GENERAL SPECIFICATION

VESTAS V27-225 kW, 50 Hz WINDTURBINE

with

TUBULAR/LATTICE TOWER

ITEM no.: 941129

VERSION
1.2.0.
24

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TYPE: VESTAS V27 - 225 kW windturbine, 50 Hz with tubular/lattice tower

CONTENTS:

1.0. WINDTURBINE DESCRIPTION.

The VESTAS **V27** is a pitchregulated upwind windturbine with active yaw and a high speed rotor with three blades.

The blades are made of glassfibre reinforced polyester each consisting of two bladeshells, glued on a supporting beam. By special glued in threadrods the blades are fastened to a 4 points bearing, which again is bolted on to the blade console.

Through an independently supported main shaft, the power is transmitted to the generator through a two stage gearbox. The generator is changeable between 8 poles as "generator 1" and 6 poles as "generator 2". The generator is asynchronous and is directly connected to the grid. The rotor has two different speeds depending on which number of poles, there are connected. This is done to achieve a maximum performance both at low and high wind speeds.

From the gearbox to the generator the power is transmitted through a transmission shaft with a build in friction clutch.

Braking of the turbine is done by full feathering. Emergency stop activates the hydraulic disc brake, which is fitted to the high speed shaft of the gearbox.

All functions of the turbine are monitored and controlled by a microprocessor based control unit, and variations in the bladeposition are performed by a hydraulic system, which also delivers pressure to the brake system.

Yawing is done by two yawing motors, which meshes with a big toothed wheel mounted on the top of the tower. The system is a slide system with built-in friction.

The turbine nacelle is fully closed in a glassfibre reinforced nacellecover. There is access through a central opening independent of the orientation of the nacelle in relation to the tower.

The tower is delivered matallized and painted white. It is with an internal ladder. Normally the tower is delivered in one or two sections.

The lattice tower is delivered galvanized.

2.0. SPECIFICATIONS

2.1. ROTOR:

Diameter:	27 m
Swept area:	573 m^2
Rotational speed, generator 1:	43 RPM
Rotational speed, generator 2:	33 RPM
Rotational direction:	Clockwise
Orientation:	Upwind
Number of blades:	3
Aerodynamic brakes:	Full feathering

2.2. BLADES:

Air foil:	NACA 63.214-63.235
Length:	13 m
Width:	1,3m/0,5 m
Twist:	13°
Weight:	600 kg/pcs.

2.3. TUBULAR TOWER

Height:	30 m
Diameter Top:	1,4 m
Diameter Bottom:	2,4 m

LATTICE TOWER:

Height:	30 m

2.4. WEIGHTS and HEIGHTS:

Tubular Tower (excl. foundationsbolts):	12.000 kg
Lattice Tower (excl. foundationsbolts):	9.000 kg
Turbine:	7.900 kg
Rotor:	2.900 kg
TOTAL:	19.800 kg
Hub height:	31,5 m
Free height:	18,0 m
Highest point:	45,0 m

2.5. OPERATIONAL DATA:

Cut-in wind speed:	3,5 m/s
Rated wind speed (225 kW):	14 m/s
Cut-off wind speed:	25 m/s
Survival wind speed:	56 m/s

2.6. POWER CURVE: (air density 1.225 kg/m^3)

WINDSPEED m/s	OUTPUT kW
3,5	1,5
4,0	4,5
5,0	16,6
6,0	31,8
7,0	52,5
8,0	82,4
9,0	114,5
10,0	148,3
11,0	181,0
12,0	205,0
13,0	217,6
14,0	**225,0**
15,0 - 25,0	225,0

2.7. YEARLY OUTPUT: (Acc. to Beldringe Site, Denmark)

Roughness class 0:	808.000 kWh
Roughness class 1:	517.000 kWh
Roughness class 2:	415.000 kWh
Roughness class 3:	275.000 kWh

3.0. COMPONENTS OF THE WINDTURBINE

3.1. BLADES:

3.1. Manufacturer:	VESTAS
Material:	GRP
Principle:	Supporting beam with glued on shells
Bolts connection:	Threadrods

3.2. BLADEBEARING:

Manufacturer:	Rothe Erde or corresponding
Type:	4 points bearing

3.3. BLADE CONSOLE:

Manufacturer:	VESTAS
Type:	Casted
Material:	SG-iron,GGG403,DIN1693

3.4. MAIN SHAFT:

Manufacturer:	VESTAS
Material:	$CrNiMo_6$
Type:	Forged with flange
Shaft/console connection:	Bolts 10.9

3.5. BEARING HOUSING:

Manufacturer:	VESTAS
Type:	Welded tubular construction.
Material:	Steel 37.2, DIN 17100

3.6. MAIN BEARINGS:

Manufacturer:	SKF or corresponding
Type:	Spherical roller bearing

3.7. MACHINEFOUNDATION:

Manufacturer:	VESTAS
Type:	Tubular construction
Material:	Steel 44.2, DIN 17100

3.8. YAWING SYSTEM:

Manufacturer:	VESTAS
Type:	Slideblocksystem with build in friction

3.8.1. YAWING GEAR, 2 UNITS:

Type:	Planetary- and reductiongear
Rated torque:	2 x 5500 Nm
Manufacturer:	Bonfiglioli/Transmittal or corresponding

3.8.2. YAWING MOTORS:

Type:	Induction/Asynchronous
Rotational speed:	920 RPM
Rated power:	0,55 kW

3.9. TOWER:

Type:	**Tubular**
Height:	30 m
Manufacturer:	VESTAS/Roug
Surface treatment:	Metallized + Paint
Weight:	12.000 kg

Paintsystem, Outside:

Sandblasting:	SA3 (DS2019)
Metallizing:	DSI/ISO 2063 Zn80
Epoxy paint:	Min. 120 μm (2 coats)
Polyurethane paint:	UV resistant min. 40 μm (1 coat)

Paintsystem, Inside:

Sandblasting:	SA2.5 (DS2019)
Zinxiferous first coat:	Min. 50 μm (1 coat)
Epoxy paint:	Min. 100 μm (1 coat)

Type:	**Lattice**
Height:	30 m
Manufacturer:	Carl C. Jensen, DK
Surface treatment:	Galvanized
Weight:	9.000 kg

3.10. GEARBOX:

Nominal power:	433 kW
Ratio:	1 : 23.4
Type:	Two stage, parallel shafts
Oilquantity:	70 l
Slowspeed shaft:	Hollow shaft
Manufacturer:	Hansen, Flender or corresponding

3.11. COUPLINGS:

Main shaft, gearbox:

Type:	Conical shrink disc

Gearbox, generator:

Type:	Transmission shaft with friction clutch

3.12. GENERATOR:

Type:	Doublewinding, asynchronous
Manufacturer:	Siemens, AEG, ABB or corresponding
Rated power:	225 kW
Voltage:	400 VAC
Rated current:	396 A
Frequency:	50 Hz
Class of insolation:	F
Rotational speed (225 kW):	1008 RPM
Consumed reactive power:	163 kVAr at 1/1 load

Rated power:	50 kW
Voltage:	400 VAC
Rated current:	101 A
Frequency:	50 Hz
Class of insolation:	F
Rotational speed (50 kW):	760 RPM
Consumed reactive power:	48 kVAr at 1/1 load

3.13. BRAKE UNIT:

Type:	Disc brake
Diameter:	600 mm
Calipers:	2 hydraulic activated
Manufacturer, Calipers:	Brembo
Disc material:	SG-iron, GGG50,DIN 1693

3.14 HYDRAULIC UNIT:

Pump capacity:	4,5 l/min.
Max. pressure:	100 bar
Brake pressure:	25 bar
Pressure switches:	Piezoelectrical
Oil quantity:	30 l

3.15 ANEMOMETER:

Type:	Optoelectrical
Manufacturer:	VESTAS

3.16. WINDVANE:

Type:	Optoelectrical
Manufacturer:	VESTAS

3.17. CONTROL UNIT:

Heavy current:

Voltage:	3x400 V, 50 Hz
Max. power:	400 A
Lockable circuit breaker:	400 A/400 - 500A
Power supply for light:	1x10 A
Generator cut in:	By thyristors
Phasecompensation:	2 stages : 100/37,5 kVAr

Computer:

CPU:	2 x 8086
Programming language:	Modula-2
Build up:	Module builded up
Operation:	Numeric keyboard + functionkeys
Showing:	Display 4x40 characters

Top processor:

Supervision/Control:	Yawing Hydraulic Surroundings (Wind-Temp.) Rotation Generator Pitch system

Bottom processor:

Supervision/Control:	Grid Phasecompensation Thyristors

Operator panel:

Information:	Operation data Production Operation Log Alarm Log
Commands:	Operation/Pause Man. Yaw start/stop Maintenance routine
Remote supervision:	Possibility of connection of serial communication
MTBF for Computer:	43.800 hours

3.18 MEASURING DEVICE: Can be supplied for build together with the control unit.

Measuring type: Productionsmeasuring or Sale/Purchase measure.

4.0. INSTALLATION:

4.1. TERRAIN:

If the terrain within a 100 m radius of the turbine has a slope of more than 10° or 18%, there must be taken particularly considerations.

4.2. CLIMATIC CONDITIONS:

The turbine is designed for an ambient temperature range from -20° C to +40° C. Outside this range special precautions must be taken.

In regard to wind the turbine is designed in accordance with Danish conditions (roughness class 0, 1, 2 and 3).

The windturbine is designed for a mean air density of 1.23 kg m^3. Operational data and the power curve are given at this air density. If the mean air density differs from this value the data as well as the power curve will be changed.

4.3. GRID CONNECTION:

Intermittent or rapid fluctuations of utility grid frequencies may cause serious damage to the wind turbine. Steady variations within +1/-3 Hz are acceptable. The voltage may have a variation of ±10% as the highest.

The short circuit power must in most cases be at least 10 times the rated power of the generator in order to fulfill this requirement.

Grid drop out must only take place 1 time per week in the lifetime of the turbine.

A groundconnection of max. 10 Ω must be present. (In the Netherlands Max. 2,5 Ω)

In the case of small independent grids it is necessary to check the actual conditions.

Furthermore please see the electrical installation instruction for VESTAS V27 .

In consequence of our current continuing development and updating of our products, we reserve the right to change in the specifications.