

Appendix C-2

Certificates of Design Compliance

Type Certificate

Registration-No.	44 220 21850888-TC-IEC-b, Rev. 5
This Certificate is issued to	GE Wind Energy GmbH Holsterfeld 16 48499 Salzbergen Germany
For the wind turbine	GE6.1-158, GE5.x-158, GE4.x-158
WT Class	IEC S

This Certificate attests compliance with the below cited standards concerning the Design, Testing and Manufacturing. It is based on the following reference documents:

44 220 19711611-TDB-IEC, Rev. 6	Design Basis Conformity Statement on the Wind Turbine GE6.1-158, GE5.x-158; GE4.x-158, TÜV NORD, dated 2021-12-07
44 220 21850888-D-IEC-b, Rev. 6	Design Evaluation Conformity Statement on the Wind Turbine GE6.1-158, GE5.x-158, GE4.x-158 , TÜV NORD, dated 2022-08-30
44 220 19288026-M-IEC, Rev. 10	Manufacturing Conformity Statement on the Wind Turbine GE5.x-158, GE4.x-158, TÜV NORD, dated 2022-07-27
44 220 19288026-T-IEC, Rev. 4	Type Test Conformity Statement on the Wind Turbine GE5.x-158, GE4.x-158, GE6.1-158, TÜV NORD, dated 2022-03-31
44 220 21554772-CC-IEC, Rev.1	Component Certificate for Rotor Blade LM77.4P3, issued by TÜV NORD, dated 2022-06-20, valid until 2026-12-09
44 220 21884831-CC-IEC, Rev.0	Component Certificate for Rotor Blade LM77.4P6 IMS 4.1 and LM77.4P6, issued by TÜV NORD, dated 2021-12-10, valid until 2026-12-09
8118 850 888-20 E II, Rev.6	Final Evaluation Report, TÜV NORD, dated 2022-08-30

Normative references:	Certification scheme: IEC 61400-22 "Wind turbines - Part 22: Conformity testing and certification", Edition 1.0, 2010-05 in combination with: IEC 61400-1 "Wind Turbines - Part 1: Design requirements", Third Edition, 2005-08 and Amendment 1, 2010-10
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The wind turbine type is specified on pages 3 - 24 of this Certificate.

Any change in the design, the production and erection or the manufacturer's quality system has to be approved by TÜV NORD CERT GmbH. Without approval this Certificate loses its validity.

Provided that valid Component Certificate of the Rotor Blades are available, this Type Certificate is valid until: 2027-01-30 (First issue: 2022-01-31) (under the condition of regular maintenance according to chapter 6.5.2 of IEC 61400-22)

TÜV NORD CERT GmbH
Certification Body
Wind Energy



Deutsche
Akkreditierungsstelle
D-ZE-12007-01-02

Essen, 2022-08-30

Dr. F. Messer

Am TÜV 1 • 45307 Essen • email: windenergy@tuev-nord.de

Wind turbine type specification:

Machine parameters:

Model	GE6.1-158, GE5.x-158, GE4.x-158
Type	Horizontal axis wind turbine with variable rotor speed
Wind turbine manufacturer and country	GE Wind Energy GmbH / Germany
Power regulation	Independent electromechanical pitch system for each blade
Variable Rating Concept	Torque and Thrust based
Rotor diameter	158 m
Rotor orientation	Upwind
Number of rotor blades	3
Rotor tilt	4°
Cone angle	5°
IEC WT class	S
Operating wind speed range $V_{in} - V_{out}$	3 – 25 m/s s (reduced power mode above V_{HWSNR})
Operational range	6 – 12 rpm
Lightning protection class	Protection class 1 as per IEC 61400-24
Software version	see control & safety system

Configuration	1 (PRD 68)	2 (PRD 69)	3 (PRD 35)	4 (PRD 136)
Rated Power	5530 kW (possible variable rating down to 4500 kW)	5530 kW (possible variable rating down to 4500 kW)	5530 kW (possible variable rating down to 4500 kW)	6130 kW (possible variable rating down to 4830 kW)
Hub Height	107.4 m	125.4 m	101 m	125.4 m
Frequency	60 Hz	60 Hz	60 Hz	60 Hz
Rated wind speed	11.55 m/s	11.55 m/s	11.55 m/s	12 m/s
Rated rpm	9.7 rpm	10.1 rpm	10.1 rpm	10.1 rpm
IEC WT class	S	S	S	S
Design Lifetime WT	20 years ⁽⁴⁾	25 years ^(3,4)	25 years ^(3,4)	25 years ^(3,4)
I_{ref}	Specific turbulence profile ⁽²⁾	Specific turbulence profile ⁽²⁾	Specific turbulence profile ⁽²⁾	Specific turbulence profile ⁽²⁾
V_{ave}	9.5 m/s ⁽¹⁾	9.6 m/s ⁽¹⁾	10.2 m/s ⁽¹⁾	7.2 m/s ⁽¹⁾
V_{ref}	28.0 m/s	28.0 m/s	36.4 m/s	40 m/s
V_{e50}	39.2 m/s	39.2 m/s	50.96 m/s	56 m/s
Mean inflow	0.3°	2.7°	6.9°	2.7°
Air density	1.156 kg/m ³	1.138 kg/m ³	1.104 kg/m ³	1.096 kg/m ³
Climate	STW	STW	STW	STW
Ice conditions	none	none	none	none
V_{HWSNR}	15 m/s	15 m/s	15 m/s	18 m/s

Configuration	5 (PRD 142)	6 (PRD 169)
Rated Power	6130 kW (possible variable rating down to 4830 kW)	6130 kW (possible variable rating down to 4830 kW)
Hub Height	101 m	117 m
Frequency	60 Hz	60 Hz
Rated wind speed	12 m/s	11.55 m/s
Rated rpm	10.1 rpm	10.1 rpm
IEC WT class	S	S
Design Lifetime WT	25 years ^(3,4)	20 years ⁽³⁾
I _{ref}	Specific turbulence profile ⁽²⁾	Specific turbulence profile ⁽²⁾
V _{ave}	7.2 m/s ⁽¹⁾	7.9 m/s
V _{ref}	40 m/s	39.9 m/s
V _{e50}	56 m/s	55.86 m/s
Mean inflow	6.9°	1.6°
Air density	1.104 kg/m ³	1.089 kg/m ³
Climate	STW	STW / CWE
Ice conditions	none	168 hours/year
V _{HWSNR}	18 m/s	18 m/s

⁽¹⁾Reported V_{ave} corresponds to the value used for Extreme Loads. For Fatigue Loads, refer to corresponding evaluation report

⁽²⁾Details available in loads evaluation report

⁽³⁾Design lifetime of components relevant for operation of safety functions: 20 years, replacement required to continue

⁽⁴⁾Design lifetime pitch drive: 15 years when equipped with LM77.4P3 blades or LM77.4P6 blades

Electrical network conditions:

Normal supply voltage and range	33 kV, 34.5 kV ± 10%
Normal supply frequency and range	60 Hz ± 3 Hz
Voltage imbalance	4 %
Maximum duration of electrical power network outages	no information
Number of electrical network outages	20 / year

Other environmental conditions:

STW: Normal Temperature Range (operational)	-15°C - +40°C (Start: -10 °C, derated above 35°C)
STW: Extreme Temperature Range (survival)	-20°C - +50°C
CWE: Normal Temperature Range (operational)	-30°C - +40°C (Start: - 10°C, derated above 35°C and below -15°C)
CWE: Extreme Temperature Range (survival)	-40°C - +50°C
Air density	see tables above
Relative humidity of the air	up to 95%
Solar radiation	1000 W/m ²

Ice conditions:

STW: no ice in operation considered

Earthquake model and parameters:

CWE: see table above
not considered

Major components:

Manufacturing site(s) for hub and nacelle assembly:

(1) GE Wind Energy, Salzbergen, Germany
(2) GE Wind Energy Equipment Manufacturing (Shenyang), China
(3) GE Energia Renováveis Ltda, Camaçari, Brazil

Nacelle cover

Designed by:
GE Part no.:

GE Renewable Energy
450W4473G001 (Cover)
450W4798G002 (Brackets)

alternative:

Designed by:
GE Part no.:

GE Renewable Energy
450W4473G003 (Cover)
450W4798G004 (Brackets)

alternative:

Designed by:
GE Part no.:

GE Renewable Energy
451W6589G001 (Cover)
450W4798G004 (Brackets)

alternative:

Designed by:
GE Part no.:

GE Renewable Energy
453W0897G001 (Cover)
450W4798G004 (Brackets)

Blade

for configurations 1-6:

Designed by:
Designation:
Material:
Blade length:
Number of blades:
Drawing no.:
GE PN (root group):
GE PN (tip group):
Specification:
Attachments:

LM Wind Power Group
LM77.4P3 Gen A
E-glass and carbon fibre reinforced polyester
77.491 m
3
DR-09345/A6, Rev. A6
451W4184G001-G018
451W4182G001-G014
BS-01170/A5, Rev. A5
Vortex Generators
Serrations / LNTE
T-spoilers / Stiffner plate

for configurations 1-6:

Designed by:	LM Wind Power Group
Designation:	LM77.4P3 Gen B
Material:	E-glass and carbon fibre reinforced polyester
Blade length:	77.491 m
Number of blades:	3
Drawing no.:	DR-09345/A6, Rev. A6
GE PN (root group):	454W3270G001-G012
GE PN (tip group):	451W4182G001-G014
Specification:	BS-01170/A5, Rev. A5
Attachments:	Vortex Generators / Serrations / LNTE T-spoilers / Stiffner plate

for configurations 1-6:

Designed by:	LM Wind Power Group
Designation:	LM77.4P6 with IMS
Material:	E-glass and carbon fibre reinforced polyester
Blade length:	77.491 m
Number of blades:	3
Drawing no.:	DR-15590/A4, Rev. A4
GE PN:	452W3948G001 452W3948G002
Specification:	BS-01369/A2, Rev. A2
Attachments:	Vortex Generators Serrations / LNTE T-spoilers / Stiffner plate

for configurations 1-6:

Designed by:	LM Wind Power Group
Designation:	LM77.4P6 without IMS
Material:	E-glass and carbon fibre reinforced polyester
Blade length:	77.491 m
Number of blades:	3
Drawing no.:	DR-15590/A4, Rev. A4
GE PN:	452W8900G001-G004
Specification:	BS-01510/A2, Rev. A2
Attachments:	Vortex Generators Serrations / LNTE T-spoilers / Stiffner plate

Manufacturer/Site:	LM Wind Power A/S All manufacturing sites covered by same global Manufacturing process and ISO9001 certificate No. 10000451440-MSC-UKAS-DNK
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Blade bearing

Type: Ball bearing slewing ring
Designed by: GE Renewable Energy
Designation: 448W4841G001/G002
Drawing no.: 448W4841, Rev. A, dated 2020-01-08
Manufacturer/Site: (1) Tianma (Chengdu) Precision Machinery Co.
Ltd., Chengdu, P.R. China
(2) Shilla Brazil Industria de Rolament de Giro Ltda,
Tiete, Brazil
(3) SKF do Brazil Ltda, Cajamar, Brazil

alternative:

Designed by: GE Renewable Energy
GE Part no.: 452W1372G001
453W6327G001
Drawing no.: 452W1372, Rev. B, dated 2021-07-07
453W6327, Rev. -, dated 2021-10-25
Manufacturer/Site: (1) Shilla Brazil Industria de Rolament
de Giro Ltda, Tiete, Brazil
(2) SKF do Brazil Ltda, Cajamar, Brazil
(3) Liebherr Components GmbH, Biberach,
Germany
(4) Tianma (Chengdu) Precision Machinery Co.
Ltd., Chengdu, P.R. China

alternative:

Designed by: GE Renewable Energy
GE Part no.: 453W1204G001
Drawing no.: 453W1204, Rev. -, dated 2021-09-24
Manufacturer/Site: (1) SKF do Brazil Ltda, Cajamar, Brazil
(2) Liebherr Components GmbH, Biberach,
Germany
(4) Tianma (Chengdu) Precision Machinery Co.
Ltd., Chengdu, P.R. China

Pitch drive

Type: 3-stage planetary gearbox
Designed by: Bonfiglioli Trasmital
Designation: 2T709T3157A02
Drawing no.: I7090T012600, Rev. D, dated 2019-02-01
GE Part no.: 446W6974P001
GE VSPN: 446W6973P001
Manufacturer/Site: (1) Bonfiglioli Riduttori S.p.A., Bologna, Italy

alternative:

Designed by: Liebherr Components Biberach GmbH
 Designation: DAT 350/2491 V2 (12805547)
 Drawing no.: 268 491 3000 99 2, Rev.02,
 dated 2019-10-14
 GE Part no.: 446W6974P001
 GE VSPN: 448W3394P001
 Manufacturer/Site: (1) Liebherr Machinery (Dalian) Co., Ltd., China
 (2) Liebherr Components GmbH, Biberach,
 Germany

alternative:

Designed by: SEW Eurodrive Brasil
 Designation: PW022
 Drawing no.: 2422 433 2.30.1, Rev.00,
 dated 2019-06-08
 GE Part no.: 446W6974P001
 GE VSPN: 449W7381P001
 Manufacturer/Site: (1) Sew-Eurodrive Brasil Ltda, Indaiatuba, Brazil

alternative:

Designed by: NGC
 Designation: FDX104E-01-00R3
 Drawing no.: FDX104E-01-00R3, Rev. B,
 dated 2020-06-18
 GE Part no.: 446W6974P001
 GE VSPN: 451W2061P001
 Manufacturer/Site: Nanjing High Speed & Accurate Gear, Nanjing,
 China

Pitch Motor

Designed by: AMD /Nidec
 GE Part no.: 448W0101P001
 GE VSPN: 448W3984P001
 Designation: 1175.291.1256

Pitch lock

Type: Blade Locking Device
 Designed by: GE Renewable Energy
 GE Part no.: 449W5494
 Drawing no.: 449W5494, Rev. -, dated 2019-08-22

Hub

Designed by:	GE Renewable Energy
Type:	Cast
Designed by:	GE Renewable Energy
Material:	acc. to spec. B50WE001
GE Part no.:	449W9972G001(serial, standard) 450W0325G001/G003 (Serial. IMS) 451W4185G001/G003
Drawing no. (machining):	449W9972, Rev. -, dated 2020-01-31 450W0325, Rev. -, dated 2020-01-31 451W4185, Rev. A, dated 2021-10-12
Drawing no. (casting):	449W9971, Rev. -, dated 2019-11-15
Manufacturer/Site:	(1) Jiangsu FAW Foundry Co. Ltd, Wuxi, Jiangsu, P.R. China (2) Himile Mechanical Science and Technology Co. Ltd, Shandong, P.R. China (3) Stepan ind de Maquinas e Motoresl, Campinas, Brazil (4) Emalto Industria Mecanica Ltda, Timoteo, Brazil (5) Emalto Usinagem e Tratamento Anticorrosivo Ltda, Santand do Paraiso, Brazil

Main shaft

Type:	Forged
Designed by:	GE Renewable Energy
Material:	34CrNiMo6, WTG-113 acc. to spec.
GE Part no.:	450W3625G001/G002
Drawing no.:	450W3625, Rev. -, dated 2020-06-10
Manufacturer/Site:	(1) Tongyu Heavy Industry Co. Ltd, Yucheng City, P.R. China (2) Jinlei Technology Co. Ltd., Laiwu City, Shandong, P.R. China (3) Mecanizados Tar, S.L., Arrona-Zestoa, Spain.

Main bearing

Type:	Spherical roller bearing
Designed by:	NTN Bearing Corporation of America
GE Part no.:	448W2212P001
Designation:	5MX4-240/1120BPX3V4S30
Drawing no.:	19-01937, Rev. -, dated 2019-03-15
Manufacturer/Site:	(1) NTN Houdatsushimizu Corporation, Ishikawa, Japan (2) NTN Waelzlager Europa GmbH, Erkrath, Germany

alternative:

Designed by: Schaeffler Technologies AG & Co. KG
GE Part no.: 448W2212P001
Designation: F-623433.03.PRL-WPO-J48BB
Drawing no.: EDD F-623433.03.PRL-WPO-J48BB 000,
Rev. AE, dated 2019-03-21
Manufacturer/Site: (1) Schaeffler Technologies AG & Co. KG,
Schweinfurt, Germany
(2) Schaeffler Technologies AG & Co. KG,
Brasov, Romania

**Low Speed
Coupling**

Type: Shrink disc
Designed by: Stüwe GmbH & Co KG
GE Part no.: 446W5714P001
GE VSPN: 449W0153P001
Designation: HSD 890-23-2
Main Drawing no.: HSD 890-23-2, Rev. 1, dated 2018-01-31
Manufacturer/Site: (1) Stüwe GmbH and Co. KG, Hattingen,
Germany

alternative:

Designed by: Rexnord Tollok
GE Part no.: 446W5714P001
GE VSPN: 449W0156P001
Designation: TLK622 890x1310 Y2360
Main Drawing no.: Y2360, Rev. -, dated 2018-01-29
Manufacturer/Site: (1) Rexnord Tollok S.r.l., Masi Torello, Italy

alternative:

Designed by: Luoyang Haozhi
Machinery Co.,Ltd
GE Part no.: 446W5714P001
GE VSPN: 449W0155P001
Designation: FN890-23B
Main Drawing no.: 446W5714P001 (FN890-23B), Rev. 2,
dated 2019-01-21
Manufacturer/Site: (1) Luoyang Haozhi Machinery Co. Ltd.,
Luoyang, P.R. China

Gearbox

Type: planetary helical gearbox
 Designed by: ZF Wind Power Antwerpen
 GE Part no.: 451W6174P003
 451W6174P005
 GE VSPN: 451W6175P001 (Hydac Pump / Filter)
 451W6175P003 (Hydra Specma Pump / Filter)
 451W6175P005 (P001 + Planet Brg. Sensor)
 451W6175P007 (P003 + Planet Brg. Sensor)
 Designation: EH0941A-0X2 (JB-Version)
 Rated Power (mech.): 5530 kW
 Gear ratio: 142.86
 Main drawing no.: 097-EH0941A021, Rev. A, dated 2021-06-17
 Sectional drawing no.: 098-EH0941A021, Rev. A, dated 2020-06-23
 Manufacturer/Site: (1) ZF Wind Power Antwerpen N.V. Lommel, Belgium
 (2) ZF Wind Power Coimbatore pvt. Ltd., Coimbatore, India

alternative:

Type: planetary helical gearbox
 Designed by: ZF Wind Power Antwerpen
 GE Part no.: 451W6174P011
 GE VSPN: 451W6177P001 (Hydac Pump / Filter)
 Designation: 451W6177P003 (Hydra Specma Pump / Filter)
 Rated Power (mech.): 5530 kW
 Gear ratio: 142.86
 Main drawing no.: 097-EH0941A021, Rev. A, dated 2021-06-17
 Sectional drawing no.: 098-EH0941B011, Rev. A, undated
 Manufacturer/Site: (1) ZF Wind Power Antwerpen N.V. Lommel, Belgium
 (2) ZF Wind Power Coimbatore pvt. Ltd., Coimbatore, India

alternative:

Type: planetary helical gearbox
 Designed by: Moventas Gears Oy
 GE Part no.: 451W6174P001
 GE VSPN: 451W6176P001 (Hydac Pump + Hydac Filter)
 451W6176P003 (Hydac Pump + Agro-Hytos Filter)
 Designation: PPH-5700
 Gear ratio: 143.079
 Main drawing no.: GDRM107213, Rev. B, dated 2019-09-09
 Sectional drawing no.: GDRM105685, Rev. -, dated 2018-04-11
 Manufacturer /Site: (1) Moventas Gearx Oy, Jyväskylä, Karkkila, Finland

alternative (only for configurations 4, 5, 6):

Type:	planetary helical gearbox
Designed by:	ZF Wind Power Antwerpen
GE Part no.:	451W0528P003 453W3938P001
GE VSPN:	451W0529P001 (Hydac Pump + Filter) 453W3946P001 (Hydac Pump + Filter) 451W0529P003 (Hydra Specma Pump + Filter) 453W3946P003 (Hydra Specma Pump + Filter)
Designation:	EH0941A-004 EH0941A-014
Gear ratio:	142.86
Main drawing no.:	097-EH0941A003, Rev. A, undated
Sectional drawing no.:	098-EH0941A003, Rev. A, undated
Manufacturer/Site:	(1) ZF Wind Power Antwerpen N.V. Lommel, Belgium (2) ZF Wind Power Coimbatore pvt. Ltd., Coimbatore, India

Gearbox support

Type:	Cast part
Designed by:	GE Renewable Energy
GE Part no.:	451W2612G001
Material:	SSDI class C acc. to spec. A50WE053
Main drawing no. (machining):	451W2612, Rev. B, dated 2021-06-01
Main drawing no. (casting):	451W4798, Rev. -, dated 2020-07-30

Gearbox Elastomer Bearing

Type:	Elastomer bearing
Designed by:	ESM Energie- und Schwingungstechnik Mitsch GmbH
GE Part no.:	449W5051P001 (Serial)
Designation:	UB17_001_02
Main drawing no.:	UB17_001_02, Rev. -, dated 2019-07-30

Generator Elastomer Bearing

Type:	Generator isolation mount
Designed by:	ESM Energie- und Schwingungstechnik Mitsch GmbH
GE Part no.:	448W9164P001
Designation:	ML01_003_44
Main drawing no.:	ML01_003_44_KD, dated 2019-03-15

Generator coupling	Type:	Friction clutch
	Designed by:	Flender GmbH
	GE Part no.:	449W3630P001/P002
	GE VSPN:	449W3633P001
	Designation:	ARV-4 KZR 570-4
	Main drawing no.:	A5E47722315A_AB, Rev.002, dated 2020-04-21
	Manufacturer/Site:	(1) Flender GmbH, Bocholt, Germany
	<u>alternative:</u>	
	Type:	Friction clutch
	Designed by:	KTR-Group
	GE Part no.:	449W3630P002
	GE VSPN:	449W3632P002
	Designation:	RADEX-N 220 NANA 4 special
	Main drawing no.:	M 809751, Rev. 0, dated 2020-07-13
	Manufacturer/Site:	(1) KTR Kupplungstechnik GmbH, Rheine, Germany
Rotor brake	Type:	Hydraulic braking system
	Designed by:	KTR Group
	GE Part no.:	449W3580P001 (Serial)
	GE VSPN:	449W3583P001 (Serial)
	Designation:	KTR-STOP YAW M C-40
	Number of brakes:	1
	Position:	High speed shaft
	Drawing no.:	M 777412, Rev.1, dated 2019-08-16
	Manufacturer/Site:	(1) KTR Brake Systems GmbH, Schloss Holte Stukenbrock, Germa
	<u>alternative:</u>	
	Designed by:	Svendborg Brakes
	GE Part no.:	449W3580P001
		449W3258P001
	GE VSPN:	449W2412P001
		449W3259P001
	Designation:	BSAB90 / CB90R
	Number of brakes:	1
	Position:	High speed shaft
	Drawing no.:	490-6914-801, Rev. A, dated 2019-04-04 490-6909-801, Rev. A, dated 2020-03-03
	Manufacturer/Site:	(1) Svendborg Brakes A/S, Vejstrup, Denmark (2) Altra Industrial Motion do Brasil S.A., Cotia, Brazil (3) Svendborg Brakes (Shanghai), Shanghai, China

**Low speed
Rotor Lock Disk**

Type:
Designed by:
GE Part no.:
Drawing no.:
Manufacturer/Site:

Manual Rotor Lock Disc
GE Renewable Energy
448W2972P001
448W2972, Rev.-, dated 2019-01-04
(1) Shandong Weiteng Machine Co Ltd.,
Weifang, Shandong, China
(2) Energy Hardware Holdings, LLC
(Shanghai Aerotech), P.R. China
(3) Liyang Flying Industry Co. Ltd., Liyang
City, Jiangsu Province, P.R. China
(4) Wheels India Limited, Chennai, India

**Low speed
Rotor Lock Pin**

(only for configurations 1-3):

Type:
Designed by:
GE Part no.:
GE VSPN:
Drawing no.:
Manufacturer/Site:

Manual Rotor Lock Pin
Svendborg Brakes A/S
448W4722P001
448W4730P001
490-6366-802, Rev.-, dated 2018-05-04
(1) Svendborg Brakes A/S, Vejstrup, Denmark
(2) Svendborg Brakes Shanghai Co. Ltd.,
Shanghai, China
(3) Altra Industrial Motio do Brasil, Cotia, Brazil

alternative (only for configurations 1-3):

Designed by:
GE Part no.:
GE VSPN:
Designation:
Drawing no.:
Manufacturer/Site:

KTR Group
448W4722P001
448W4731P001
KTR-STOP RL M-B-355-214 (740101)
740101, Rev. 0, dated 2018-09-12
(1) KTR Brake Systems GmbH, Schloss
Holte Stukenbrock, Germany

alternative:

Designed by:
GE Part no.:

Drawing no.:

Manufacturer/Site:

GE Renewable Energy
451W7440G001
453W4704G001
451W7440, Rev. -, dated 2020-09-16
453W4704, Rev. -, dated 2021-09-17
(1) Svendborg Brakes A/S, Vejstrup, Denmark
(2) Altra Industrial Motio do Brasil, Cotia, Brazil
(3) Svendborg Brakes (Shanghai) Co. Ltd,
Shanghai, China
(4) CSIC Heisheng Technology Co Ltd., Yichang,
China

(5) Dellner Bubenzer Germany Wind GmbH,
Dorsten, Germany
(6) Antec Eolica Fabricacao e Comercio de Freios
Ltda., Camacari, Brazil
(7) KTR Brake Systems GmbH, Schloss Holte
Stukenbrock, Germany

**High speed
Rotor lock**

Type:
Designed by:
GE Part no.:
Main Drawing no.:
Manufacturer/Site:

Manual Rotor Lock
GE Renewable Energy
448W2230G001
448W2230, Rev.-, dated 2018-10-17
(1) Duomo Euroservices S.L., Santiago,
Toledo, Spain
(2) Shenyang Sunny Lion Equipment Co.
Ltd., Shenyang, China
(3) Dalian E & T., Development Zone, Jingshang
Mould Co., Ltd., Dalian, China
(4) Energy Hardware Holdings, LLC (Shanghai
Aerotech), P.R.China

**Bolted connection
Hub-Rotor Shaft**

Type:
Designed by:
GE Part no.:
Drawing no.:

Double-row bolted connection
GE Renewable Energy
450W9911G001
451W1408, Rev. -, dated 2020-06-03

Bedplate

Type:
Designed by:
GE Part no.:

Material:
Main Drawing no. (machining):

Main Drawing no. (casting):

Cast
GE Renewable Energy
450W8034G001
452W9306G001
452W7091G001
453W7241G001
454W0334G001
SSDI class C acc. to spec. A50WE053
450W8034, Rev. B, dated 2020-12-02
452W9306, Rev. -, dated 2021-05-17
452W7091, Rev. -, dated 2021-03-19
453W7241, Rev. A, dated 2022-03-04
454W0334, Rev. -, dated 2022-01-28
450W8033, Rev. -, dated 2020-06-02
453W7240, Rev. -, dated 2021-11-18

Manufacturer/Site:

- (1) Jiangsu Sinojit Wind Energy Technology Co. Ltd, Jiangsu, P.R. China
- (2) Jiangsu FAW Foundry Co. Ltd, Wuxi, Jiangsu, P.R. China
- (3) GE Energias Renovaveis Ltda, Brazil
- (4) Himile Mechanical Science and Technology Co. Ltd, Shandong, P.R. China
- (5) Emalto Usinagem e Tratamento Anticorrosivo Ltda, Santand do Paraiso, Brazil

Pillow Block

Type:
Designed by:
GE Part no.:

Cast
GE Renewable Energy
451W4791G001
452W7093G001
453W7242G001

Material:
Main Drawing no. (machining):

SSDI class C acc. to spec. A50WE053
451W4791, Rev. A, dated 2020-12-02
452W7093, Rev. -, dated 2021-03-19
453W7242, Rev.-, dated 2022-03-07

Main Drawing no. (casting):
Manufacturer/Site:

- 452W1636, Rev. -, dated 2020-11-27
- (1) Wuxi Rhester Machinery Co. Ltd., Wuxi, Jiangsu, China
 - (2) Jiangsu Sinojit Wind Energy Technology Co. Ltd, Jiangsu, China
 - (3) Himile Mechanical Science and Technology Co. Ltd, Shandong, P.R. China
 - (4) Shandong Weiteng Machine Co. Ltd., Weifang, Shandong, P.R. China
 - (5) Baettr Lem A/S, Lem, Denmark

Generator frame

Type:
Designed by:
GE Part no.:
Material:
Main Drawing no. (fabrication):
Main Drawing no. (machining):
Manufacturer/Site:

Welded part
GE Renewable Energy
452W4085G001
S355J2 or ASTM A572 Grade 50 (steel)
452W4084, Rev. -, dated 2021-02-04
452W4085, Rev. -, dated 2021-02-05

- (1) Liyang Flying Industry Co. Ltd. Jiangsu Province, P.R. China
- (2) Himile Mechanical Science and Technology, Shandong, P.R. China
- (3) Painco Industria e Comercio S/A, rio das Pedras, Brazil
- (4) Wuxi Rhester Machinery Co. Ltd., Wuxi, Jiangsu, China

alternative:

Designed by: GE Renewable Energy
 GE Part no.: 453W0577G001
 453W3848G001
 Material: S355J2 or ASTM A572 Grade 50 (steel)
 Main Drawing no. (fabrication): 452W4084, Rev. A, dated 2021-03-18
 453W3847, Rev. A, dated 2021-10-14
 Main Drawing no. (machining): 453W0577, Rev. -, dated 2021-06-23
 453W3848, Rev. A, dated 2021-10-14
 Manufacturer/Site: see above

Yaw system

Type: Active, yaw bearing slewing ring with 4 active yaw drives and 20 hydraulic brakes

Yaw drive

Type: 4 stage planetary gearbox
 Designed by: Bonfiglioli Transmittal
 GE Part no.: 449W3493P001
 GE VSPN: 449W3495P001
 Designation: 714T4 (JB00004586)
 Drawing no.: I7140T012700, Rev. -, dated 2019-05-23
 Manufacturer/Site: (1) Bonfiglioli Riduttori S.p.A., Bologna, Italy
 Manufacturer motor: Bonfiglioli
 Designation motor: BN132MB 6

alternative:

Designed by: SEW Eurodrive Brasil
 GE Part no.: 449W3493P001
 452W6636P001
 GE VSPN: 450W1703P001/P002
 452W7635P001
 Designation: PW067 / PW067L
 Drawing no.: 2422 441 3.30.1, Rev.00, dated 2019-07-08
 2422 441 5.30.1, Rev.00, dated 2020-08-31
 Manufacturer/Site: (1) Sew-Eurodrive Brasil Ltda., Indaiatuba, Brazil
 Manufacturer motor: SEW Eurodrive
 Designation motor: DRN132M6

alternative:

Designed by: NGC
 GE Part no.: 449W3493P001
 452W6636P001
 GE VSPN: 449W8163P001/P002
 NGC PN: 110200000326 / 110200000328
 Drawing no.: SYW07A010101 / SYW07A010301, Rev. A,
 dated 2020-09-10
 Manufacturer/Site: (1) Nanjing High Speed & Accurate Gear,
 Nanjing, China
 Manufacturer motor: LEGO / Marathon
 Designation motor: AKEJ132M2-6H / LEB 132MD-6

alternative:

Designed by: Liebherr Components Biberach GmbH
 GE Part no.: 449W3493P001
 452W6636P001
 GE VSPN: 450W7982P001
 Designation: DAT 450/3462-4MA0 (13401783)
 Drawing no.: 368 462 4000 99 0, Rev. 08, dated 2021-01-26
 Manufacturer motor: LEGO
 Designation motor: AKEJ132M2-6H
 Manufacturer/Site: (1) Liebherr Components GmbH, Biberach,
 Germany
 (2) Liebherr Machinery (Dalian) Co., Ltd.,
 P.R. China

Yaw bearing

Type: Ball bearing slewing ring
 Designed by: GE Renewable Energy
 Designation: 448W3840G001
 449W9228G001
 Drawing no.: 448W3840, Rev. -, dated 2018-11-21
 449W9228, Rev. -, dated 2021-01-26
 Manufacturer/Site: (1) Tianma (Chengdu) Precision Machinery
 Co. Ltd., Chengdu, P.R. China
 (2) CS Bearing Co. Ltd., Kyoungnam, Korea
 (3) Shilla Corporation, Cheonan-si,
 Chungnam, South Korea
 (4) Shilla Brazil Industria de Rolament de Giro
 Ltda, Tiete, Brazil
 (5) SKF do Brazil Ltda, Cajamar, Brazil
 (6) Changzhou Shilla Machinery Manufacturing
 Co. Ltd., Changzhou, China

Yaw brake

Type:	Yaw brake
Designed by:	JHS Jungblut GmbH & Co.KG
GE Part no.:	446W7576P001
GE VSPN:	446W7577P001
Designation:	JHS-08-1x100
Drawing no.:	VA002274, Rev. D, dated 2018-09-06
Manufacturer/Site:	(1) Dellner Bubbenzer Germany Wind GmbH, Dorsten, Germany (2) KTR Brake Systems GmbH, Schloss Holte Stukenbrock, Germany

Passive Cooler

Type:	passive cooler with plate heat exchanger
Designed by:	Ymer Technology
GE PN Cooler:	452W0376P001
	453W1497P001
	453W4029P001
	453W6400P001
Designation cooler:	3000x1274x63
GE PN Heat Exchanger:	452W0379P001
Designation Heat Exchanger:	840x394x450 – 1071.0491
GE Drawing Cooler no.:	450W8866, Rev. -, dated 2020-11-09
	453W1944, Rev. -, dated 2021-07-26
	453W4314, Rev. -, dated 2021-09-13
GE Drawing Heat Exchanger:	452W1013, Rev. -, dated 2020-11-17

Hydraulic system

Type:	Hydraulic system
Designed by:	HAWE-Hydraulik
GE Part no.:	447W8054P001 (STW)
	449W3384P001 (CWE)
GE VSPN:	448W3498P001(STW)
	449W3391P001 (CWE)
Designation:	17-111-H-01-00 (8801 0270-00) (STW)
	17-111-H-01-01 (8801 0506-00) (CWE)
Main drawing no. STW:	00_DE-D00018518, Rev. 00(STW)
	00_DE-D00025855, Rev. 00 (CWE)
Circuit Diagram no. STW:	00_DE-D00018005, Rev. 01 (STW)
	00_DE-D00024437, Rev. 01 (CWE)

alternative:

Type:	Hydraulic system
Designed by:	Svendborg Brakes
GE Part no. STW:	447W8054P001(STW)
	449W3384P001 (CWE)

GE VSPN STW:	449W2454P001(STW) 449W3392P001 (CWE)
Designation STW:	1110-0027-801 (STW) 1110-0027-802 (CWE)
Main Drawing no. STW:	1110-0027-801, Rev. -, dated 2019-03-22(STW) 1110-0027-802, Rev. -, dated 2019-10-31 (CWE)
Circuit Diagram no. STW:	1110-0027-601, Rev.C, dated 2019-04-25 (STW) 1110-0027-602, Rev. -, dated 2019-11-05 (CWE)

Generator

(only for configurations 1-3):

Type:	Asynchronous doubly-fed induction
Designed by:	Indar
GE Part no.:	448W9503P004
GE VSPN:	448W9505P002
Designation:	NAR710G6B60NS2 (3002045)
Rated power:	5733 kW
Rated frequency:	60 Hz
Rated speed:	1444 rpm
Rated voltage:	6000 V (stator)
Insulation class:	F
Degree of protection:	IP34 (generator) IP23 (slip ring)
Manufacturer/Site:	(1) Indar Electric S.L., Beasain, Gipuzkoa, Spain

alternative (only for configurations 4-6):

Type:	Asynchronous doubly-fed induction
Designed by:	Indar
GE Part no.:	452W6597P002
GE VSPN:	452W1605P002
Designation:	NAR710G6SB60N
Rated power:	5733 / 6049 / 6357 kW
Rated frequency:	60 Hz
Rated speed:	1444 rpm
Rated voltage:	6000 V (stator)
Insulation class:	F
Degree of protection:	IP34 (generator) IP23 (slip ring)
Manufacturer/Site:	(1) Indar Electric S.L., Beasain, Gipuzkoa, Spain

alternative (for configurations 1-6):

Type:	Asynchronous doubly-fed induction
Designed by:	Winergy
GE Part no.:	452W6597P002
GE VSPN:	447W9924P003
Designation:	W1G53000345
Rated power:	6357 kW
Rated frequency:	60 Hz
Rated speed:	1444 rpm
Rated voltage:	6000 V (stator) 489 V (rotor)
Rated current:	510 A (stator) 1532 A (rotor)
Insulation class:	F
Degree of protection:	IP34 (generator) IP23 (slip ring)
Manufacturer/Site:	(1) Siemens d.o.o. Belgrade, Subotica, Serbia

Converter

Designed by:	GE Power Conversion
Designation:	151X1258KA01SA03
GE Part no.:	448W0372P003
Power:	4.5 to 6.1 MW
Rated voltage (grid side):	690 V AC
Rated current (grid side):	1050 A
Rated voltage (machine side):	0 to 825 V AC
Rated current (machine side):	2400 A
Degree of protection:	IP 21 (cabinet) IP 41 (bridge cabinet) IP 22 (filter and inductor cabinet) IP 21 (AC entry cabinet)
Manufacturer/Site:	(1) GE Power and Water, Hai Phong City, Vietnam (2) GE Shenyang, Liaoning, P.R. China (3) Jabil do Brasil Industria Electroeletronica Ltda, Betim, Brazil

Transformer

Type: dry type
 Designed by: Hainan Jinpan Smart Technology (JST)
 Rated power: 6228 kVA
 Degree of protection: IP 00 (degree not yet defined)
 Location: Inside nacelle
 Manufacturer/Site: (1) Hainan Jinpan Electric Co. Ltd. (JST), Haikou, P.R. China
 (2) JST Power Equipment Inc., Nogales, Mexico

GE Part no.	GE VSPN	Supplier Designation	Rated voltage (HV)
452W0495P001	452W0496P001	316010893001	33-34.5 kV
452W0495P003	452W0496P003	316010913001	
452W0495P002	452W0496P002	316010903001	34.5 kV

Medium voltage switchgear

Manufacturer: Schneider Electric
 Designation: DVCAS 38.5 (operation from 30°C to 40°C)
 Rated voltage: 38.5 kV
 Rated current: 630 A
 Location: Inside tower
 Manufacturer/Site: (1) Schneider Electric, Libourne, France
 (2) Schneider Electric, Stezzano, Italy
 (3) Schneider Electric, Mungia, Spain

alternative:

Manufacturer: Schneider Electric
 Designation: RM6 (operation from -25°C to 45°C)
 Rated voltage: 24 kV
 Rated current: 630 A
 Location: Inside tower
 Manufacturer/Site: see above

alternative:

Manufacturer: Schneider Electric
 Designation: Flusarc (operation from -25°C to 55°C)
 Rated voltage: 36 kV
 Rated current: 630 A
 Location: Inside tower
 Manufacturer/Site: see above

alternative:

Manufacturer: Ormazabal
 Designation: cgm.3 (operation from -30°C to 40°C)
 Rated voltage: 38 kV
 Rated current: 600 A
 Location: Inside tower
 Manufacturer/Site: (1) Ormazabal, Igorre, Spain
 (2) Ormazabal do Brasil, Sao Paulo , Brazil

alternative:

Manufacturer: ABB
 Designation: SafePlus 36 (operation from -25°C to 40°C)
 Rated voltage: 36 / 40.5 kV
 Rated current: 630 A
 Location: Inside tower
 Manufacturer/Site: (1) ABB, Skien, Norway
 (2) ABB Eletrificacao Ltda, Sorocaba, Brazil

Tower HH107.4
 (Config. 1)

Type: tubular steel tower
 Designed by: GE Renewable Energy
 Sections: 5
 Length: 104.785 m
 Main drawing no.: 447W2844, Rev. B
 Foundation specification: Foundation_Load_Drawing_5.5-158_60Hz_107.4mHH_PRD068_EN_r01

Tower HH125.4
 (Config. 2 , 4)

Type: tubular steel tower
 Designed by: GE Renewable Energy
 Sections: 5
 Length: 122.705 m
 Main drawing no.: 449W9393
 451W1779 (alternative)
 451W2505 (alternative)
 Foundation specification: (1) Foundation_Load_Drawing_5.5-158_60Hz_125.4mHH_PRD069_EN_r01
 (2) Foundation_Load_Drawing_6.1-158_60Hz_125.4mHH_PRD136_EN_r02

Tower HH101
 (Config. 3, 5)

Type: tubular steel tower
 Designed by: GE Renewable Energy
 Sections: 4
 Length: 98.345 m
 Main drawing no.: 449W5216

Foundation specification: Foundation_Load_Drawing_5.5-158_60Hz_101mHH_PRD035_EN_r01
(2) Foundation_Load_Drawing_6.1-158_60Hz_101mHH_PRD142_EN_r01

Tower HH117
(Config. 6)

Type: tubular steel tower
Designed by: GE Renewable Energy
Sections: 5
Length: 114.305 m
Main drawing no.: 452W3871, Rev. -, dated: 2021-09-13
Foundation specification: (1) Foundation_Load_Drawing_6.1-158_60Hz_117mHH_PRD169_EN_r01

All Towers

Manufacturers/Sites: (1) Torres Eolicas do Nordeste SA, Jacobina, Brazil
(2) Ventower Industries, Monroe, Michigan, USA

Manuals

See Evaluation Report on Safety System and Manuals in the Design Evaluation Conformity Statement.
For the Rotor Blade LM77.4P3: see manuals BM-00207/A8 and SI-00922/B9

Control and safety System:

Designed by: GE Renewable Energy
Hardware: Mark VIe
Software: V5.7.2

Note:

Please refer to the mentioned evaluation reports for revision control of drawings/documents, detailed drawings, detailed design documents and other requirements and conditions.

- End of Annex -