SLOVENSKI STANDARD
SIST EN 12618-1:2003

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Proizvodi in sistemi za zaġļ ito in popravilo betonskih konstrukcij - Preskusne metode ï 1. del: Sprijemna in razteznostna sposobnost proizvodov za injektiranje z omejeno duktilnostjo

Products and systems for the protection and repair of concrete structures - Test methods - Part 1: Adhesion and elongation capacity of injection products with limited ductility

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Teil 1: Haftung und Dehnung flexibler Füllgüter für Risse

Produits et systemes pour la protection et la réparation des structures en béton - Méthodes d'essai - Partie 1: Capacité d'adhérence et d'allongement des produits d'injection a ductilité limitée

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Products and systems for the protection and repair of concrete structures - Test methods - Part 1: Adhesion and elongation capacity of injection products with limited ductility

Produits et systèmes pour la protection et la réparation des structures en béton - Méthodes d'essai - Partie 1: Capacité d'adhérence et d'allongement des produits d'injection à ductilité limitée

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Teil 1: Haftung und Dehnung flexibler Füllgüter für Risse

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

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Contents

Foreword

This document (EN 12618-1:2003) has been prepared by Technical Committee CEN /TC 104, "Concrete and related products", the secretariat of which is held by DIN.

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

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of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This part of this European Standard describes the reference procedure for determining the adhesive bond capacity and elongation capacity of injection products, intended for ductile filling of cracks and cavities.

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

EN 1504-1:1998, *Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity - Part 1: Definitions.*

prEN 1504-5:2002, *Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity - Part 5: Concrete injection.*

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

3 Terms and definitions

For the purposes of this European Standard, the definitions of EN 1504-1:1998 and prEN 1504-5:2002 shall apply.

4 Test method

4.1 Principles

The extensibility and tensile bond strength of the product (and the effect of crack width upon these parameters) are determined after injection into cracks of different widths and three moisture conditions of the crack: dry, wet and water-filled.

The elongation and bond strength testing are carried out at (3 ± 2) °C.

4.2 Equipment

4.2.1 Tensile test machine

The laboratory in which these tests are carried out shall be equipped with a test machine complying with the requirements of EN 196-1. The test machine shall be fitted with self aligning application of load to ensure axial tensile loading of the specimen and have a controlled environment cabinet able to maintain constant temperatures of (3 ± 2) °C.

The tensile force shall be at least 50 kN with an adjustable speed of 0,01 mm/min.

4.2.2 Formwork

The steel formwork consists of:

- an upper steel plate provided by four M 12 threaded bolts, four M 16 galvanised threaded bolts, six headcap screws and an opening for concrete, grooves for steel sheets;
- a lower steel plate provided by four M 12 threaded bolts, four M 16 galvanised threaded bolts, and a 24 screw, grooves for steel sheets;
- two large and two small steel sheets as side boardings;
- three M 8 threaded tubes and nuts, with steel brads, to provide injection product entrance, vent and pressure control;
- three fitting plates, six headcap screws;
- eight M 16 threaded bolts and twenty M 16 nuts to link the upper and lower steel plates;
- a rubber strip;
- a crown.

The pieces are described in Table 2 and Figures 1, 2, 3, 4 and 5.

4.2.3 X - Y recorder

Capable of displaying load deformation curves. The deformation base shall be capable of being read to an accuracy of 0,001 mm.

4.2.4 Displacement transducer

The displacement transducer shall give a continuous recording of the deformation with an accuracy of 0,001 mm.

4.2.5 Displacement gauge, with measuring plates

The displacement gauge, with measuring plates, shall measure a measuring length of about 100 mm with an accuracy of 0,001 mm.

4.2.6 Injection equipment

In the concrete cube are three injection packers with an inner diameter of 2-3 mm. The openings of the packers are closed with valve. The manufacturer determines: mixing equipment, injection pump, kind of packer.

4.2.7 Pressure gauge

A pressure gauge suitable for measuring pressures up to 6 MPa, with an accuracy of 0,05 MPa.

4.3 Procedure

4.3.1 Specimen preparation

A separate specimen is required for each crack width in each of the moisture states of the cracks/crack flanks (surface).

Three specimens are to be tested for each test condition, 18 specimens in all. The test parameters are summarised in Table 1. Other test temperatures in addition to those listed in Table 1 may be agreed.

The specimens consist of cubes made of reference types of concrete as specified by EN 1766, with cracks of defined width. The concrete specimens are made in steel forms (see Figures 1, 2 and 3) placed on a vibrating table. The concrete is cast through an opening in the upper steel plate of the form. Four M 12 bolts (Table 2:11) and one M 24 screw (Table 2:9) are fixed in the lower plate before filling the form with concrete. After filling the form, the concrete is compacted and another four M 12 bolts (Table 2:11) are fixed through the upper plate. The three screwed tubes (Table 2:10) with a steel brad inside (Table 2:12) (protection against fresh concrete penetration) are pushed into the concrete, then the final compaction of concrete is done.

The filled forms are then maintained at (21 ± 2) °C and (60 ± 10) % relative humidity.

The steel side-sheets of the forms (Table 2:5 + 6) and the steel brads are removed after two days, the specimens are fitted with measuring plates on all sides and a zero measurement is made with the displacement gauge in the uncracked state (crack width w = 0).

At an age of 3 days, a crack is induced in the specimen by splitting (see Figure 6), after the nuts of the threaded bolts M 16 (Table 2:7) have been loosened at one side. Then the crack width defined in Table 1 is set by adjusting the bolt nuts M 16 and the nuts are secured with locking nuts (Table 2:7).

Each concrete specimen is then enclosed in a rubber strip (Table 2:13), fixed with an adhesive, and a reusable crown made of steel (Table 2:14).

The crack width before injection is measured with the displacement gauge.

4.3.2 Injection procedure

At an age of 7 to 10 days the specimen shall be prepared for injection (see Figure 7).

The specimen and the injection product shall be conditioned at (21 ± 2) °C for 48 hours before injection.

The injection shall be performed for two crack widths (0,3 mm and 0,5 mm) in three different moisture states of the crack : W (water-filled), M (moist) and D (dry). Each moisture state is obtained as described in Table 1 - Test conditions.

For each situation (crack width - moisture state), three specimens shall be injected.

The two components of the injection product shall be mixed according to the manufacturer’s instructions.

The injection takes place via the central tube of the crowned specimens.

The injection pressure is measured with the pressure gauge, which is fitted to one of the side tubes. The other side tube is left clear for the venting of air or water, and is closed as soon as injection product emerges.

Injection is continued, terminating when the injection product leaks out under the rubber strip or when the injection pressure reaches 6 MPa.

The crack width after injection is measured with the displacement gauge.

The injected specimens are stored at (21 ± 2) °C for 6 days.

4.3.3 Measurement of adhesion and elongation capacity

The crowns and rubber strip shall be removed and the injected specimens provided with four displacement transducers (one on each side).

Each injected specimen shall then be conditioned at (3 ± 2) °C for at least 48 h before the test.

The specimen shall be fitted into the tension test machine (see Figure 8) with sufficient load applied to take up the slack in the fittings.

A manual displacement measurement takes place with the displacement gauge on each side; this is the zero measurement, or initial crack width on each side.

The threaded bolts M 16 are removed in this tensioned state with simultaneous loosening of the nuts (Table 2:7 and 7a); the deformation, if any, linked with the removing of the threaded bolts is recorded with the X-Y recorder.

The specimen is now subjected to tensile testing; the test is displacement-controlled at 0,01 mm/minute, until failure occurs.

The load/deformation curve is recorded with the X-Y recorder.

The type of the failure (cohesive or adhesive rupture) and the degree of filling (percentage ratio of the injected area to the crack area) are observed and noted.

Table 1 —Test conditions

Crack width (mm)		0,3	0,5
Temperature (°C)	**Injection**	21 ± 2	
	Storing 6 days	21 ± 2	
	Storing 48 h before test	3 ± 2	
	Test	3 ± 2	
Moisture state of the crack		W [a]	
		M [b]	
		D [c]	

[a] W (water-filled) The dammed crack is filled with water for 30 min and injected immediately afterwards.

[b] M (moist) The dammed crack is filled with water, blown out with compressed air after 10 min and injected immediately afterwards.

[c] D (dry) Crack flank without water treatment.

5 Calculation

The tensile strength shall be calculated from the maximum stress recorded divided by the injected cross-sectional area of the specimen and expressed in N/mm^2.

The elongation at failure shall be calculated on each side from the linear deformation given by each transducer in relation to the initial crack width measured in 4.3.3, at the moment of maximum force.

The elongation at failure for the tested specimen is the mean value of the 4 sides.

6 Test report

The test report shall contain the following information:

a) a reference to this test method standard;

b) name and address of the test laboratory;

c) identification number and date of the test report;

d) name and address of the manufacturer or supplier of the product;

e) name and identification marks or batch number of the product;

f) date of supply of the product;