

# Lighting columns —

## Part 7: Requirements for fibre reinforced polymer composite lighting columns

The European Standard EN 40-7:2002 has the status of a British Standard

ICS 93.080.40

## National foreword

This British Standard is the official English language version of EN 40-7:2002. The UK participation in its preparation was entrusted by Technical Committee B/509, Road equipment, to Subcommittee B/509/50, Street lighting columns, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

### Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 April 2003

### Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 23 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

### Amendments issued since publication

Amd. No.	Date	Comments

© BSI 29 April 2003

ISBN 0 580 41737 9

English version

## 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.



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

## Contents

	page
Foreword .....	3
1 Scope .....	4
2 Normative references .....	4
3 Terms and definitions .....	4
4 Symbols .....	5
5 Materials .....	5
6 Dimensions .....	5
7 Design and design verification .....	6
8 Construction and Properties .....	6
9 Joints .....	6
10 Protection against mechanical impact .....	6
11 Internal finish and sharp edges .....	7
12 Corrosion protection .....	7
13 Marking .....	7
14 Conformity control .....	7
15 Acceptance criteria .....	10
16 Re-testing .....	11
17 Performance under vehicle impact - Passive safety .....	11
Annex A (informative) Constituents and properties of fibres .....	12
Annex B (normative) Design and verification of fibre reinforced polymer composite lighting columns .....	14
Annex C (normative) Characteristic property determination .....	17
Annex D (informative) Corrosion protection for fibre reinforced polymer composite lighting columns .....	18
Annex E (normative) Initial type tests .....	19
Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Construction Products Directives .....	20

## 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.

## 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  $\phi_1$  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.
- $\nu_{12}$  Poisson's ratio when loaded in the longitudinal direction.
- $\nu_{21}$  Poisson's ratio when loaded in the transverse direction.
- $\tau_u$  Interlaminar shear strength.
- $\eta$  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.

## 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

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;

## EN 40-7:2002 (E)

- 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**

<b>Number of articles in the lot</b>	<b>Minimum number of articles in the control sample</b>
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.

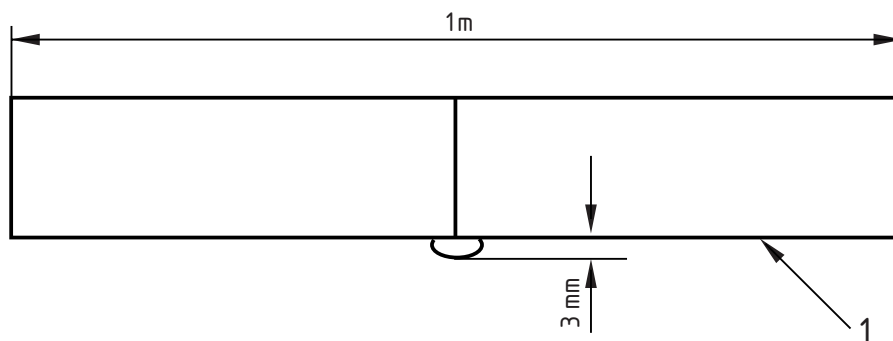
Measurements shall be taken with the column/bracket in the horizontal position. Dimensions shall be verified using a measuring tape or gauge which shall be checked for accuracy according to a documented calibration procedure.

### 14.4 Straightness verification

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

#### 14.5 Material verification

The quality and thickness of material manufactured shall be verified by the manufacturer. Records shall be in place to establish that verified material(s) have been used in the articles in the lot.

#### 14.6 Design verification

Design shall be based on loads specified in accordance with EN 40-3-1 and shall be verified in accordance with clause 7 of this standard.

#### 14.7 Identification verification

The marking shall be checked to confirm correct identification.

#### 14.8 Records

Details of all materials, processes and procedures used and details of sampling and testing shall be recorded and retained for a minimum of seven years and made available for examination when required.

### 15 Acceptance criteria

#### 15.1 General requirement

The lot shall be deemed acceptable, provided all the following requirements are met by all the articles in the control sample.

#### 15.2 Dimensions

All applicable dimensions of the checklist given in 14.2 shall be within the specified tolerances.

#### 15.3 Straightness

**Method A:** When verified by method A no measurement between the line and the column shall exceed that calculated for column length in accordance with prEN 40-2:1991, 5.1.

**Method B:** When verified by method B in 14.4 it shall not be possible for both ends of the gauge to be in contact with the column at any location.

#### 15.4 Material

Certificates shall confirm that material specifications are in accordance with the requirements of clause 5 and not less than those specified in the design.

#### 15.5 Design

A certificate of compliance in accordance with 14.6 shall be provided.

#### 15.6 Marking

Marking shall be legible and comply with the requirements of clauses 13 and 14.7.

#### 15.7 Records

Examination shall show that all records are current and available.

## 16 Re-testing

If any of the first control samples fail on any of the acceptance criteria 15.2 to 15.7 then two further control samples shall be taken and subjected to re-assessment of the appropriate properties.

If either of the control samples meets the appropriate requirements 15.2 to 15.7 then the lot shall be deemed to be acceptable.

If the second control sample fails then all items in the lot shall be quarantined until further testing or verification is agreed.

## 17 Performance under vehicle impact - Passive safety

If required, the behaviour of the lighting column in passive safety terms when subjected to vehicle impact shall be in accordance with one of the classes given in EN 12767. If not required, the lighting column shall be deemed to be of class 0 in conformity to EN 12767.

## Annex A (informative)

### Constituents and properties of fibres

#### A.1 Typical constituents for E-glass

E-glass fibres are a material with a composition typically as given in Table A.1, in fibrous form with a typical diameter between 15 and 20  $\mu\text{m}$ .

**Table A.1 — Typical composition of E-glass fibre**

Molecule	Percent
$\text{SiO}_2$	54
$\text{Al}_2\text{O}_3$	15
CaO - MgO	22
$\text{B}_2\text{O}_3$	6.5

#### A.2 Typical Properties of E-glass

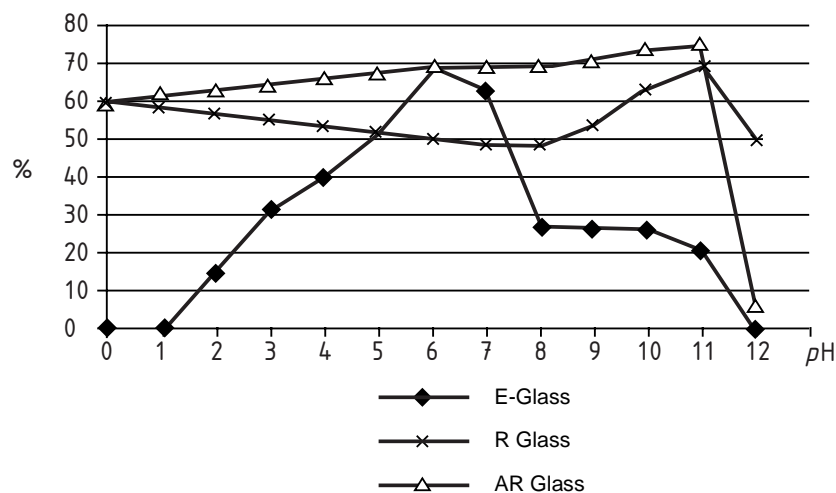
The typical properties of E-glass fibre are given in Table A.2.

**Table A.2 — Typical properties of E-glass fibre**

Property	Value
Tensile Modulus	72 GPa
Tensile Strength	1500 MPa

#### A.3 Typical Corrosion resistance for various glass types (E, R, AR)

The typical corrosion resistance of various glass types is given in Figure A.1



**Figure A.1 - Retained tensile strength with pH**

#### A.4 Typical properties for Isophthalic Polyester Resin

The typical properties of fully cured isophthalic polyester resin are given in Table A.3.

**Table A.3 — Typical properties of fully cured Isophthalic polyester resin**

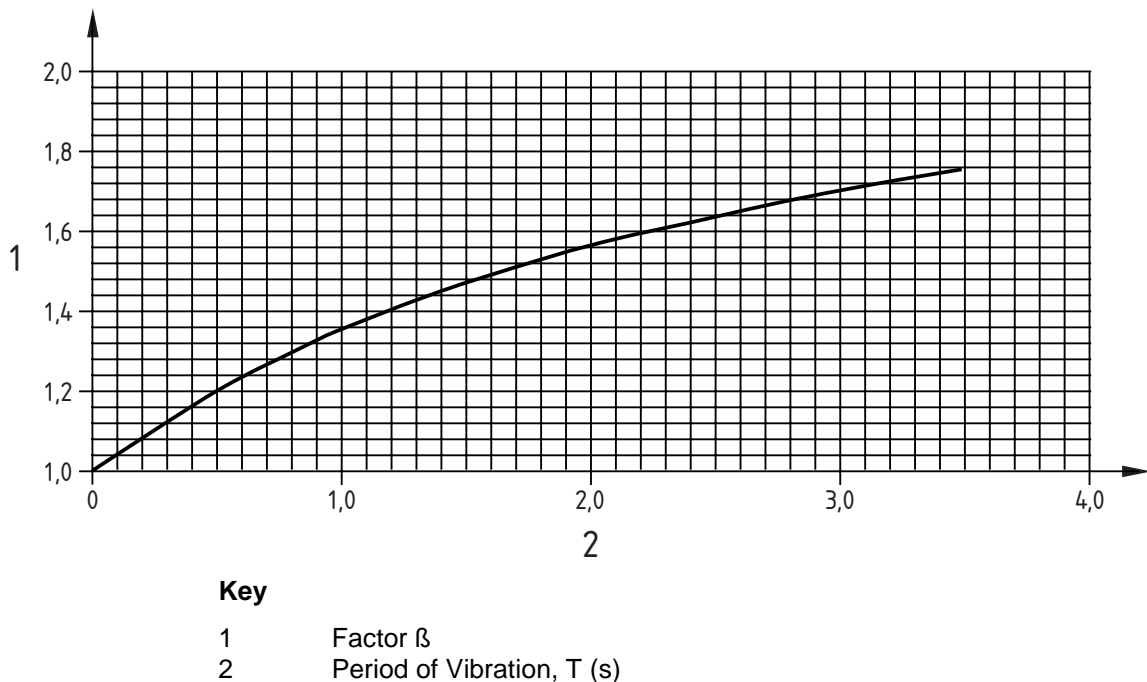
Property	Value
Tensile Modulus	3.4 GPa
Tensile Strength	79 MPa
Elongation at break	3.5 %
Barcol Hardness	43
Deflection temperature under load	78 °C

## Annex B (normative)

### Design and verification of fibre reinforced polymer composite lighting columns

NOTE Related clause numbers from EN 40-3 are shown in parenthesis

#### B.1 Specification for characteristic loads (40-3-1:2000, Figure 1)



**Figure B.1 — Coefficient  $\beta$  for the dynamic behaviour of fibre reinforced polymer composite columns**

#### B.2 Verification by testing (EN 40-3-2)

##### B.2.1 Structural requirements (clause 5.3)

For fibre reinforced polymer composite lighting columns the residual deflection after removal of the test-load shall be no greater than 5 % of the deflection caused by the test load.

##### B.2.2 Minimum ultimate requirement (clause 5.4)

For fibre reinforced polymer composite lighting columns  $f_{yT}$  shall be the flexural strength and shall be determined as in annex C from test pieces produced using materials and manufacturing processes which are configured, as far as is reasonably possible, the same as those produced for the test column.



### B.2.3 Fatigue requirements (clause 11)

Due to the low working strain compared to ultimate strain of fibre reinforced polymer composite lighting columns it is not normally necessary to consider fatigue for such columns. However, at the design stage, account should be taken of the effect of all stress concentrations on tension, compression and shear properties.

## B.3 Verification by calculation (prEN 40-3-3)

NOTE Clause 7 requires verification by type testing. The calculation methods set out in clauses B.3.2, B.3.3, B.3.4 and B.3.5 are for guidance only.

### B.3.1 Partial material factor (clause 5.6.2.1. Table 2)

The partial material factor  $\gamma_m$  for fibre reinforced polymer composite shall have a value of 1.5.

### B.3.2 Calculations (clause 5.6.2)

The calculations for fibre reinforced polymer composite lighting columns may be in accordance with the requirements for metal columns in prEN 40-3-3:1996, 5.6.2 and the amendments in B.3.3 to B.3.5.

### B.3.3 Bending strength

The co-efficient  $\phi_1$  in prEN 40-3-3:1996, 5.6.2.1, equation 2, is multiplied by a factor  $K$ , where  $K$  should not be less than 1 and is calculated as follows:

For circular cross-sections.

$$K = [2[1 + \nu_{12}(E_2/E_1)^{1/2}](E_2/E_1)^{1/2}(G/E_1)^{1/2}]^{1/2} \quad (\text{B.1})$$

And for octagonal sections.

$$K = 0.5[(E_2/E_1)^{1/2} + \nu_{12}[E_2/E_1] + 2(1 - \nu_{12}[E_2/E_1])(G/E_1)] \quad (\text{B.2})$$

where

- $E_1$  = flexural modulus in the longitudinal direction in kilonewtons per square metre (kN/m<sup>2</sup>);
- $E_2$  = flexural modulus in the transverse direction in kilonewtons per square metre (kN/m<sup>2</sup>);
- $G$  = in-plane shear modulus in kilonewtons per square metre (kN/m<sup>2</sup>);
- $\nu_{12}$  = Poisson's ratio when loaded in the longitudinal direction with associated transverse strains;
- $\nu_{21}$  =  $\nu_{12}E_1/E_2$  Poisson's ratio for a change in the longitudinal direction associated with a transverse deformation.

The values of  $\nu_{12}$ ,  $\nu_{21}$  and  $G$  should be determined using an appropriate industry standard technique for measurement and subsequent calculation to derive transformed values.

NOTE Stephen Tsai – Laminate Analysis, is one example.

Values for  $E_1$  and  $E_2$  shall be obtained from testing as defined in annex C.

### B.3.4 Torsional strength

The coefficient  $\phi_2$  in prEN 40-3-3:1996, 5.6.2.1, equation 3, takes the value of:

$$\phi_2 = \left[ \frac{0.533(1 + \nu_{12}) \cdot G \cdot t}{(1 - \nu_2 \nu_{21}) \tau_u R} \right]^{3/2} \quad (\text{B.3})$$

Subject to a maximum value of 1 where

$\nu_{12}$ ,  $\nu_{21}$  and  $G$  should be defined as in B.3.3;

$t$  = wall thickness of column in millimetres (mm)

$R$  = radius to external face of circular column or radius of circle inscribed through apexes of an octagonal column in millimetres (mm);

$\tau_u$  = in plane shear strength of column material in kilonewtons per square metre ( $\text{kN/m}^2$ );

$\tau_u$  shall be obtained from testing as defined in annex C.

### B.3.5 Buckling Strength

The high strain capacity of fibre reinforced polymer composite materials can lead to the buckling strength becoming the dominating failure mechanism for many designs.

The buckling strength may be calculated using the following generic relationship:

$$\sigma_B = \left[ \frac{E_1 \cdot E_2}{3(1 - \nu_{12}\nu_{21})} \right]^{1/2} \cdot \frac{t}{R} \cdot \eta \quad (\text{B.4})$$

where

$E_1$ ,  $E_2$ ,  $\nu_{12}$  and  $\nu_{21}$  are as defined in B.3.3;

$t$  and  $R$  are as defined in B.3.4;

$\eta$  is a constant related to the material properties and the size of the door opening;

manufacturers shall satisfy the purchasing authority that they have sufficient test experience to establish reliable values for  $\eta$ .

## B.4 Characteristic material properties (clause 5.5)

For fibre reinforced polymer composite lighting columns characteristic material properties shall be obtained by testing in accordance with annex C.

## B.5 Fatigue requirements (clause 8)

For fatigue, see clause B.2.3.

## **Annex C** (normative)

### **Characteristic property determination**

#### **C.1 General**

This annex gives methods for the determination of tensile strength, flexural and in-plane shear properties.

#### **C.2 Tensile**

Characteristic tensile properties shall be determined from test pieces produced using materials and manufacturing processes which are configured in the same way as those produced for the test column, as far as is reasonably possible. Test samples should be prepared in longitudinal and transverse orientations.

The procedures for tensile testing shall be in accordance with EN ISO 527-4 and EN ISO 527-5.

#### **C.3 Flexural**

Characteristic flexural properties shall be determined from test pieces produced using materials and manufacturing processes which are configured in the same way as those produced for the test column, as far as is reasonably possible. Test samples should be prepared in longitudinal and transverse orientations.

The procedure for flexural testing shall be in accordance with EN ISO 14125.

#### **C.4 In-plane shear**

Characteristic in-plane shear properties may be determined either by calculation, or by evaluation of test pieces produced using materials and manufacturing processes which are configured in the same way as those produced for the test column, as far as is reasonably possible.

The procedure for in-plane shear testing shall be in accordance with EN ISO 14129.

## Annex D (informative)

### Corrosion protection for fibre reinforced polymer composite lighting columns

For corrosion protection purposes the column is divided into the following areas:

Area A: The exterior surface of the column from the top of 0,2 m above ground level or the whole exterior for a column with flange plate, where it is deemed desirable Area A should extend to 0,05 below ground level.

NOTE The 0,2 m allows a protection overlap.

Area B: The exterior surface of the ground section including a length 0,25 m above ground level.

Area C: The interior surface of the column.

The following treatments are recommended:

Area A: No treatments are necessary. However in certain parts of the EU with high UV radiation levels the option of applying a polyurethane or other UV resistant coating may be considered at the discretion of the specifier. Where this is considered desirable the coating should be taken to 0,05 m below ground level.

Area B: No surface treatments are necessary. Polyurethane or acrylic external coating can be applied below ground level to prevent or delay the ingress of certain ground chemicals. The coating should only be applied after an appropriate preliminary treatment to ensure adhesion.

Area C: No surface treatments are necessary. Additional protection can be provided to the ground section where protection should be applied as for area B.

## Annex E (normative)

### Initial type tests

**E.1** When a product shall first demonstrate conformity with this standard, for example when a new product type is developed, and before offering it for sale, appropriate tests shall be carried out to confirm that the properties of the product meet the requirements of this standard.

The tests shall be either physical tests or by calculation. Where tests have previously been done in conformity with the requirements of this standard the results may be taken into account for initial type testing.

Whenever a significant change occurs in the raw material or the production process which could change the properties of the finished product this shall be considered as constituting a new product type.

**E.2** The tests shall be the reference tests called up in this standard for the properties selected from the following list, consistent with the intended use of the product:

**E.2a**

- dimensions;
- straightness;
- material;
- protection against mechanical impact.

**E.2b**

- design;
- performance under vehicle impact (passive safety).

The results of the initial tests shall be recorded.

## Annex ZA (informative)

### Clauses of this European Standard addressing essential requirements or other provisions of EU Construction Products Directives

#### ZA.1 Clauses of this European Standard addressing the provisions of EU Construction Products Directive

This European Standard has been prepared under Mandate M/111, Circulation fixtures, given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard, shown in this annex, meet the requirements of the mandate M/111 given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction product covered by this European Standard for its intended use(s).

**WARNING:** Other requirements and other EU Directives, not affecting the fitness of intended use(s), can be applicable to the construction product falling within the scope of this European Standard.

**NOTE 1** In addition to any specific clauses relating to dangerous substances contained in this standard there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive these requirements also need to be complied with when and where they apply.

**NOTE 2** An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (*CREATE*, accessed through <http://europa.eu.int>).

**Table ZA.1 — Scope and relevant requirement clauses**

<b>Construction products:</b> Fibre reinforced polymer composite lighting columns			
<b>Intended uses:</b> Road lighting columns for circulation areas			
Requirement/Characteristic from the Mandate:	Requirement Clause(s) in this or other European Standard(s):	Mandated level-s and/or classes:	Notes:
Resistance to horizontal Loads	7, 9	None  None	Technical class A or B (partial load factor $\gamma_f$ )  Technical class I, II or III (maximum horizontal deflection)
Performance under vehicle impact (passive safety)	17	None	Technical classes
Durability	8, 9, 12		

The requirement on a certain characteristic is not of application in those Member States where there are no regulations for such characteristic. In this case, manufacturers willing to place their products in the market of these Member States are not obliged to determine nor to declare the performance of their products with regard to this characteristic and the option 'no performance determined' (NPD) in the information accompanying the CE marking (see ZA.3) may be used.

The NPD option may not be used where the characteristic is subject to a threshold level. Otherwise it may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements.

## ZA.2 Procedure for the attestation of conformity

The system of attestation of conformity of fibre reinforced polymer composite lighting columns of Table ZA.1, in accordance with the decision of the Commission 96/579/EEC of 24 June 1996 as given in Annex III of the mandate M/111 for Circulation fixtures, is shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es):

**Table ZA.2 — System of attestation of conformity**

Product	Intended use	Levels or classes	Attestation of conformity system
Road lighting columns	For circulation areas	None	1
System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i) without audit testing of samples.			

The attestation of conformity of fibre reinforced polymer composite lighting columns in Table ZA.1 shall be based on the evaluation of conformity procedure indicated in Table ZA.3 resulting from application of the clauses of this European Standard indicated therein.

**Table ZA.3 — Assignment of evaluation of conformity tasks**

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (F.P.C)	Parameters related to all characteristics of Table ZA.1	14.1.1
	Further testing of samples taken at the factory	All characteristics of Table ZA.1	14.1.1
Tasks for the notified body	Initial type testing	All characteristics of Table ZA.1	14.1.2 (E.1 and E.2b)
	Initial inspection of factory and of F.P.C	Parameters related to all characteristics of Table ZA.1	14.1.1
	Continuous surveillance, assessment and approval of F.P.C.	Parameters related to all characteristics of Table ZA.1	14.1.1

When compliance with the conditions of this annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity) with the information indicated below.

The EC Certificate of conformity shall include the following information:

- name, address and identification number of the certification body;
- name and address of the manufacturer, or the name of his authorised representative in the EEA, and place of production;
- description of the product type (type, identification, use, copy of information accompanying the CE marking giving indications to identify the characteristics of the product);
- provisions to which the product conforms (e.g. annex ZA of this European Standard);
- particular conditions applicable to the use of the product (e.g. provisions for the use of a common cement under certain conditions etc.);
- the number of the certificate;
- conditions and period of validity of the certificate, where applicable;

## EN 40-7:2002 (E)

- name of, and position held by, the person empowered to sign the certificate.

This EC Certificate of conformity entitles the manufacturer to affix the CE marking, as described in ZA.3.

In addition the manufacturer shall draw up a declaration of conformity (EC Declaration of conformity) including the following:

- name and address of the manufacturer, or his authorised representative established in the EEA;
- name and address of the certification body;
- description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (e.g. annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- number of the accompanying EC Certificate of conformity;
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The above mentioned declaration and certificate shall be available in the official language or languages of the Member State(s) of the EU in which the product is to be used.

### ZA.3 CE marking and labeling

The manufacturer or his authorised representative established within the EU or EFTA is responsible for the affixing of the CE marking.


The CE conformity symbol shall be in accordance with Directive 93/68/EEC and shall be accompanied by the following information:

- the identification number of the certification body;
- the name or identifying mark of the producer;
- the registered address of the producer;
- the last two digits of the year in which the marking was affixed;
- the number of the EC certificate of conformity;
- a reference to this European Standard;
- description of the product and intended use (code number and name);
- the characteristics of the product to declare:
  - resistance to horizontal loads: type of design verification calculation (C) or testing (T), reference wind velocity, partial load factor class, wind area and weight at top, deflection class, terrain category if different to II;
  - performance under vehicle impact (passive safety): performance type, backfill type of testing if not standard.



The CE marking and the accompanying information shall be placed in one of the following locations: on the product itself, on a label attached to it, on its packaging or on the accompanying commercial documentation.

Example of CE marking:


Identification number of notified body Any Company Ltd, PO Box 21, B-1050 00 Certificate number:
EN 40-7: 2001 Fibre reinforced polymer composite road lighting columns for circulation areas Code number and name Resistance to horizontal loads: C-v = 26m/s; Class A, 0.25m <sup>2</sup> , 20kg, Class II Performance under vehicle impact (passive safety): <i>Untested:</i> Class 0 or <i>Tested:</i> Speed class – 100; energy absorption class – NE; level of occupant risk – 3.

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

---

---

## BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

### Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.  
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

### Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.  
Fax: +44 (0)20 8996 7001. Email: [orders@bsi-global.com](mailto:orders@bsi-global.com). Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

### Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.  
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: [info@bsi-global.com](mailto:info@bsi-global.com).

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.  
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.  
Email: [membership@bsi-global.com](mailto:membership@bsi-global.com).

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

### Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager.  
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.  
Email: [copyright@bsi-global.com](mailto:copyright@bsi-global.com).