Type Certificate

Certificate-No.: **TC-159/125428096/2018, Rev.00**

Applicant and Manufacturer: **PASL Wind Solutions (P) Ltd.**
34-35, Phase 1, GIDC Vatva, Ahmedabad-382445,
India

Wind Turbine Type(s): **PWS 900I,** 800.0 kW, P-28, HH 71.0 m, IEC wind class II A
The technical specifications of the wind turbine are given in the attached Annex.

The conformity evaluation has been carried out according to:

GL 2010: Germanischer Lloyd, "Guideline for the certification of Wind Turbines"; Edition 2010.

This Certificate attests compliance with:

GL 2010: Germanischer Lloyd, "Guideline for the certification of Wind Turbines"; Edition 2010,

concerning the design and manufacture. It is based on the following reference documents:

Module	Reference document	Dated	Issued by
Design Evaluation - Conformity Statement	DE-159/125428096/2018, Rev.00	2018-09-04	TÜV Rheinland
Manufacturing Evaluation - Conformity Statement	STC-161204, Rev.00	2016-12-22	DEWI-OCC
Prototype Testing - Conformity Statement	STC-161205, Rev.00	2016-12-22	DEWI-OCC
Type Characteristics - CEA Conformity Statement	Statement is based on evaluation report no.: 968/GI 1014.00/17, Rev.0.0	2017-11-22	TÜV Rheinland
Final Evaluation Report	125428096/8.9, Rev.00	2018-09-04	TÜV Rheinland

Any changes in the design or the manufacturer's quality system are to be approved by TÜV Rheinland, Certification Body for Wind Turbines. Without approval the Type Certificate loses its validity.

The Type Certificate is valid until 2023-09-03.

Cologne, 2018-09-04

Jai Prakash Narayan

Karl Friedrich

Certification Body Wind Turbines TÜVRheinland® Industrial Services

TÜV Rheinland Industrie Service GmbH,
Certification Body for Wind Turbines,
Am Grauen Stein,
51105 Cologne,
Germany

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Type Certificate

Annex

2018-09-04

Wind turbine type specifications

Certificate No.: **TC-159/125428096/2018, Rev.00**

Applicant and Manufacturer: **PASL Wind Solutions (P) Ltd.**

Wind Turbine Type(s): **PWS 900i,** 800.0 kW, P-28, HH 71.0 m, IEC wind class II A

Machine Parameters

WTG Manufacturer	:	PASL Wind Solutions (P) Ltd.
Wind Turbine Model	:	PWS 900i
Wind Turbine Configuration	:	Geared Wind Turbine with 'two - bearing' Support *(Drive Train)*
Wind Turbine Axis of Rotation	:	Horizontal Axis
Power Regulation	:	Active Pitch with variable speed
Rotor Orientation	:	Upwind
Rotor Tilt	:	5.00 deg.
Rotor Cone Angle	:	2.00 deg.
Rated Power	:	800.0 kW
Rated Wind Speed, V_r	:	11.40 m/s
Rated Rotational Speed	:	22.50 rpm
Rotor Diameter	:	58.0 m
Hub Height	:	71.0 m
Operating Wind Speed Range, $V_{in} - V_{out}$	:	3.0 ~ 25.0 m/s
Design Life Time	:	20.0 years
Generator Type	:	Asynchronous Induction Generator
Tower Type	:	Tubular Steel
Primary Brake System	:	Mechanical Brake
Pitch/ Stall System	:	Electrical Pitch System

Wind Conditions

Wind Class	:	II *(according to IEC 61400-1:1999)*
Turbulence Class	:	A *(according to IEC 61400-1:1999)*
Characteristic Turbulence Intensity, I_{15}	:	0.18 *(@ V_{hub} = 15.0 m/s)*
Slope Parameter, a	:	2.0
Annual Average Wind Speed, V_{ave}	:	8.5 m/s
Reference Wind Speed, V_{ref}	:	42.50 m/s
50-year Extreme Wind Speed, V_{e50}	:	59.50 m/s

Wind speed values refer to hub height

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Applicant and Manufacturer: **PASL Wind Solutions (P) Ltd.**

Wind Turbine Type(s): **PWS 900i**, 800.0 kW, P-28, HH 71.0 m, IEC wind class II A

Electrical Network Conditions

Normal Supply Voltage and Range	:	690.0 V ± 10%
Normal Supply Frequency and Range	:	50.0 Hz ± 2%
Voltage Imbalance	:	Max. 2%
Electrical Network Outages per year	:	350.0

Other Environmental Conditions

Environmental Condition	:	Normal Climate Condition *(according to IEC 61400-1:1999)*
Operating Temperature Range	:	-10.0 ~ + 40.0 deg. C *(Outside)*
Extreme Temperature Range	:	-20.0 ~ + 50.0 deg. C *(Outside)*
Air Density	:	1.225 kg/m³
Solar Radiation	:	1000.0 W/m²
Lightning Protection System	:	Protection Level I *(according to IEC 61400-24)*

Major Wind Turbine Components

Rotor Blade:

Blade Name/Model	:	P-28
Blade Length	:	28.0 m
Blade Material	:	Glass fibre reinforced epoxy resin
Bolt Circle Diameter	:	1400.0 mm
Blade Root Connection Type	:	T-Bolt Concept
Blade Mass	:	3035.0 kg *(with bolted joints, flanges and balancing masses)*
Static Moment from blade root	:	29287.0 kgm

Pitch Gearbox:

Manufacturer/Supplier	:	Bonfiglioli
Name/Model	:	705T3N *(with gearbox ratio = 176.5:1)*

Blade Bearing (Slew Ring):

Manufacturer/Supplier	:	Galperti Tech. S.r.l.
Name/Model	:	V82 1670 000 24 30 1500; Rev. No.: 2.0

Hub:

Manufacturing Process	:	Casting
Material	:	EN-GJS-400-18U-LT *(EN 1563)*
Drawing Reference	:	PWS 900 0013.01; Rev. No.: 2.0

Main Shaft:

Manufacturing Process	:	Casting
Material	:	EN-GJS-400-18U-LT
Drawing Reference	:	PWS 900 0002; Rev. No.: 7.0

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Annex **2018-09-04**

Wind turbine type specifications

Certificate No.: **TC-159/125428096/2018, Rev.00**

Applicant and Manufacturer: **PASL Wind Solutions (P) Ltd.**

Wind Turbine Type(s): **PWS 900i**, 800.0 kW, P-28, HH 71.0 m, IEC wind class II A

Rotor Lock Disc:		
Manufacturing Process	:	Fabricated
Material	:	IS 2644 Grade II *(CS-700)*
Drawing Reference	:	PWS 900 0020; Rev. No.: 4.0
Rotor Lock Pin:		
Manufacturing Process	:	Forging
Material	:	34CrNiMo6
Drawing Reference	:	PWS 900 0001.07; Rev. No.: 0.0
Main Bearings:		
Manufacturer/Supplier	:	Schaeffler KG
Name/Model	:	240/500B-MB-R200-300-E18D *(front)*
		23988-MB-E18D *(rear)*
Main Bearing Housings:		
Manufacturing Process	:	Casting
Material	:	EN-GJS-400-18-LT
Drawing Reference	:	PWS 900 0012.01; Rev. No.: 6.0 *(front)*
	:	PWS 900 0011.01; Rev. No.: 5.0 *(rear)*
LSS Shrink Disc - Rotor Side:		
Manufacturer/Supplier	:	Siemens
Name/Model	:	HSD-460-83
Main Gearbox:		
Manufacturer/Supplier	:	Winergy AG
Name/Model	:	PEAB 4320 *(2 - planetary stage & 1 - spur wheel stage)*
Gear Ratio	:	1:67.481
Torque Arm (Main Gearbox) Support:		
Manufacturing Process	:	Casting
Material	:	EN-GJS-400-18U-LT
Drawing Reference	:	PWS 900 0014; Rev. No.: 3.0 *(lower gear mount)*
	:	PWS 900 0015; Rev. No.: 3.0 *(upper gear mount)*
Elastomer Bearings:		
Manufacturer/Supplier	:	Aegis Rubber Engineering Ltd.
Type	:	Split Bush Type
Mechanical Brake:		
Manufacturer/Supplier	:	Kateel Engineering Industry Pvt. Ltd.
Name/Model	:	KL-HA-75x2WW

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Applicant and Manufacturer: **PASL Wind Solutions (P) Ltd.**

Wind Turbine Type(s): **PWS 900i,** 800.0 kW, P-28, HH 71.0 m, IEC wind class II A

HSS Coupling:		
Manufacturer/Supplier	:	Flender
Name/Model	:	ARS-6 KRZN 280-6
Main Frame:		
Manufacturing Process	:	Casting
Material	:	EN-GJS-400-18U-LT *(EN 1563)*
Drawing Reference	:	PWS 900 0001; Rev. No.: 6.0
Generator Frame:		
Manufacturing Process	:	Casting
Material	:	EN-GJS-400-18U-LT
Drawing Reference	:	PWS 900 0019.08; Rev. No.: 1.0 *(I beam for the left side generator)*
	:	PWS 900 0019.09; Rev. No.: 1.0 *(I beam for the right side generator)*
	:	PWS 900 0019.11; Rev. No.: 1.0 *(cross beam)*
	:	PWS 900 0021; Rev. No.: 0.0 *(main beam left side)*
	:	PWS 900 0022; Rev. No.: 0.0 *(main beam right side)*
Generator :		
Manufacturer/Supplier	:	Siemens
Name/Model	:	1 LG8 457-4 *(Asynchronous Induction Generator)*
Rated Voltage	:	690.0 V *(stator side)*
Rated Current	:	876.0 A *(stator side)*
Rated Power	:	900.0 kW (*800 kW @ 22.50 rpm)*
Rated Speed	:	1506.0 rpm
Rated Frequency	:	50.0 Hz
Duty Type	:	S1 *(continuous: according to IEC 60034-1)*
Insulation Class	:	H
Degree of Protection	:	IP55
Frequency Converter (Option 1):		
Manufacturer/Supplier	:	Converteam
Name/Model	:	PPEDLJ31000-3005
Nominal Apparent Power	:	950.0 kVA
Rated Voltage	:	690.0 V ±10%
Nominal DC Bus Voltage	:	1100.0 V
Power Factor Range	:	0.86 to 1.0
Maximum Rated Current	:	1000.0 A *(Generator side)*/ 1000.0 A *(Grid side)*
Rated Grid Frequency	:	50.0 ± 2% Hz
Switching Frequency	:	2.5 kHz
Degree of Protection	:	IP21

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Applicant and Manufacturer: **PASL Wind Solutions (P) Ltd.**

Wind Turbine Type(s): **PWS 900I**, 800.0 kW, P-28, HH 71.0 m, IEC wind class II A

Frequency Converter (Option 2):

Manufacturer/Supplier	:	ABB
Name/Model	:	ACS800-77LC-1375/1125-7
Nominal Apparent Power	:	700.0 kVA
Rated Voltage	:	690.0 V ± 10%
Nominal DC Bus Voltage	:	1070.0 V
Power Factor Range	:	0.85 to 1.0
Maximum Rated Current	:	1143.0 A *(Generator side)*/ 941.0 A *(Grid side)*
Rated Grid Frequency	:	50.0/60.0 Hz ± 2%
Switching Frequency	:	2.0 kHz
Degree of Protection	:	IP54

Low Voltage Main Circuit Breaker:

Manufacturer/Supplier	:	Schneider Electric
Name/Model	:	NS 1000 type H
Rated Voltage	:	690.0 V
Rated Nominal Current	:	1000.0 A
Breaking Current Capacity	:	42.0 kA

Yaw Drive:

Manufacturer/Supplier	:	Bonfiglioli
Name/Model	:	709T4F *(with gearbox ratio = 1687:1)*

Yaw Bearing (Slew Ring):

Manufacturer/Supplier	:	Galperti Tech. S.r.l.
Name/Model	:	V82 2000 002 24 45 1822; Rev. No.: 1.0

Tower:

Manufacturer/Supplier	:	Patel Alloy Steel (P) Ltd.
Hub Height	:	71.0 m
Type(s) and Section(s)	:	Tubular Steel Sections: 1st, 2nd & 3rd - Cylindrical and 4th - Conical
Length	:	67.591 m *(tower bottom to tower top)*
Top/Bottom Outer Diameter	:	1827.0 mm/3500.0 mm
Weight	:	78600.0 kg *(with flanges, without top mass, tower internals and painting)*
Bolt Number(s), Size and Grade	:	100 x M42 10.9 (bottom & 1st flange), 176 x M24 10.9 *(2nd flange)*
	:	92 x M24 10.9 *(3rd flange)*
Material	:	Shell parts, flanges (seamless) and door frame:
	:	S355 JR *(EN 10025-2)* + Z15 *(EN 10164)*
Reference Drawing	:	9TT-0-00-00-01; Rev. No.: 2.0

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Tower Top Flange:

Material	:	S355
Reference Drawing	:	9TT-0-00-00-01; Rev. No.: 2.0

Control and Safety System:

Main Controller Manufacturer	:	Beckhoff/ABB
Main Controller Model/Hardware	:	CX 1020-0111/PM592-XC

Manuals:

Manufacturing Process	:	PWS/900/HAD/01; Rev. No.: 00; Dated: 2013-02-27
Transportation Process	:	PWS/GEN/EM/01; Rev. No.: 02; Dated: 2012-07-12
Installation & Commissioning Manual	:	PWS/GEN/COM/01; Rev. No.: 06; Dated: 2012-10-08
Operation Manual	:	PWS/GEN/OM/01; Rev. No.: 05; Dated: 2013-01-05
Service Manual	:	PWS/GEN/MP/01; Rev. No.: 05; Dated: 2013-01-07
Personnel Safety	:	PWS/GEN/PS/01; Rev. No.: 01; Dated: 2012-05-02

End of Annex

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