SLOVENSKI STANDARD
SIST EN 12618-3:2004

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Proizvodi in sistemi za zaģļ ito in popravilo betonskih konstrukcij ï Preskusne metode ï 3. del: Doloļ evanje sprijemnosti injekcijske mase s cikliļ nim spreminjanjem temperature ali brez njega ï Metoda poģevnega striga

Products and systems for the protection and repair of concrete structures - Test methods - Part 3: Determination of the adhesion of injection products, with or without thermal cycling - Slant shear method

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Teil 3: Bestimmung der Haftzugfestigkeit von Rissfüllstoffen mit oder ohne thermische Behandlung - Schrägscherfestigkeit

Produits et systemes pour la protection et la réparation des structures en béton - Méthodes d'essais - Partie 3: Détermination de l'adhérence des produits d'injection, apres cycles thermiques ou non - Méthode par cisaillement oblique

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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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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 12618-3:2004) 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of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This document describes the method for determining the slant shear bond strength of all injection products intended to restore the integrity of cracked concrete and covered by prEN 1504-5.

The test may be performed upon cracks injected in the dry, damp, wet or with water flowing through them. It should always be carried out after the appropriate period of curing under the standard conditions of test detailed below, but may additionally be performed upon a further set of specimens after a period of artificial ageing by thermal cycling.

Whilst the testing of the repaired crack is normally by short term static load, it may also be performed as a creep test by long term static load, or as a dynamic test by the application of a cyclic load.

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 196-1, *Method of testing cements - 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 1504-5:2001, *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 - Tests methods - Reference concretes for testing*.

EN 12390-1, *Testing hardened concrete – Part 1: Shape, dimensions and other requirements for test specimens and moulds*.

EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests*.

EN 12390-4, *Testing hardened concrete – Part 4: Compressive strength - Specification for testing machines.*

EN 13687-4, *Products and systems for the protection and repair of concrete structures - Tests methods - Determination of thermal compatibility - Part 4: Dry thermal cycling.*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 1504-1:1998 and prEN 1504-5:2001 apply.

4 Test method

4.1 Principle

The principle of this test is the compressive testing of a restored concrete prism that is scarf jointed at 30° to its main axis, the joint having been formed by the injection repair of a straight line crack in the concrete (see Figure 3). The joint is thus subjected to a combination of shear and compressive stresses. The result is presented as the compressive strength of the composite prism (with observations upon the mode of failure), since this is easily related to conventional concrete appraisal and design procedures. The test specimens are produced by sawing prisms from concrete slabs which have been split in a controlled manner and repaired by injecting the product or system under test.

Control specimens of concrete used in the preparation of the slab are also prepared and tested in a similar manner to provide comparative information.

4.2 Apparatus

4.2.1 Compression testing machine conforming to EN 12390-4.

4.2.2 Moulds for casting the concrete slabs shall comply with the accuracy and tolerance requirements of EN 12390-1 and shall be of a size to produce slabs having the dimensions specified in 4.3.8.

NOTE A suitable two-gang mould may be made by preparing a steel block 150 mm x 155 mm x 40 mm and machining a slot to receive it in two opposite faces of a 150 mm cube mould complying with EN 12390-1. This then forms two mould cavities each 55 mm wide.

4.2.3 Trapezoidal mild steel plates, having dimensions shown in Figure 1, subject to a tolerance of ± 0,5 mm.

4.2.4 Elastomeric pads 150 mm x 150 mm. The characteristics of the elastomeric material need to be such as to ensure a relatively straight crack when splitting a slab. 10 mm thick reinforced rubber sheet as used in conveyor belting has been found to be suitable, as has 6 mm thick unreinforced polyurethane elastomer sheet of 90 Shore A hardness.

4.2.5 Diamond saw, suitably mounted and capable of producing clean vertical cuts through the 55 mm thickness of the concrete slab.

4.3 Preparations

4.3.1 Preparation of concrete slabs

The slabs shall be cast from a reference concrete of the type MC (0,40) or MC (0,45) as defined in EN 1766. After de-moulding they shall be cured for a total of 28 days in accordance with EN 12390-2 before any further conditioning or use.

4.3.2 Slab splitting

Assemble the concrete slab with the trapezoidal plates and elastomeric pads as shown in Figure 1. Place this assembly between the platens of a press[1)] and apply load evenly and smoothly until the slab fractures. This is illustrated at Figure 2. Release the load and remove the assembly carefully from the press.

Hold the two halves of the slab lightly together, to prevent loss of any debris from the crack. This may be done by lightly clamping the slab, or by fitting a stout rubber band round the slab before splitting. After removal of the top elastomeric pad and steel plates the slab is ready for use as a test piece.

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1) The compression test machine at 4.2.1 may be used for this purpose, but a simple hand operated press of lesser specification will suffice. A force of about 300 kN may be required to split the plaque.

NOTE This will normally give a crack width of the order of 0,2 mm to 0,5 mm. If it is desired to investigate the performance of the injection product in repairing wider cracks, the two halves of the slab may be further separated; this fact then need to be stated in the test report.

4.3.3 Preparation for injection

Prepare the two ends of the crack, i.e. at the 55 mm faces, for injection by the procedure recommended by the supplier of the injection product. This may involve bonding metal or plastic tubes over the crack for use as inlet and outlet ports, or leaving a short length of crack unsealed if the injection nozzle is to be applied direct to the concrete. Seal the remainder of the crack periphery by the procedure recommended by the supplier of the injection product.

Before injection of the repair composition, condition the prepared split slab in the environment under which the injection of the product is to proceed :

Dry cracks. If the repair is to be carried out in dry concrete, allow the split slab to dry in air at the standard conditions of test for a period of not less than 16 h.

Damp cracks. If the injection product is to be evaluated for the repair of damp concrete, treat as detailed below for wet cracks. At the end of the 48 h saturation period, remove the slab from the water and allow it to drain for 30 min before proceeding to inject.

Wet cracks. If the repair is to be carried out in wet conditions, force water through the crack to displace all trapped air and then totally immerse the slab in lime-saturated water for a period of not less than 48 h. When ready to proceed with the injection, remove the slab from the water, allow the excess water to run out and then fit the injection hoses without any further delay.

Water-filled cracks. If injection is to be carried out in water filled cracks, the delivery hose of the injection equipment shall be fitted to the entry port whilst the slab is still under water. For convenience of injection, the slab may then be removed from the conditioning tank, without allowing the water to drain out of the crack. If it is required to prove that the resin system can be injected against a head of water, a water supply at the desired pressure may be connected to the outlet port.

4.3.4 Injection of the repair composition

Condition the components of the injection system and the mixing vessel at the standard conditions of test (or other specified conditions) for at least 16 h before proceeding. Support the slab with its principal axis vertical. The lower end of the crack shall be the entry port for the resin injection. Mix the components of the injection system in accordance with the manufacturer's instructions. Introduce the mixed product into the crack via the entry port by the method stated in the manufacturer's instructions. In the absence of specific instructions, inject the product from a mastic gun, grease gun, peristaltic pump or similar device. Maintain the flow of the product until all air (or water) has been displaced from the crack and unadulterated product is flowing from the discharge port. Seal the discharge port. If required by the manufacturer's instructions, raise the pressure of the product within the crack by further pumping. Seal the inlet port. Return the injected slab to the conditioning environment employed in 4.3.3 for a further 7 days for resin injection systems, or 28 days for cementitious systems, before proceeding to test as described in article 5, unless an alternative curing period is specified by the supplier of the injection product.

4.3.5 Thermal cycling

If a test after artificial ageing is to be conducted, a set of slabs produced as above for that purpose shall be subjected to the thermal cycling regime described in EN 13687-4 before proceeding.

4.3.6 Preparation of test specimens from composite slabs

After the resin has cured, saw the slab into three sections, so that in the middle section the repair joint or interface bisects the prism at a nominal angle of 30° and runs of the prism on two opposite long sides, clear of the top and bottom (see Figure 3).

Discard the outer sections of the sawn slab and use the middle section as the test specimen.

4.3.7 Preparation of control specimens

Control specimens of the reference concrete shall be of the same dimensions as the composite test specimens and shall be sawn from further slabs of the same mix used to prepare the slabs for those specimens, cast at the same time and conditioned along with them.

4.3.8 Dimensions of specimens

Composite test specimens and control specimens shall be right true prisms having dimensions 55 mm x 55 mm x 150 mm sawn from slabs having dimensions 55 mm x 150 mm x 150 mm subject to a tolerance of ± 0,5 mm on all cast faces and ± 0,5 mm on the sawn width (of the test specimen) (see Figures 1 and 3 for details of measurements and orientation of casting).