Wind load definition

In NextGen it is possible to calculate the wind profile automatically using standards such as Eurocodes, ASCE, UBC or define a custom profile.
Online version: https://nextgen.sant-ambrogio.it/KB783486
Latest update: 23 ago 2024

Vertical vessels on supports such as skirts and legs can be affected by the wind and can transfer substantial loads to the base. In NextGen it is possible to calculate the wind profile automatically using the following standards:

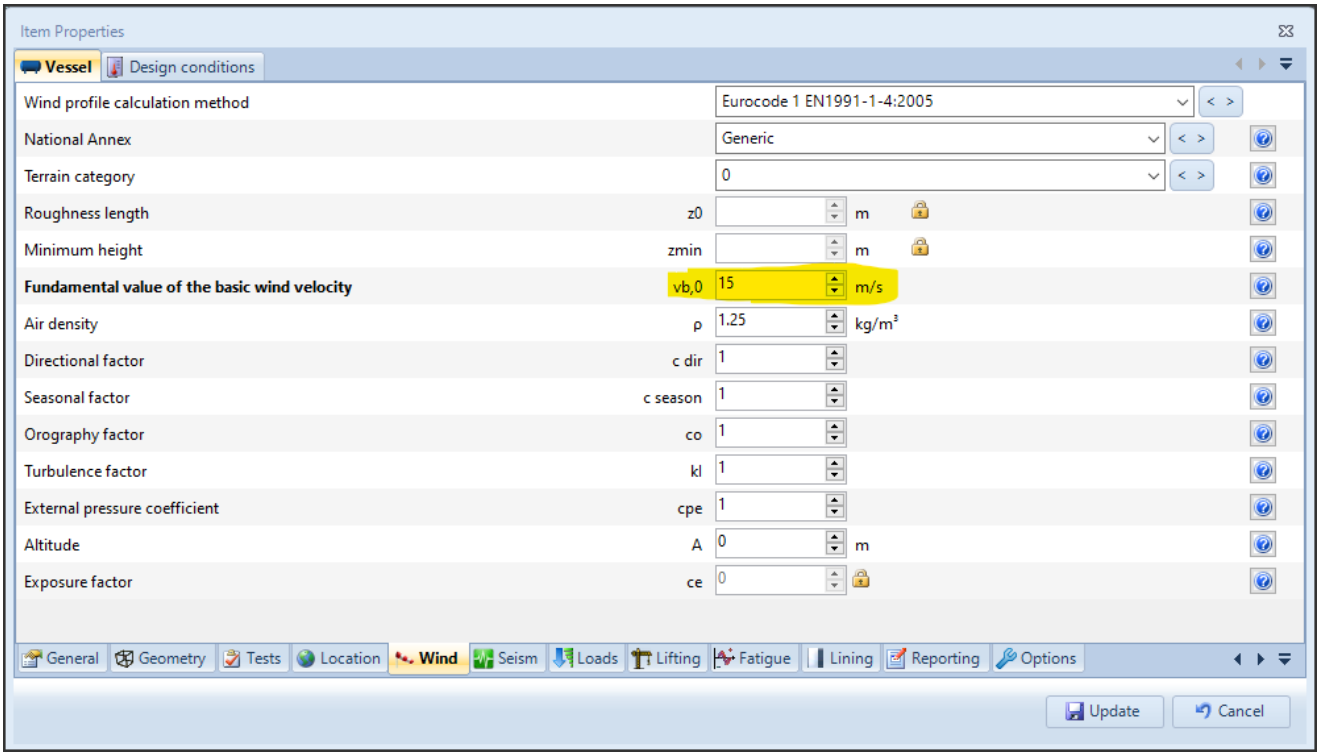
- Eurocode 1 EN 1991-1-4
- Uniform Building Code (UBC 97)
- ASCE/SEI, IBC
- IS 875 (Part 3)
- NTC

It is also possible to manually enter a wind profile, for those cases where the calculation is to be performed with a standard not supported by NextGen.

> *Filling in the wind and earthquake data only influences the calculation if supports are present. Pressure components are generally not influenced by external loads, except in some specific cases.*

Definition using a known Standard

Inside the *Item* properties Item > Properties, in the *Wind* section there is a list from which to choose the Code according to which you want NextGen to calculate the load due to the wind.

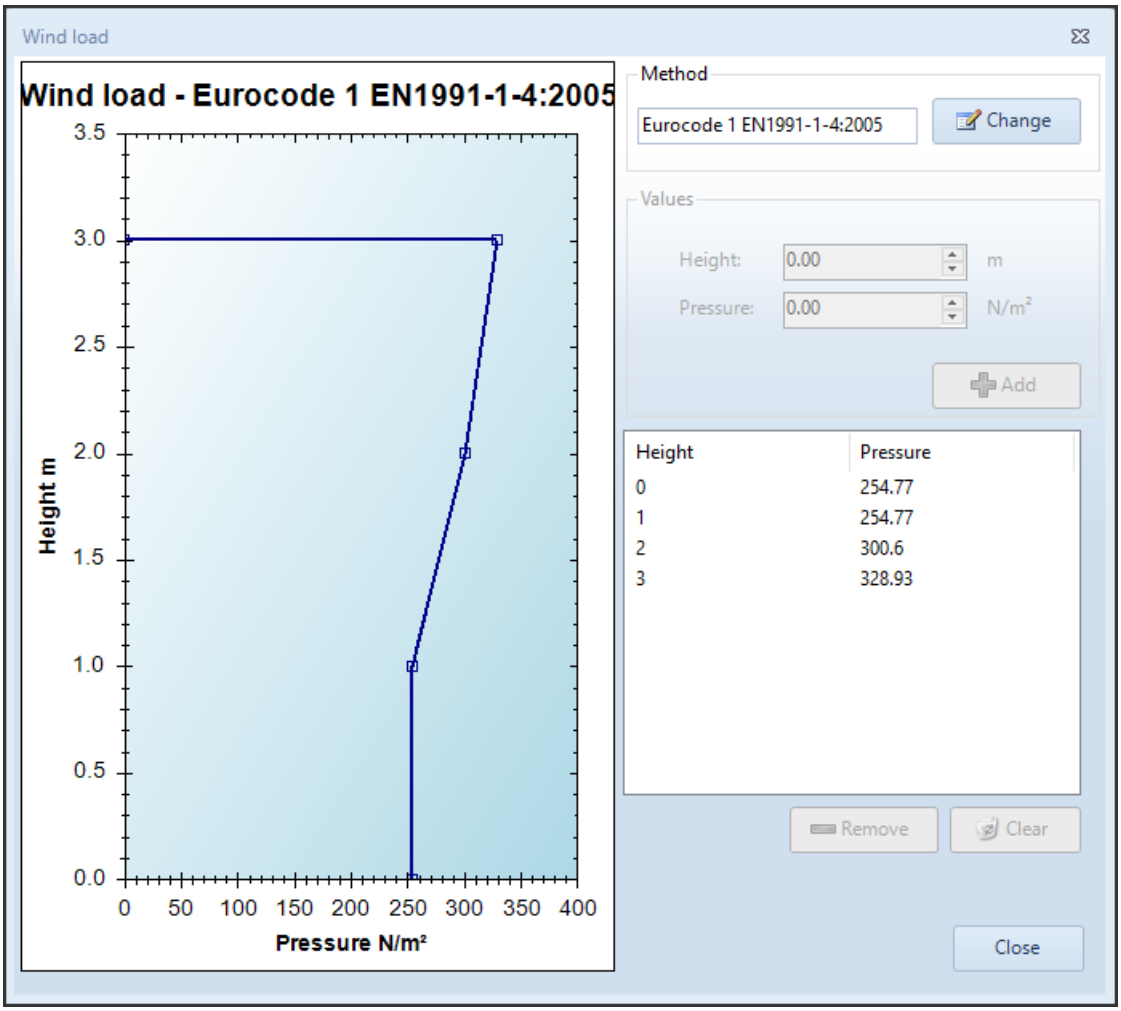


In the example, a wind calculation according to Eurocode 1 has been set and with a basic wind speed of 15

m/s.

> *Refer to the contextual help for more information on each of the input data*

Click on *Update* to save the changes. Then, moving on to the profile view in *Item* > *Wind*, you can see that the program has set the wind thrust at different altitudes as established by the standard, limiting itself to the height reached by the equipment.

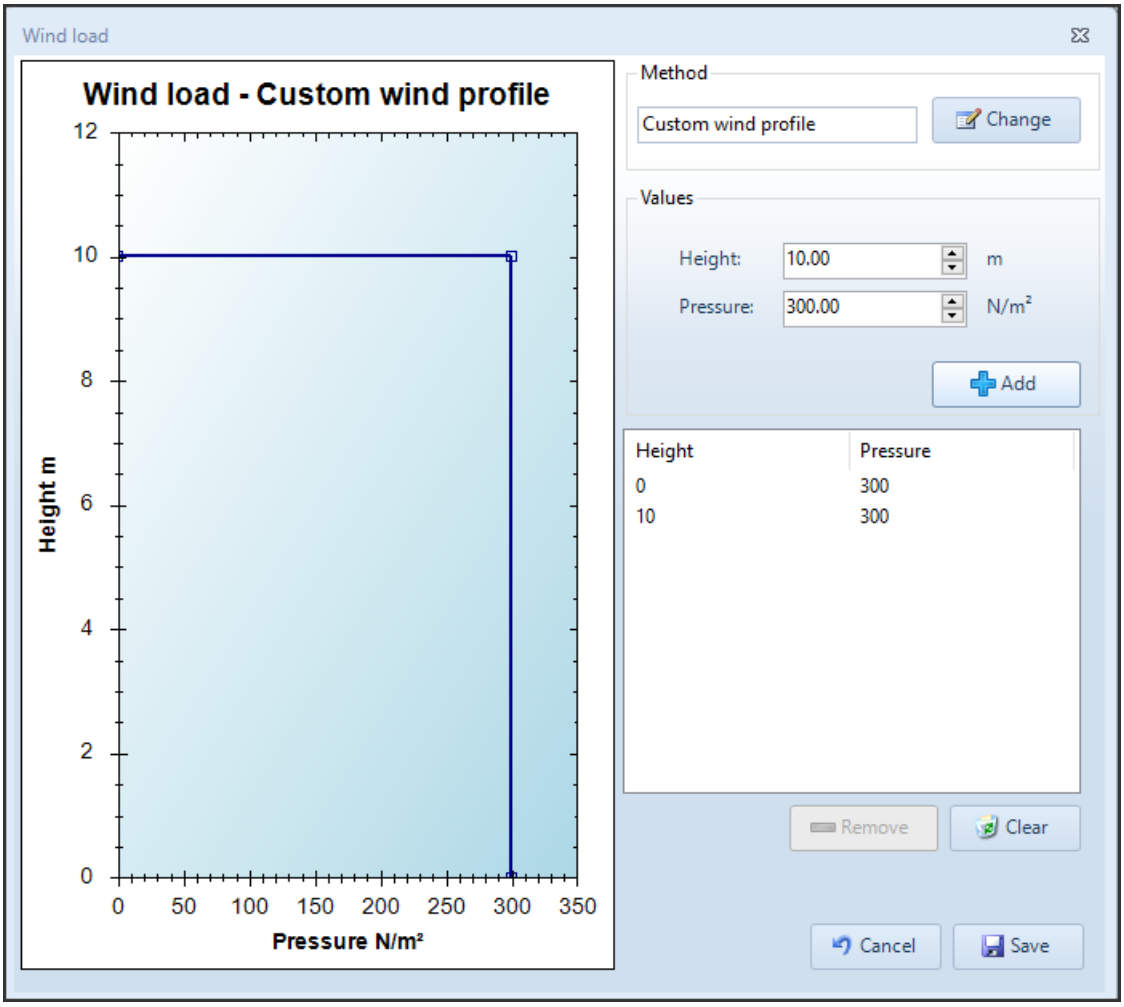


If the vessel is placed at an offset from the ground, this distance can be set in the properties of the *Item*, in particular in Item > Properties > Geometry > Distance from reference line

Manual definition of the wind profile

In the window relating to the properties of the *Item* seen previously, the profile called *Custom* must be chosen.

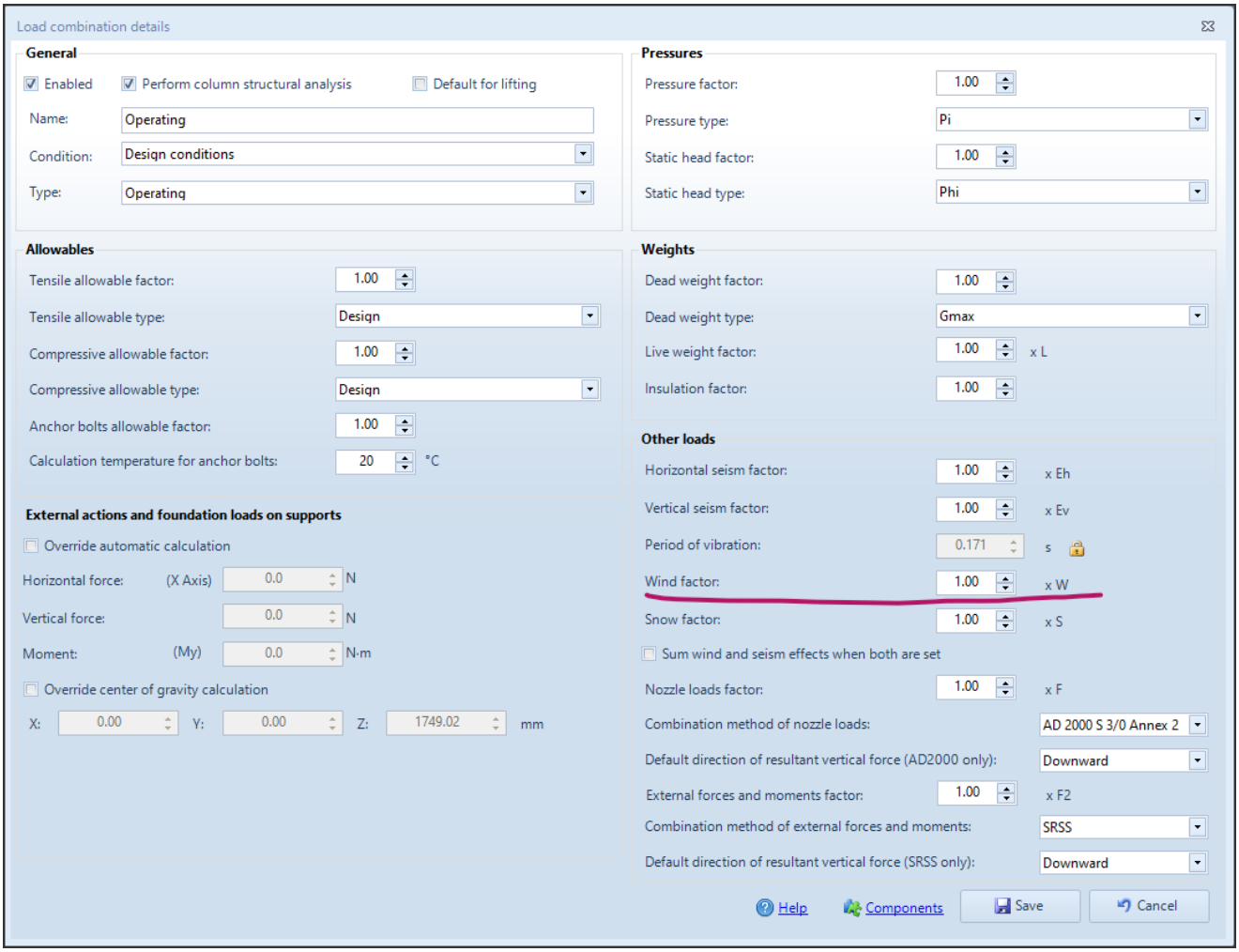
Then, by choosing Item > Wind it is possible to define a series of manual points for the graph, indicating a series of elevation-pressure pairs.



Load combinations

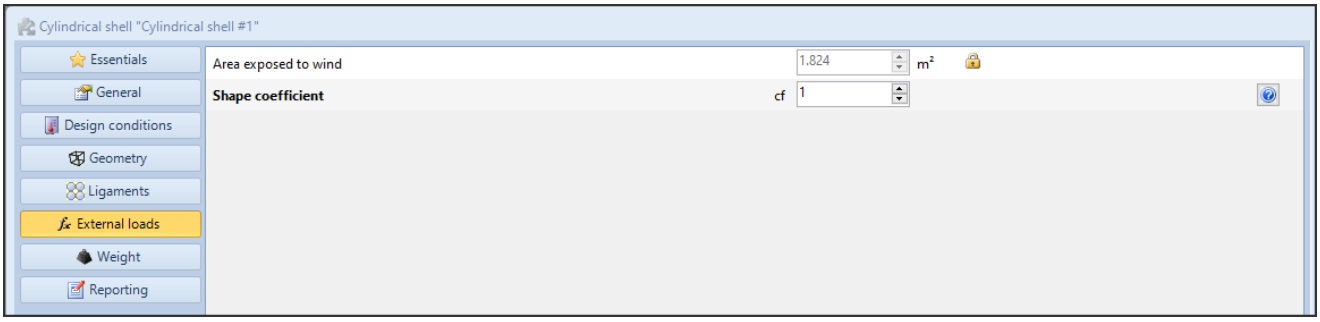
The stress due to the wind is used by the calculation of the supports, through the scenarios defined as *Load Combinations* in Item > Load Combinations.

For each *Load Combination* it is possible to consider or not the wind and define a coefficient.



Resistant profile

NextGen automatically calculates the wind resistant profile. As usual, it is possible to intervene on this calculation by acting on the components, in their *External loads* category.



You can customize both the surface exposed to the wind and the shape coefficient.

Report

In the initial summary pages of the calculation report, if set to active, there is the section containing the wind calculation:

Wind profile calculation

According to: Eurocode 1 EN1991-1-4:2005

Wind profile

National Annex:			Generic
Terrain category:			0
Fundamental value of the basic wind velocity	vb0	=	15.00 m/s
Directional factor	cdir	=	1.00
Seasonal factor	cseasonal	=	1.00
Altitude factor	calt	=	1.00000
Basic wind velocity	vb	=	15.00 m/s
Orography factor	corography	=	1.00
Turbulence factor	kI	=	1.00
Air density	ρ	=	1.25 kg/m³
External pressure coefficient	cpe	=	1.000
Roughness length	z0	=	0.003 m
Minimum height	zmin	=	1.00 m
	z0,II	=	0.05 m
Terrain factor	$k_r = 0.19 \cdot (\frac{z_0}{z_{0,II}})^{0.07}$	=	0.15604
Roughness factor	$c_r = k_r \cdot ln(\frac{z}{z_0})$	=	*
Mean wind velocity	$v_m = c_r \cdot c_o \cdot v_b$	=	*
Turbulence intensity	$I_v = \frac{k_I}{c_o \cdot ln(z/z_0)}$	=	*
Wind pressure	$q_p = (1 + 7 \cdot I_v) \cdot \frac{1}{2} \cdot \rho \cdot v_m^2$	=	*

Height	Roughness factor	Mean wind velocity	Turbulence intensity	Wind pressure
z	cr	vm	Iv	qp
0 m	0.90643	13.60 m/s	0.17214	254.77 N/m²
1.00 m	0.90643	13.60 m/s	0.17214	254.77 N/m²
2.00 m	1.01459	15.22 m/s	0.15379	300.60 N/m²
3.00 m	1.07786	16.17 m/s	0.14476	328.93 N/m²

The support calculation, for the *Load Combinations* in which the wind is present, will show the relative load:

Foundation loads

Shear (wind)	Sw = c_wp · W_p · A	=	695 N
Shear (earthquake)	Se = c_sh · Sh · W_e	=	0 N
Total force parallel to x axis due to local loads	Fx	=	0 N
Total force parallel to y axis due to local loads	Fy	=	0 N
Total force parallel to z axis due to local loads (positive upward)	Fz	=	0 N
Moment (wind)	Mw = Sw · hc	=	1 243.2 N·m
Moment (earthquake)	Me = Se · hg	=	0 N·m
Total moment about x axis due to local loads	Mx	=	0 N·m
Total moment about y axis due to local loads	My	=	0 N·m
Total moment about z axis due to local loads	Mz	=	0 N·m
Vertical load due to snow	S = s · a	=	0 N
Vertical load	VL = We · (g + c_sv · Sv) - Fz + c_sn·S	=	6 002 N
Horizontal load	HL = max(Sw; Se) + √(Fx²+Fy²)	=	695 N