


TN-18-011
VICTORY 26-50 – MY2017 – internal access
GENERAL DESCRIPTION

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1 INTRODUCTION

1.1 PURPOSE

This document contains a general description of the Wind Turbine referred to as the VICTORY 26-50 MY2017 manufactured by Tozzi Nord S.r.l.

Main changes are:

- Internal access tower
- Passive brakes on high speed shaft
- Completely electrical YAW system

1.2 REFERENCES

TITLE	CODE	EDITION
[Ref.1] IEC 61400-1, "Wind turbines generator systems – Part 1: Safety Requirements", 2005	IEC 61400-1	Ed.3, 2007
[Ref.2] Germanisher Lloyd, "Guideline for the Certification of Wind Turbines", Edition 2010	GL-guidelines	2010

Table 1 – Reference Documents

1.3 LIST OF ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
WT	W ind T urbine
WEC	W ind E nergy C onverter
PLC	P rogrammable L ogic C ontroller
IEC	I nternational E lectrotechnical C ommission
DLC	D esign L oad C ase
VICTORY 26-50	Tozzi Nord VICTORY 26-50 Wind Turbine

Table 2 – List of abbreviations and definitions

2 ENVIRONMENT

This chapter describes the design environmental conditions of the VICTORY 26-50 wind turbine.

2.1 WIND CLASS

The VICTORY 26-50 wind turbine has been designed to conform to the special wind class IVA in accordance with standard IEC 61400-1.

<i>Wind conditions:</i>			
<i>Wind class Special IV A</i>			
<i>Reference wind speed V_{ref} (average for 10 min, hub height, 50 year return period)</i>	<i>30.0</i>	<i>[m/s]</i>	
<i>Annual average wind speed V_{ave}</i>	<i>6.0</i>	<i>[m/s]</i>	
<i>Turbulence intensity at 15m/s I_{ref}</i>	<i>0.16</i>	<i>[-]</i>	
<i>Extreme wind speed V_{e50} (average for 3 sec, hub height, 50 year return period)</i>	<i>42.0</i>	<i>[m/s]</i>	

Table 3 - Design environmental conditions for the VICTORY 26-50

3 TECHNICAL DESCRIPTION

Tozzi Nord's VICTORY 26-50 wind turbine is a three-bladed, horizontal shaft, upwind wind turbine with a rotor diameter of 26m, a power rating of 49.5 kW, active pitch control and variable speed. The standard hub height is 30m.

Tozzi Nord products are designed to maximise power production in low wind conditions.

3.1 ROTOR

The rotor consists of three blades made of epoxy glass fibre.

The blades are attached to the hub by means of bearings that enable it to rotate around its longitudinal axis.

The VICTORY 26-50 wind turbine is equipped with a collective blade pitch control system.

3.2 POWER TRAIN

The torque is transmitted to the electric generator by means of a two stage parallel shaft gearbox, the latter coupled through a special joint to the main low speed shaft.

3.3 YAW SYSTEM

An active yaw control system is used.

The angle of yaw is adjusted by means of two electric gear-motors positioned on the lower side of the frame, meshed with the external teeth of a special slewing ring which connects the nacelle to the underlying support tower.

3.4 TOWER

The VICTORY 26-50 has

- calendered circular section tubular steel tower, painted RAL 7035, built in three segments and coupled by bolted connections giving a total length of 29.18m. The access to nacelle is through a ladder inside the tower.

3.5 BLADE PITCH ADJUSTMENT SYSTEM

The collective blade pitch adjustment system is operated by a hydraulic linear actuator, driven by a high pressure hydraulic pump.

3.6 CONTROL SYSTEM

3.6.1 Architecture of the control system

The control system for the VICTORY 26-50 wind turbine is based on a heavy-duty PLC.

The main signals are:

- rotational speed of the rotor;
- rotational speed of the generator;
- wind speed;
- wind direction;
- tower top acceleration;
- generator temperature;
- hydraulic unit oil temperature and pressure;
- gearbox oil temperature;
- position of the pitch linear actuator.

3.6.2 Yaw control

The yawing movement is controlled on the basis of a relative direction signal supplied by the wind vane positioned on the rear exterior of the nacelle. A special safety system prevents excessive winding of the electrical cables, which run from the nacelle down the inside of the tower.

3.6.3 Blade pitch control

Blade pitch is controlled by a collective blade pitch system. When the rotor has reached its maximum rotation speed, the pitch angle of the blades is adjusted in such a way that the rotation speed remains constant. This logic is based on a continuous real time assessment of the speed of rotation and rate of acceleration of the rotor.

3.7 BRAKING SYSTEM

The VICTORY 26-50 wind turbine is fitted with two independent rotor braking systems:

- aerodynamic braking of the rotor by means of a collective adjustment of the pitch of the three blades into the parking position, using the hydraulic actuator;
- emergency braking using two mechanical passive brakes positioned on the high speed shaft.

3.7.1 Aerodynamic braking system

Aerodynamic rotor braking takes place by means of the hydraulic piston used in the blade pitch control system, which puts the blades simultaneously into the parking position.

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The hydraulic system is adjusted by a servo-proportional valve controlled by the PLC. In order to prevent malfunctions, even when the electrical network is not functioning, the system is equipped with a bladder accumulator that acts as a pressure reservoir eventually activated by passive relays.

3.7.2 Mechanical braking system

The VICTORY 26-50 wind turbine is provided with a disk brake that acts on the gearbox high speed shaft. The mechanical brakes are of the negative "fail-safe" type, which guarantees the safety of the machine in any fault or malfunction situation.

3.8 PROTECTION OF THE ELECTRICAL POWER SYSTEM

The function of protecting the electrical power chain is undertaken mainly by the logic controller of the static converter, which protects the entire system from the following possible faults:

- short circuit of the generator to earth;
- phase-phase short circuit in the generator;
- short circuit in the cabling between the generator and the inverter;
- inverter breakdown;
- network breakdown.

3.9 PROTECTION FROM LIGHTNING STRIKES

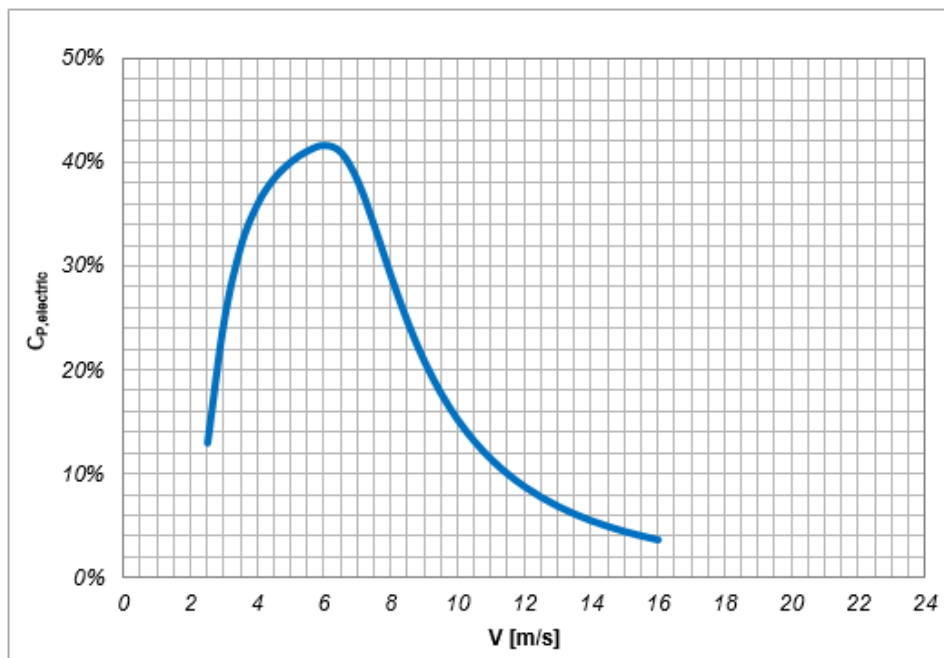
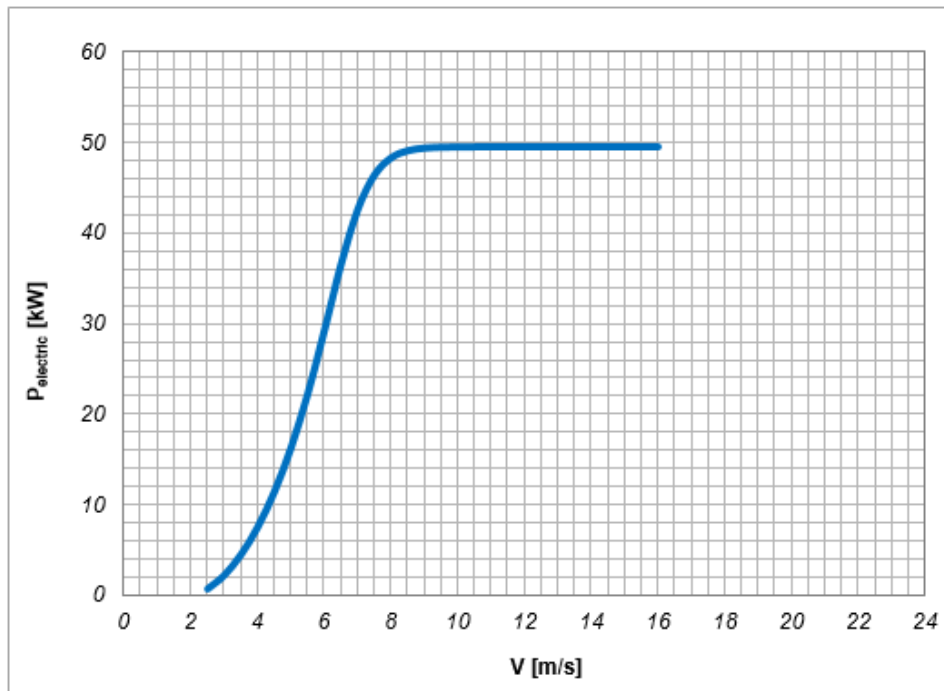
The VICTORY 26-50 wind turbine has a lightning protection system that includes both the nacelle and the support tower.

Protection against lightning is also available for the rotors (optional).

4 PERFORMANCE

The following table shows the performance of the VICTORY 26-50 wind turbine obtained with software ECN-BOT (10% turbulence, air density $\rho=1.225\text{kg/m}^3$). Calculation uncertainty $I_M=8\%$

TOZZI NORD - VICTORY 26-50				
Wind Speed		P	C _p	C _T
[m/s]	[mph]	[kW]	[-]	[-]
2.5	5.6	0.7	13.0%	80.3%
3.0	6.7	2.2	24.7%	80.2%
3.5	7.8	4.4	31.9%	80.2%
4.0	8.9	7.5	36.0%	80.2%
4.5	10.1	11.4	38.4%	80.1%
5.0	11.2	16.3	40.0%	80.1%
5.5	12.3	22.2	41.1%	80.0%
6.0	13.4	29.2	41.6%	80.0%
6.5	14.5	36.5	40.9%	79.9%
7.0	15.7	42.6	38.2%	79.9%
7.5	16.8	46.4	33.8%	60.2%
8.0	17.9	48.3	29.0%	46.7%
8.5	19.0	49.1	24.6%	37.8%
9.0	20.1	49.4	20.8%	31.3%
9.5	21.3	49.5	17.7%	26.3%
10.0	22.4	49.5	15.2%	22.5%
10.5	23.5	49.5	13.1%	19.4%
11.0	24.6	49.5	11.4%	16.9%
11.5	25.7	49.5	10.0%	14.8%
12.0	26.8	49.5	8.8%	13.1%
12.5	28.0	49.5	7.8%	11.7%
13.0	29.1	49.5	6.9%	10.5%
13.5	30.2	49.5	6.2%	9.4%
14.0	31.3	49.5	5.5%	8.6%
14.5	32.4	49.5	5.0%	7.8%
15.0	33.6	49.5	4.5%	7.1%
15.5	34.7	49.5	4.1%	6.5%
16.0	35.8	49.5	3.7%	6.0%



APPENDIX A: VICTORY 26-50 TECHNICAL SPECIFICATIONS

Architecture:

Type:	Upwind rotor with active blade pitch and yaw control.
Direction of rotation:	Clockwise viewed from upwind
Number of blades:	3
Rotor diameter:	26.0 m
Hub height:	30.0 m
Electrical power rating:	49.5 kW
Power regulation:	Active pitch (pitch to feather)
Cut-in wind speed:	2.5 m/s
Cut-out wind speed:	16.0 m/s
Power rating @:	7.5 m/s
Swept area:	531 m ²

Rotor

Blade length:	12.6 m
Material:	Epoxy glass fibre
Protection against lightning:	Optional
Hub:	Rigid

Power train

Transmission:	Two stage parallel shaft gearbox - reduction ratio 23.3
Main bearings:	roller adjustable
Nominal speed of rotation of the high speed shaft:	909 rpm
Nominal speed of rotation of the low speed shaft:	39 rpm

Generator

Power rating:	49.5 kW
Type:	20 pole permanent magnet synchronous generator
Protection:	IP20
Insulation class:	H

Yaw system

Type:	Active yaw control
Angular rotational speed:	≅1.4 deg/s

Controller

Type:	PLC
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Remote monitoring: Tozzi Nord SCADA System / Real Time Viewer
 UPS: Back-up batteries: 2x12V

Braking system

Aerodynamic braking: Collective adjustment of the blade pitch (3 speeds of the pitch linear actuator: 12, 25, 51 mm/s).
 Mechanical braking: Disc brake on high speed shaft with two negative calipers.

Tower

Height: 29.18 m
 Type: Calendered S355J2 steel, 3 segments
 Design wind class: Special IV A

Weights

Nacelle, excluding hub group \cong 5500 kg
 and blades:
 Hub group and blades: \cong 2400 kg
 Tower: \cong 10500 kg

APPENDIX C: VIEW OF THE TKA13 BLADE

