

## SUBJECT: FLAGPOLE PROPERTIES VERIFICATION: "CRESKO S.R.L"

Poles of various height will be examined taking into account the wind force which could be acting on the flag.  
The flag could be of two different sizes - 4 m in height and 1,5 m in width or 2 m in height and 3 m in width.

In both cases the surface is equal to 6 sq. m.

Obviously we are speaking of a non-solid body structure so a percentage of the wind force which exerts on it should be considered.

Since the flag could be orientated itself we will have to position it according to the wind direction and not in the direction orthogonal to it. 30% of the kinetic pressure will be assumed.

It's a different question when a pole of a solid material should be examined where the entire surface is considered.

As per the technical standards we consider the kinetic pressure  $p = q_{ref} C_e C_p C_d$

$q_{ref} = \frac{1}{2} \rho V_{ref}^2$  ( $\rho =$  air density = 1,25 Kg/sq.m)

As per the tables in EUROCODE it is obtained  $C_e = 1,26$   $C_p = 1$   $C_d = 1$

The wind speed  $V_{ref}$  for the observed zone is equal to 28 m/s where  $q_{ref} = \frac{1}{2} V_{ref}^2$   $1,25 = \frac{1}{2} 28^2$   $1,25 = 490$

kinetic pressure  $p = q_{ref} C_e C_p C_d = 490 \times 1,26 \times 1 \times 1 = 618$  N/sq.m equivalent of 62 Kg/sq. m

We proceed now on the verification of various flagpoles:

FLAGPOLE ART. N° 0508/B – REVOLVING ARM – MATERIAL STAINLESS STEEL

FLAGPOLE SIZE:  $h = 10$  m, diameter range:  $\phi$  50 mm (from 10 to 7,80);

$\phi$  80 mm (from 7,80 to 4) and  $\phi$  114 mm (from 4 to 0)

FLAG SIZE:  $h = 4,00$  m  $l = 1,50$  m, (3,00 m x 2,00 m) Surface = 6,00 sq. m.

Kinetic pressure applied on the flagpole: (for cylindrical body structures)  $F = c_f c_d q d$  (with  $q = 62$  Kg/sq.m)

As per our technical regulations  $c_f = 1,2$   $c_d = 1$  it is obtained  $1,2 \times 1 \times 62 \times 0,08 = 6$  Kg/ sq.m

Pole surface:  $0,05 \times 2,20 + 0,08 \times 3,80 + 0,114 \times 4 = 0,870$  sq.m.

$F = 6 \times 0,87 = 5,22$  Kg which applied at 5 m height (the middle of the pole)

creates a bending moment  $M$  (Pole) =  $5,22 \times 5 = 26,1$  Kgm = 26 Kgm

Kinetic pressure on the flag:

The central point of the flag will be at 8 m height starting from the fixing point on the base.

$p = 30\% c_d c_f q A$  from the tables  $c_f = 0,7$   $c_d = 1$

obtained:  $30\% \times 0,7 \times 1 \times 62 \times 6 = 78,12$  Kg which applied at 8 m

height creates a bending moment  $M$  (flag) =  $78,12 \times 8 = 625$  Kgm

$M$  total =  $625 + 26 = 651$  Kgm

At a height of 4 m and 7,8 m the junctions are equivalent to a pair of forces with an arm 3,80 m

Il momento flettente diventa  $78,12 \times 3,8 = M$  giunto = 297 Kgm

The form of resistance of cylindrical bodies is:  $W = \pi (D^4 - d^4) : 32 D$ .

The tube with  $\phi$  114 has thickness 3 mm and the others have thickness 2 mm so

the junction section has  $D = 114$  mm  $d = 104$  mm for which  $W = 45$  sq. cm.

The base is formed of tubes and a tubular support with 4 mm thickness made of iron with three break bars disposed all along the structure so it is considered a section of size  $D = 114$  mm and  $d = 100$  mm.

Obtained:  $W = 59$  sq. cm.

Being a mixture of stainless steel it will be assumed a tension allowable  $\sigma_{amm} = 1600$  Kg/sq.cm

Verifications:

JUNCTION  $\sigma = M/W = 29700 : 45 = 660$  Kg/sq.cm  $< \sigma_{amm} = 1600$  Kg/sq.cm

FLAGPOLE  $\sigma = M/W = 65100 : 59 = 1103$  Kg/sq.cm  $< \sigma_{amm} = 1600$  Kg/sq.cm

THE VERIFICATION IS SATISFIED

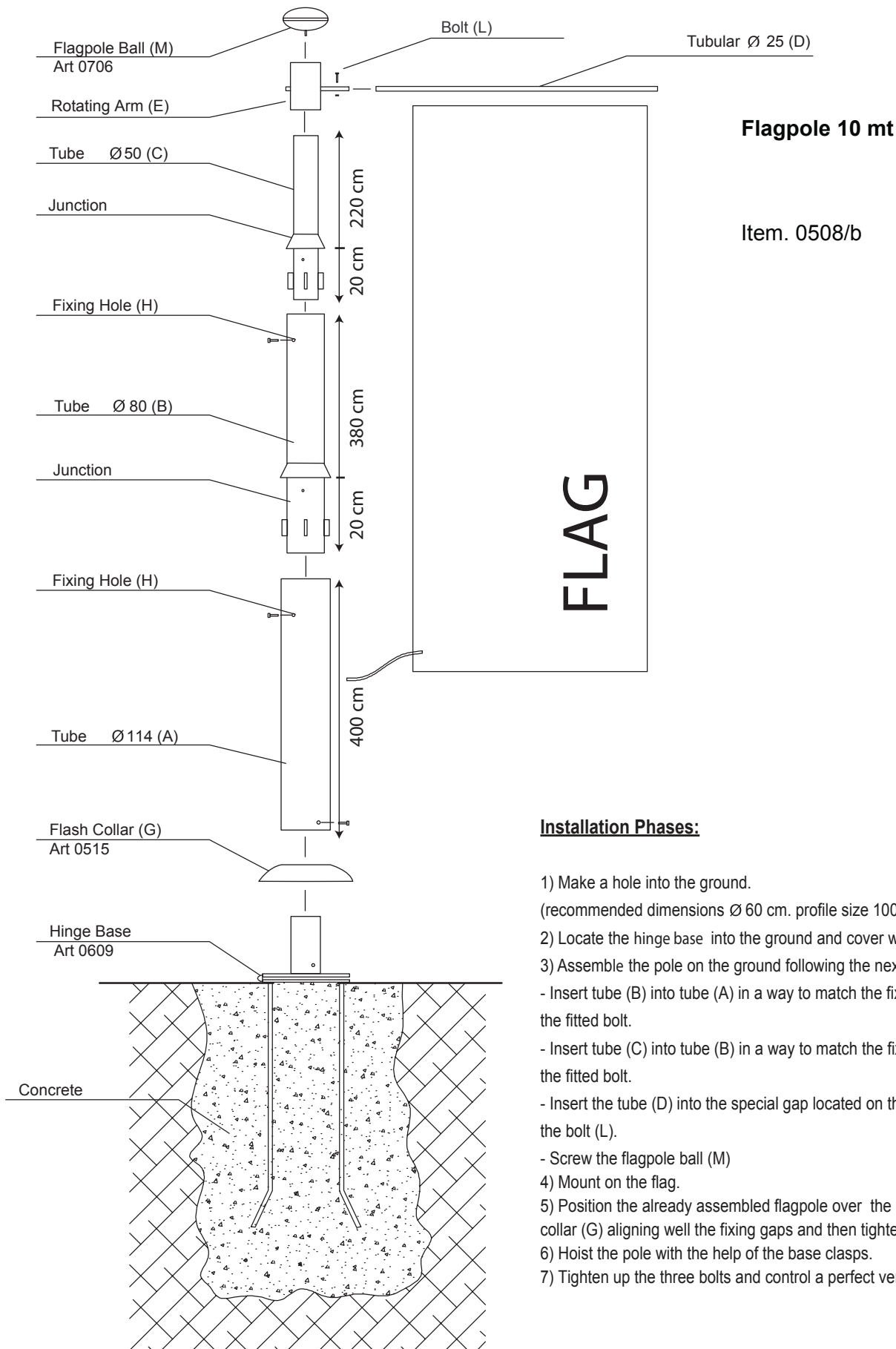
Engineer: Renato Mura



Engineer: Vittorio Mura



# INSTALLATION SHEET



## Installation Phases:

- 1) Make a hole into the ground.  
(recommended dimensions Ø 60 cm. profile size 100 cm)
- 2) Locate the hinge base into the ground and cover with concrete.
- 3) Assemble the pole on the ground following the next procedure:
  - Insert tube (B) into tube (A) in a way to match the fixing hole (H) and then tighten the fitted bolt.
  - Insert tube (C) into tube (B) in a way to match the fixing hole (H) and then tighten the fitted bolt.
  - Insert the tube (D) into the special gap located on the revolving arm (E) screwing the bolt (L).
  - Screw the flagpole ball (M)
- 4) Mount on the flag.
- 5) Position the already assembled flagpole over the base plate putting over the flash collar (G) aligning well the fixing gaps and then tighten the supplied bolt.
- 6) Hoist the pole with the help of the base clasps.
- 7) Tighten up the three bolts and control a perfect vertical alignment to be achieved.

Ref	Quality	Title /Flagpole with rotating arm			Item/Ref	
Designed by Project Department Cresko	Checked by Arch. Marco Scozzari	Approved by Dott. Enrico Scozzari	File name Flagpole revolving arm 10 mt	Date 21/05/2009	Scale ----	
			<b>Flagpole 3 Piece with Banner</b>			
			Proof Sheet	Modify 0	Page 1/1	