DNV·GL

B-TYPE CERTIFICATE

Certificate No.:	Issued:	Valid until:
TC-B-GL-IV-1-04108-1	2019-04-16	2020-03-05

Issued for:

RRBEL V39 – 500 KW turbine with 47m Rotor Diameter

Specified in Annex 1

Issued to:

RRB Energy Limited

182/2, Bypass Road,
Poonamallee, Chennai 600056, India

According to:

GL-IV-1:2010 Guideline for the Certification of Wind Turbines

Based on the documents:

BDA-GL-IV-1-04108-0	Statement of Compliance for Design Assessment, dated 2019-04-16
IPE-B-GL-IV-1-04108-0	Statement of Compliance for IPE, dated 2019-04-16
TT-B-GL-IV-1-04108-0	Statement of Compliance for Type testing, dated 2019-04-16
0018150-01	Quality System Certificate issued by Intertek, dated 2017-12-18, valid until 2020-12-14
FCR-TC-B-GL-IV-1-04108-1	Final Certification Report, dated 2019-04-16

Changes of the system design, the production and erection or the manufacturer's quality system are to be approved by DNV GL.

Outstanding issues are listed in Annex 2.

Hamburg, 2019-04-16

For DNV GL Renewables Certification

Bente Vestergaard
Service Line Leader for Type and Component Certification

DAkkS Deutsche Akkreditierungsstelle D-ZE-11053-01-00

By DAkkS according DIN EN IEC/ISO 17065 accredited Certification Body for products. The accreditation is valid for the fields of certification listed in the certificate.

Hamburg, 2019-04-16

For DNV GL Renewables Certification

Mary Prabha Samson
Project Manager

B-TYPE CERTIFICATE – ANNEX 1

General	
Wind turbine class	IEC II and III
Power regulation	pitch-controlled
Rotor orientation	upwind
Rotor tilt	5°
Cone angle	2.5°
Rated power	500 kW
Rated wind speed v_r	15 m/s
Rotor diameter	47 m
Hub height(s)	50 m
Hub height operating wind speed range v_{in} - v_{out}	4 – 25 m/s
Design life time	20 years
Wind conditions	
Characteristic turbulence intensity I_{15} at v_{hub} = 15 m/s	0.1820
Annual average wind speed at hub height v_{ave}	52.2 m/s
Reference wind speed v_{ref}	38.1 m/s
Mean flow inclination	5°
Hub height extreme wind speed v_{e50}	70 m/s
Electrical network conditions	
Normal supply voltage and range	690V ±10%
Normal supply frequency and range	50Hz, -3Hz & +1Hz of nominal value
Voltage imbalance	2%
Maximum duration of electrical power network outages	2 days
Number of electrical network outages	350 per year
Other environmental conditions	
Normal and extreme temperature ranges	-20°C to +50˚C
Relative humidity of the air	100 %
Air density	1.28 kg/m^3
Solar radiation	1000 W/m^2
Description of lightning protection system	Based on TC81 (CO) 14 Guide A in accordance with The protection level I_IV in IEC 1024-1 table 2.

B-TYPE CERTIFICATE – ANNEX 1

Major components

Blade	Type	Vestas 23m horizontal axis
	Material	Fibre Reinforced Plastic
	Manufacturer	RRB Energy Limited
	Blade length	23 m
	Number of blades	3
	Drawing / Data sheet / Part no.	702265.R11
Hub	Type	Cast
	Manufacturer	AutoKast, Cochin
	Drawing/Data sheet/Part no.	731130.R4
Blade bearing	Type	4- points slewing ring
	Manufacturer	Rothe Erde / La Leonessa
	Drawing / Data sheet / Part no.	060.45.1000.300.41.1422 / S-45-1130-X01
Main shaft	Type	Forged
	Material	Chrome nickel steel (34CrNiMo6)
	Manufacturer	Bharat forge limited
	Drawing / Data sheet / Part no.	704800.R6
Main bearing	Type	Sperical roller bearing
	Manufacturer	SKF
	Drawing / Data sheet / Part no.	Front-23060 CC/W33 Rear – 24156 CC/W33
Gearbox	Type	3 stage planetary gearbox
	Manufacturer	ZF (Hansen)
	Gear Ratio	1:58.2
	Drawing / Data sheet / Part no.	EH 55G31S-BNC
Mechanical Brake	Type	Disc brake, Hydraulic activated, applied on highspeed shaft
	Manufacturer	MICKE Bruhmann Gmbh
	Drawing / Data sheet / Part no.	P2.I.44
Yaw system	Drive type	2 yaw drives
	Drive manufacturer	Bharat Bijilee
	Drawing / Data sheet / Part no.	R700317.R0
	Bearing type	Synthetic slide Bearing
	Bearing manufacturer	Deepak Agencies
	Drawing / Data sheet / Part no.	085484.R3 085487.R0 085488.R0 085494.R0,085495.R0,085496.R0,085497.R0,085498.R0,085499.R0
	Gear type	Planetary and worm Gear
	Gear manufacturer	Bonfiglioli

B-TYPE CERTIFICATE – ANNEX 1

	Drawing / Data sheet / Part no.	56111450.D 56111460.D
	Brake type	Built in Friction
Generator	Type	Asynchronous with 4 poles
	Manufacturer	Siemens
	Rated power	500 kW
	Rated frequency	50 Hz
	Rated speed	1531rpm
	Rated voltage	690 V
	Rated current	475A
	Insulation class	F
	Degree of protection	IP55
	Drawing / Data sheet / Part no.	4D-2840-4106-0238105-001
Tower	Type	Lattice tower
	Manufacturer	Associated Power Structures
	Number of sections	6
	Length	50 m
	Drawing / Data sheet / Part no.	V47-01 to V47-21
Manuals	O&M manual (Mechanical)	PS-943050.R1
	Transport manual	PS-0300-01.R1
	O&M manual (Electrical)	PS-941860.R1
	Start up Procedure	PS-942258.R1
	Erection Manual	PS-942259.R2

Outstanding issues

All the outstanding items listed below are not safety relevant within the validity period of the issued B – Type certificate and shall be closed within the validity period of B- Type certificate.

A) Loads and Environmental conditions:

- Design methods shall be updated according to section 4.1.3 of GL 2010.
- Extreme wind conditions shall be updated according to section 4.2.3.2 of GL 2010.
- Design load cases for extended design situations shall be updated according to section 4.3.3.9 of GL 2010.
- Failure of active features shall be considered in the load analysis as load case DLC 2.2 and shall fulfill the requirements of section 4.3.4.2 of GL 2010.
- The load document further be updated for requirements of Chapter 4.5 Load-Relevant Control and Safety System Functions.

B) Blades, Nacelle cover and spinner

- Blade design calculation document shall be updated according to section 6.2.2 of GL 2010.
- Further detailed analysis according to section 6.2.4 of GL 2010 must be carried for A level design assessment.
- Blade static test shall be evaluated for further requirements according to section 6.2.5 of GL 2010.
- Nacelle covers, and spinners documents shall be updated to meet the requirements according to section 6.4 of GL 2010.
- Document meeting the requirements for the fibre reinforced plastics and bonded joints shall be submitted to meet the requirements according to section 6.2.2 of GL 2010.

C) Machinery Components

- Blade pitching system documents needs to be updated according to section 7.2 of GL 2010.
- Rating life of bearings calculation shall be updated according to section 7.3.5.2 of GL 2010.
- Contact stress of bearing calculation shall be updated according to section 7.3.5.3 of GL 2010.
- Boundary conditions of bearing shall be updated according to section 7.3.5.4 of GL 2010.
- Main gearbox factory inspection shall be performed to meet the requirements according to section 7.4.9 of GL 2010.
- Running in period definition of gearbox shall be evaluated for A-level requirements.
- Manuals related to the gearbox shall be updated according to section 7.4.11 of GL 2010.

- Additional verifications as laid down in Section 7.5, Mechanical Brakes and Locking Devices need to be carried out.
- The yaw gearbox documentation shall be updated to meet the requirements according to section 7.8.4.1 of GL 2010.
- Lubrication system documentation of yaw assembly shall be updated to meet the requirements according to section 7.8.4.4 of GL 2010.
- Additionally, drive train dynamics study shall be performed according to section 7.10 of GL 2010
- Bolted connection document shall be updated to meet the requirements according to section 6.5 of GL 2010.

D) Control and protection system, manuals

- Control and protection system documents shall be updated with fault consideration according to section 2.1.3 of GL 2010.
- Control and protection system document shall be updated with required risk reduction through protection functions according to section 2.1.4 and 2.3.1 of GL 2010.
- Safety system document shall be updated to establish the requirements according to ISO 13849-1 and Appendix 2.c of GL 2010.
- Documentation related to software used in the safety system shall be updated to meet the requirements according to section 2.2.3.3 of GL 2010.
- The mechanical break and non-independent blade pitch system document shall be updated to meet the requirements according to section 2.2.3.4.2 of GL 2010.
- Functional description document related to locking devices shall be further updated to meet the requirements according to section 2.3.3 of GL 2010.
- Erection manual shall be updated to meet the requirements of section 9.1 of GL 2010.
- Commissioning manual shall be updated to meet the requirements of section 9.2 of GL 2010.
- Operating manual shall be updated according to section 9.3.3 of GL 2010.
- Maintenance manual shall be updated according to section 9.4.3 of GL 2010.

E) Electrical Design

- Electrical system documents shall be updated with temperature assumption according to section 8.1.4 of GL 2010.
- The documents related to Electrical overview diagram for the safety system with the SRP/CS must be submitted to meet the requirements of section 8.7.7 of GL 2010.
- Electrical system design document shall be updated to include relevant requirement for generators as per section 8.1.7.2 of GL 2010.

- Electrical system design document shall be updated for rating of auxiliary motor as per section 8.2.8 of GL 2010.
- Test reports for the low-voltage switchgear, control gear and switchboards to be fulfilled as per IEC 60364-6; shall be submitted as required in Section 8.7.1, para 5 and according to IEC 61439-1 as required in Section 8.7.4.4.
- The design document shall be updated for calculation of short-circuit current as per section 8.7.2.2 para 1 to 4 of GL 2010.
- Additional document listing switching devices shall be provided and shall meet the requirements of section 8.7.2.2, para 5 of GL 2010.
- The design document shall be updated for description of electric arc detection as per section 8.7.2.2 para 6 of GL 2010.
- The design document shall be updated for description of protection class as per section 8.7.4.2 of GL 2010.
- The design document shall be updated for climate conditions as per section 8.7.4.2 of GL 2010.
- Test to verify the characteristics of a switchboard shall be performed according to IEC 60439-1.
- Design documents shall be updated with calculation of bus bar according to section 8.7.5.3 of GL 2010.
- Design documentation shall be updated for the plausibility verification of the design of the safety related parts within the electrical installations as per section 8.7.7, para 3 of GL 2010.
- Design documentation for cables, lines and accessories shall be updated according to section 8.8.3 of GL 2010.
- Lightening protection system document shall be updated to meet the requirements of section 8.9 of GL 2010.

F) Structural components: Tower

- Design documents or relevant documents shall be updated with requirements according to section 6.6 of GL 2010.
- Design documents shall be updated with analysis concepts as per section 5 of GL 2010.
- Bolted connection document shall be updated to meet the requirements according to section 6.5 of GL 2010.

G) IPE of the critical components of the wind turbine listed below shall be carried out in separate inspections.

  - Gearbox
  - Main shaft
  - Main frame
  - Rotor blade

- Generator
- Lattice tower

H) Type testing

- Power curve measurement shall be performed according to IEC 61400-12-1 edition 2.
- Measurement of the electrical characteristics of the wind turbine shall be carried out in accordance with IEC 61400-21.
- Test of turbine behaviour shall be carried out to meet the requirements according to section 10.5 of GL 2010.
- New load measurement shall be carried out to meet the requirements according to section 10.6 of GL 2010.
- Witnessing of the commission shall be carried out to achieve A level type certificate according to section 10.8 of GL 2010.
- Test operation of the gearbox at the wind turbine shall be performed according to section 10.7.3 of GL 2010.

Periodic monitoring:

- Periodic monitoring of the wind turbine shall be performed before the validity date of B- Type certificate