Certificate No.

IECRE.WE.CC.19.0009-R0

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

COMPONENT CERTIFICATE

Wind Turbine

This certificate is issued to	Siemens Gamesa Renewable Energy A/S Borupvej 16 7330 Brande Denmark
for the component	Offshore Direct Drive Turbine SWT-7.0-154
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-0074-00706-4 22.02.2017
Design evaluation conformity statement Dated	DE-DNVGL-SE-0074-00703-7 27.06.2018
Type test conformity statement Dated	TT-DNVGL-SE-0074-00705-4 27.09.2017
Manufacturing conformity statement Dated	ME-DNVGL-SE-0074-00704-7 27.06.2018
Final evaluation report Dated	FER-TC-DNVGL-SE-0074-00707-8 28.06.2018

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

The component 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:
21.07.2019

Approved for issue on behalf of the IECRE Certification Body:

Mersudin Bajric / Bente Vestergaard
Project Manager / Service Line Leader,
Component Certification
Hamburg 2019-03-27

DNVGL Renewables Certification
Brooktorkai 18
20457 Hamburg, Germany

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COMPONENT CERTIFICATE

Wind Turbine

Machine parameters:

Power regulation:	Pitch-controlled
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	5°
Rated power:	7000 kW / Power Boost 7350 kW (see configuration matrix page 12 and 13)
Rated wind speed Vr:	12 m/s
Rotor diameter:	154 m
Hub height(s):	120 m
Hub height operating wind speed range Vin – Vout:	3 – 25 m/s
Design life time:	25 years
Software version:	137.0.0x

Wind conditions:

Characteristic turbulence intensity Iref at Vhub = 15 m/s:	For IB: 0.14
Annual average wind speed at hub height Vave :	10 m/s
Reference wind speed Vref :	50 m/s
Mean flow inclination:	8°
Hub height 50-year extreme wind speed Ve50:	70 m/s

Electrical network conditions:

Normal supply voltage and range:	Low voltage side: 690 V +/- 10%V High voltage side: 33/34 kV
Normal supply frequency and range:	50/60 Hz +/- 2%
Voltage imbalance:	Max 2% according to IEC 60146
Maximum duration of electrical power network outages:	No limits when requirements in manuals are followed
Number of electrical network outages	Maximum 20 per year

Other environmental conditions (where taken into account):

Design conditions in case of offshore WT (water depth, wave conditions, salinity, etc.):	Other environmental (climatic) conditions as outlined in IEC 61400-3, ed.1: 2009: “Wind turbines – Part 3: Design requirements for offshore wind turbines”, Chapter 6.5 “Other environmental conditions”
Normal and extreme temperature ranges:	Normal: -10°C to +35°C Extreme: -20°C to +45°C
Relative humidity of the air:	Outside: 100%
Air density:	1.225 kg/m^3
Solar radiation:	1000 W/m^2
Lightning protection system (standard and protection class):	Designed according to IEC 61400-24 Ed. 1.0, protection level 1
Corrosion class for the wind turbine acc. to ISO 12944	External structural surfaces: C5-M High Internal structural surfaces: C3 High and C4 High

Interfaces

The certification covers the rotor-nacelle assembly including yaw system and tower top flange including bolt connection between tower top flange and yaw ring.

Interface to other components or systems and design loads	See Final Evaluation Report FER-TC-DNVGL-SE-0074-00707-8

Major components:

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

Blade:

Type:	B75-00
Material:	Glass fibre reinforced epoxy and balsa
Blade length:	75 m
Number of blades:	3
Manufacturer:	Siemens Gamesa Renewable Energy A/S
Drawing / Data sheet / Part No.:	D1054429-186078

Blade bearing:

Type:	Alt. 1	Double row 4-point slewing ball bearing
Manufacturer:		Rollix
Drawing / Data sheet / Part No.:		13-3550-01, Rev. B

Type:	Alt. 2	Double row 4-point slewing ball bearing
Manufacturer:		Rothe Erde
Drawing / Data sheet / Part No.:		090.70.3547.004.49.1421, Rev.A

Pitch System:

Type:	Hydraulic, 2 cylinders per blade
Motor / Actuator Type:	B4466/A9B10051807, Rev. 10
Pitch Controller Type:	Hydraulic
Manufacturer:	Siemens Gamesa Renewable Energy A/S

Main bearing:

Type:	Alt. 1	Double row tapered roller bearing
Manufacturer:		Rothe Erde GmbH
Drawing / Data sheet / Part No.:		140.99.3480.000.62.1320, Rev. F

Type:	Alt. 2	Double row tapered roller bearing

Manufacturer:		Rothe Erde GmbH
Drawing / Data sheet / Part No.:		140.99.3480.009.62.1320, Rev. B
Type:	Alt. 3	Double row tapered roller bearing
Manufacturer:		Rothe Erde GmbH
Drawing / Data sheet / Part No.:		140.99.3480.010.62.1320, Rev. A

Yaw System:

Drive Type:		Active, 16 yaw drives
Manufacturer:		Siemens Gamesa Renewable Energy
Drawing / Data sheet / Part No.:		Included in yaw gear
Bearing Type:		Plain bearing, yaw clamps
Manufacturer:		Siemens Gamesa Renewable Energy
Drawing / Data sheet / Part No.:		D1168565-90070
Gear Type:		PG 1904 PR, Ratio: 948/1
Manufacturer:		Comer Industries
Drawing / Data sheet / Part No.:	Alt. 1.1	N06483_3, Rev. 3 with 40 Nm motor brake
Gear Type:		709 T4W, Ratio 960/1
Manufacturer:		Bongfiglioli italia S.P.A.
Drawing / Data sheet / Part No.:		A7090T016300
Brake Type:		Friction and brake on motor
Manufacturer:		Siemens Gamesa Renewable Energy
Drawing / Data sheet / Part No.:		Included in yaw gear motor

Generator:

Type	Synchronous, PMG, DD76
Manufacturer:	Siemens Gamesa Renewable Energy
Nominal Power:	7.4 MW (PB mode 7.7 MW)
Rated Frequency:	12 Hz (PB mode 13 Hz)

Rated Speed:	10.3 rpm (PB mode 10.8 rpm)
Rated Voltage:	750V
Rated Current:	2 x 3.4 kA
Insulation Class:	F
Degree of Protection:	IP44
Drawing / Data sheet / Part No.:	D1194372-182112

Converter:

Type:	D7 type 2 SICS AA1001/1002
Manufacturer:	Siemens
Rated Voltage (grid side):	Generator side: 750 V Grid side: 690 V
Rated Current (grid side):	2 x 4.0 kA
Degree of Protection:	IP23D
Drawing / Data sheet / Part No:	SICS AA1001_1002 Ver_001

Transformer:

Type:	Alt.1	TDN-823A03W1K-99 Liquid-immersed
Manufacturer:		Siemens AG Österreich, Transformers Weiz
Rated Voltage:		34 kV / 0.69 kV
Degree of Protection:		n.a.
Drawing / Data sheet / Part No.:		Transformer rating plate 246931171, Rev.1

Type:	Alt.2	Liquid-immersed TDN-823A03W1K-99
Manufacturer:		Siemens AG Österreich, Transformers Weiz
Rated Voltage:		34 kV / 0.69 kV
Degree of Protection:		n.a.
Drawing / Data sheet / Part No.:		Transformer rating plate 246937021

Type:	Alt.3	Liquid-immersed TDN-823A063W1K-99
Manufacturer:		Siemens
Rated Voltage:		66 kV / 0.69 kV

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Degree of Protection:		n.a.
Drawing / Data sheet / Part No.:		Transformer rating plate 246931931, Rev. 1

Switchgear:

Type:	Alt.1	2 x NXPLUS C Wind
Manufacturer:		Siemens AG
Rated Voltage:		36 kV
Rated current:		630 A
IAC-Classification:		IAC A FLR 25 kA 1 s

Type:	Alt.2	8VM1
Manufacturer:		Siemens
Rated current:		1250 A
Rated voltage:		72 kV
IAC-Classification:		AFLR 25 kA 1 s
Drawing / Data sheet / Part no.:		G81072-E0096-A

Manuals:

O&M manual

ZOM 1036343	261095, rev. 8	User terminal for SICS on DD turbines, Operating manual, software version 129.0.0
SI 545781	218364, R16	Basic health and safety rules for access to and work in Siemens Wind Power turbines
ZAI 1040332	259439	Turbine-specific safety instructions
Service manual, SWT-6.0-154		
ZSM 1048017	256418, R17	Service manual
Service manual, SWT-7.0-154		
ZSM1047720	261358	Maintenance manual SWT 7.0-154

Transport manual

ZWI 1042411	137624	Preparing B75 for road transportation
ZWI 1042412	234588	Rotating of B75 on Transport Equipment
ZWI 1042413	234588	Mounting of B75 storage and transport equipment

ZWI 1042484	234588	Transport on port sites with B75 blade mover V1 and V2
D3179310	002/165172	B75 - Lifting instruction - Truck load/unload
D3179302	006/264161	B75 Lifting instruction, Load out
D1028685	001/146674	Lift instr f B75 w truss
D1019598	001/144118	Trans. Instruction B75 storage
D1019481	003/232404	Transportation instruction - B75 - Truck
ZWI 1042180	260709	Load out B75
ZWI 1044269	265105	Seafastening of blades
1037221	86740	B75 blade, instruction f. storage
1037222	86740	B75 blade, transport instr. road
1037223	86740	B75 blade, transport instr. offshore
1037224	86740	B75 blade, lift. Instr. F. transport
1037356	86740	Instr. For B75 rotor assembly w 2 cranes
D3179449	001/206327	Lift. instr. - B75 Truck load/unload, V2 (Option-2)
D3179339	001/143341	B75 - Lifting instruction - rotation, V1 (Option-1)
D3179397	001/206327	B75 - Lifting inst. B75 - rotation, V2 (Option-2)
D1423723	002/260336	Sea trans. instruction - B75
D1192332	003/256436	Lift. instr. D6/D7 Gen., frame, adapt.
D3179188	004/256436	Lift. Instr. Gen w. Metis 6.0/7.0 MW
D3179187	004/261154	Mount. instr. Metis 6.0/7.0 MW
D3179133	003/261154	Trans Instr gen Sea Metis 6.0/7.0 MW
D3179134	003/261154	Trans Instr gen Truck Metis 6.0/7.0 MW
D1193194	002/220506	Trans. instr. truck 6.0/7.0 generator
D1193218	002/220506	Trans. instr. vessel 6.0/7.0 generator
ZWI 1039704	102710	Loading/unloading of generator onto/from vessel - storage
ZWI 1039705	102711	Loading/unloading generator onto/from truck trailer
D1392422	001/257721	Upending instr. f. Gen. D6/D7
1035646	003/257358	Lift instr. for hub to 6 deg SWT6.0/7.0
D1193265	003/261154	Transport instr. truck 6.0/7.0 hub
ZWI 1039708	102716	Loading/unloading of hub onto/from truck trailer/vessel
D1191202	004/261154	Lift. Instr. Hub and transp. Frame 6.0/7.0MW
ZWI-1043495	164677	Loading/unloading of hub with adaptor onto/from truck/vessel
ZWI 1030907	C01007727	General work instruction for internal use

		in Siemens Wind Power
D1193268	002/190892	Transport instr. vessel 6.0/7.0 hub
D1300390	002/227445	Lift. inst. rotor SWT-7.0-154 PT1/PT2
1035288	002/190892	Lift. inst. f. rotor SWT-6.0/7.0-154
ZWI 1044273	260259	Seafastening of nacelle (with hub)
1038016	88667	Ass instr f lifting yoke 6MW
1037822	123405	Lift instr Nac w gen SWT6.0 0-series
ZWI 1048177	257628	Nacelle with generator on “Maia” frame. Loading/unloading and Transport on Trailer or vessel
ZWI 1048178	257628	Nacelle with generator and hub on “Maia” frame. Loading/unloading and Transport on Trailer or vessel
D3179701	159686	Transport instruction, 6.0MW nacelle, full
D1282604	003/253892	Trans. Instr. 6.0MW nacelle Maia
D1282605	003/253892	Trans. Instr. 7.0MW nacelle Maia
D1190579	002/106954	Transport instr. truck 6.0 nacelle
D1190642	002/106954	Transport instr. vessel 6.0 nacelle
D1282608	003/253892	Trans. Instr. Maia 6.0MW nacelle full
D1282609	003/253892	Trans. Instr. Maia 7.0MW nacelle full
D1030284	003/220506	Lift instr f SWT6.0/7.0 Turbine
D1024706	003/220506	Lift Instr f SWT6.0/7.0 Turbine w SBTS
D1029536	003/220506	Lift instr f SWT6.0/7.0 w SBTS and Hydraulic
D1282606	003/253892	Trans. Instr. Maia 6.0MW nac. incl. Gen
D1282607	003/253892	Trans. Instr. Maia 7.0MW nac. incl. Gen
ZWI 1048176	257628	Nacelle rear end on “Maia” frame. Loading/unloading and Transport on Trailer or vessel
D1282614	001/225372	Lift. Instr. Maia frame and 6.0MW nacelle
D1282615	001/225372	Lift. Instr. Maia frame and 7.0MW nacelle
ZWI 1042179	259841	Lifting full tower
ZWI 1044271	262186	Seafastening of full towers
ZWI-1038230	94422	Loading/unloading of tower sections onto truck trailer/vessel
ZWI 1042295	134907	Odin transport system – Mounting and demounting
ZWI 1042296	134908	Odin transport system – Transport off and on shore
ZWI 1042297	134909	Odin transport system – Lifting and upending

ZWI-1044222	176140	Mounting of Vortex Strakes
ZWI-1044224	176140	Removal of Vortex Strakes
Installation manual		
ZWI 1040104	109037	Introduction to installation manual
ZWI 1040107	109037	Pre-assembly of switchgear unit
ZWI 1047521	264986	D7 Bolt tightening
ZWI 517095	50278	Bolt tightening - torque and tension
ZWI 1047627	257037	Mounting of generator
ZWI 1047649	260259	Installation of hub
ZWI 1042170	226418	Turner tool functionality test – pre-assembly site
ZWI 1042171	226418	Mounting Turner tool in nacelle (Pre-assembly site)
ZWI 1042172	265142	Placing Turner tool container on nacelle
ZWI 1042174	263218	Turner tool operation – single blade installation
ZWI 1042175	263218	Dismantling of Turner tool
ZWI 1040115	261529	Preparing nacelle for hub installation
ZWI 1040337	265037	Preparation for lifting nacelle with hub
ZWI 1047690	258110	Installation of nacelle with hub
ZWI 1049202	264681	Retightening of pressure fittings to brake caliper
ZWI 1049246	264679	Pre-assembly retightening of fittings and pressure test on brake system
ZWI 1048421	259651	Preparing nacelle and hub for single blade installation
ZWI 1042181	234450	Single blade installation
ZWI 1042176	132115	Blade Yoke User instruction
ZWI 1047658	247222	Final tensioning of blade bolts
ZWI 1040122	109037	Operating manual pitch handle with the turbines own hydraulic station
ZWI 1048426	259666	Installation of helihoist
ZWI 1040329	111259	Installation of lightning detectors
ZWI 1047707	247222	Installation of coolers on nacelle roof
ZWI 1044300	221999	Installation of wind sensors
ZWI 1040330	111259	Installation of marine lantern and fog horn controller
ZWI 1042374	261040	Re-assembly of nacelle after single blade installation
ZWI 1048372	259346	Connecting small cable between tower and nacelle
ZWI 1047866	253528	Inspection of main bearing sealings ring,

		generator and hub side
ZWI 1046402	209959	Pressure testing and filling of cooling system
ZWI 1044919	187710	Guiding rubber collar at yaw ring into grease tray
ZWI 1044285	175067	Connecting MV cable to transformer

Commissioning manual

ZWI1040117	109037	Connecting external generator
ZWI 1040335	163460	Precommissioning tower
ZWI 1048375	259374	Precommissioning nacelle with hub
ZWI 1040348	259459	Final commissioning
ZWI 1045401	226427	Final site test of MV system after commissioning of turbine

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TYPE CERTIFICATE

Wind Turbine(s)

Configuration variant 1.1, SWT-7.0-154 (without PB)

Variant	Wind turbine class	Rated power	Rotational speed	Operating wind speed range	Derating temperature
1.1	S**	7.0 MW	10.3 rpm	3 – 25 m/s	25°C

**Wind class IB with 25 years design lifetime and including ice loads

Options:

Variant	HWRT	HWRT operating wind speed range	Power Boost	Power boosted power	Power Curve Upgrade Kit	Detect Loose Objects
1.1	Yes	25 – 31 m/s	No	N/A	Yes, PCUK3	Yes

Further information:

Variant	Controller name (BHawC)	Controller version (BHawC)	Load set name	Turbine control software version
1.1	STC-1Ctrl.dll	126.0.0.9	D770154LR301	137.0.0.x

HWRT: High Wind Ride Through
PB: Power Boost

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Wind Turbine(s)

Configuration variant 1.2, SWT-7.0-154 (with PB)

Variant	Wind turbine class	Rated power	Rotational speed	Operating wind speed range	Derating temperature
1.2	S**	7.0 MW	10.8 rpm	3 – 25 m/s	25°C

**Wind class IB with 25 years design lifetime and including ice loads

Options:

Variant	HWRT	HWRT operating wind speed range	Power Boost	Power boosted power	Power Curve Upgrade Kit	Detect Loose Objects
1.2	Yes	25 – 31 m/s	Yes	7.35 MW	Yes, PCUK3	Yes

Further information:

Variant	Controller name (BHawC)	Controller version (BHawC)	Load set name	Turbine control software version
1.2	STC-1Ctrl.dll	128.0.0.10	D770154LR302	137.0.0.x

HWRT: High Wind Ride Through
PB: Power Boost

Scope of the present certificate

In addition to the above, the standard tower internals structural assessment is included in the certification scope for this wind turbine. The tower and foundation is sufficiently documented to enable type testing and load calculations for the complete wind turbine.

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Configuration matrix - Variants covered by this certificate

Variant	Wind Turbine Type	Relevant Page
1.1	SWT-7.0-154 (without PB)	page 12
1.2	SWT-7.0-154 (with PB)	page 13