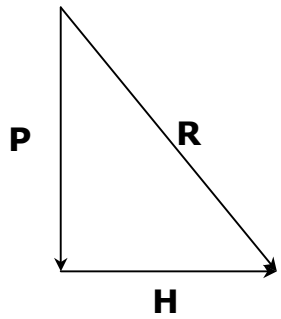
Mechanical calculations

The mechanical calculations, referring to aerial line conductors, consist generally in determining the sag in a given line clearance, in order that the efforts resulting in keeping the conductors within safety limits.

The aerial line conductors, in addition to the load related to its own weight, are also subject to those loads resulting from wind pressure, acting horizontally.

Therefore, to determine total mechanical effort to which the conductor will be submitted, we must take into account the resultant of loads acting over it, that is, its own weight and wind pressure.



P = Cable weight (kg/m)
H = Horizontal component, resulting from wind (kg/m)
R = Resulting load = $\sqrt{P^2 + H^2}$

Calculation of load resulting from wind:

H = p.D (kg/m) where:
p = wind pressure by area unit (kg/m^2)
D = cable diameter (m)

Wind pressure can be determined by the expression:

$$p = \frac{v^2}{8} \text{ (kg/m}^2\text{)}$$

v = wind speed (m/s)

Usually, we adopt the value of 50 kg/m^2 for "p", which corresponds to a wind speed of 20 m/s, that is, 72 km/h.

R = (kg/m)

Determination of total effort

$$T = \frac{R \cdot L^2}{8 \cdot f} \text{ (kg)}$$

T = Total effort (kgf)
f = Sag (m)
L = Clearance length (m)
R = Resulting load (kg/m)

Safety Coefficient

The safety coefficient is the ratio between sustaining cable's breaking load (messenger) and total effort:

$$K = \frac{Q}{T}$$

K = Safety coefficient
Q = Messenger breaking load (kgf)
T = Total effort (kgf)

Considering as satisfactory the "K" values ranging from 2.5 and 3.0.

Calculation Sample:

Quadruplex Cable 35 mm^2 Neutral AAAC

- Cable weight = 0.515 kg/m
- External diameter = 0.0251 m
- Messenger breaking load = 1,122 kgf
- Clearance between posts = 60 m

Let us assume the wind pressure is equal to 50 kg/m^2 and the sag is equal to 2.5% of clearance.

$H = p \cdot d = 50 \times 0.0251 = 1.255$ kg/m

$$R = \sqrt{P^2 + H^2} = \sqrt{(0.515)^2 + (1.255)^2} = 1.357 \text{ kgf}$$

$$T = \frac{R \cdot L^2}{8 \cdot f} = \frac{1.357 \times (60)^2}{8 \times 1.5} = 407 \text{ kgf}$$

$$K = \frac{Q}{T} = \frac{1122}{407} = \mathbf{2.76 \text{ (satisfactory)}}$$