GENERAL SPECIFICATION

VESTAS V27-225 kW, 50 Hz WINDTURBINE

with

TUBULAR/LATTICE TOWER

ITEM no.: 941129
GENERAL SPECIFICATION
VERSION 1.2.0.

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

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1.0. WINDTURBINE DESCRIPTION.

The VESTAS V27 is a pitchregulated upwind wind turbine 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 blade position 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 nacelle cover. 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 m²
- 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. foundations/bolts): 12.000 kg
- Lattice Tower (excl. foundations/bolts): 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/m³)

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<th>WINDSPEED m/s</th>
<th>OUTPUT kW</th>
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<tr>
<td>3.5</td>
<td>1.5</td>
</tr>
<tr>
<td>4.0</td>
<td>4.5</td>
</tr>
<tr>
<td>5.0</td>
<td>16.6</td>
</tr>
<tr>
<td>6.0</td>
<td>31.8</td>
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<tr>
<td>7.0</td>
<td>52.5</td>
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<tr>
<td>8.0</td>
<td>82.4</td>
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<td>9.0</td>
<td>114.5</td>
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<tr>
<td>10.0</td>
<td>148.3</td>
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<td>11.0</td>
<td>181.0</td>
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<tr>
<td>12.0</td>
<td>205.0</td>
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<td>13.0</td>
<td>217.6</td>
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<tr>
<td>14.0</td>
<td>225.0</td>
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<tr>
<td>15.0 - 25.0</td>
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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:

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: CrNiMo6
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)
Zinxiiferous 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

VESTAS 13, Jan 1994
3.10. **GEARBOX:**

Nominal power: 433 kW  
Ratio: 1 : 23.4  
Type: Two stage, parallel shafts  
Oil quantity: 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 built up
- **Operation:** Numeric keyboard + functionkeys
- **Showing:** Display 4x40 characters
Top processor:
Supervision/Control:

Yawning
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
Possibility of connection of serial communication

Remote supervision:
MTBF for Computer:

3.18 MEASURING DEVICE:

Measuring type:

Can be supplied for build together with the control unit.

Productions measuring 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 wind turbine 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 ground connection 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.