

## 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  $q_{ref} = \frac{1}{2} V_{ref}^2 = \frac{1}{2} 28^2 = 392$

kinetic pressure  $p = q_{ref} C_e C_p C_d = 392 \times 1,26 \times 1 \times 1 = 494$  N/sq.m equivalent of 49,4 Kg/sq. m

We proceed now on the verification of various flagpoles:

FLAGPOLE ART. N° 0338 – REVOLVING ARM – MAT. MATERIAL ALUMINIUM

FLAGPOLE SIZE:  $h = 8,50$  m, diameter range:  $\phi$  50 mm (from 8,5 to 3,0);

$\phi$  80 mm (from 3 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)  $F = c_r c_d q d$  (with  $q = 62$  Kg/sq.m)

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

Pole surface:  $0,05 \times 5,5 + 0,08 \times 3,0 = 0,52$  sq. m.

$F = 6 \times 0,52 = 3,12$  Kg which applied at 4,25 m height (the middle of the pole)

creates a bending moment  $M$  (Pole) =  $3,12 \times 4,25 = 13,26$  Kgm

Kinetic pressure on the flag:

The central point of the flag will be at 6,50 m height starting from the fixing point on the base.

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

obtained:  $30\% \times 0,7 \times 1 \times 62 \times 6 = 78,12$  Kg which applied at 6,5 m

height creates a bending moment  $M$  (flag) =  $78,12 \times 6,5 = 508$  Kgm

$M$  total =  $508 + 13,26 = 522$  Kgm

At a height of 3,5 m the junction is equivalent to a pair of forces with an arm (6,5 – 3,5) : 2

The bending moment is reduced  $78,12 \times 1,5 = M$  junction = 118 Kgm

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

The junction section has  $D = 80$  mm  $d = 60$  mm for which  $W = 34$  sq. cm.

The base is formed of tubes and a tubular support made of iron with three break bars disposed all along the structure so it is considered a section of size  $D = 100$  mm and  $d = 70$  mm

Obtained:  $W = 86$  sq. cm.

Being a mixture of steel and aluminum alloy it will be assumed a tension allowable  $\sigma_{amm} = 1100$  Kg / sq. cm.

It is always considered the section of aluminum alloy. In fact that one which is made of steel has a much higher permissible tension (1600 Kg / sq. cm); the dimensions do not change so it is obvious that for safety there will be verified only the first type of flagpole.

Verifications:

JUNCTION  $\sigma = M/W = 11800 : 34 = 347$  Kg/ sq.cm  $< \sigma_{amm} = 1100$  Kg/ sq.cm

FLAGPOLE  $\sigma = M/W = 52200 : 86 = 607$  Kg/ sq.cm  $< \sigma_{amm} = 1100$  Kg/ sq.cm

THE VERIFICATION IS SATISFIED

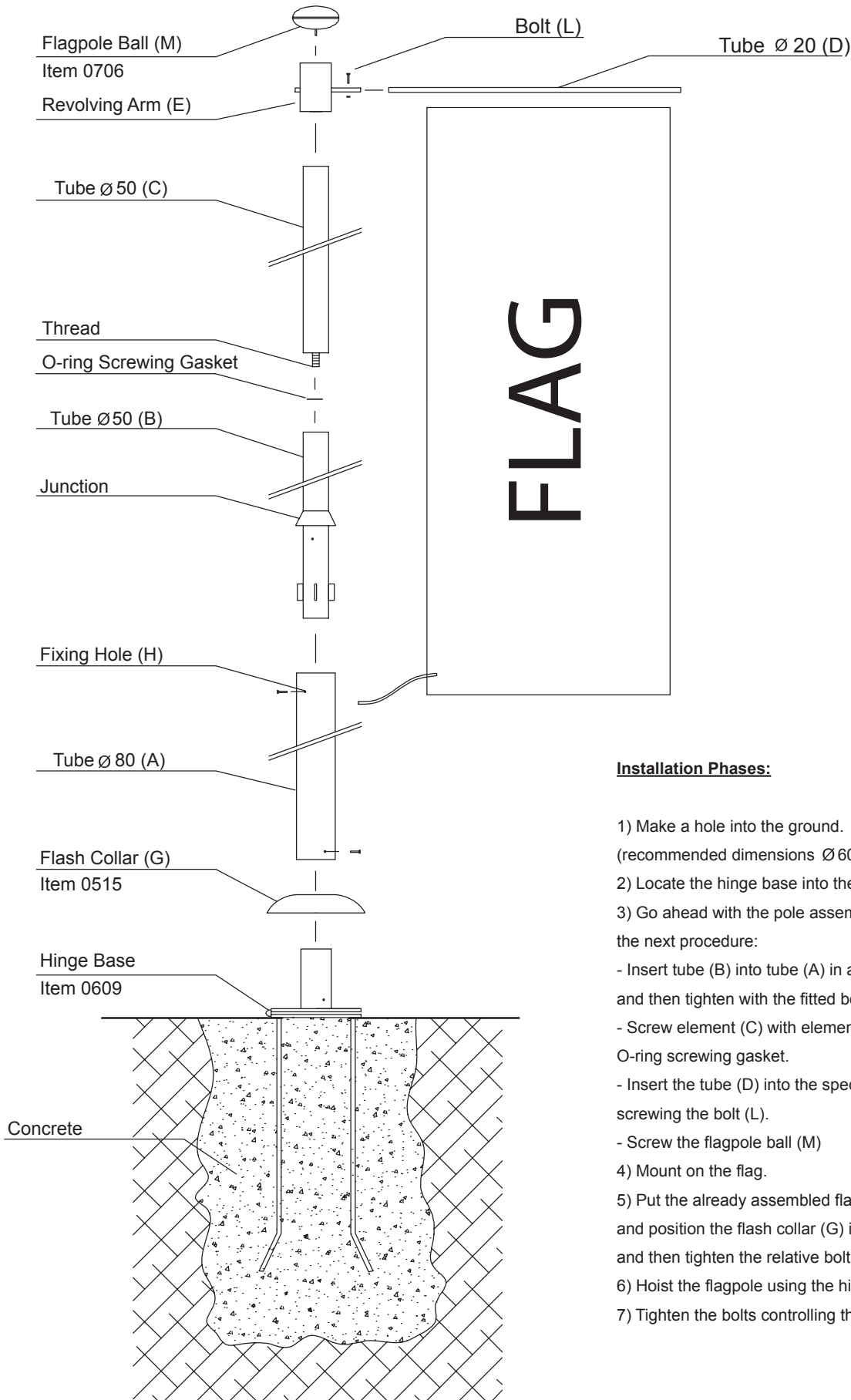
Engineer: Renato Mura



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# INSTALLATION SHEET



## Flagpole

Item 0334  
Item 0335  
Item 0336  
Item 0337  
Item 0338  
Item 0339

### Installation Phases:

- 1) Make a hole into the ground.  
(recommended dimensions  $\varnothing$  60 cm., profile size 80 cm)
- 2) Locate the hinge base into the ground and cover with concrete.
- 3) Go ahead with the pole assembly 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 with the fitted bolt.
  - Screw element (C) with element (B) using the special equipped O-ring screwing gasket.
  - 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) Put the already assembled flagpole over the hinge base and position the flash collar (G) in such a way to match the fixing holes and then tighten the relative bolt.
- 6) Hoist the flagpole using the hinges of the baseplate.
- 7) Tighten the bolts controlling the perfect vertical alignment.

Ref.	Quality	Title/ Flagpole With A Revolving Arm			Item Number/Reference	
Projected by: CRESKO'S PROJECT OFFICE	Checked by: Arch. Marco Scozzari	Approved by: Dr. Enrico Scozzari	File Name: Flagpole With A Revolving Arm	Date: 13/12/2006	Scale: ----	
			<b>3 PIECES FLAGPOLE WITH BANNER</b>			
			Technical Sheet	Modification 0	Sheet 1/1	