Title:

Wind turbine

Maintenance plan

G33-000-31-00-00-00-0-320-0-F

APPLICABILITY

- Product attributes

Model	G132 - 3.3 MW - 3.465 MW
Operating voltage	ALL
Frequency	ALL
Temperature	ALL
Dust	ALL
Corrosion	ALL
Power Converter	ALL
Yaw system	ALL

- Component attributes

PLC operation	ALL

CHANGES

Rev.	Author	Date	Description
02	DFALCES	20/05/16	Included replacement at 60 months of the synthetic gearbox oil for low-temperature wind turbine versions
03	DFALCES	17/02/17	• The tower subsections are regrouped by metal towers and hybrid towers • The 114 - DIBT 134 and 154 m metal towers are included • Lubricating the front ball bearings of the generator (50 Hz) at 24 months is included • Lubricating the front ball bearings of the generator (60 Hz) at 18 months is included • The name Ground electrical cabinet is corrected by tower base electrical cabinet • The name Top electrical cabinet is corrected by control electrical cabinet of the nacelle

INDEX

1 MAINTENANCE PLAN EVERY 6 MONTHS

NOTE:

The maintenance tasks defined below are to be performed every 6 months.

01 YAW SYSTEM

Chapter	Subsystem / Component	Task title
01.1	System in general	Noise inspection of the yaw system
01.2	Yaw system ring	Lubricating the yaw system ring teeth
01.3	Yaw system sliding elements	Lubricating the sliding elements of the yaw system
01.4	Yaw system sliding elements	Visually inspecting for dust on the sliding elements of the yaw system

03 BLADES

Chapter	Subsystem / Component	Task title
03.1	Blade	Noise inspection of aerodynamic noise
03.2	Blade	Noise inspection of mechanical noise
03.3	Structure	Visually inspecting the blades

04 HYDRAULIC SYSTEM AND PITCH CONTROL

Chapter	Subsystem / Component	Task title
04.1	Pitch control system cylinders	Noise inspection for gaps in the supports of the pitch control system cylinders

08 GEARBOX SYSTEM

Chapter	Subsystem / Component	Task title
08.1	Gearbox	Noise inspection of the gearbox in operation
08.2	Gearbox	Inspection for the absence of metal particles in the oil
08.3	Oil	Sampling lubrication oil

09 MAIN SHAFT SYSTEM

Chapter	Subsystem / Component	Task title
09.1	Main shaft system	Visually inspecting for leaks
09.2	Grease collection tray	Empty the grease collection tray

10 BLADE BEARING SYSTEM

Chapter	Subsystem / Component	Task title
10.1	Lubrication system	Visually inspecting for grease leaks in the blade bearings
10.2	Blade bearing unit - Interior retainer	Visual inspection
10.3	Blade bearing unit - Exterior retainer	Visual inspection
10.4	Blade bearing unit	Visually inspecting the dust seals
10.5	Blade bearing system	Manual lubrication

11 WIND TURBINE INSTRUMENTATION SYSTEM

Chapter	Subsystem / Component	Task title
11.1	Operating sensor - Vibration sensor	Checking operation

13 NACELLE COVER AND CONE SYSTEM

Chapter	Subsystem / Component	Task title
13.1	Cone unit	Visually inspecting the metal structure welding

15 GENERATOR SYSTEM

Chapter	Subsystem / Component	Task title
15.1	Generator	Replacing the air filter in the ring chamber
15.2	Brush	Checking wear and seat of phase brushes
15.3	Brush	Checking wear and seat of ground brushes
15.4	Ring body	Cleaning
15.5	Generator bearings	Lubrication of the generator bearings
15.6	Grease collection tray	Cleaning the grease collection tray

20 BUILT-IN SYSTEMS

Chapter	Subsystem / Component	Task title
20.1	PMS	Collecting data recorded by the PMS
20.2	PMS - Monitoring and processing unit	Visual inspection
20.3	PMS	Visually inspecting the ground connections

20.4	PMS accelerometers	Visually inspecting the general condition of the accelerometers

31 WIND TURBINE

Chap-ter	Subsystem / Component	Task title
31.1	Safety element	Checking the operation of the emergency push-buttons in the nacelle
31.2	Safety element	Verifying the operation of the emergency push-buttons of the lower platform
31.3	Wind turbine	Cleaning

2 MAINTENANCE PLAN EVERY 12 MONTHS

NOTE:

The maintenance tasks defined below are to be performed every 12 months.

01 YAW SYSTEM

Chapter	Subsystem / Component	Task title
01.1	Clamp	Visually inspecting the bolted joints between the clamps (and spacers) and frame
01.2	Passive brake pad	Adjustment
01.3	Ring - Base	Visually inspecting the bolted joint between the ring base and the tower
01.4	Ring	Visual inspection
01.5	Gear motor	Visually inspecting oil leaks
01.6	Gear motor	Visually inspecting the gear motor bolted joints
01.7	Position control unit - Yaw sensor	Visually inspecting the yaw system yaw sensor

02 NACELLE AND ROTOR THERMAL CONDITIONING SYSTEM

Chapter	Subsystem / Component	Task title
02.1	Conditioning and air distribution system	Visually inspecting the fastening elements of the heaters in the yaw system and front frame area
02.2	Conditioning and air distribution system	Visually inspecting the fastening elements of heaters in the nacelle

03 BLADES

Chapter	Subsystem / Component	Task title
03.1	Joint - Bolted joint	Visually inspecting between the blade and blade bearing

04 HYDRAULIC SYSTEM AND PITCH CONTROL

Chapter	Subsystem / Component	Task title
04.1	Hydraulic unit - Manifold block	Inspecting and adjustment of the reducing valve of the yaw system brake (Pos. 110)
04.2	Hydraulic unit - Manifold block	Inspecting and adjusting the mechanical brake's pressure relief valve (Pos.33)
04.3	Hydraulic unit - Manifold block	Inspecting and adjusting the pressure limiting valve of the pitch control system brake (Pos. 25)

04.4	Nacelle hydraulic circuit - Yaw system brake hydraulic circuit	Visually inspecting for leaks
04.5	Nacelle hydraulic circuit - Mechanical brake hydraulic circuit	Visually inspecting for leaks
04.6	Nacelle hydraulic circuit - Yaw system brake hydraulic circuit	Checking hydraulic pressure without orienting
04.7	Hydraulic unit - Yaw system brake accumulator	Verification of the precharge pressure and adjustment
04.8	Hydraulic unit - Mechanical brake accumulator	Verification of the precharge pressure and adjustment
04.9	Hydraulic unit - Accumulator	Verification of the precharge pressure and adjustment
04.10	Nacelle hydraulic circuit	Visually inspecting for leaks
04.11	Pitch control system - Hydraulic circuit in rotor	Inspection of condition of hoses
04.12	Nacelle hydraulic circuit	Inspection of condition of hoses
04.13	Pitch control system - Hydraulic rotary joint	Visually inspecting for leaks
04.14	Pitch control system - Hydraulic circuit in rotor	Visually inspecting for leaks
04.15	Hydraulic unit - Oil filter	Filter cartridge replacement
04.16	Pitch control system - Filtering system	Replacing the filter cartridge (hub)
04.17	Thermal conditioning system	Visually inspecting the intercooler
04.18	Pitch control system - Solenoid valve for the hydraulic cylinder manifold block	Checking operation
04.19	Hydraulic unit - pressure switch	Checking and adjusting the mechanical brake pressure switch (Pos.31)
04.20	Pitch control system - Pressure switch	Verifying and adjusting the pressure switch (Pos. 98)
04.21	Pitch control system - Hydraulic cylinder fork	Visually inspecting the bolted joints
04.22	Pitch control system - Hydraulic cylinder bracket	Visually inspecting the bolted joints
04.23	Blade bearing unit - Blade plate	Visually inspecting the bolted joints between the pin support and plate
04.24	Hydraulic unit - Oil	Visually inspecting the level
04.25	Hydraulic unit - Air filter	Inspection and replacement

04.26	Pitch control system - Emergency accumulator support	Inspecting the support-hub bolted joints
04.27	Pitch control system - Emergency accumulator supports	Inspecting the accumulators-support bolted joints
04.28	Pitch control system - Emergency accumulator supports	Visually inspecting the condition of the support of the accumulators and cabinet
04.29	Pitch control system - Emergency accumulator support	Visually inspecting the distributor block-support bolted joints

05 FRAME SYSTEM

Chap-ter	Subsystem / Component	Task title
05.1	Frame system	Visual inspection
05.2	Frame system	Visually inspecting the bolted joints
05.3	Frame system	Inspecting the condition of the non-slip tape

06 HUB SYSTEM

Chap-ter	Subsystem / Component	Task title
06.1	Hub	Visual inspection

07 HIGH SPEED SHAFT COUPLING SYSTEM

Chap-ter	Subsystem / Component	Task title
07.1	Coupling	Visually inspecting the bolted joints
07.2	Coupling	Visual inspection
07.3	Mechanical brake	Inspect for oil leaks
07.4	Mechanical brake	Bleeding the hydraulic circuit
07.5	Mechanical brake - Brake pad	Inspection and replacement

08 GEARBOX SYSTEM

Chap-ter	Subsystem / Component	Task title
08.1	Gearbox	Visually inspecting the structure
08.2	Lubrication system - Hoses	Visual inspection
08.3	Cooling system	Inspection for leaks

08.4	Gearbox - Oil filter	Replacement
08.5	Gearbox - Offline oil filtering system	Replacement
08.6	Gearbox - Pressure switch	Checking and adjustment
08.7	Cooling system - Intercooler	Cleaning
08.8	Gearbox - Torque arm	Visually inspecting the bolted joints to the frame
08.9	Gearbox - Oil	Level inspection
08.10	Gearbox - Torque arm	Inspection of gaps in the damper packages
08.11	Gearbox - Air filter	Inspection and replacement

09 MAIN SHAFT SYSTEM

Chapter	Subsystem / Component	Task title
09.1	Main shaft - Bearings	Lubrication
09.2	Main shaft	Visually inspecting the bolted joints to the hub
09.3	Main shaft	Visually inspecting the bolted joints to the frame
09.4	Main shaft	Visually inspecting the structure
09.5	Main shaft	Inspecting the rotor lock disc
09.6	Main shaft – collar	Visually inspecting the bolted joints

10 BLADE BEARING SYSTEM

Chapter	Subsystem / Component	Task title
10.1	Blade bearing unit	Visually inspecting the bolted joints to the hub
10.2	Blade bearing unit - Blade plate	Visually inspecting the bolted joints between the pin support and plate

11 WIND TURBINE INSTRUMENTATION SYSTEM

Chapter	Subsystem / Component	Task title
11.1	Environmental condition sensor	Verifying the operation of the wind sensor

12 TOWER SYSTEM

84, 97, 114 - IEC, 114 - DIBT, 134 AND 154 METER METAL TOWER

Chap-ter	Subsystem / Component	Task title
12.1	Tower - Structure - Metal joint structure	Visually inspecting the flange - ring welding
12.2	Tower - Structure - Metal joint structure	Visually inspecting the bolted joints between sections
12.3	Foundation - Metal foundation ring	Visually inspecting the flange
12.4	Foundation	Visually inspecting the bolted joints between the foundation and lower section
12.5	Foundation - Pedestal	Visual inspection
12.6	Foundation	Inspection of gaps between the foundation section and the pedestal
12.7	Internal element	Inspection and replacement of the door filters
12.8	Tower - Structure - Metal joint structure	Visually inspecting the bolted joints between the sections of a section (if applicable)
12.9	Internal element - Lifeline	Prescribed inspection

12 TOWER SYSTEM

134 METER HYBRID TOWER *MAX BÖGL*

Chap-ter	Subsystem / Component	Task title
12.1	Tower - Structure - Metal joint structure	Visually inspecting the bolted joints between sections
12.2	Tower - Structure - Adapting concrete structure - Metal	Visually inspecting the bolted joints between the adapting part and metal section
12.3	Tower - Structure - Adapting concrete structure - Metal	Close up visual inspection of the condition of the adapting part
12.4	Tower - Structure - Concrete structure	General visual inspection of the condition of the concrete tower
12.5	Foundation	General inspection of the condition of the foundation
12.6	Foundation	Visually inspecting the general condition of pre-stressed tendons and their anchors
12.7	Internal element	Inspection and replacement of the door filters
12.8	Internal element - Lifeline	Prescribed inspection

12 TOWER SYSTEM

TRACTEL / *AVANTI* ELEVATORS

Chap-ter	Subsystem / Component	Task title
12.1	*Tractel* / *Avanti* elevator	Checking brake operation in *Tractel* or *Avanti* elevators

12.2	*Tractel* / *Avanti* elevator	Inspecting and checking the operation of the lower limit switch lever
12.3	*Tractel* / *Avanti* elevator	Visually inspecting and checking the operation of the emergency upper limit switch
12.4	*Tractel* / *Avanti* elevator	Visually inspecting the conductor cable guides in *Tractel* or *Avanti* elevators
12.5	*Tractel* / *Avanti* elevator	Visually inspecting the guide cables in *Tractel* or *Avanti* elevators
12.6	*Tractel* / *Avanti* elevator	Visually inspecting the hoisting cable in *Tractel* or *Avanti* elevators
12.7	*Tractel* / *Avanti* elevator	Visually inspecting the safety cables in *Tractel* or *Avanti* elevators
12.8	*Tractel* / *Avanti* elevator	Visually inspecting the shackles in *Tractel* or *Avanti* elevators
12.9	*Tractel* / *Avanti* elevator	Visually inspecting the support beam
12.10	*Tractel* / *Avanti* elevator	Visually inspecting the bolted joints between beam-tower
12.11	*Tractel* / *Avanti* elevator	Visually inspecting to verify that all of the signs are in good condition

12 TOWER SYSTEM

ELEVATORS *GORACON*

Chap-ter	Subsystem / Component	Task title
12.1	*Goracon* elevator	Inspecting the general condition of the elevator
12.2	*Goracon* elevator	Inspecting the condition of the cabin guide cables
12.3	*Goracon* elevator	Inspecting the condition of the guide along the ladder
12.4	*Goracon* elevator	Inspecting the redirection of the cables
12.5	*Goracon* elevator	Inspecting the points for the safety for personnel
12.6	*Goracon* elevator	Inspection and functional test of the doors
12.7	*Goracon* elevator	Visually inspecting the hoisting and functional test elements
12.8	*Goracon* elevator	Visually inspecting the fall arrest retention element and functional test
12.9	*Goracon* elevator	Functional test of the elevator
12.10	*Goracon* elevator	Inspecting safety ropes
12.11	*Goracon* elevator	Upward emergency shutdown
12.12	*Goracon* elevator	Downward emergency shutdown
12.13	*Goracon* elevator	Inspecting the power cable
12.14	*Goracon* elevator	Inspecting the flat cable guide (optional)

13 NACELLE COVER AND CONE SYSTEM

Chap-ter	Subsystem / Component	Task title
13.1	Nacelle cover	Visual inspection (outside the transformer compartment)
13.2	Nacelle cover	Visual inspection (inside the transformer compartment)
13.3	Nacelle cover	Visually inspecting the fireproof fabrics (inside the transformer compartment)
13.4	Cone unit	Visually inspecting the cone's fiber panels

13.5	Cone unit	Visually inspecting the bolted joints between the support ring welded structure and the cone cover
13.6	Cone unit	Visually inspecting the bolted joints of the support structure with the hub
13.7	Nacelle cover	Visually inspecting the tub fiber and side supports

14 LOAD HOIST SYSTEM

Chap-ter	Subsystem / Component	Task title
14.1	Fixed hoist system	Lubrication
14.2	Fixed hoist system - Hoist component	Checking brake operation
14.3	Fixed hoist system - Hoist component	Visually inspecting the load limiter
14.4	Fixed hoist system - Hoist component	Visually inspecting the lifting nose
14.5	Fixed hoist system - Hoist component	Visually inspecting the chain end's mechanical stop
14.6	Mobile hoist system - Crane	Visually inspecting the upper trolley of the hoist
14.7	Mobile hoist system- Bridge crane frame	Visual inspection

15 GENERATOR SYSTEM

Chap-ter	Subsystem / Component	Task title
15.1	Generator	Visually inspecting the bolted joints to the frame
15.2	Generator - Electrical element	Inspection of the inside of the stator terminal box

18 TRANSFORMER SYSTEM

Chap-ter	Subsystem / Component	Task title
18.1	Transformer	Visually inspecting the neutral cable ground connection
18.2	Transformer - Electrical safeguard	Visually inspecting the surge arrester connections
18.3	Transformer - Neutral relay	Checking the switchgear trip
18.4	Transformer – Arc protector	Checking the operation of the arc sensor
18.5	Wall - Lock system	Checking of transformer access door microswitches operation
18.6	Transformer	Cleaning
18.7	Transformer	Visually inspecting the low voltage cables, terminals and fuses

18.8	Transformer	Visually inspecting the high-voltage delta connection and terminals

19 ELECTRICAL CABINET SYSTEM

Chap-ter	Subsystem / Component	Task title
19.1	Tower base electrical cabinet	Air filter replacement
19.2	Control electrical cabinet of the nacelle	Air filter replacement
19.3	Hub control electrical cabinet	Air filter replacement
19.4	Electrical cabinet - Converter	Air filter replacement
19.5	Electrical cabinet - Stator module	Air filter replacement
19.6	Electrical cabinet converter - Cooling system	Inspection of the hoses
19.7	Electrical cabinet converter - Cooling system	Inspecting for leaks from hoses of the cooling circuit
19.8	Electrical cabinet converter - Cooling system	Inspection of the intercooler
19.9	Control electrical cabinet of the nacelle	Cleaning
19.10	Tower base electrical cabinet	Cleaning
19.11	Hub control electrical cabinet	Cleaning
19.12	Converter electrical cabinet	Cleaning
19.13	Electrical cabinet - Stator module	Cleaning
19.14	UPS electrical cabinet	Cleaning
19.15	Hub electrical cabinet	Visually inspecting the hub electrical cabinet - support bolted joints
19.16	Electrical cabinet stator - Circuit breaker	Visually inspecting, checking the operation and insulation between ground connections of switch FG008
19.17	Electrical cabinet stator - Circuit breaker	Lubrication of the opening and closing mechanism of the FG008 circuit breaker switch

20 BUILT-IN SYSTEMS

Chap-ter	Subsystem / Component	Task title
20.1	Overspeed guard system	Checking the relay operation

26 COMPLETE NACELLE WIRING

Chap-ter	Subsystem / Component	Task title
26.1	Electrical equipment - Wiring	Visually inspecting the power wiring

31 WIND TURBINE

Chap-ter	Subsystem / Component	Task title
31.1	Safety element	Visually inspecting the safety signs
31.2	Safety element	Checking the operation of the switchgear trip button in the control electrical cabinet of the nacelle
31.3	Safety element	Inspecting the overvoltage dischargers in tower base electrical cabinet F57
31.4	Safety element	Checking the operation of relay KR910
31.5	Safety element	Visually inspecting the safety eyebolt of the emergency descent device
31.6	Safety element	Inspecting the fire extinguishers
31.7	Safety element	Inspecting the condition of the container with the descent device

36 BEACON SYSTEM

Chap-ter	Subsystem / Component	Task title
36.1	Beacons	Checking operation

37 LIGHTNING TRANSMISSION SYSTEM

Chap-ter	Subsystem / Component	Task title
37.1	Lightning transmission unit	Visual inspection
37.2	Grounding connection	Visually inspecting the grounding cables between tower sections
37.3	Grounding connection	Visually inspecting the transformer grounding cable
37.4	Grounding connection	Visually inspecting the high-voltage switchgear grounding cable
37.5	Grounding connection	Visually inspecting the foundation grounding cables

3 MAINTENANCE PLAN EVERY 18 MONTHS

NOTE:

The maintenance tasks defined below must be performed every 18 months.

15 GENERATOR SYSTEM

Chap-ter	Subsystem / Component	Task title
15.1	Generator	Lubricating the front ball bearings of the generator (60 Hz)

4 MAINTENANCE PLAN EVERY 24 MONTHS

NOTE:

The maintenance tasks defined below are to be performed every 24 months.

01 YAW SYSTEM

Chapter	Subsystem / Component	Task title
01.1	Gear motor - Oil	Level inspection

11 WIND TURBINE INSTRUMENTATION SYSTEM

Chapter	Subsystem / Component	Task title
11.1	Operating sensor - Smoke sensor	Checking smoke sensor operation

12 TOWER SYSTEM

84, 97, 114 - IEC, 114 - DIBT, 134 AND 154 METER METAL TOWER

Chapter	Subsystem / Component	Task title
12.1	Internal element - Light	Checking the operation of the lights
12.2	Tower - Structure - Access door	Visual inspection

12 TOWER SYSTEM

134 METER HYBRID TOWER *MAX BÖGL*

Chapter	Subsystem / Component	Task title
12.1	Internal element - Light	Checking the operation of the lights
12.2	Tower - Structure - Access door	Visual inspection

12 TOWER SYSTEM

TRACTEL / *AVANTI* ELEVATORS

Chapter	Subsystem / Component	Task title
12.1	*Tractel* / *Avanti* elevator	Inspecting and checking the operation of the load limiter in *Tractel* or *Avanti* elevators

12 TOWER SYSTEM

ELEVATORS *GORACON*

Chap-ter	Subsystem / Component	Task title
12.1	*Goracon* elevator	Inspecting the suspension beam

15 GENERATOR SYSTEM

Chap-ter	Subsystem / Component	Task title
15.1	Generator	Lubricating the front ball bearings of the generator (50 Hz)

18 TRANSFORMER SYSTEM

Chap-ter	Subsystem / Component	Task title
18.1	Transformer - Fuse	Checking of fuse microswitch operation

36 BEACON SYSTEM

Chap-ter	Subsystem / Component	Task title
36.1	Uninterruptible power supply for beacons (UPS)	Checking operation

5 MAINTENANCE PLAN EVERY 36 MONTHS

NOTE:

The maintenance tasks defined below are to be performed every 36 months.

08 GEARBOX SYSTEM

Chap-ter	Subsystem / Component	Task title
08.1	Gearbox - Oil	Mineral oil replacement

6 MAINTENANCE PLAN EVERY 48 MONTHS

03 BLADES

Chap-ter	Subsystem / Component	Task title
03.1	Blade root	Visual inspection

19 ELECTRICAL CABINET SYSTEM

Chap-ter	Subsystem / Component	Task title
19.1	Electrical cabinet stator - Circuit breaker	Inspecting the arc chambers of switch FG008

7 MAINTENANCE PLAN EVERY 60 MONTHS

NOTE:

The maintenance tasks defined below are to be performed every 60 months.

04 HYDRAULIC SYSTEM AND PITCH CONTROL

Chap-ter	Subsystem / Component	Task title
04.1	Hydraulic unit	Taking oil samples

08 GEARBOX SYSTEM

Chap-ter	Subsystem / Component	Task title
08.1	Gearbox - Oil	Synthetic oil replacement

31 WIND TURBINE

Chap-ter	Subsystem / Component	Task title
31.1	Safety element	Restamping extinguishers

8 MAINTENANCE PLAN EVERY 96 MONTHS

NOTE:

The maintenance tasks defined below are to be performed every 96 months.

31 WIND TURBINE

Chapter	Subsystem / Component	Task title
31.1	Safety element	Replacing the ropes on the descent device

9 MAINTENANCE PLAN AFTER 3 MONTHS FROM STARTUP

15 GENERATOR SYSTEM

Chap-ter	Subsystem / Component	Task title
15.1	Brush	Checking wear and seat of phase brushes
15.2	Brush	Checking wear and seat of ground brushes

20 BUILT-IN SYSTEMS

Chap-ter	Subsystem / Component	Task title
20.1	PMS	Collecting data recorded by the PMS

31 WIND TURBINE

Chap-ter	Subsystem / Component	Task title
31.1	Wind turbine	Maintenance of structural and electrical bolted joints

10 MAINTENANCE PLAN AFTER A STORM

NOTE:

The maintenance tasks defined below are to be performed after each storm

03 BLADES

Chapter	Subsystem / Component	Task title
03.1	Blade system	Noise inspection of aerodynamic noise
03.2	Blade system	Noise inspection of mechanical noise
03.3	Structure	Visually inspecting the blades

36 BEACON SYSTEM

Chapter	Subsystem / Component	Task title
36.1	Beacons	Checking beacon operation

11 MAINTENANCE PLAN IF THE CLOGGED FILTER SIGNAL APPEARS

NOTE:

The maintenance tasks defined below are to be performed if the filter sensor signal appears clogged

08 GEARBOX SYSTEM

Chap-ter	Subsystem / Component	Task title
08.1	Gearbox - Oil filter	Replacement
08.2	Gearbox - Offline oil filtering system	Replacement

12 MAINTENANCE PLAN AFTER EACH USE

NOTE:

The maintenance tasks defined below are to be performed after each use

12 TOWER SYSTEM

84, 97, 114 - IEC, 114 - DIBT, 134 AND 154 METER METAL TOWER

Chapter	Subsystem / Component	Task title
12.1	Tower - Structure - Access door	Inspecting the retention system of the door
12.2	Internal element - Lifeline	Verifying the last inspection date of the lifeline

12 TOWER SYSTEM

134 METER HYBRID TOWER *MAX BÖGL*

Chapter	Subsystem / Component	Task title
12.1	Tower - Structure - Access door	Inspecting the retention system of the door
12.2	Internal element - Lifeline	Verifying the last inspection date of the lifeline

12 TOWER SYSTEM

TRACTEL / *AVANTI* ELEVATORS

Chapter	Subsystem / Component	Task title
12.1	*Tractel* / *Avanti* elevator	Inspecting and checking the operation of the retention device in *Tractel* or *Avanti* elevators
12.2	*Tractel* / *Avanti* elevator	Visually inspecting and checking the emergency push-button operation
12.3	*Tractel* / *Avanti* elevator	Visually inspecting the anchor point on the elevator cabin in *Tractel* or *Avanti* elevators

12 TOWER SYSTEM

ELEVATORS *GORACON*

Chapter	Subsystem / Component	Task title
12.1	*Goracon* elevator	Visually inspecting the fall arrest retention element and functional test
12.2	*Goracon* elevator	Visually inspecting and checking the emergency push-button operation
12.3	*Goracon* elevator	Visually inspecting the elevator cabin anchor point

13 NACELLE COVER AND CONE SYSTEM

Chap-ter	Subsystem / Component	Task title
13.1	Nacelle cover - Roof	Visually inspecting the anchor points
13.2	Nacelle cover - Roof	Visually inspecting the bolted joints between the anchor points and the nacelle roof (outside the transformer compartment)
13.3	Nacelle cover - Roof	Visually inspecting the bolted joints between the anchor points and the nacelle roof (inside the transformer compartment)

14 LOAD HOIST SYSTEM

Chap-ter	Subsystem / Component	Task title
14.1	Fixed hoist system - Hoist component	Checking emergency push-button operation
14.2	Fixed hoist system - Hoist component	Visually inspecting the hoist hook and security latch
14.3	Fixed hoist system - Hoist component	Visually inspecting the chain guide
14.4	Fixed hoist system - Hoist component	Visually inspecting the chain safety anchor
14.5	Fixed hoist system - Hoist component	Visually inspecting the brake adjustment nut
14.6	Fixed hoist system - Hoist component	Visually inspecting the support and bolted joints
14.7	Fixed hoist system - Hoist component	Inspecting the fastening bolts of the motor to the hoist structure

13 MAINTENANCE PLAN EVERY TIME THE WIND TURBINE IS ACCESSED

NOTE:

The maintenance tasks defined below are to be carried out whenever accessing the wind turbine

31 WIND TURBINE

Chap-ter	Subsystem / Component	Task title
31.1	Safety element	Checking the condition of the extinguishers, safety labels and the last inspection date

SIEMENS Gamesa
RENEWABLE ENERGY

ADMINISTRATION PRICES 2017	Italy
Administration prices	**Italy**
	PVP
Senior local Engineer	85,91 €
Junior local Engineer:	56,03 €
Specialist technical support (local):	52,00 €
Tech.Assitance International (Contractor's suppliers)	143,88 €
Local maintenance Technician:	40,80 €
Local fitter:	31,75 €
Local labourer:	24,33 €
Overtime (Maintenance Technician)	
Working day up to 10 p.m.: €/h	57,58 €
Working day after 10 p.m.: €/h	64,49 €
Weekend/holiday work: €/h	55,28 €
Travel time: €/h	46,06 €
Expenses	
Senior and junior local engineer:	203,28 €
Local technicians:	127,05 €
International Technicians	Quotation
Mileage: €/Km	0,62 €
Vigilance Availibility Weekend&Holidays (€/pair·day)	141,97 €
Note: Watch (Duty Service) could not be kept in countries with low Gamesa´s representation. In these cases it will be special agreements	

Support from Spain	
Senior Engineer:	
Hour of work up to 10 p.m.: €/h	141,65 €
Hour of overtime after 10 p.m.: €/h	212,50 €
Weekends and bank holidays: €/h	283,33 €
Hour of travel: €/h	141,65 €
Junior Engineer:	
Hour of work up to 10 p.m.: €/h	92,39 €
Hour of overtime after 10 p.m.: €/h	138,59 €
Weekends and bank holidays: €/h	184,79 €
Hour of travel: €/h	92,39 €
Specialist technical support:	
Hour of work up to 10 p.m.: €/h	75,96 €
Hour of overtime after 10 p.m.: €/h	113,94 €
Weekends and bank holidays: €/h	151,92 €
Hour of travel: €/h	107,38 €
Maintenance Technician:	
Hour of work up to 10 p.m.: €/h	57,58 €
Hour of overtime after 10 p.m.: €/h	143,88 €
Weekends and bank holidays: €/h	57,58 €
Hour of travel: €/h	46,69 €
Expenses	35,78 €
Travel expenses	0,00 €
Mileage: €/Km	0,00 €

Conditions: Service include, labour costs, tools, safety equipment, vehicle, phone expenses, social security.

4 - SERVICES Maintenance Scope and Exclusions

Field Services	Predictive Maintenance (oil / vibration analysis)	Included
	Preventive Maintenance	Included
	Corrective Maintenance	Included
	Workmanship normal working hours	Included
	Work / Dispatch outside normal working hours	A
	BoP preventive maintenance (trafo)	O
	BoP preventive maintenance (switchgear, substation)	O
	BoP corrective maintenance (switchgear, trafo, substation)	A
Material	Consumables	Included
	Minor spare parts	Included
	Main components	Included
Operational Support	Cranes	Included
	Remote Monitoring 24 x 7	Included
	SCADA maintenance	Included
	SCADA software updates (no upgrades)	Included
	Monthly reporting (availability figures, service reports, fault-analysis report, etc.)	Included
	Predictive maintenance reports	O
Other Field Services	Tower cleaning/painting/resurfacing	A
	Blades cleaning/resurfacing and cosmetic damage repair	A
	Upgrades	A
	Safety elements maintenance and annual certification (by SGRE not by Third parties)	Included
	Waste management	Included
	Management of Spare Parts Stock (if applicable: RSPS purchased by customer)	Included
	Civil works maintenance	A
Other Operational Support	Customer Portal	Included
	Telecommunication Line	O
	Training	O
	WEB Mega	O
Risk Management	Availability Warranty (time-based)	Included Year 1 = 97% Year >2 = 98%
	Bonus on availability	50% extra production share

O = Optional/ Price list; A = Ad-hoc, to be reviewed and quote upon request

SIEMENS Gamesa
RENEWABLE ENERGY

SUBCONTRACTORS LIST –

Cranes contractors
- Fratelli Paradiso
- Runco
-Piano lago
- Vernazza
- Conti

Workforce contractors
- Anywind
- Regsreen
- Wind1000
- GES
-Yes international
-Ingeteam

Global service
- Acawind
- Huso 29
- Lowind
- Fairwind

Supervisor and H&S contractors
- Tetra
- EOS
- Clever
- Frater
- Mais Vento
- Resgreen
- RDT
- Control Vertical

_quieron prevencion

Abantos Vertical

Contractors for quality inspection
- Tetra
- EOS
- Clever
- Frater
- Mais Vento
- Resgreen

- RDT
- Control Vertical

Contractors for assembly supervision

- Tetra
- EOS
- Clever
- Frater
- Mais Vento
- Resgreen
- RDT
- Control Vertical

Contractors for installation of internal elevator

- Avanti

PARENT COMPANY GUARANTEE

THIS GUARANTEE is made this • day of • [date]

BETWEEN:

1. [*Issuer of the Parent Company Guarantee shall be defined according to the MergeCo Treasury general guidelines (Circular No. [•])*] with registered office at [•] and [•],[•] (the "**Guarantor**"); and

2. [PECH S.r.l.], with registered office at [address], (the "**Beneficiary**").

WHEREAS:

(A) PECH S.r.l. and [name of MergeCo Subsidiary] (the "**SiemensGamesa Subsidiary**") entered into an agreement dated [date] (the "**Agreement**") for the full maintenance service of wind turbine generators referred to therein. The Guarantor has received copy of the Agreement and acknowledges its terms and conditions.

(B) Pursuant to the terms provided for under Article 3.15 of the Agreement, the SiemensGamesa Subsidiary agreed to procure for the benefit of the Beneficiary a parent company guarantee (the **"Guarantee"**) as security for all the SiemensGamesa Subsidiary's obligations under the Agreement. For the sake of clarity, the Guarantor acknowledges and accepts that the Beneficiary is entitled to enforce this Guarantee according to the terms provided below.

(C) The Guarantor has agreed to guarantee all the SiemensGamesa Subsidiary's obligations under the Agreement.

THE PARTIES AGREE as follows:

1. INTERPRETATION

In this Guarantee and the recitals hereto, unless the context otherwise requires or unless otherwise defined or provided for in this Guarantee, words and expressions used herein shall have the same meaning attributed to them under the Agreement.

2. UNDERTAKING

Subject to Clause 3 of this Guarantee, the Guarantor irrevocably guarantees to the Beneficiary the due and punctual performance of the SiemensGamesa Subsidiary's, and its successors' and permitted assigns', obligations under the Agreement when and as such obligations become due and performable in accordance with the Agreement, including, for the sake of clarity, all the payment obligations for liquidated damages under the Agreement (the **"Guaranteed Obligations"**). To the extent the SiemensGamesa Subsidiary does not fulfil the Guaranteed Obligations, either the Guarantor or such other entity (within the Guarantor's group) nominated by the Guarantor shall perform any such Guaranteed Obligations, being understood that the Guarantor shall be liable for the performance of the Guaranteed Obligations carried out by the above entity nominated by the Guarantor.

The obligations of the Guarantor set out herein shall constitute and be continuing obligations.

3. LIMITATIONS OF LIABILITY

3.1 The Guarantor may raise all objections and defences the SiemensGamesa Subsidiary may have under the Agreement and may assume all such rights of set off, defence, counterclaim, limitation and/or exclusion of liability as the SiemensGamesa Subsidiary may have against the Beneficiary pursuant to the Agreement.

3.2 The liability of the Guarantor pursuant to this Guarantee shall not exceed the 100% of the annual fee price, calculated according to the pricing under Article 7 of the Agreement, per each year of duration of the Agreement (the "**Maximum Amount**"), being understood that should this Guarantee be enforced by the Beneficiary in whole or in part during a certain year of duration of the Agreement, the maximum guaranteed amount under this Guarantee is automatically increased up to the Maximum Amount from the starting of the following year of duration of the Agreement.

3.3 The Guarantor's liability under clause 2 shall be conditional on the Beneficiary first having made demand in writing for due performance of the respective Guaranteed Obligations on the SiemensGamesa Subsidiary and the expiry of the relevant grace period provided under the Agreement (if any).

3.4 Any payment by Guarantor under this Guarantee shall be made within [10] Business Days from receipt by Guarantor of the Beneficiary's request, on the bank account indicated by Beneficiary therein. If Guarantor fails to timely pay any

amount under this Guarantee, it shall, forthwith, pay interest on the overdue amount from the due date up to the date of actual payment, as well after as before judgement, at a rate equal to Euribor + 6%.

3.5 All payments made hereunder shall be made free, without set-off, and clear of, and without deduction for or on account of any present or future stamp or other taxes, levies, imposts, duties, charges, fees, deductions or withholdings of any nature now or hereafter applicable.

4. EXPIRY

4.1 The obligations of the Guarantor set out herein shall expire on [•] (the "**Date of Expiry**"). The Guarantor (i) acknowledges that according to the Agreement this Guarantee shall remain in full force and effect until the date which falls 30 days after the date of termination of the Agreement (the "**Term**"), and (ii) if the Date of Expiry falls before the Term, undertakes to deliver – 30 days before the Date of Expiry - a new Guarantee or to extend the Date of Expiry of this Guarantee in favour of the Beneficiary which shall remain in full force and effect until the Term but, in any case, before [•] (the "**Final Expiry Date**"). It is understood that, the breach by the Guarantor to deliver a new Guarantee or to extend this Guarantee according this Clause 4.1 (ii) is considered as an Operator Event of Default under Clause 17.1 of the Agreement.

4.2 Any claim by the Beneficiary under this Guarantee after the Final Expiry Date shall be barred and be unenforceable, without prejudice to any liability of the Guarantor accrued prior to such Final Expiry Date, provided that written notice of the same specifying in reasonable detail the nature and amount of the claim has been received by the Guarantor within one (1) month after the Final Expiry Date and any proceedings pursuant to Clause 10 in respect of such claim are commenced within six (6) months of such Final Expiry Date.

4.3 The Beneficiary undertakes to return this Guarantee to the Guarantor immediately upon its expiry. However, for the avoidance of doubt, this Guarantee expires independently of its return.

4.4 In the event that the Guarantor ceases to hold, directly or indirectly, the majority of the voting rights of the SiemensGamesa Subsidiary or the majority of shares of the SiemensGamesa Subsidiary, the Guarantor may offer a replacement guarantee for this guarantee, substantially in the form hereof, to be issued by another guarantor. If the Beneficiary, in its sole discretion and acting reasonably having due regard to the remaining performance risk of the Guaranteed

Obligations to be fulfilled by the SiemensGamesa Subsidiary and the credit risk of the replacement guarantor determines such replacement guarantee is issued by an acceptable guarantor, the Beneficiary shall accept such replacement guarantee as security for the Guaranteed Obligations, and upon the execution of such replacement guarantee this Guarantee shall automatically expire. The Beneficiary undertakes to return the Guarantee to the Guarantor immediately following such expiry but for the avoidance of doubt, this Guarantee shall expire independently of its return.

5. PRESERVATION OF RIGHTS

Subject to clause 3, the obligations of the Guarantor under this Guarantee shall not be discharged by any of the following:

5.1 Any amendment to, or any variation, waiver or release of any obligation of the SiemensGamesa Subsidiary under the Agreement;

5.2 Any time or indulgence being granted or agreed to be granted to the SiemensGamesa Subsidiary in respect of its obligations under or pursuant to the Agreement;

5.3 The taking, variation, renewal or release of, or enforcement or neglect to perfect or enforce any right, guarantee, remedy or security from or against the SiemensGamesa Subsidiary;

5.4 Any legal limitation, or incapacity relating to the SiemensGamesa Subsidiary; and/or

5.5 The winding-up, dissolution, administration or reorganisation of the SiemensGamesa Subsidiary or any change in its status, function, control or ownership.

6. ASSIGNMENT

Neither party shall assign or transfer any of its rights hereunder without the prior consent of the other party, which shall not be unreasonably withheld or delayed, being understood that the Beneficiary shall be entitled to assign, assign by way of security, and transfer, also for the purpose of Article 1263 of Italian civil code, the rights and benefits of this Guarantee to any lender providing any financing to the Beneficiary, without any Guarantor's consent, such consent being irrevocably granted by the Guarantor, also for the purpose of Article 1248 and 1264, paragraph 1 of the Italian civil code, by releasing this Guarantee.

7. NOTICES

7.1 Any notice to or demand on the Guarantor to be served under this Guarantee must be in writing and be delivered in person or sent by recorded delivery post to the Guarantor at its address appearing in this Guarantee or at such other address as it may have notified to the Beneficiary in accordance with this Clause 7.

7.2 Any such notice or demand shall be deemed to have been served:

(i) if delivered in person, at the time of delivery; or

(ii) if posted, upon receipt by the Guarantor.

8. WAIVER

8.1 No delay or omission of the Beneficiary in exercising any right, power or privilege under this Guarantee shall impair or be construed as a waiver of such right, power or privilege nor shall any single or partial exercise of any such right, power or privilege preclude any further exercise of such right, power or privilege or the exercise of any other right, power or privilege.

9. PARTIAL INVALIDITY, AMENDMENTS

9.1 The invalidity, illegality or unenforceability in whole or in part of any of the provisions of this Guarantee shall not affect the validity, legality and enforceability of the remaining part or provisions of this Guarantee.

9.2 Any term or provision of this Guarantee may only be amended, modified, altered, waived, supplemented or terminated in writing signed by the Beneficiary and the Guarantor. Such writing requirement may only be waived in writing and may not be substituted by electronic form.

10. DISPUTE RESOLUTION AND GOVERNING LAW

This Guarantee and any dispute arising in connection with it (including but not limited to any non-contractual obligations) are governed by Italian law.

The Guarantor hereby waives any rights under the provisions of Article 1247, 1944, 1947, where applicable, 1952 paragraph 3, 1955, 1956 and 1957 paragraph 2 and 3 of the Italian Civil Code.

All disputes arising out of or in connection with the present Guarantee, including any question regarding its existence, validity or termination, shall be submitted to the exclusive competence of the Court of Milan.

Signed by duly authorised for and on behalf of *Issuer of the Parent Company Guarantee shall be defined according to the MergeCo Treasury general guidelines (Circular No. [•])*]

Place, Date:

Signature(s) of signatories of the Guarantor

Accepted:

Place, Date:

Signature(s) of signatories of the Beneficiary

[On the Siemens Gamesa Italy letterhead]

To:

PECH S.R.L.

Viale Abruzzo, 410

66100 – Chieti

Italy

For the attention of: Mr. Lino Bergonzi

[*Place and date*]

Dear Sirs,

We make reference to the full maintenance services agreement for the wind farm to be realized in the Municipality of Casalduni, Italy, entered into on [•] between PECH S.r.l. and [•] (the "**Agreement**").

Words and expressions defined in the Agreement have the same meaning when used in this letter unless otherwise defined or the context otherwise requires.

In accordance with Article [•] of the Agreement, I, the undersigned _____, as duly authorised director of [•] and [•], hereby certify and confirm that the representations under Article 10.1 of the Agreement are true, complete, correct and accurate at the date hereof and will be true, complete, correct and accurate during the Term.

Best regards

[•]

_____