.0

Nanjing High Speed Gear

Manufacturer Co. Ltd., Nanjing, P.R. China

FDX104A-02-00R1

109W1175P001

109W1178P001

138.55

FDX104A-02-00R1, Rev. A

FDX104A-02-00R1, Rev. -

FDX104A-01-06R1, Rev. -



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Major components cont.:

Pitch Motor

Manufacturer Motor No. 1:
Vendor Designation Motor No.1:
GE Part no.:
Manufacturer Motor No. 2:
Vendor Designation Motor No.2:
GE Part No.:

GE Motors
5BT1356B003 (spline
108W5453P002
Advanced Motor & Dr
FP2-4002 (spline)
104W9343P003

Main shaft:

Type:
Manufacturer:

Forged
Sumitomo, Korea
Taewong, Korea
Shadong Tongyu Group Co. Ltd., P.R: China
34CrNiMo6 / 30CrNiMo8 (P3C-WE-0005)
200W0789P001 & P002
200W0789

Material:
GE Part No.:
GE drawing No.:

Main bearing :

Type:
Manufacturer:
Designation:
GE Part No.:
Main drawing No.:

Cylindrical roller bearing
NTN Bearing, Korea
240/750BL1PX1V4S30
200W2278P001
14-09009, Rev. –

alternative:

Manufacturer:
Designation:
GE Part No.:
Main drawing No.:

Koyo, Japan
240/750RHAW33TS1CS FYPZ/00
200W2278P001
DSA306194, Rev. 4

Gearbox (50 Hz):

Type:
Gear Ratio:
Manufacturer:

Designation:
GE Part No.:
GE Vendor Part No.:

Planetary helical gearbox
130.146
Nanjing High Speed Gear Manufacturing Co.,
Ltd., Nanjing, P.R. China
FDM2B-00R1/-00R2
100W1505P002
100W1507P002 (Hydac Lubrication system
with Hydac cooler)
109W9030P002 (Hydra Grene Lubrication
system with Nissens cooler)

Gearbox (60 Hz):

Type:
Gear Ratio:
Manufacturer:

Designation:
GE Part No.:
GE Vendor Part No.:

Planetary helical gearbox
104.314
Nanjing High Speed Gear Manufacturing Co.,
Ltd., Nanjing, P.R. China
FDM2-00R1 /-00R2
100W1505P001
100W1507P001 (Hydac Lubrication system
with Hydac cooler)
109W9030P001 (Hydra Grene Lubrication
system with Nissens cooler)



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Major components cont.:

Yaw System :

Drive Type (50Hz):

Manufacturer:

E-Motor designation:

Gear Type:

Vendor designation:

GE Generic Part No.:

GE VSPN:

Vendor designation (alternative):

GE Generic Part No. (alternative):

GE VSPN (alternative):

alternative:

Drive Type (50Hz):

Manufacturer:

E-Motor designation:

Gear Type:

Vendor designation:

GE Generic Part No.:

GE VSPN:

Vendor designation (alternative):

GE Generic Part No. (alternative):

GE VSPN (alternative):

alternative:

Drive Type (50Hz):

Manufacturer:

E-Motor designation:

Gear Type:

Vendor designation:

GE Generic Part No.:

GE VSPN:

alternative:

Drive Type (60Hz):

Manufacturer:

E-Motor designation:

Gear Type:

Vendor designation:

GE Generic Part No.:

GE VSPN:

E-Motor with gearbox

Nanjing High Speed Gear Manufacturing Co.

Ltd. , Nanjing, P.R. China

AKEJ132M1-6a

4-stage planetary gearbox

FDX207G-01-00R15

108W5440P001

108W5441P001

FDX207G-03-00R15

111W1410P001

108W1411P001

E-Motor with gearbox

Bonfiglioli Transmissions Pvt limited, Chennai,
India

Bonfiglioli Riduttori S.p.A., Italy

BN132MA6 400/690-50 IP55 CLF B5 FD 120 SB
230 SA D3 H1

4-stage planetary gearbox

714T4W

108W5440P001

108W8435P001

714T4W (MT714T032)

111W1410P001

11W1413P001

E-Motor with gearbox

Liebherr Components AG, Germany

FB132LM/6WU-P120

4-stage planetary gearbox

DAT450/2427

108W5440P001

109W5032P001

E-Motor with gearbox

Bonfiglioli USA Inc., Hebron, Kentucky, USA

Bonfiglioli Riduttori S.p.A., Italy

BN132MA6 400/690-50 IP55 CLF B5 FD 120 SB
230 SA D3 H1

4-stage planetary gearbox

714T4W

103W3154P001

108W8434P001



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Wind Turbine

Major components cont.:

Vendor designation (alternative):
GE Generic Part No. (alternative):
GE VSPN (alternative):

714T4W (MT714T033)
111W1405P001
111W1409P001

alternative:

Drive Type (60Hz):
Manufacturer:
E-Motor designation:
Gear Type:
Vendor designation:
GE Generic Part No.:
GE VSPN:
GE Generic Part No. (alternative):
GE VSPN (alternative):

E-Motor with gearbox
Nabtesco Corporation, Japan
AMBY 132S/A6-MY13/A6A-C3098
3-stage planetary gearbox
RGS100B
103W3154P001
108W8523P001
111W1405P001
111W1407P001

alternative:

Drive Type (60Hz):
Manufacturer:
E-Motor designation:
Gear Type:
Vendor designation:
GE Generic Part No.:
GE VSPN:

E-Motor with gearbox
Liebherr Components AG, Germany
FB132LM/6WU-P120 (10194049)
4-stage planetary gearbox
DAT450/2440
103W3154P001
109W5033P001

alternative:

Drive Type (60Hz):
Manufacturer:

E-Motor designation:
Gear Type:
Vendor designation:
GE Generic Part No.:
GE VSPN:
Vendor designation (alternative):
GE Generic Part No. (alternative):
GE VSPN (alternative):

E-Motor with gearbox
Nanjing High Speed Gear Manufacturing Co.
Ltd. , Nanjing, P.R. China
AKEJ132M1-6b
4-stage planetary gearbox
FDX207G-01-00R1
103W3154P001
108W4725P001
FDX207G-03-00R1
111W1405P001
111W1406P001

Bearing Type:
Manufacturer:

Ball bearing slewing ring
ILJIN USA SC Plant, Greer, USA
Tianma Chengdu Railway Bearing, P.R. China
Shilla, Korea
Sumitomo, Korea
NTN Bearing, Korea
109W7629G001, G002
109W7629, Rev. A

GE Part No.:
GE drawing No.:



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Major components cont.:

Brake Type:
Manufacturer:

Mechanical with spring washer
JHS GmbH, Germany
Haisheng - China Shipbuilding Industry
Corporation, P.R. China
Core Tech, US
123W1833, Rev. A
444W2461G001/444W2462G001/
444W2463G001
444W2461/444W2462/444W2463

Brake Pads Drawing No.:
GE Part No.:

GE drawing No.:

Generator:

Manufacturer:
Vendor Designation:
GE Generic Part No.:
GE VSPN:
Type:
Rated Power:
Rated Frequency:
Rated Speed:
Rated Voltage:
Rated Current:
Insulation Class:
Degree of Protection:

Siemens LD, Subotica, Serbia
JFPA-560SR-04A
109W7234P101
109W7236P101
Doubly-fed induction
2385 kW
50 Hz
1820 rpm
690 V
2348 A
F
IP 34 (generator)
IP 23 (slip ring)

alternative:

Manufacturer:
Vendor Designation:
GE Generic Part No.:
GE VSPN:
Type:
Rated Power:
Rated Frequency:
Rated Speed:
Rated Voltage:
Rated Current:
Insulation Class:
Degree of Protection:

Ingeteam Inc., Milwaukee, WI, USA
NAR560G6B60N
109W7234P102
109W7235P102
2385 kW
60 Hz
1455 rpm
690 V
1748 A (Stator), 726 A (Rotor)
F
IP 34 (generator)
IP 23 (slip ring)

Converter :

Manufacturer:
Vendor Designation:

GE Part No.:

Type:
Rated Voltage (grid side):
Rated Current (grid side):
Degree of Protection:

GE Energy
2.x DTA DFIG Converter
151X1237KA01SA01
151X1237KA01SA03
109W7188P001
109W7188P002
MMW DFIG Converter
690 V
2560 A
IP 54 (Control and bridge cabinet)
IP 21 (Filter and power distribution cabinet)



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Major components cont.:

Transformer :

Out of scope (outside of tower)

Tower:

Manufacturer:

Shrenik Industries Private Limited, Maharashtra,
India

Trinity Structural Towers Inc, Clinton, Newton,
Tulsa, USA

Marmen, Brandon, SD, USA

Marmen, Rheine, NA

Foundation Specification:

Foundation_Load_Drawing_2.3-116_50-
60Hz_80mHH_IECS_EN_r01, Rev.1

HH 80 m (NAMTS):

Sections:

3

Length:

77.3 m

Drawing / Data sheet / Part No.:

444W0614, Rev.- (STW, CWE)

HH 80 m (Robust Assembly):

Sections:

3

Length:

77.3 m

Drawing / Data sheet / Part No.:

200W2526, Rev. B

HH 94 m:

Sections:

4

Length:

91.15 m

Drawing / Data sheet / Part No.:

444W1779, Rev.- (STW, CWE)

Foundation :

Not in scope

Foundation Adaptor :

N/A

Manuals:

O&M Manual:

- Operating_Manual_2.0-
2.4MW_xxHz_Operating_EN_r01

- Operating_Manual_1-2MW-
xxHz_Maintenance_EN_r22

Transport Manual:

- Transport_Documents_2.0-2.4-60Hz_1-
2MW_Road and Crane_EN_r01

Installation /

Commissioning Manual:

- Installation_Manual_2.0-2.4-xxHz_1-
2MW_EN_r01

- Converter Commissioning: 2.0-2.4_MW_ESS-
Series_CCT, Rev. 1.0

- 2.0-2.4_MW_ESS-

Series_Downtower_Commissioning_PCAT-
FCA, Rev. 1.0

- 2.0-2.4_MW_ESS-

Series_Uptower_Commissioning_PCAT-FCA,
Rev. 1.0