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SIST EN 12617-2:2004

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 12617-2**

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English version

**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**

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

This European Standard was approved by CEN on 27 February 2004.

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.

CEN members are the national standards bodies of 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.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
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**Contents**

page

Foreword.....	3
1 Scope .....	4
2 Normative references .....	4
3 Test principle.....	4
4 General requirements for testing - Apparatus .....	4
5 Test procedure .....	5
6 Expression of results .....	5
7 Test report .....	6

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[SIST EN 12617-2:2004](https://standards.iteh.ai/catalog/standards/sist/802e951b-6723-45f8-a208-365b23642c8d/sist-en-12617-2-2004)

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## 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).

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.

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**EN 12617-2:2004 (E)****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  $(21 \pm 2) ^\circ\text{C}$  cures to the final product also at  $(21 \pm 2) ^\circ\text{C}$ .

The density after polymerisation (curing) is measured at  $(21 \pm 0,5) ^\circ\text{C}$  by measuring the buoyancy of the specimen immersed in silicone oil.

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**4 General requirements for testing - Apparatus**

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- 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  $+(21 \pm 0,5) ^\circ\text{C}$ ;
- 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  $(21 \pm 0,5) ^\circ\text{C}$  to EN ISO 2811-2. Calculate the overall density at time 0,  $Q_{\text{MO}}$ , using the following equation:

$$Q_{\text{MO}} = \frac{(m_{\text{A}} + m_{\text{B}}) \times Q_{\text{A}} \times Q_{\text{B}}}{(m_{\text{A}} \times Q_{\text{B}}) + (m_{\text{B}} \times Q_{\text{A}})} \quad (1)$$

where

$Q_{\text{A}}$  is the density of component A, in gram per millilitre;

$Q_{\text{B}}$  is the density of component B, in gram per millilitre;

$m_{\text{A}}$  is the mass of component A used for preparation of a specimen, in gram;

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

Then remove as much as possible of the silicone oil adhering to the specimen, using filter paper, washing with petroleum ether<sup>1)</sup>. Dry the specimen, for one hour, at  $(110 \pm 2) ^\circ\text{C}$  (for epoxy and polyester binders) and place the specimen in a desiccator to cool to  $(21 \pm 2) ^\circ\text{C}$ .

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  $M_{\text{FSL}}$ , otherwise another more suitable immersion liquid shall be chosen.

## 6 Expression of results

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

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

where

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

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

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

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

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

**EN 12617-2:2004 (E)**

**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:

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

where

$Q_{\text{FS}}$  is the density of the polymerized (cured) product at  $(21 \pm 0,5) \text{ } ^\circ\text{C}$ , in gram per millilitre;

$Q_{\text{MO}}$  is the density of the product at  $(21 \pm 0,5) \text{ } ^\circ\text{C}$  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; [SIST EN 12617-2:2004](https://standards.iteh.ai/catalog/standards/sist/802e951b-6723-45f8-a208-365b23642c8d/sist-en-12617-2-2004)
- g) test results: <https://standards.iteh.ai/catalog/standards/sist/802e951b-6723-45f8-a208-365b23642c8d/sist-en-12617-2-2004>
  - 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.