

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.

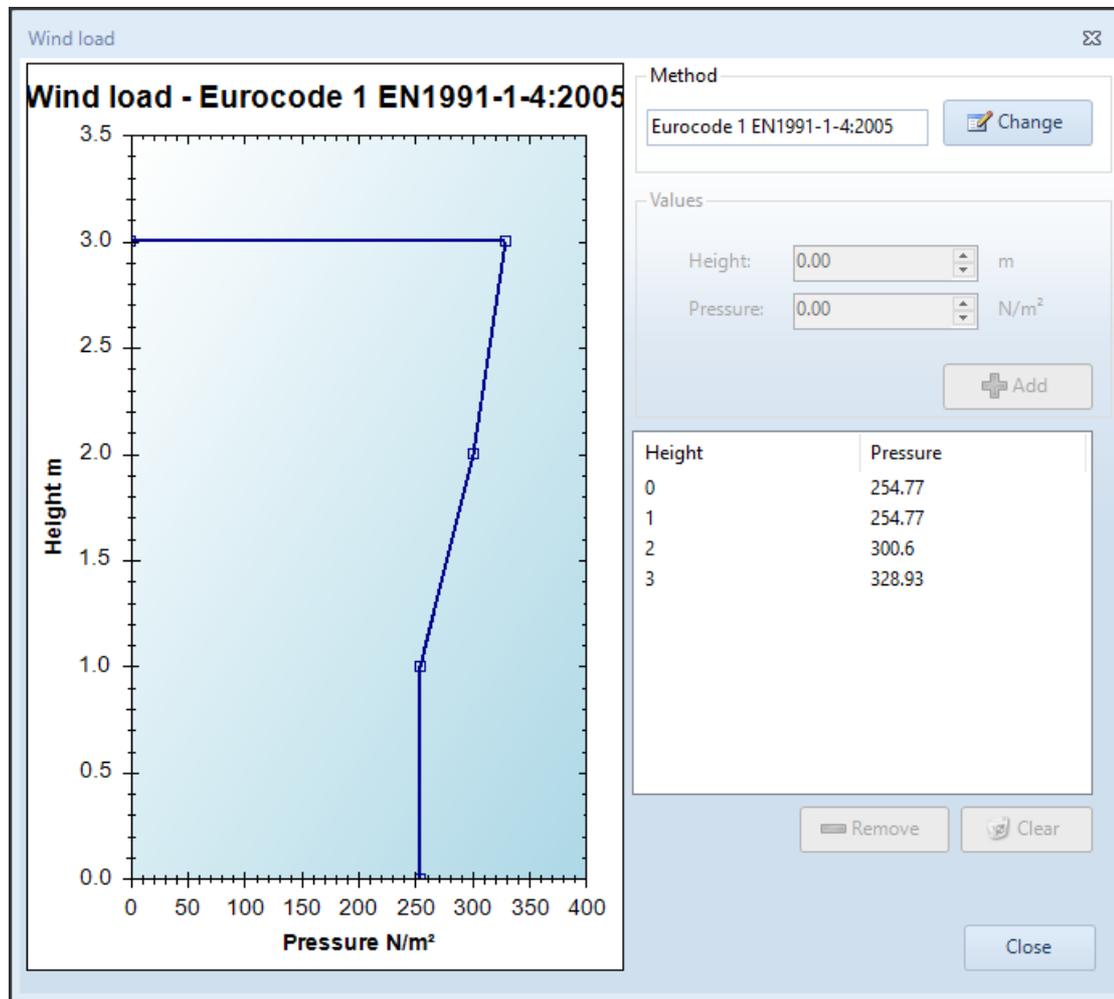
Property	Value	Unit	Locked
Wind profile calculation method	Eurocode 1 EN1991-1-4:2005		
National Annex	Generic		
Terrain category	0		
Roughness length (z0)	0	m	Yes
Minimum height (zmin)	0	m	Yes
Fundamental value of the basic wind velocity (vb,0)	15	m/s	No
Air density (p)	1.25	kg/m³	No
Directional factor (c dir)	1		No
Seasonal factor (c season)	1		No
Orography factor (co)	1		No
Turbulence factor (kl)	1		No
External pressure coefficient (cpe)	1		No
Altitude (A)	0	m	No
Exposure factor (ce)	0		Yes

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.

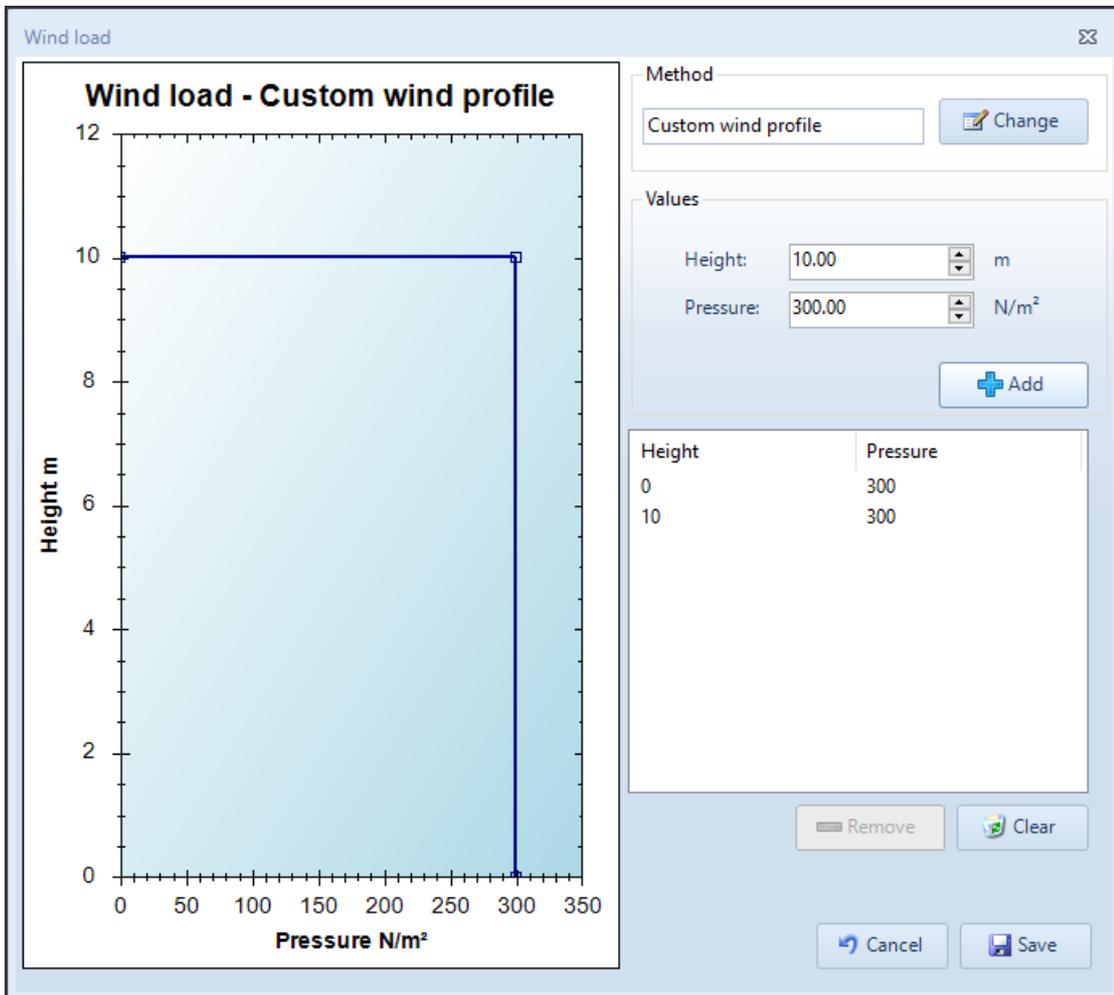


If the vessel is placed at an offset from the ground, this distance can be set in the properties of the *Item*, in particular in *Item > Properties > Geometry > Distance from reference line*

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.

Load combination details

General

Enabled Perform column structural analysis Default for lifting

Name:

Condition:

Type:

Pressures

Pressure factor:

Pressure type:

Static head factor:

Static head type:

Allowables

Tensile allowable factor:

Tensile allowable type:

Compressive allowable factor:

Compressive allowable type:

Anchor bolts allowable factor:

Calculation temperature for anchor bolts: °C

Weights

Dead weight factor:

Dead weight type:

Live weight factor: x L

Insulation factor:

External actions and foundation loads on supports

Override automatic calculation

Horizontal force: (X Axis) N

Vertical force: N

Moment: (My) N-m

Override center of gravity calculation

X: Y: Z: mm

Other loads

Horizontal seism factor: x Eh

Vertical seism factor: x Ev

Period of vibration: s

Wind factor: x W

Snow factor: x S

Sum wind and seism effects when both are set

Nozzle loads factor: x F

Combination method of nozzle loads:

Default direction of resultant vertical force (AD2000 only):

External forces and moments factor: x F2

Combination method of external forces and moments:

Default direction of resultant vertical force (SRSS only):

[Help](#) [Components](#)

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.

Cylindrical shell "Cylindrical shell #1"

- Essentials
- General
- Design conditions
- Geometry
- Ligaments
- External loads
- Weight
- Reporting

Area exposed to wind m²

Shape coefficient cf

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			kl =		1.00
Air density			ρ =		1.25 kg/m ³
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			$k_r = 0.19 \cdot \left(\frac{z_0}{z_{0,II}}\right)^{0.07} =$		0.15604
Roughness factor			$c_r = k_r \cdot \ln\left(\frac{z}{z_0}\right) =$		*
Mean wind velocity			$v_m = c_r \cdot c_o \cdot v_b =$		*
Turbulence intensity			$I_v = \frac{k_l}{c_o \cdot \ln(z/z_0)} =$		*
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	lv	qp
	0 m	0.90643	13.60 m/s	0.17214	254.77 N/m ²
	1.00 m	0.90643	13.60 m/s	0.17214	254.77 N/m ²
	2.00 m	1.01459	15.22 m/s	0.15379	300.60 N/m ²
	3.00 m	1.07786	16.17 m/s	0.14476	328.93 N/m ²

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

Foundation loads		
Shear (wind)	$S_w = c_{wp} \cdot W_p \cdot A =$	695 N
Shear (earthquake)	$S_e = c_{sh} \cdot S_h \cdot W_e =$	0 N
Total force parallel to x axis due to local loads	$F_x =$	0 N
Total force parallel to y axis due to local loads	$F_y =$	0 N
Total force parallel to z axis due to local loads (positive upward)	$F_z =$	0 N
Moment (wind)	$M_w = S_w \cdot hc =$	1 243.2 N·m
Moment (earthquake)	$M_e = S_e \cdot hg =$	0 N·m
Total moment about x axis due to local loads	$M_x =$	0 N·m
Total moment about y axis due to local loads	$M_y =$	0 N·m
Total moment about z axis due to local loads	$M_z =$	0 N·m
Vertical load due to snow	$S = s \cdot a =$	0 N
Vertical load	$VL = W_e \cdot (g + c_{sv} \cdot S_v) - F_z + c_{sn} \cdot S =$	6 002 N
Horizontal load	$HL = \max(S_w; S_e) + \sqrt{F_x^2 + F_y^2} =$	695 N