



# SLOVENSKI STANDARD

## SIST EN 12636:2000

01-maj-2000

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### Proizvodi in sistemi za zaščito in popravilo betonskih konstrukcij - Preskusne metode - Določevanje sprijetosti betona na beton

Products and systems for the protection and repair of concrete structures - Test methods - Determination of adhesion concrete to concrete

Produkte für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Bestimmung der Verbundwirkung Beton-Beton

Produits et systemes pour la protection et la réparation des structures en béton - Méthodes d'essais - Détermination de l'adhérence béton sur béton

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 12636

May 1999

ICS 91.100.30

English version

Products and systems for the protection and repair of concrete  
structures - Test methods - Determination of adhesion concrete  
to concrete

Produits et systèmes pour la protection et la réparation des  
structures en béton - Méthodes d'essais - Détermination de  
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Betontragwerken - Prüfverfahren - Bestimmung der  
Verbundwirkung Beton-Beton

This European Standard was approved by CEN on 16 April 1999.

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.

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

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 104 "Concrete (performance, production, placing and compliance criteria)", 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 november 1999, and conflicting national standards shall be withdrawn at the latest by november 1999.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

It has been prepared by Sub-Committee 8 "Products and systems for the protection and repair of concrete structures" (Secretariat AFNOR).

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## 1 Scope

This European Standard describes methods for the measurement of the adhesion of structural bonding agents between fresh or hardened concrete and a hardened concrete substrate.

## 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.

EN 196-1, *Methods of testing cement - Part 1 : Determination of strength.*

EN 1542:1999, *Products and systems for the protection and repair of concrete structures - Test methods - Pull-off test.*

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

EN 12189, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of open time.*

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## 3 Test method

### 3.1 Hardened concrete-to-hardened concrete

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The adhesion between hardened concrete substrates is measured using the results from tensile bending tests performed on pairs of concrete test prisms which have been bonded using the bonding agent under test.

For satisfactory performance of the bonding agent, the tensile bending test should result in fracture in the concrete. When fracture occurs within the bond line it is considered that the structural bonding agent has not performed satisfactorily.

Alternatively, the tensile bending test can be performed in the presence of a longitudinal clamping force where the intended use involves the application of longitudinal prestress.

### 3.2 Fresh concrete-to-hardened concrete

The method for the determination of the bond strength of fresh concrete adhesively bonded to hardened concrete involves coring through the fresh concrete overlay beyond the bonded surface and into the hardened concrete substrate, and then performing a pull off test.

For satisfactory performance of the bonding agent the pull off test should result in fracture in the concrete. When fracture occurs within the bond line it is considered that the structural bonding agent has not performed satisfactorily.

## 4 Hardened concrete-to-hardened concrete

### 4.1 Equipment

4.1.1 Steel moulds for producing concrete test pieces of size 40 mm x 40 mm x 160 mm conforming to EN 196-1.

4.1.2 Concrete mixer as in prEN 1766.

4.1.3 Grit blasting equipment.

4.1.4 A stop clock calibrated in minutes to a maximum of 120 min.

4.1.5 A suitable frame for clamping the concrete test pieces together, for example, see figure 1 of EN 12189.

4.1.6 Testing machine capable of gradually applying a force of up to 20 kN during the tensile bending test.

4.1.7 Steel support frame, support rollers, loading rollers and spreader beam as shown in figure 1 for four point bending test on bonded concrete prisms.

4.1.8 Steel wire brush.

### 4.2 Test procedure

#### 4.2.1 Sampling material

The bonding agent to be tested shall be taken from one production batch.

#### 4.2.2 Number of test specimens

Tensile bending tests shall be conducted on a minimum of three pairs of bonded concrete prisms.

#### 4.2.3 Concrete prisms

Concrete test prisms, measuring 40 mm x 40 mm x 160 mm and using Reference concrete Type MC (0,40) shall be manufactured and cured in accordance with prEN 1766. The test prisms shall be removed from the water and cut in half to form two prisms, each measuring 40 mm x 40 mm x 80 mm. Saw cutting shall be carried out on a suitable bench such that the flatness of the surface is to within a tolerance of 0,5 mm and spalling of the cut edges does not exceed 1 % of the bonded area. The sawn concrete surfaces to be bonded shall be cleaned in running water using a steel wire brush and then grit blasted in accordance with prEN 1766. The test pieces shall then be conditioned as defined below depending upon whether bonding is to be carried out on a dry or wet hardened concrete substrate.

#### 4.2.4 Conditioning

The resin and hardener component of the bonding agent shall be conditioned before mixing to the test temperature of  $(21 \pm 2)$  °C.

a) dry surface

Condition test components for 48 h at  $(21 \pm 2)$  °C and a RH of  $(60 \pm 10)$  %. Dust shall be removed by brushing immediately prior to application of the bonding agent ;

b) wet surface

Condition test components by immersion in water at room temperature for 48 h. The area to be bonded shall be placed in a vertical position for 15 min at  $(21 \pm 2)$  °C and a RH of  $(60 \pm 10)$  % to allow free water to drain off before application of the bonding agent ;

## c) extreme temperatures

For testing at extremes of environmental conditions, alternative conditioning and test temperatures as specified by the supplier shall be used.

**4.2.5 Specimen preparation**

The components of the bonding agent shall be mixed at the test temperature and applied in a layer 1 mm thick, to the prepared concrete end faces of both prisms in each pair all in accordance with the manufacturer's instructions. Appropriate spacers shall be used to control the thickness of the bonding agent.

Immediately, the corresponding faces of the two concrete prisms in each pair shall be placed against the coated face and the two prisms clamped together to achieve a 1 mm to 2 mm thick bond line with no entrapped air voids. The complete assemblies shall then be cured at the test temperature for 7 days or such other time that may be specified.

**4.2.6 Measurement**

At the end of the specified curing period the bonded concrete prisms shall be positioned within the testing machine over a span of 150 mm as shown in figure 1. The load shall then be applied vertically at the third span points by means of the spreader beam and increased smoothly at the rate of  $(50 \pm 10)$  N/s until fracture.

Alternatively, the tensile bending test may be performed on the pair of bonded concrete prisms in the presence of a longitudinal clamping force, as described in EN 12189.

The load at failure and the position of the failure plane shall be recorded for each pair of prisms.

**4.3 Test report**

The report shall include the following information:

- a) identification of all the constituents in the adhesive mix, including manufacturer's name, code numbers if applicable, type description and date of production ;
- b) the conditioning and test temperature ;
- c) the substrate surface condition, dry or wet ;
- d) curing period in days between bonding and testing ;
- e) the method of clamping the concrete test pieces together ;
- f) for each pair of bonded prisms :
  - the elapsed time interval between application of the bonding agent and closing of the joint ;
  - the longitudinal clamping force imposed during the tensile bending test ;
  - the failure load recorded in the tensile bending test ;
  - the position of the failure plane;
- g) date of the test ;
- h) reference to this European Standard.



## 5 Fresh concrete-to hardened concrete

### 5.1 Equipment

The equipment can be divided in two parts depending on choice of test method, i.e. circular bonded dollies or friction grip.

Friction grip should be used when the thickness of the top layer exceeds 40 mm.

#### 5.1.1 Adhesively bonded dollies method (see figure 2)

- a) mixer for the repair material as recommended by the manufacturer ;
- b) climatic chambers for the conditions studied ;
- c) vernier callipers accurate to not less than 0,1 mm ;
- d) adhesive, rapid hardening two component epoxy or similar ;
- e) grinding equipment ;
- f) steel wire brush ;
- g) cleaning solvent ;
- h) diamond core drilling bit, internal diameter of  $(51 \pm 1)$  mm. The core bit should have a cutting edge which protrudes from the cylinder by 1 mm to 2 mm (to minimise lateral forces being applied to the test area) ;
- i) pull-off test equipment according to EN 1542 with a pulling capacity of at least 10 kN. The accuracy shall be within  $\pm 2$  %.

The pull-off equipment shall be capable of applying the load according to 3.1 of EN 1542 and shall be provided with a measurement device which displays the exerted force by an analogue or digital system. The measurement device shall retain the reading of maximum force exerted, the so called failure load. The level of the failure load should be recorded ;

- j) cylindrical steel dollies, with a diameter of  $(50 \pm 0,5)$  mm and a height of at least 25 mm. On the side on which the adhesive is to be applied, the dolly shall be flat with a tolerance of  $\pm 0,1$  mm per 50 mm length.

#### 5.1.2 Friction grip method

- a) climatic chambers for the conditions studied ;
- b) vernier callipers accurate to not less than 0,1 mm ;
- c) diamond core drill with a diameter depending on friction grip used. The core bit should have a cutting edge which protrudes from the cylinder by 1 mm to 2 mm (to minimise lateral forces being applied to the test area) ;
- d) a steel grip (see figure 3) suitable for gripping cores of the specified diameter, shall have an attachment for the pull-off test equipment, so that an axial tensile force may be smoothly applied to the core. The internal depth of the grip, i.e. the length of the core which can be accommodated above the annular clamp, shall be at least 3 times the nominal size of the largest aggregate in the composition being gripped, at least 1/3 of the thickness of the bonded layer and at least 1/4 of the diameter of the core ;
- e) pull-off test equipment according to EN 1542 with a pulling capacity of at least 10 kN. The accuracy shall be within  $\pm 2$  %.