

Conc.: Climate conditions and foundation loads for Vestas V29.

Following note gives a resume of the climate and load conditions, which are used in the design of the Vestas/DWT V29 wind turbine. The rotor coordinate system (Small case letters x,y,z) is shown in figure 1, since it is the coordinate system normally used to express the rotor loads.

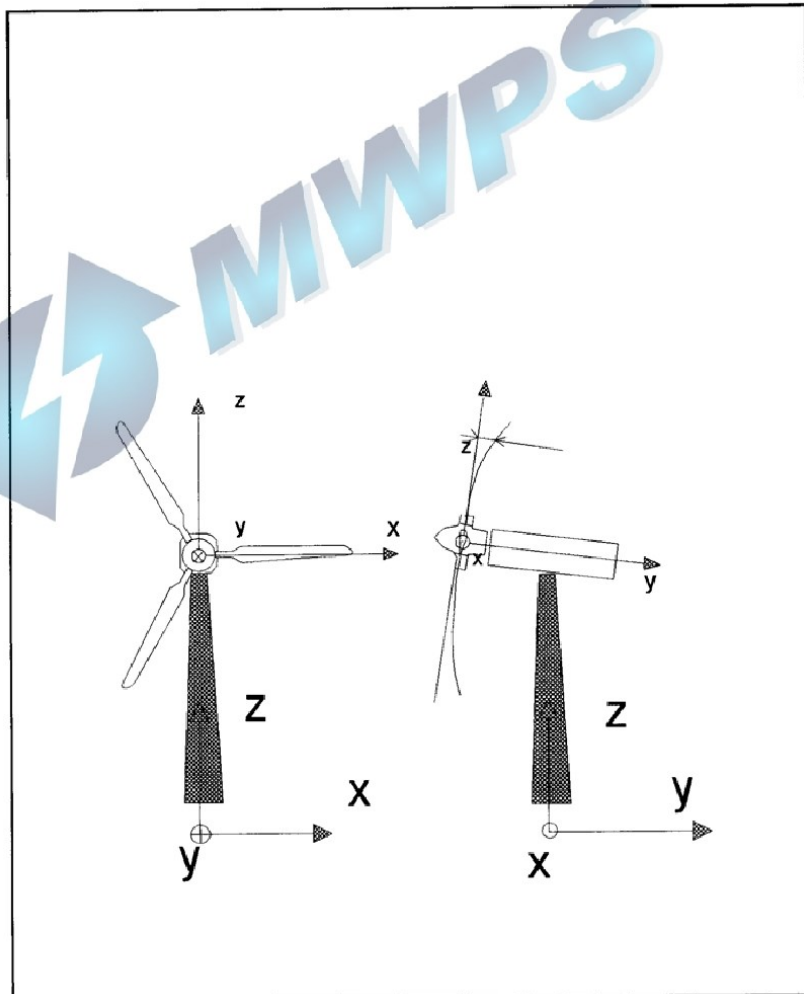


Figure 1: Coordinate syst. Definition

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V29 specifications.

The climate conditions for the V29 turbine is given from the table below:

Extreme windspeed:		Short time	V m/sec	56
		10 min. mean	V ₁₀ m/sec	40
Wind speed distribution (Weibull):			A m/sec	9.5
			C	2
Turbulence intensity:			I	0.17
Air density: Operating			kg/m ³	1.23
Extreme			kg/m ³	1.28
Temperature range			° Celcius	-20 - 40
Operation wind speeds: Cut-in			V ₁₀ m/sec	3.5
Cut-out			V ₁₀ m/sec	25.0

Loads on top of concrete foundation, tubular tower.

Following tables list the foundation loads for different tower height for the Vestas V29 - 225 kW turbine. It is assumed, that a standard Vestas tubular design is used and a Wöhler m = 4 has been used for calculation of the equivalent fatigue loads.

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VESTAS V27 and V29, tower height 31 m			
	Extreme load	Fatigue load at $n = 10^7$	
		Mean	Peak to peak
F_x (kN)	0	0.0	1.6
F_y (kN)	190	12.2	30.0
F_z (kN)	-260	-260.0	3.4
M_x (kNm)	4510	430.5	1035.0
M_y (kNm)	0	21.3	51.0
M_z (kNm)	0	0.8	106.6

VESTAS V27 and V29, tower height 35 m			
	Extreme load	Fatigue load at $n = 10^7$	
		Mean	Peak to peak
F_x (kN)	0	0.0	1.6
F_y (kN)	193	12.2	30.0
F_z (kN)	-287	-287.0	3.4
M_x (kNm)	4942	460.0	1160.0
M_y (kNm)	0	21.3	51.0
M_z (kNm)	0	0.8	106.6

VESTAS V27 and V29, tower height 39 m			
	Extreme load	Fatigue load at $n = 10^7$	
		Mean	Peak to peak
F_x (kN)	0	0	1.6
F_y (kN)	194	12.2	30.0
F_z (kN)	-320	-320.0	3.5
M_x (kNm)	5790	475.0	1282.0
M_y (kNm)	0	21.3	51.0
M_z (kNm)	0	0.8	106.6

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Natural frequencies - Foundation stiffness.

It is be assured, that the natural frequencies of the turbine and the foundation differ with at least 10 % from the following rotor frequencies given by the rotor speed.

Frequencies	V29, 1 p	V29, 3 p
Large generator	0.68 Hz	2.05 Hz
Small generator	0.51 Hz	1.54 Hz

