
**Drogovi za razsvetljavo - 7. del: Zahteve za drogove za razsvetljavo iz
vlaknatoarmiranega polimernega kompozita**

Lighting columns - Part 7: Requirements for fibre reinforced polymer composite lighting
columns

Lichtmaste - Teil 7: Anforderungen an Lichtmaste aus faserverstärktem
Polymerverbundstoff

Candélabres - Partie 7: Spécifications pour les candélabres en composite renforcés de
fibres

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93.080.40	Ó•q æÁæ•ç^dqæq]iã ææð æ[]i^æ	Street lighting and related equipment
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

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**Lighting columns - Part 7: Requirements for fibre reinforced
polymer composite lighting columns**

Candélabres - Partie 7: Spécifications pour les candélabres
en composite renforcés de fibres

Lichtmaste - Teil 7: Anforderungen an Lichtmaste aus
faserverstärktem Polymerverbundstoff

This European Standard was approved by CEN on 7 November 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document EN 40-7:2002 has been prepared by Technical Committee CEN/TC 50 "Lighting columns and spigots", the secretariat of which is held by BSI.

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 June 2003, and conflicting national standards shall be withdrawn at the latest by September 2004.

This document supersedes CR 40-7:1984.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

This part of EN 40 is the seventh in a series of specifications and requirements for lighting columns. The Parts in the series are:

Part 1: *Definitions and terms.*

Part 2: *General requirements and dimensions.*

Part 3: *Design and verification.*

3.1 *Specification for characteristic loads.*

3.2 *Verification by testing.*

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.*

Annexes A and D are informative. Annexes B, C and E are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This part of this European Standard specifies the performance requirements for fibre reinforced polymer composite lighting columns for which the main intended use is road lighting. It includes materials and test methods. The composite materials considered are those constructed of a resin matrix reinforced by a high strength fibrous material. It applies to post top columns not exceeding 20 m height for post top lanterns and columns with brackets not exceeding 18 m height for side entry lanterns.

This European Standard specifies the classes of performance related to the essential requirements of resistance to horizontal (wind) loads, and performance under vehicle impact (passive safety) in application of Essential Requirement No 4 Safety in Use measured according to the corresponding test methods included in this European Standard or available in separate European Standards.

It provides for the evaluation of conformity of the product to this European Standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

prEN 40-2:1991, *Lighting columns - Part 2: General requirements and dimensions.*

EN 40-3-1, *Lighting columns - Part 3-1: Design and verification - Specification for characteristic loads.*

EN 40-3-2, *Lighting columns - Part 3-2: Design and verification - Verification by testing.*

prEN 40-3-3:1996, *Lighting columns - Part 3-3: Design and verification - Verification by calculation.*

EN 12767, *Passive safety of support structures for road equipment - Requirements and test methods.*

EN 50102, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code).*

EN ISO 527-4, *Plastics - Determination of tensile properties - Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO 527-4:1997).*

EN ISO 527-5, *Plastics - Determination of tensile properties - Part 5: Test conditions for unidirectional fibre-reinforced plastic composites (ISO 527-5:1997).*

EN ISO 14125, *Fibre-reinforced plastic composites - Determination of flexural properties (ISO 14125:1998).*

EN ISO 14129, *Fibre-reinforced plastic composites - Determination of the in-plane shear stress/shear strain response, including the in-plane shear modulus and strength, by the +/- 45° tension test method (ISO 14129:1997).*

3 Terms and definitions

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

4 Symbols

The following symbols are used in Part 7 of this European Standard in addition to those provided in prEN 40-3-3.

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

- K Factor applied to ϕ_1 in bending strength calculation.
- E_1 Flexural modulus of elasticity in the longitudinal direction.
- E_2 Flexural modulus of elasticity in the transverse direction.
- G In plane shear modulus.
- ν_{12} Poisson's ratio when loaded in the longitudinal direction.
- ν_{21} Poisson's ratio when loaded in the transverse direction.
- τ_u Interlaminar shear strength.
- η Constant.

5 Materials

5.1 Fibre Reinforcement

The fibre material shall have mechanical and durability characteristics that are adequate for the environment and design life of the column. E-glass fibre reinforcement having the typical properties described in annex A is likely to comply. Additional or alternative fibres shall have mechanical and durability characteristics that are equivalent to or greater than E-glass.

A verification shall be obtained for each fibre batch supplied to the lighting column manufacturer, verifying that the batch complies with the fibre manufacturers' performance specification.

5.2 Polymer resin

The resin system shall have mechanical and durability characteristics that are adequate for the environment and design life of the column, and should have processing characteristics suited to the manufacturing process and fibre reinforcement. Thermosetting isophthalic polyester resin having the typical properties given in annex A, Table A.3 is likely to comply. Alternative or additional resins shall have mechanical and durability characteristics that are equivalent or greater than thermosetting polyester. Filler content shall not adversely affect the mechanical and durability properties of the resin. To minimise the degradation of the material and colour fading during the designed lifetime a suitable UV stabilizer shall be added to the resin.

A verification shall be obtained for each resin batch supplied to the lighting column manufacturer, certifying that the batch complies with the resin manufacturers' performance specification.

5.3 Attachments and fixings

All structural attachments and fixings should be made of polymer composite materials or other materials that offer equivalent or enhanced durability.

6 Dimensions

The main dimensions of fibre reinforced polymer composite lighting columns shall be in accordance with prEN 40-2.

EN 40-7:2002 (E)**7 Design and design verification**

The design and verification of fibre reinforced polymer composite lighting columns shall be in accordance with EN 40-3-1, EN 40-3-2 and prEN 40-3-3 and the additional requirements of annex B of this standard.

The column shall be designed to sustain the dead loads and the wind loads, specified in accordance with EN 40-3-1.

The structural design of a lighting column shall be verified by either calculation in conformity to prEN 40-3-3, or by testing, in conformity to EN 40-3-2. If calculation is used, the method of calculation and parameters used shall be verified by appropriate physical type testing (see annex E).

8 Construction and Properties**8.1 Pigmentation**

Composite laminates shall be completely pigmented with a uniform colour throughout the structure.

8.2 Surface finish

The columns and brackets shall have a smooth finish with a suitable surface coating to prevent fibres breaking out of the surface during the design life of the column.

NOTE This surface coating can be in the form of a surface veil producing a protective resin rich layer integral with the structure, or an appropriate polyurethane or acrylic coating system or a gel coat backed by a suitable layer of chopped strand mat.

8.3 Cut edges

All cut edges to the extremities or to openings in the column shall be sealed to prevent the ingress of water or any other contaminants. Sealing shall be through the application of the parent resin or a suitable alternative and shall be completed prior to the application of any external coatings.

8.4 Mechanical properties

The characteristic properties of the resulting laminates shall be determined in accordance with annex C.

9 Joints

All joints shall be designed and verified in accordance with clause 7.

10 Protection against mechanical impact

A type test shall be carried out on each type and nominal height of column, or part column provided each end of the part extends at least 0,3 m above and below the door opening, and shall comply with an impact protection category of IK08 as specified in EN 50102 with the door fitted.

The test equipment shall be either impact pendulum hammer or vertical free fall hammer.

The number of impacts shall be five and shall be applied around the horizontal circumference at the mid height of the door. For circular columns the impact points shall be equi-spaced around the remaining circumference excluding the door. For octagonal columns these shall be on each of the adjacent faces excluding the door.

After testing there shall be no indentation greater than 3 mm in depth when measured with a profile gauge. The test validates those products of which the outside diameter (or flat dimension) is equal to or less than the diameter being tested, with the same wall thickness and material strength.

NOTE 1 A type is defined by the shape, the dimensions and thickness and material of the section at mid door height.

NOTE 2 For sections other than circular or octagonal the provisions defined above apply.

11 Internal finish and sharp edges

11.1 Cableways

Cableways in columns shall conform to the requirements of prEN 40-2.

11.2 Access points

All access points used for the installation and fitting of electrical equipment shall be free from rough edges and burrs.

12 Corrosion protection

Fibre reinforced polymer composite lighting columns require no specific corrosion protection under this European Standard other than the sealing of cut edges which shall conform to 8.3.

NOTE Annex D provides recommendations that can help to extend the service life.

13 Marking

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All columns and brackets shall be clearly and durably marked with:

- a) the name or symbol of the manufacturer;
- b) the year of manufacture;
- c) a reference to this European Standard;
- d) a unique product code.

NOTE The marking can be formed in the material, by painting or by securely fixed label.

14 Conformity control

14.1 Evaluation of conformity

14.1.1 Factory production control

Lighting columns and brackets shall be manufactured under a permanent factory production control system which incorporates the requirements of 14.3 to 14.8 and clauses 15 and 16.

The production control system shall include the following operations:

- the specification and verification of raw materials and constituents;
- the identification of the controlling and checking procedures for the design of new or modified products including the inspection and calibration of equipment;

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- the controls and tests to be carried out during manufacture according to a frequency laid down;
- the identification and recording of any instances of non-conformity;
- the procedures for correcting any instances of non-conformity.

The manufacturer shall record the results of the production control system. The records shall include at least the following:

- identification of the product tested;
- the dates of sampling;
- the test methods used;
- the test and inspection results;
- the dates of the tests;
- the identification of the responsible authority within the factory;
- calibration of records.

When third party surveillance is required the following shall apply:

- the tests necessary to confirm conformity shall be identified;
- the frequency of surveillance tests shall be specified;
- the third party shall be able to undertake verification of the manufacturer's test results;
- records shall be made available to the third party for examination.

14.1.2 Initial type testing

Initial type tests shall conform to annex E.

14.2 Sampling

If required in a particular specification of the customer, all lighting columns and/or brackets manufacturers shall be submitted for verification. A control sample for verification testing shall be taken randomly from each lot and presented for testing. All lighting columns and/or brackets manufactured shall be submitted for verification. The minimum number of articles from each lot to form the control sample shall comply with Table 1.

A lot shall consist of columns or brackets of the same nominal height/projection, type and design strength.

Table 1 — Control sample size related to lot size

Number of articles in the lot	Minimum number of articles in the control sample
1 to 3	1
4 to 500	3
501 to 1200	5

14.3 Dimensional verification

All dimensional parameters given in prEN 40-2 and applicable to the lot shall be verified. These include:

- length/projection;
- cross-section - at each end, at all changes in cross-section;
- door opening;
- cable entry slot;
- planting depth;
- flange plate dimensions;
- base plate dimensions;
- lantern fixing diameter, length and angle.

Tolerances shall be in accordance with prEN 40-2 with the additional requirement that wall thickness shall not vary by more than + 40 % – 0 % at any particular cross-section.

Measurements shall be taken with the column/bracket in the horizontal position. Dimensions shall be verified using a measuring tape or gauge which shall be checked for accuracy according to a documented calibration procedure.

14.4 Straightness verification

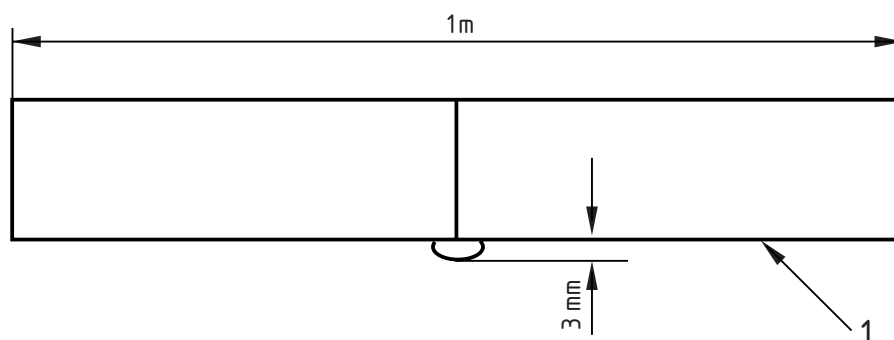
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When any article in the control sample indicates non-compliance, it shall be verified using either or both of the following methods. The column shall be placed horizontally on flat ground or timber bearers with the face showing the greatest curvature at 90° to the vertical plane.

Method A: A line shall be fixed at each end of the column above the maximum bow, tautened, and measurements taken from the line to the column surface with rule or tape measure at a minimum of six locations at or near the apparent position of maximum curvature.

Method B: A gauge as shown in Figure 1 shall be placed with edge 'X' on the suspect surface normal to the axis of the column and moved along the surface at intervals not exceeding 1 m. For polygonal columns the two adjacent surfaces shall also then be checked and for circular columns the surfaces at $15^\circ \pm 5^\circ$ on each side of the line originally checked.



Key

1 Edge X

Figure 1 - Steel gauge for verifying straightness