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Belysningsstolpar –
Del 3-1: Konstruktion och verifiering – Specifikation av laster

Lighting columns –
Part 3-1: Design and verification – Specification for characteristic loads

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Denna standard ersätter SS-EN 40-3-1, utgåva 1.

The European Standard EN 40-3-1:2013 has the status of a Swedish Standard. This document contains the official version of EN 40-3-1:2013.

This standard supersedes the Swedish Standard SS-EN 40-3-1, edition 1.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English Version

Lighting columns - Part 3-1: Design and verification - Specification for characteristic loads

Candélabres d'éclairage public - Partie 3-1: Conception et vérification - Spécification pour charges caractéristiques

Lichtmaste - Teil 3-1: Bemessung und Nachweis - Charakteristische Werte der Lasten

This European Standard was approved by CEN on 25 November 2012.

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Contents

Page

Foreword 3
1 Scope 4
2 Normative references 4
3 Terms and definitions 4
4 Symbols 4
5 Basis of loads 5
5.1 Dead loads 5
5.2 Wind pressures 5
5.2.1 General 5
5.2.2 Reference wind pressure q(10) 6
5.2.3 Factor for column size δ 6
5.2.4 Factor for the dynamic behaviour of lighting columns, β 6
5.2.5 Topography factor f 7
5.2.6 Exposure coefficient $c_e(z)$ 7
5.3 Shape coefficient 9
5.3.1 Shape coefficient for columns and brackets with circular cross-sections 9
5.3.2 Shape coefficient for columns and brackets with regular octagonal cross-sections 9
5.3.3 Shape coefficients for columns and brackets with other cross-sections 11
5.3.4 Shape coefficient for luminaires 11
6 Forces and moments 11
6.1 Forces due to wind pressure and dead load 11
6.1.1 Horizontal force on any part of the column shaft 11
6.1.2 Horizontal force on any part of the bracket projecting from the column 12
6.1.3 Forces on the luminaire 12
6.1.4 Forces due to dead loads 12
6.2 Moments due to wind pressure and dead loads 12
6.2.1 Bending moments acting on the column shaft and the bracket 12
6.2.2 Torsional moments acting on the column shaft due to wind loads 13
Annex A (normative) National wind and meteorological information 14
Bibliography 15

Foreword

This document (EN 40-3-1:2013) has been prepared by Technical Committee CEN/TC 50 “Lighting columns”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 40-3-1:2000.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

There are seven parts to the series of standards EN 40 - Lighting columns, as follows

- Part 1: Definitions and terms;
- Part 2 : General requirements and dimensions;
- Part 3: Design and verification:
  - Part 3-1: Specification for characteristic loads;
  - Part 3-2: Verification by testing;
  - Part 3-3: Verification by calculation;
- Part 4: Requirements for reinforced and prestressed concrete lighting columns,
- Part 5: Requirements for steel lighting columns;
- Part 6: Requirements for aluminium lighting columns;
- Part 7: Requirements for fibre reinforced polymer composite lighting columns.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies design loads for lighting columns. It applies to lighting columns of nominal height (including any bracket) not exceeding 20 m. Special structural designs to permit the attachment of signs, overhead wires, etc. are not covered by this European Standard.

The requirements for lighting columns made from materials other than concrete, steel, aluminium or fibre reinforced polymer composite (for example wood, plastic and cast iron) are not specifically covered in this standard. Fibre reinforced polymer composite lighting columns are covered in this document, in conjunction with Annex B of EN 40-7:2002.

This European Standard includes performance requirements for horizontal loads due to wind. Passive safety and the behaviour of a lighting column under the impact of a vehicle are not addressed. Such lighting columns will have additional requirements (see EN 12767).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 40-1:1991, *Lighting columns — Part 1: Definitions and terms*

EN 1990, *Eurocode — Basis of structural design*

EN 1991-1-4:2005, *Eurocode 1: Actions on structures — Part 1-4: General actions — Wind actions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 40-1:1991 apply.

4 Symbols

The following symbols are used in this European Standard.

The definitions are abbreviated, the full definitions being given in the text.

A_b	Projected area of section bracket being considered
A_c	Projected area of section of column shaft being considered
A_l	Projected area of the luminaire
c	Shape coefficient
C_{ALT}	Altitude Factor
$c_e(z)$	Exposure coefficient
C_s	Probability factor
$c_r(z)$	Roughness Factor
D	Diameter or distance across flats
f	Topography factor
F_b	Partial horizontal force on section of bracket being considered

F_c	Partial horizontal force on section of column shaft being considered
F_l	Partial horizontal or vertical wind force on luminaire
h	Nominal height
k_r	Terrain factor depending on the roughness length
p	Design annual probability of exceedence
$q(10)$	Reference wind pressure
$q(z)$	Characteristic wind pressure
r	Radius of corner
Re	Reynolds number
T	Period of vibration
V	Wind speed
v	Kinematic viscosity of air
V_{ref}	10 minute mean wind velocity at 10 m above ground level for terrain category II
$V_{ref,o}$	basic value of the reference wind velocity at 10 m above sea level
z	Height above ground
z_{min}	Is the minimum length defined in Table 3
Z_o	Is the roughness length
β	Factor for the dynamic behaviour
δ	Factor for column size
ρ	Air density

5 Basis of loads

5.1 Dead loads

In addition to the selfweight of the lighting column, the weights of the brackets and the luminaires shall also be taken into consideration.

5.2 Wind pressures

5.2.1 General

The characteristic wind pressure $q_{(z),}$ in N/m^2, for any particular height above the ground, z, shall be obtained from the following formula:

$$q_{(z)} = \delta \times \beta \times f \times c_e(z) \times q(10) \quad (1)$$

where

q(10) given in 5.2.2, is the reference wind pressure.

δ given in 5.2.3, is a factor related to the column size.

β given in 5.2.4, is a factor dependent on the dynamic behaviour of the column.

f given in 5.2.5, is a factor related to topography.

$c_e(z)$ given in 5.2.6, is a factor dependent on the terrain of the site and the height above the ground, z.

NOTE 1 $q(10)$, f and $c_e(z)$, are based on the principles given in EN 1991-1-4.

NOTE 2 The procedure above, using β and δ factors, is intended as a simplified procedure that will offer a conservative approach.

5.2.2 Reference wind pressure q(10)

The value of q(10) (in N/m²) accounts for the geographical location of the lighting column. It is derived from the reference wind velocity V_{ref} (in m/s) using the following formula:

$$q(10) = 0,5 \times \rho \times (C_s)^2 \times V_{ref}^2 \quad (2)$$

where

V_{ref} is the 10 minute mean wind velocity at 10 m above ground level for terrain category II (see Table 1) having an annual probability of exceedence of 0,02 (commonly referred to as having a mean return period of 50 years).

$$V_{ref} = C_{ALT}\, V_{ref,0}$$

$V_{ref,o}$ is the basic value of the reference wind velocity at 10 m above sea level obtained from the wind maps referred to in Annex A;

C_{ALT} is an altitude factor to be taken as 1,0 unless otherwise recommended in the National Annex to EN 1991-1-4

ρ is the air density. The air density is affected by altitude and depends on the temperature and pressure to be expected at the site location during wind storms. The value of ρ shall be taken as 1.25 kg/m3, unless otherwise recommended in the National Annex to EN 1991-1-4.

C_s is a factor to convert V_{ref} from an annual probability of exceedence of 0,02 to other probabilities, and can be derived from the formula given in Annex A. For lighting columns the normal requirement is for a mean return period of 25 years, for which the factor C_s should be taken as $\sqrt{0,92.}$

5.2.3 Factor for column size δ

The greater the size of a surface subject to wind, the more unlikely it is that the maximum pressure, on which the calculation is based, acts over its full area.

The resultant smaller wind load on a component is taken into account by the factor δ dependent on the size of the area.

The ruling dimension for the size of the area subject to the wind is the greatest dimension in one direction.

For a lighting column, this is the nominal height in metres.

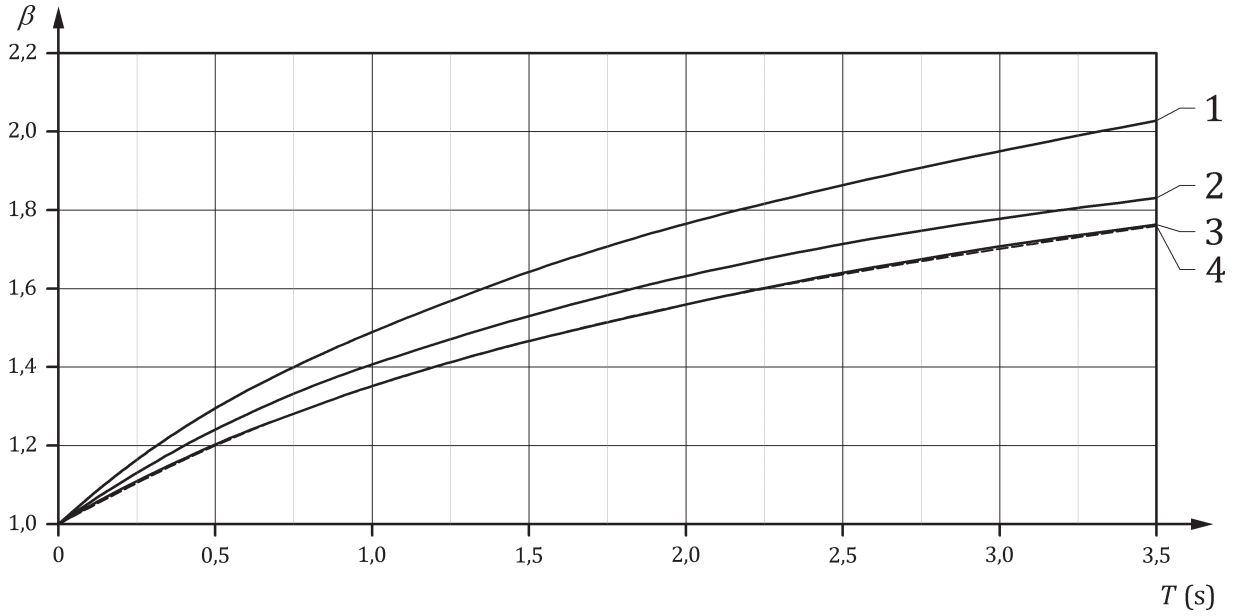
The value of the factor δ shall be obtained from the formula:

$$\delta = 1 - 0,01\ h$$

5.2.4 Factor for the dynamic behaviour of lighting columns, β

The factor β is dependent upon the basic period of vibration T and the damping of the "column/luminaire" system and takes into account the increase in the load, resulting from the dynamic behaviour of the lighting column, caused by wind gusts.

The period of vibration T in seconds for the determination of β in accordance with Figure 1 shall be obtained either by calculation or by testing.



Key

1 metal
2 prestressed concrete
3 reinforced concrete
4 fibre reinforced polymer composite

Figure 1 — Coefficient β for the dynamic behaviour of columns

NOTE In place of Figure 1, curve 1, β for metal can be calculated using the following formula:

$$\beta = 1.00240 - 0.00500T^4 + 0.05144T^3 - 0.22793T^2 + 0.67262T$$

5.2.5 Topography factor f

The topography factor *f* shall be taken as 1, unless topography is specified as significant.

Where a topographic feature is significant, the methodology in EN 1991-1-4:2005, Annex A should be used.

The altitude used for calculating C_{ALT} shall be the altitude at the base of the topography slope in the upwind direction.

5.2.6 Exposure coefficient $c_e(z)$

The exposure coefficient accounts for variation of wind pressure with respect to height above ground and depends on terrain category.

The appropriate terrain category for the location of the lighting column shall be decided on the basis of Table 1.