SLOVENSKI STANDARD
SIST EN 13687-4:2002

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Proizvodi in sistemi za zaġļ ito in popravilo betonskih konstrukcij - Preskusne metode - Doloļ evanje toplotne zdruġljivosti - 4. del: Cikliļ no segrevanje in ohlajevanje suhih preskuġancev

Products and systems for the protection and repair of concrete structures - Test methods - Determination of thermal compatibility - Part 4: Dry thermal cycling

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Bestimmung der Temperaturwechselverträglichkeit - Teil 4: Trockene Temperaturwechselbeanspruchung

Produits et systemes pour la protection et la réparation des structures en béton - Méthodes d'essai - Détermination de la compatibilité thermique - Partie 4: Cycles thermiques a sec

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English version

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This European Standard was approved by CEN on 23 December 2001.

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 Management Centre 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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Contents

Foreword

This document EN 13687-4 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of an identical text or by endorsement, at the latest by August 2002, and conflicting national standards shall be withdrawn at the latest by December 2002.

It has been prepared by sub-committee 8 "Products and systems for the protection and repair of concrete structures" the secretariat of which is held by AFNOR.

This Part of this European Standard describes a method of test for determining the thermal compatibility of grouts, mortars and concretes or surface protection systems applied to a standard concrete, by dry thermal cycling between 55 °C and -25 °C without contact with de-icing salt or water. It is one of a series of inter-related parts dealing with the thermal compatibility of repair products and systems. The other parts in this standard are :

EN 13687-1, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of thermal compatibility - Part 1: Freeze-thaw cycling with de-icing salt immersion.*

EN 13687-2, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of thermal compatibility - Part 2: Thunder-shower cycling (thermal shock).*

EN 13687-3, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of thermal compatibility - Part 3: Thermal cycling without de-icing salt impact.*

EN 13687-5, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of thermal compatibility - Part 5 : Resistance to temperature shock.*

Annex A is normative.

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

1 Scope

This standard is the fourth in a series of five parts to assess the thermal compatibility of repair products and systems, comprising grouts, mortars and concretes and surface protection systems, used for the repair and protection of concrete structures. The method specified in this Part measures the effect of dry thermal cycling without exposure to de-icing salt, upon the repair product or system. The method is suitable for repair products and systems based on CC, PCC and PC binders and for surface protection systems.

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 amndments).

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

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

prEN 1504-2, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems.*

prEN 1504-3, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 3: Structural and non-structural repair.*

EN 1542, *Products and systems for the protection and repair of concrete structures - Test methods - Measurement of bond strength by pull-off.*

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 terms and definitions given in EN 1504-1 apply.

4 Test principle

A layer of the repair grout, mortar and concretes and/or the surface protection system is applied to a reference concrete test specimen prepared according to EN 1766. After curing, the test specimen is subjected to freeze-thaw cycling in air at temperatures of between 55 °C and -25 °C. Following the temperature cycling, visible defects (cracking, peeling, chalking etc) are recorded and the adhesion of the repair product or system to the concrete substrate is determined by pull-off test (according to EN 1542).

5 Apparatus

5.1 Laboratory, maintained at the standard laboratory climate of (21 ± 2) °C and (60 ± 10) % RH (see annex A).

5.2 Mixer, for mixing the constituents of the mortar. Unless stated otherwise by the manufacturer, use a forced action pan mixer.

5.3 Concrete test specimens, of dimensions of 300 mm x 300 mm x 100 mm to EN 1766 and type as specified in prEN 1504-2 or prEN 1504-3.

5.4 Core drilling machine with a diamond tool, internal diameter 50 mm as specified in EN 1542.

5.5 Pull off equipment, for measuring the pull-off strength according to EN 1542.

5.6 Climatic cabinet, for thermal cycling comprising an enclosed cabinet with heating and cooling equipment, with an operating range of -25 °C to +55 °C, with temperature control adjustable to within ± 2 °C.

6 Preparation of test specimens

Three concrete test specimens (see 5.3) are required for each test, with one serving as a reference specimen. Prior to application of the repair product or system, all materials shall be stored in the standard laboratory climate (see 5.1) for at least 24 h. The repair grout, mortar or concrete and/or the surface protection system shall be prepared and applied to the concrete test specimens in accordance with manufacturers instructions at the standard laboratory climate (see 5.1) or such alternative environments as may be specified for the intended use.

After application of the repair product or system, the samples shall be cured in accordance with the requirements of annex A.

7 Procedure

After completing the preparation, two of the test specimens shall be positioned in the climatic cabinet (see 5.6) in an upright position with a distance of at least 100 mm between the specimens and at least 50 mm from the specimens to the walls. The test cycle shown in Figure 1 then starts, with one cycle lasting for 6 h and comprising the following stages :

— cool down from (21 ± 2) °C to (-25 ± 2) °C at a rate of 3 °C/min (15 min) ;

— 153 min air storage at T = (-25 ± 2) °C ;

— 27 min heating in air to T = (55 ± 2) °C (rate: 3 °C/min) ;

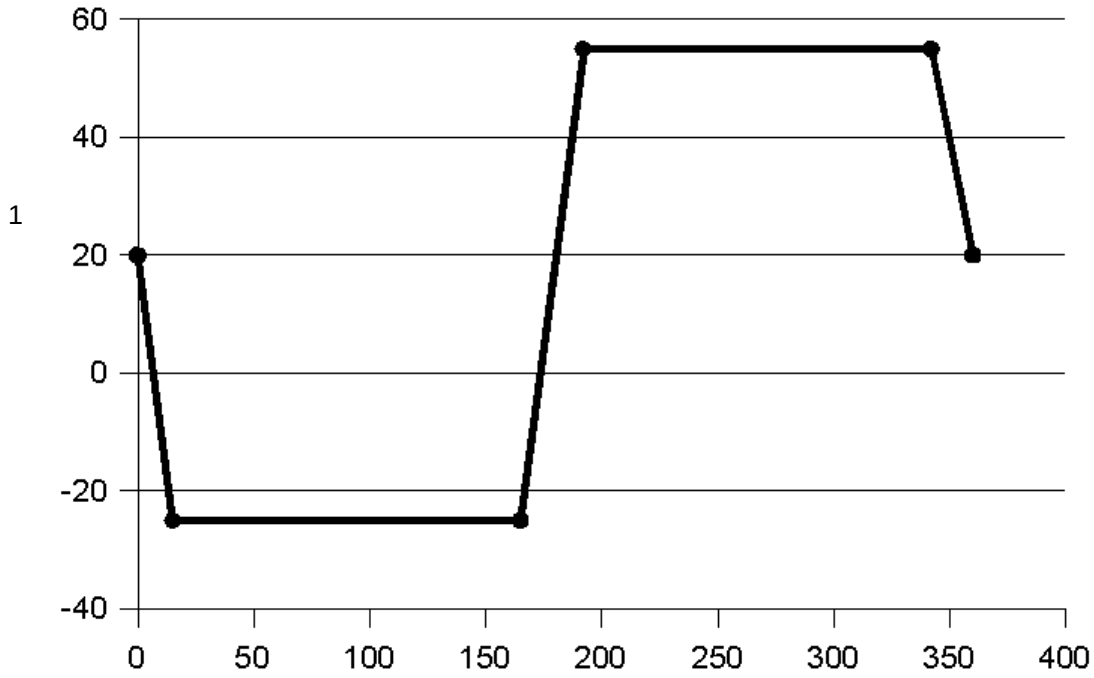
— 153 min air storage at T = (55 ± 2) °C ;

— 12 min cooling in air to T = (21 ± 2) °C (rate: 3 °C/min).

During any interruption of the cycling the specimens shall be stored at standard laboratory climate (see 5.1).

The six hour cycle shall be repeated for the number of cycles specified in prEN 1504-2 or prEN 1504-3.

The reference specimen shall be stored in the standard laboratory climate (see 5.1).



Key

1 Temperature (deg °C)
2 Time (min)

Figure 1 — Dry thermal cycle

8 Evaluation of results

Every ten cycles, the test specimens shall be visually inspected :

i) for scaling and/or cracking if a PC, PCC or CC product is tested ;

ii) for surface alterations (cracks, peeling, blistering, delamination, bubbling or other surface defects) if a surface protection system is tested.

Cracks > 0,05 mm and any observed surface alterations shall be reported. The final visual inspection shall be performed at least 16 h after the end of the cycling.

The pull-off strength of the repair product or system applied to the reference specimen and the two test specimens shall be determined according to EN 1542 after conditioning at the standard climate conditions for not less than seven days after completion of cycling.

9 Test report

The test report shall include the following information :

a) a reference to this European Standard, including the number, title and date of issue ;

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(s) ;

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

f) date of supply of the product(s) ;

g) date of preparation of the test specimens ;

h) conditions of storage of prepared specimens prior to test ;

i) date of test and details of test equipment used including the make, type and capacity and calibration details or identification number of the apparatus ;

j) the total number of cycles carried out ;

k) the results (single values, mean values and standard deviations) of the pull off test including individual forms of fracture, and any observed surface alterations after removal from the test cabinet ;

l) the type and dimension of the concrete test specimens according to EN 1766 ;

m) a description of the product or system under test and whether it is a single or multi layer system ;

n) precision data ;

o) date of test report and signature.