BRITISH STANDARD

BS EN
1544:2006

Products and systems for the protection and repair of concrete structures — Test methods — Determination of creep under sustained tensile load for synthetic resin products (PC) for anchoring of reinforcing bars

The European Standard EN 1544:2006 has the status of a British Standard

ICS 91.100.30

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National foreword

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A list of organizations represented on B/517/8 can be obtained on request to its secretary.

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EUROPEAN STANDARD

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English Version

Products and systems for the protection and repair of concrete structures - Test methods - Determination of creep under sustained tensile load for synthetic resin products (PC) for the anchoring of reinforcing bars

Produits et systèmes pour la protection et la réparation des structures en béton - Méthodes d'essais - Mesure du fluage, sous contrainte maintenue des produits à base de résine de synthèse destinés à l'ancrage d'armature

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Bestimmung des Kriechverhaltens von für die Verankerung von Bewehrungsstäben verwendeten Kunstharzprodukten (PC) bei Dauerzuglast

This European Standard was approved by CEN on 7 September 2006.

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Foreword

This document (EN 1544:2006) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by April 2007, and conflicting national standards shall be withdrawn at the latest by December 2008.

It has been prepared by Sub-Committee 8 "Protection and repair of concrete structures", the Secretariat of which is held by AFNOR.

This European Standard is one of a series dealing with products and systems for the protection and repair of concrete structures. It describes a method of test for determining the creep of anchoring products under sustained tensile load.

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.

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1 Scope

This European Standard specifies a method for carrying out a sustained tensile load test on a reinforcing steel bar (rebar) anchored in a concrete block. The test is performed to determine the tensile creep under standard conditions, or under maximum service temperature conditions recommended by the manufacturer.

The test applies to products based on synthetic resins or hybrid synthetic resin/hydraulic cements.

It does not include those products intended to be used as grout around tendons used for the prestressing of concrete.

2 Normative references

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

EN 1766*, Products and systems for the protection and repair of concrete structures - Test methods - Reference concretes for testing*

EN 10080*, Steel for the reinforcement of concrete - Weldable reinforcing steel - General*

3 Principle

The principle is to apply a sustained tensile load to a reinforcing bar anchored into concrete with the product to be tested, and to measure the displacement of the rebar relative to the concrete test piece over different periods of time.

The test is performed using blocks of concrete – type C(0,40) in accordance with EN 1766.

The test is carried out at standard laboratory temperature of (21 ± 2) °C or such other temperature as specified by the manufacturer.

4 Apparatus

The following apparatus is required.

4.1 One mixer for concrete.

4.2 One mixer for the product to be tested.

4.3 Moulds for the preparation of concrete blocks of minimum dimensions 400 mm x 400 mm x 250 mm.

4.4 One concrete vibrator, 25 mm diameter

4.5 One rotary percussive drill or one diamond drill, or both, as specified by the manufacturer.

4.6 Three ribbed steel bars type B500B, diameter 16 mm, with a related rib area of 0,075 to 0,085 in accordance with EN 10080.

4.7 Devices for centring and maintaining alignment of the rebars during anchoring.

4.8 One thermometer accurate to within ± 1 °C.

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4.9 A room or chamber at the standard laboratory climate of (21 ± 2) °C and (60 ± 10) % RH.

4.10 A tensile testing machine measuring load to within ± 2 % which controls the rate of load increase.

4.11 An apparatus capable of applying a sustained tensile load over a period of time (A typical apparatus is given in Figure1).

NOTE Any systems providing a permanent tensile load of (50 ± 1,0) kN can be used.

4.12 A device, interlocked with the rebar during the whole test, connected to one or more displacement sensors capable of measuring relative movement between the anchored bar and a fixed reference point on the test block to an accuracy of ± 0,01 mm.

5 Specimen preparation

5.1 Composition of the concrete test specimens

The test specimens shall be cast from concrete type C (0,40) as specified in EN 1766.

5.2 Preparation of moulds

Test specimens shall be produced in a room or chamber maintained at (21 ± 2) °C.

Moulds shall be non-deformable and of minimum dimensions 400 mm x 400 mm x 250 mm for a single test, or in multiples of the 400 mm dimensions for more than one test. Before filling the inner surface of the mould it should be covered with a thin film of non reactive release material to prevent the concrete from adhering to the mould.

5.3 Preparation of concrete test blocks

The concrete shall be placed and immediately compacted in three layers of approximately equal thickness and vibrated using a 25 mm diameter concrete vibrator in such a way as to produce full compaction of the concrete with neither excessive segregation nor laitance. For a block for a single test the vibratory operation shall be carried out at four points, each position being equidistant and at about 125 mm from the two adjacent faces. For larger blocks with dimensions greater than 400 mm x 400 mm x 250 mm vibration shall be carried out at the same four positions, and also at intermediate points on a square grid pattern of approximately 150 mm.

The vibration should be applied for the minimum time necessary for the full compaction of the concrete. The vibrator should be in a vertical position and not allowed to touch the sides or bottom of the mould.

The concrete specimens shall be cured in the moulds for at least 72 h after casting at (21 ± 2) °C, either under polyethylene sheeting or at not less than 95 % relative humidity, then demoulded and cured until at least 28 days after casting. During curing the test blocks shall be stored at (21 ± 2) °C, in air at a relative humidity of not less than 95 %.

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5.4 Preparation of the anchoring grout

5.4.1 General

The anchoring product is prepared in accordance with the manufacturers instructions.

Before mixing up the anchoring product, the constituents are stored under standard laboratory climate (21 ± 2) °C and (60 ± 10) % RH for at least 24 h.

5.4.2 Preparation of the concrete for anchoring

Seven days before carrying out the anchoring operation, each concrete test-piece shall be removed from the humidity chamber or room and then stored in a chamber or room maintained at (21 ± 2) °C and (60 ± 10) % relative humidity.

On the day of the intended anchoring operation, a hole shall be drilled by a rotary percussive or diamond drill, as specified by the manufacturer, in the centre of the 400 mm x 400 mm face of the block. For larger blocks (for multiple tests) holes are drilled at a minimum distance of 200 mm from any edge and at least 400 mm from any other hole.

Holes shall be drilled to a depth of (150 ± 3) mm. The hole diameter shall be 20 mm, unless specified otherwise by the manufacturer.

Immediately after the drilling operation the hole(s) shall be cleaned in accordance with manufacturers instructions; the anchoring operation shall then be undertaken.

6 Procedure

6.1 Carrying out the anchoring operation

Before use the rebars shall be prepared in accordance with manufacturers instructions; the prepared rebars, the anchoring product, and the equipment and tools required for mixing and placing shall be stored for at least 24 h in a room or chamber maintained at (21 ± 2) °C and (60 ±10) % relative humidity.

The product shall be mixed and placed, and the rebars installed, strictly in accordance with the manufacturer's instructions.

Each rebar, set to the base of its hole, shall be located and supported along the centre line of the hole by the centering device.

NOTE The efficacy of the product is dependent on the care exercised during use, and therefore the manufacturer's recommendations should be followed.

6.2 Storage of test-pieces after carrying out the anchoring operation

The test pieces shall be stored undisturbed for the minimum curing time recommended by the manufacturer, and then up to the time of the test, at (21 ± 2) °C and (60 ±10) % relative humidity.

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6.3 Carrying out the test

After storage each rebar is subjected to a continuous tensile load of (50 ± 1,0) kN, for three months.

The load should be applied and increased as evenly as possible, at a rate which permits the test load to be attained in approximately 30 s. During the duration of the test, test pieces are stored at (21 ± 2) °C and (60 ±10) % relative humidity or such other conditions as specified by the manufacturer.

6.4 Measurements

The displacement of each rebar relative to the concrete test block is measured and recorded :

— before applying the tensile load ;

— immediately after applying the tensile load (start of the creep curve) ;

— after 1 day, 2 days and every 7 days until the test is completed at 3 months (reference value).

These values are expressed in mm to two decimal places.

They are then tabulated and plotted on a graph indicating the displacement of the rebars in terms of time (logarithmic scale).

7 Test report

The test report shall include the following information:

a) identification of the product;

b) date and place of the test;

c) the temperature and relative humidity of the room or chamber during the test;

d) the conditions for preparing the product;

e) the batch number and pack size of product;

f) the quantity of mixture prepared;

g) the method used for mixing the constituents and the time taken;

h) the time between mixing the constituents and installing the anchor;

i) the diameter and the measured depth of the hole and the method of drilling;

j) the time taken to place the product and install the anchors, and any difficulties encountered;

k) the temperature during the creep loading;

l) the creep results in tabular and graphical form;

m) any incident liable to have affected the results;

n) any deviation from the conditions specified in this standard;

o) reference to this standard.

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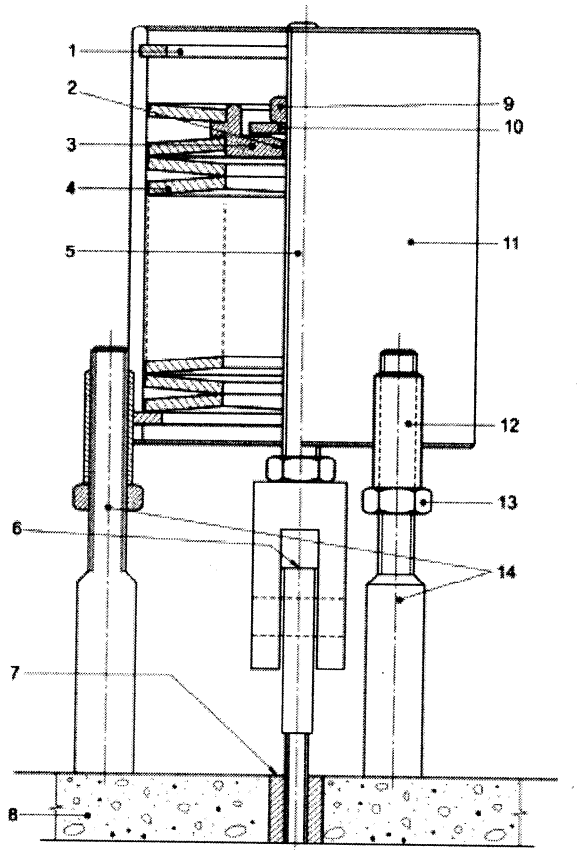

Key

1 circlip
2 spherical bearing washer
3 load cell
4 spring
5 tensile threaded rod M16
6 creep measurement point
7 ½ cross section of the anchoring product being tested
8 concrete block
9 hexagon nut (B)
10 bearing washer
11 load application cylinder
12 calibrated sleeve
13 hexagon nut (A)
14 3 adjustable bases (stainless steel)

Figure 1 – Apparatus for applying constant tensile load

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