STATICS

Deflection

Deflection is indicated with the letter f and is expressed in cm.
It is assessed at the centre of the profile length and is the movement caused by the pressure exerted by a load on the profile. The deflection used to assess the moment of inertia must be lower than 1/300 of the length of the loaded profile. The deflection value however must never exceed 0.8 cm, in compliance with DIN regulations.

Dynamic pressure

The pressure exerted by wind against a window is indicated with the letter q and is expressed in KN/m2. This load greatly varies because it is not only related to the wind speed but also to other factors, such as: the height of the window from the ground, the building conformation and inclination compared to the wind direction.

Taken the wind speed (v) in m/sec, the load or pressure can be assessed with the following formula:

q(KN/m2)=0.0006 x v2(m/sec)

The wind speed can be easily changed from Km/h into m/sec with the following formula: v(Km/h)/3.6=v(m/sec).

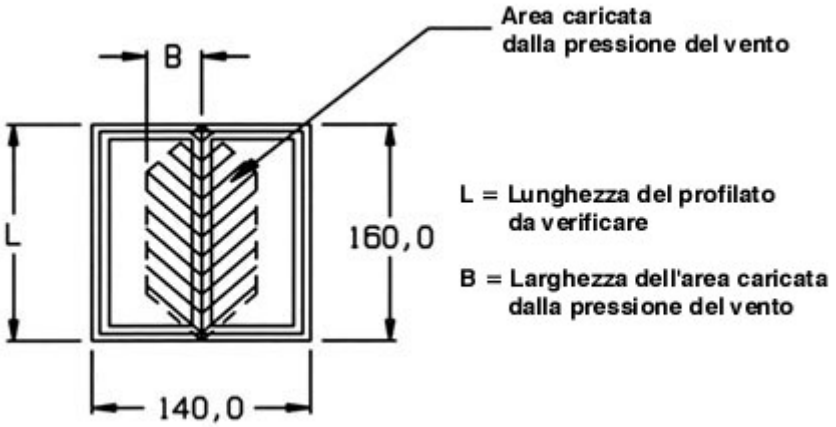
Coefficient of elasticity

The elasticity of a material is the capacity that a material has to take again its original form after a momentary change of shape caused by a load. The elastic module is the value within which deformations are considered elastic.

It is indicated with the letter E and is expressed in KN/cm2. Even though PVC profiles have their own elastic module, only the elastic module of reinforcements, which is about 21,000 KN/cm2, will be taken into consideration for the calculations.

Length of the profile to be reinforced

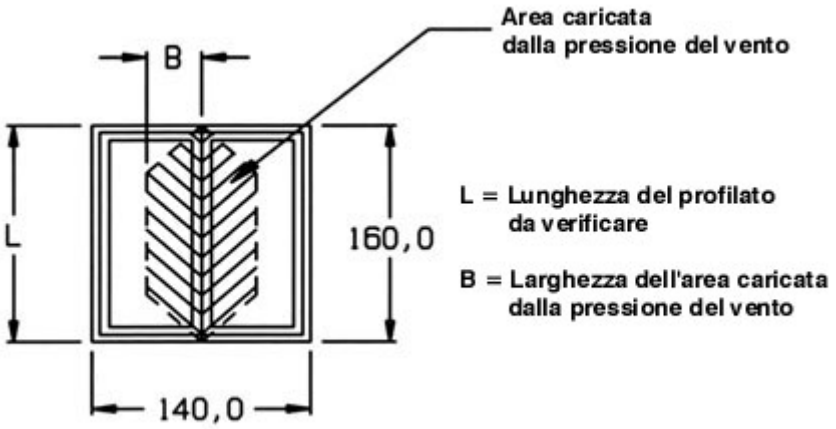
It is indicated with the letter L and is the length of the profile that must be calculated expressed in cm. (Tav. 4.2.4.A)



Tav 4.2.4.A

Width of the loaded area

It is indicated with the letter B and is the width of the area loaded expressed in cm (Table 4.2.4.A).
(Area loaded by wind pressure – L= length of the profile to be calculated – B= width of the area loaded by wind pressure)



Tav 4.2.4.A

The moment of inertia

As said before, it can be simply considered as the resistance of a profile against deformations caused by a load. The resistance depends on the section of the profile itself.

It is calculated according to barycentre axes. Barycentre axes divide the section of a profile into four identical parts. They are generally indicated with the letters x and y.

The moment of inertia is indicated with the letter J and is expressed in cm4.

Calculation formula

The profiles that must be reinforced can be compared to a beam placed on two supports at its ends and uniformly loaded. The calculation is made according to the following formula:

$$J = \frac{W \cdot L^4 * B}{1920 * E * f} * \left[25 - 40 * \left(\frac{B}{L}\right)^2 + 16 * \left(\frac{B}{L}\right)^4 \right] cm^4$$

As the calculation made with this formula might be difficult, the table 4.2.7.A (for normal buildings), and the table 4.2.7.B (for tower buildings) have been worked out. The tables indicate the moment of inertia J in different situations, i.e. for the values L (length of a profile to be reinforced), and B (width of the loaded area). The moment of inertia has been calculated for three different kinds of wind pressure at different heights:

from 0 to 8 m 0.60 KN/m2
from 8 to 20 m 0.96 KN/m2
from 20 to 100 m 1.32 KN/m2

Table of the moments of inertia for a normal building 4.2.7.A

H m	V Km/h	V m/sec	q=½ x ? xV²	W=qx1,2 (Secondo DIN 1055) N	
			KN/m²	KN/m²	KN/cm²
0-8	101.9	28.3	0,50	0,60	0,000060
8-20	128.9	35.8	0,80	0,96	0,000096
20-100	151.2	42.0	1,10	1,32	0,000132
>100	164.2	45.6	1,30	1,56	0,000156

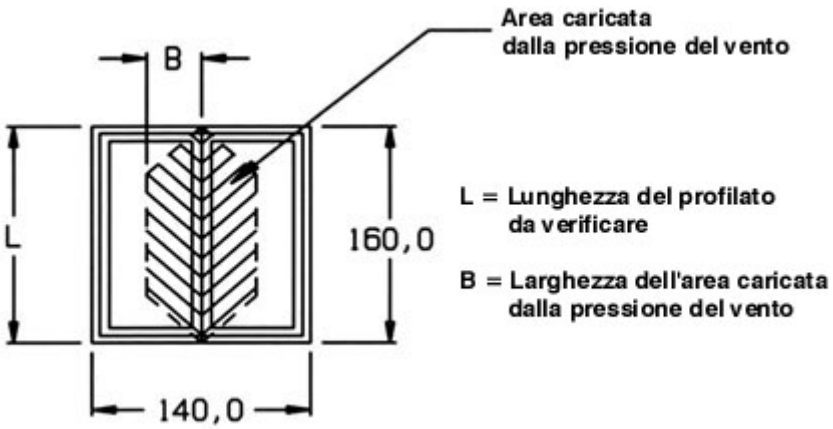
H=heigth V=wind speed q=dynamic pressure W=wind load
Tav. 4.2.7.C

Table of the moments of inertia for a tower building 4.2.7.B

H m	V Km/h	V m/sec	q=½ x ? xV²	W=qx1,6 (Secondo DIN 1055) N	
			KN/m²	KN/m²	KN/cm²
0-8	101.9	28.3	0,50	0,80	0,000080
8-20	128.9	35.8	0,80	1,28	0,000128
20-100	151.2	42.0	1,10	1,76	0,000176
>100	164.2	45.6	1,30	2,08	0,000208

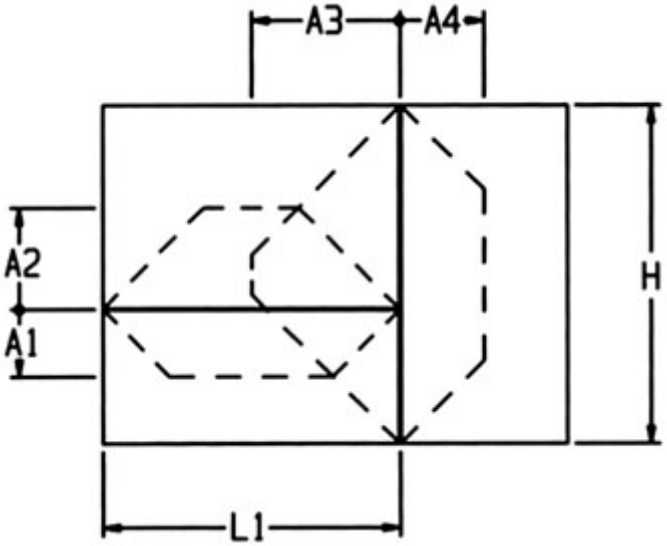
H=heigth V=wind speed q=dynamic pressure W=wind load
Tav. 4.2.7.D

Calculation example



TAV.4.2.8.A (Area loaded by the wind pressure – L= length of the profile to calculate – B=width of the area loaded by wind pressure)

The wind pressure W= 0.60 KN/m2 is obtained from Table 4.2.7.C and corresponds to the load applied to a window mounted at a height from the ground included between 0 and 8 m, with a wind speed of about 100 km/h. Once the area loaded has been assessed (in this case H=160 and B=35), it will be possible to determine the moment of inertia of the area from Tab. 4.2.7.A that in this case gives an approximate moment of inertia J=1.7 cm4. The table gives the moments of inertia with intervals of 10 cm; when a value is included in an interval between 30 and 40 as in this case (B=35), the next value will be taken into consideration, i.e. H=160 and B=40. Once the moment of inertia has been assessed, it must be multiplied by two, as the loaded area is the double of B, J=1.7 x2 =3.4 cm4. Now the installer can choose the most appropriate reinforcements, among those provided by the supplier in order to meet the specific static requirements. In special cases, the moment of inertia must be multiplied by a corrective factor (refer to Tab. 4.2.7.A). If the frame is fixed and has a vertical central rod and a horizontal rod, as shown in tab. 4.2.8.B, an appropriate reinforcement for the two profiles must be chosen, following the aforementioned steps.



TAV. 4.2.8.B