BRITISH STANDARD

BS EN
383:2007

Timber Structures — Test methods — Determination of embedment strength and foundation values for dowel type fasteners

The European Standard EN 383:2007 has the status of a British Standard

ICS 91.080.20

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 383:2007. It supersedes BS EN 383:1993 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/518, Structural timber.

A list of organizations represented on B/518 can be obtained on request to its secretary.

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 cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2007

ISBN 978 0 580 50141 8

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 383

January 2007

ICS 91.080.20

Supersedes EN 383:1993

English Version

Timber Structures - Test methods - Determination of embedment strength and foundation values for dowel type fasteners

Structures en bois - Méthodes d'essai - Détermination de caractéristiques de fondation et de la portance locale d'éléments d'assemblage de type broche

Holzbauwerke - Prüfverfahren - Bestimmung der Lochleibungsfestigkeit und Bettungswerte für stiftförmige Verbindungsmittel

This European Standard was approved by CEN on 25 October 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, 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

Ref. No. EN 383:2007: E

Contents

Page

Foreword

This document (EN 383:2007) has been prepared by Technical Committee CEN/TC 124 “Timber Structures”, the secretariat of which is held by SFS.

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 July 2007, and conflicting national standards shall be withdrawn at the latest by July 2007.

This document supersedes EN 383:1993.

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

1 Scope

This standard specifies laboratory methods to determine the embedding strength and foundation values of solid timber, glued laminated timber and wood based sheet products with dowel type fasteners.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1
dowel type fastener
bolt, nail, dowel or the like with plain or patterned surfaces

3.2
embedment strength
average compressive stress at maximum load in a piece of timber or wood based sheet product under the action of a stiff linear fastener. The fastener's axis is perpendicular to the surface of the timber. The fastener is loaded perpendicular to its axis

3.3
maximum load
maximum load measured before the deformation of the specimen has reached the deformation limit

3.4
fastener section dimension
1) Nominal diameter of round fasteners; or
2) Length of one side of the section of a square fastener; or
3) Minimum dimension of the section of an oval or rectangular fastener.

4 Symbols and abbreviations

d fastener section dimension, in millimetres

F load, in newtons

F_{max} maximum load, in newtons

$F_{max,\,est}$ estimated maximum load, in newtons

f_h embedding strength, in newtons per square millimetre

$f_{h,est}$ estimated embedding strength, in newtons per square millimetre

K_e elastic foundation modulus, in newtons per cubic millimetre

K_i initial foundation modulus, in newtons per cubic millimetre

K_s foundation modulus, in newtons per cubic millimetre

t thickness, in millimetres

w indentation or deformation, in millimetres

w_e elastic deformation, in millimetres

w_i initial deformation, in millimetres

$w_{i,mod}$ modified initial deformation, in millimetres

w_o deformation of the test apparatus at any given load, in millimetres

5 Requirements

The fasteners and the timber, glued laminated timber or wood based sheet product shall be, as far as possible, of the minimum quality allowed by the relevant specification.

6 Test methods

6.1 Principle

The test shall be carried out on the test piece and using the apparatus shown in figure 1. It is a principle of this test to avoid bending of the fastener under test.

The fastener is loaded perpendicular to its axis through a steel loading apparatus and the load and the corresponding indentation or deformation is measured, see figure 1.

The loading may be either in compression, see figure 2a, or in tension, see figure 2b. For solid timber and layered wood products with only one grain direction, the loading may be either parallel to the grain, see figures 2a and 2b or compression perpendicular to the grain, see figure 2c.

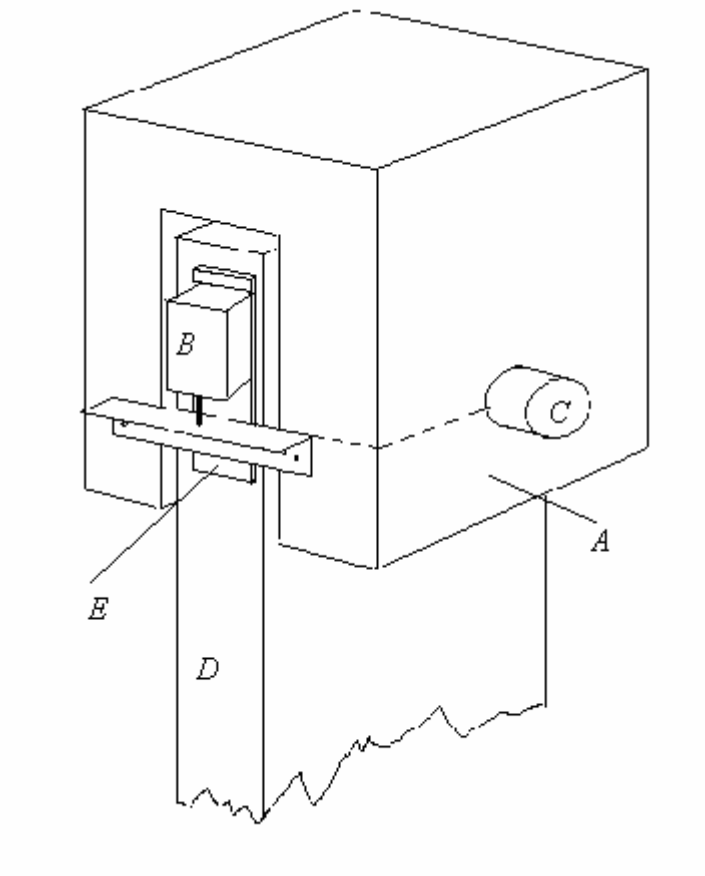
NOTE The principles of this standard may be used for other angles between the load and the grain.

6.2 Test Pieces

The test piece is a rectangular prism of wood or wood based sheet product with a fastener placed with its axis perpendicular to the surface of the prismatic test piece. The sizes of the test pieces are given in table 1.

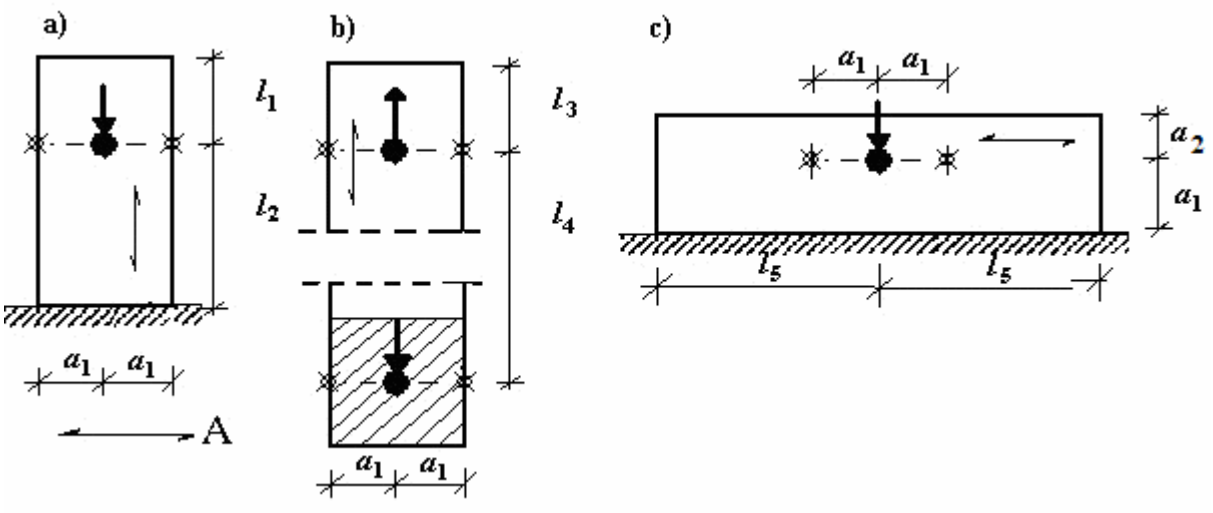
NOTE The thickness t should be in the range 1,5d to 4d in order to comply with the principle of the test.

For wood based sheet products, the thickness of the test piece shall be the thickness of the panel as produced.



Key
A Steel apparatus
B Displacement gauges
C Fastener
D Test piece
E Strip

Figure 1 — Test principle



Key

a) Compression parallel to grain
b) Tension parallel to grain
c) Compression perpendicular to grain
A Grain direction or one of the main directions of wood based sheet products
X Measuring point

Figure 2 — Test piece dimensions as specified in Table 1 with transducer pick up points

Table 1 — Sizes of test pieces

Measurements[a]	Nails not prebored	Nails prebored	Bolts and dowels	Test piece material
a_1	5*d*	5*d*	3*d*	Timber or woods based sheet products.
l_1	20*d*	12*d*	7*d*	
l_2	20*d*	12*d*	7*d*	
l_3	20*d*	12*d*	7*d*	
l_4	40*d*	40*d*	30*d*	
a_1	5*d*	5*d*	5*d*	Timber or layered wood products with one grain direction.
a_2	5*d*	5*d*	5*d*	
l_5	20*d*	20*d*	20*d*	

[a] Measurements given in Figure 2 are dependent on *d*, where *d* is given, see clauses 3.4 and 4

6.3 Apparatus

The test apparatus shall be such that no friction between steel plates and test pieces may influence the measurements. In addition to equipment for measuring the geometry, moisture content, etc. of the test pieces, the following shall be available:

a) loading equipment capable of applying and continuously recording the load to an accuracy of ± 1 % of the load applied to the test piece or, for loads less than 10 % of the maximum load applied to the piece, with an accuracy of ± 0,1 % of the maximum load;

b) equipment to continuously record the displacement of the fasteners in the wood with an accuracy of ± 1 % of the displacement, or for displacement less than 2 mm with an accuracy of ± 0,02 mm.

NOTE The equipment should ensure that eccentricities, twist, etc. have no influence on the measurements.

6.4 Preparation of the test pieces

Before placing the fastener, the wood material shall be conditioned to a constant mass in an environment having a relative humidity of (65 ± 5) % and a temperature of (20 ± 2) °C. After fabrication the test piece shall be conditioned again in the same environment. Constant mass is considered attained when the results of two successive weightings, carried out at an interval of 6 h, do not differ by more than 0,1 % of the mass of the test piece.

NOTE For particular investigations, it may be appropriate to condition the test piece to other moisture conditions both before and after placing the fastener; if other climatic conditions are used, they are to be reported.

6.5 Procedure

6.5.1 Apparatus calibration

Initially the stiffness characteristic of the loading apparatus shall be determined. A steel specimen with a tight-fitting pin of the same diameter as the fastener shall be placed in the apparatus and the load deformation curve shall be determined as described in 6.5.6.

6.5.2 Placing fastener

The diameter of the fastener and the thickness of the test piece shall be measured in millimetres to an accuracy of 1 %.

The fasteners shall be placed in the same way as would be used in practice (e.g. preboring or no-preboring for nails, tight-fitting holes for dowels, oversized holes for bolts).

NOTE To ensure that the axis of the fastener is perpendicular to the surface of the test, a guide should be used.

6.5.3 Placing of test piece in apparatus

The test piece shall be placed symmetrically in the test apparatus. The load shall be applied in the axis of the test piece

6.5.4 Transducer location

The relative displacement of the dowel-type-fastener in respect to the test specimen shall be measured between the steel apparatus that holds the dowel and points on the edges of specimens, at the level of the centre line of the dowel. Two displacement transducers are placed on opposite edges.

NOTE An example of a test set up is given in Figure 1.

6.5.5 Estimation of maximum load

The estimated maximum load $F_{max,est}$ shall be determined on the basis of experience, calculation or preliminary tests.

NOTE The estimations should be adjusted as described in 6.6.2.

6.5.6 Application of load

The loading procedure as shown in Figure 3 shall be followed except that, for particular tests, the preload cycle up to 0,4 $F_{max,est}$ may be omitted with a corresponding adjustment to the total testing time. The load shall be increased to 0,4 $F_{max,est}$ and maintained for 30 s.

The load shall then be reduced to 0,1 $F_{max,est}$ and maintained for 30 s. Thereafter, the load shall be increased.

The test shall then be stopped either when the maximum load is reached or when the deformation is w_o + 5 mm.

The load shall be increased or decreased at a constant rate of loading-head movement. The load shall be so adjusted that the maximum load is reached within (300 ± 120) s.

6.5.7 Recording of deformation

The deformations w_{o1}, w_{o4}, w_{14}, w_{11}, w_{21}, w_{24}, w_{26} and w_{28} corresponding to the points 01, 04, 14, 11, 21, 24, 26 and 28 as shown in Figure 4 shall be recorded as the mean given by the two transducers for each test piece to give the load deformation curve. The deformation at maximum load F_{max} shall also be recorded.

\\'hen a load deformation curve is not available, measurements of deformation should be taken at each 0,1 $F_{max,est}$ increment of load, see Figure 3.

6.5.8 Determination of density and moisture content

Determine the density and moisture content of the timber or wood based sheet products.

6.6 Results

6.6.1 Calculations

The embedding strength and the estimated embedding strength $f_{h,est}$ shall be calculated to an accuracy of 1 % using the following formulae:

$$f_h = \frac{F_{max}}{dt} \quad (1)$$

$$f_{h,est} = \frac{F_{max,est}}{dt} \quad (2)$$

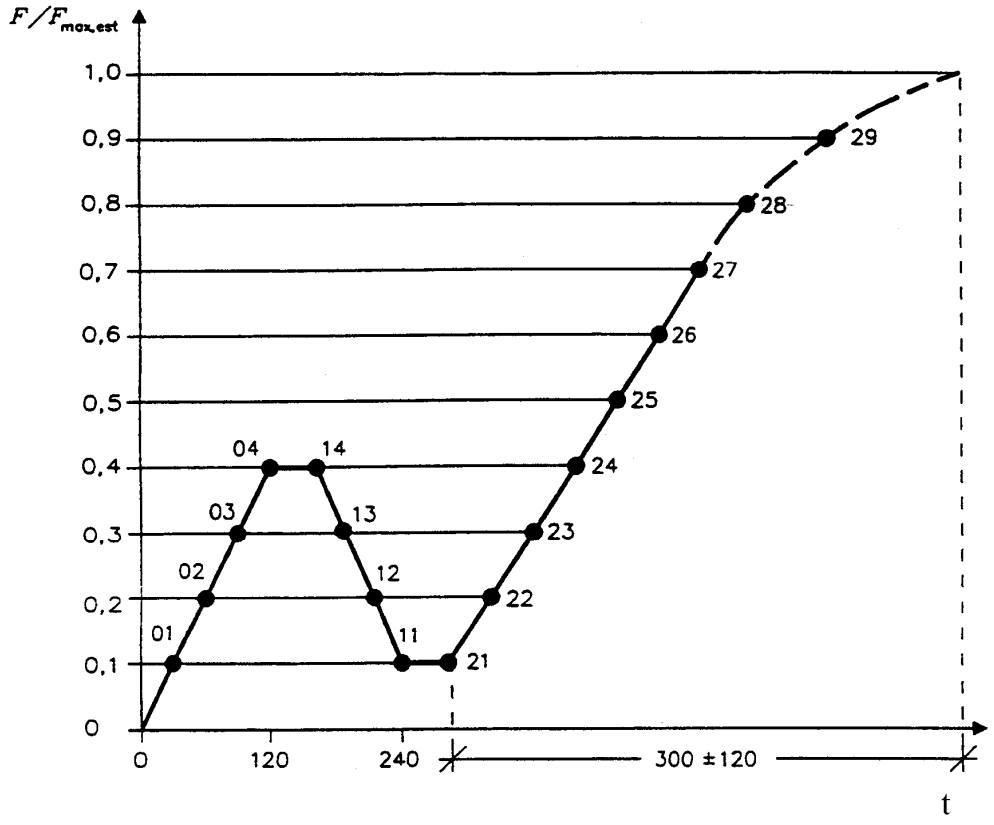
From the recorded measurements the following values, if relevant, shall be calculated:

initial deformation:

$$w_i = w_{04} \quad (3)$$

modified initial deformation:

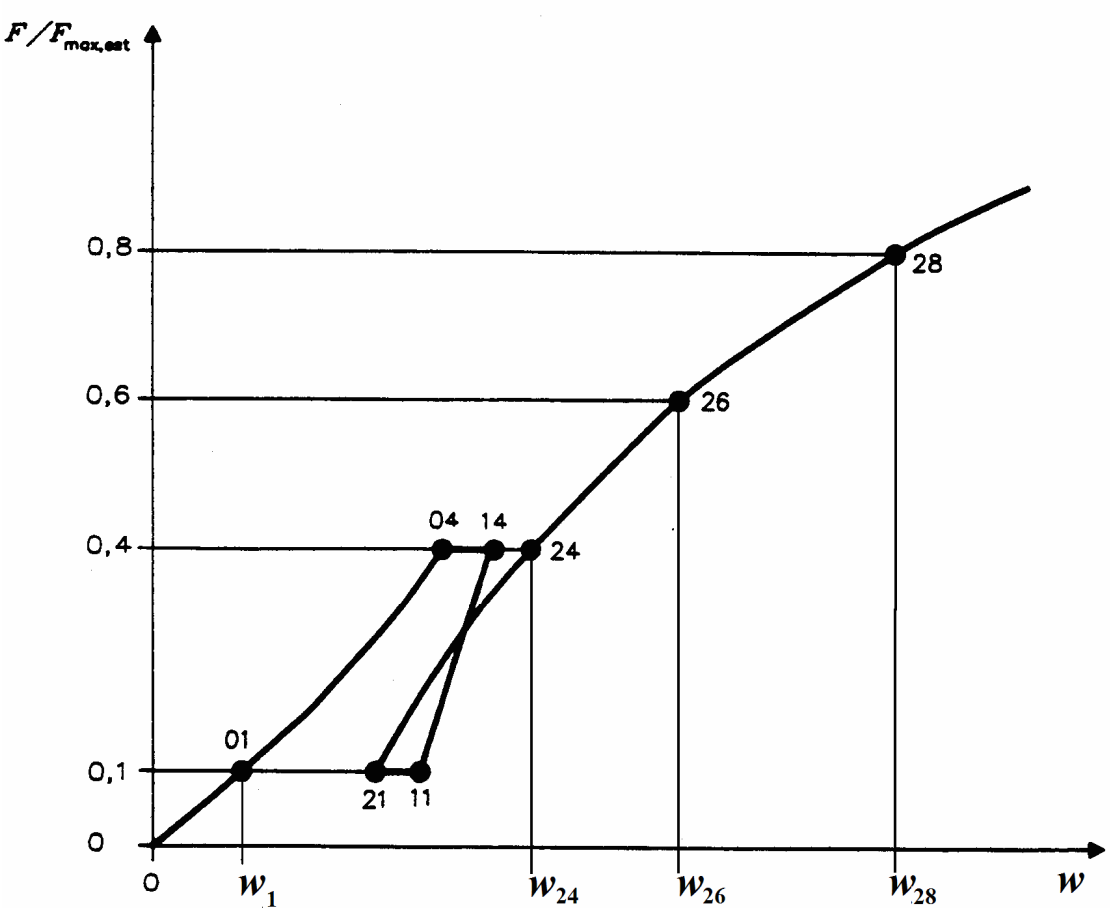
$$w_{i,mod} = \frac{4}{3}(w_{04} - w_{01}) \quad (4)$$



Key

t time

Figure 3 — Loading procedure



Key

t time
w deformation

Figure 4 — Idealized load-deformation curve and measurements

elastic deformation:

$$w_e = \frac{2}{3}(w_{14} + w_{24} - w_{11} - w_{21}) \quad (5)$$

initial foundation modulus:

$$K_i = \frac{0,4\, f_{h,est}}{w_i} \quad (6)$$

foundation modulus:

$$K_s = \frac{0,4\, f_{h,est}}{w_{i,mod}} \quad (7)$$

elastic foundation modulus:

$$K_e = \frac{0,4\, f_{h,est}}{w_e} \quad (8)$$

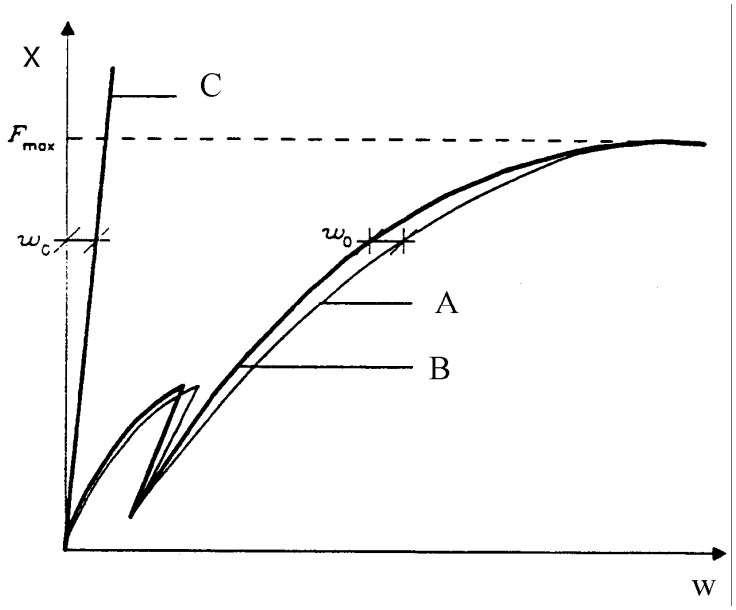
deformation at 0,6 F_{max}:

$w_{0,6}$

deformation at 0,8 F_{max}:

$w_{0,8}$

The measured load deformation curve shall, if relevant, be corrected as shown in Figure 5, before performing the calculations.



Key

A Measured load deformation curve
B Corrected load deformation curve
C Load deformation curve from calibration test
W Deformation
X Load

Figure 5 — Correction of the measured load deformation taking into account the stiffness characteristics of the loading apparatus. The measured deformation at the load *F* is reduced by the deformation w_0 at the same load found by the apparatus calibration

6.6.2 Adjustments

If, during the execution of the tests, the mean value of the maximum load of the tests already carried out deviates by more than 20 % from the estimated value, this value shall be adjusted correspondingly for subsequent tests. The values of the maximum load already determined may be accepted without adjustment as part of the final results. In this case, the values of deformation and foundation moduli determined in equations (3) to (8) shall be adjusted to correspond to the adjusted values of the estimated value.

6.7 Test report

The test report shall include the following:

a) sampling procedure;

b) specification and quality of material: species, density, grain direction or main orientation, strength properties;

c) type, diameter, strength characteristics and surface treatment of the fastener (including anticorrosion protection);

d) size of the test pieces, diameter of the hole and manner of placing the fastener in the specimen;

e) conditioning of test pieces before and after preparation, moisture content at test;

f) test results and information regarding adjustments, mean values and standard deviations, and descriptions of the modes of failure.

blank

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. 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.

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.

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

BSI
389 Chiswick High Road
London
W4 4AL