BRITISH STANDARD

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12617-2:2004

Products and systems for the protection and repair of concrete structures — Test methods —

Part 2: Shrinkage of crack injection products based on polymer binder: volumetric shrinkage

The European Standard EN 12617-2:2004 has the status of a British Standard

ICS 91.080.40

National foreword

This British Standard is the official English language version of EN 12617-2:2004.

The UK participation in its preparation was entrusted by Technical Committee B/517, Concrete, to Subcommittee B/517/8, Protection and repair of concrete structures, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

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Summary of pages

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Produits et systèmes pour la protection et la réparation des structures en béton - Méthodes d'essai - Partie 2: Retrait des produits d'injection pour fissures formulé avec des polymères : retrait volumétrique

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Teil 2: Schrumpfung von polymeren Rissfüllstoffen : Volumetrische Schrumpfung

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Contents

page

Foreword

This document (EN 12617-2:2004) has been prepared by Technical Committee CEN /TC 104, "Concrete and related products", the secretariat of which is held by DIN.

It has been 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 document describes a method for determining the volumetric shrinkage of products formulated with thermosetting polymer binders, mainly epoxy and polyester binders, that cure at ambient temperature or below.

This method is adapted for crack injection products formulated with polymer thermosetting binder.

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 ISO 2811-2, *Paints and varnishes – Determination of density – Part 2: Immersed body (plummet) method (ISO 2811-2:1997).*

3 Test principle

The total volumetric shrinkage is calculated as the percentage change in density when the polymer system at (21 ± 2) °C cures to the final product also at (21 ± 2) °C.

The density after polymerisation (curing) is measured at (21 ± 0,5) °C by measuring the buoyancy of the specimen immersed in silicone oil.

4 General requirements for testing - Apparatus

4.1 balance accurate to 0,001 g, a density measuring device, and suitable wire for suspending the specimen in silicone oil;

4.2 thermometer accurate to 0,2 °C and graduated at intervals of 0,2 °C or finer;

4.3 silicone oil bath of density Q_{Si} at + (21 ± 0,5) °C;

4.4 test tube: diameter 20 mm, length 180 mm in polyethylene or glass treated with a silicone release agent;

4.5 stopwatch;

4.6 desiccator;

4.7 temperature – controlled room or enclosure, capable of maintaining the sample at the recommended constant temperature.

5 Test procedure

5.1 Determination of the density of the material before polymerisation

Since it is difficult to determine the density of resin systems that react at ambient temperature owing to their high reactivity and the exothermic heat evolved, determine separately the densities of the components of the resin, at (21 ± 0,5) °C to EN ISO 2811-2. Calculate the overall density at time 0, Q_{MO}, using the following equation:

$$Q_{MO} = \frac{(m_A + m_B) \times Q_A \times Q_B}{(m_A \times Q_B) + (m_B \times Q_A)} \quad (1)$$

where

Q_A is the density of component A, in gram per millilitre;

Q_B is the density of component B, in gram per millilitre;

m_A is the mass of component A used for preparation of a specimen, in gram;

m_B is the mass of component B used for preparation of a specimen, in gram.

5.2 Determination of the density of polymerized (cured) material

Pour (25 ± 5) g of the resin system as specified in 5.1 into the test tube. After allowing the correct time for polymerisation (curing) at (21 ± 2) °C, leave to cool in a desiccator. When cool remove the polymerized specimen from the test tube. Weigh the specimen immediately in air: M_{FSL} then measure the apparent mass in silicone oil at (21 ± 0,5) °C : $M_{(FS + D)si}$. and weigh the suspension wire used for weighing: M_{DL} in air.

Then remove as much as possible of the silicone oil adhering to the specimen, using filter paper, washing with petroleum ether[1)]. Dry the specimen, for one hour, at (110 ± 2) °C (for epoxy and polyester binders) and place the specimen in a desiccator to cool to (21 ± 2) °C.

Weigh again, to establish whether a change in apparent mass has occurred during the measurement with the specimen in silicone oil. The change in weight shall not be greater than 0,2 % of the initial weight M_{FSL}, otherwise another more suitable immersion liquid shall be chosen.

6 Expression of results

6.1 Calculate the density of the cured material, Q_{FS}, rounded to the third decimal, using the following equation:

$$Q_{FS} = \frac{M_{FSL} \times Q_{si}}{M_{FSL} + M_{DL} - M_{(FS+D)si}} \quad (2)$$

where

Q_{si} is the density of silicone oil, in gram per millilitre;

M_{FSL} is the mass of the polymerized (cured) resin in air, in gram;

$M_{(FS+D)si}$ is the apparent mass of specimen and suspension wire in silicone oil, in gram;

M_{DL} is the mass of the suspension wire in air, in gram.

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1) Take appropriate precautions by using organic solvents. This document does not purport to address the safety problems associated with their use.

6.2 Calculate the total volumetric shrinkage, $S_{\text{vol - tot}}$, during the (polymerisation) curing as a percentage rounded to the first decimal using the following equation:

$$S_{\text{vol}-\text{tot}} = \frac{Q_{\text{FS}} - Q_{\text{MO}}}{Q_{\text{FS}}} \times 100 \qquad (3)$$

where

Q_{FS} is the density of the polymerized (cured) product at (21 ± 0,5) °C, in gram per millilitre;

Q_{MO} is the density of the product at (21 ± 0,5) °C before polymerization (curing), in gram per millilitre.

7 Test report

The test report shall include the following:

a) complete identification of the injection product or system tested, including type, source, manufacturer's code numbers and history;

b) name and address of the testing laboratory and number of the test report;

c) reference to this document;

d) proportion by weight of the components constituting the product system;

e) date and details of preparation of the specimen of the test;

f) time of polymerization;

g) test results:

- density of the components;
- calculated density before polymerisation;
- density of the cured material;
- (individual values and near value);
- calculated volumetric shrinkage;

h) any deviations from this document or any special conditions.

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