BRITISH STANDARD

BS EN
14297:2004

Chimneys — Freeze-thaw resistance test method for chimney products

The European Standard EN 14297:2004 has the status of a British Standard

ICS 91.060.40

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 14297:2004.

The UK participation in its preparation was entrusted by Technical Committee B/506, Chimneys, to Subcommittee B/506/3, Chimneys and their components having inner linings of clay or ceramic, which has the responsibility to:

— aid enquirers to understand the text;

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— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Additional information

The UK voted against this standard as it conflicted with the Freeze/Thaw test specified in BS EN 13502:2002, *Chimneys — Requirements and test methods for clay/ceramic flue terminals.*

Cross-references

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English version

Chimneys - Freeze-thaw resistance test method for chimney products

Conduits de fumée - Méthode d'essai de résistance au gel-dégel des composants de conduits de fumée

Abgasanlagen - Prüfverfahren für die Frost-Tauwasserbeständigkeit für produkte für Abgasanlagen aus Keramik

This European Standard was approved by CEN on 18 June 2004.

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Contents

Foreword

This document (EN 14297:2004) has been prepared by Technical Committee CEN /TC 166, "Chimneys", the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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Introduction

With the test method described in this document the assessment for the intended use for chimney products can be stated. The assessment of freeze-thaw resistance is one of the mandated aspects of Mandate M 105.

The requirements are part of the relevant product standards.

1 Scope

This document specifies the general test method for chimney products for their freeze/thaw resistance.

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.

prEN 13279-1: *Gypsum binders and gypsum plasters - Part 1: Definitions and requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
pit
damage in form of superficial fault consisting of a fraction of material detached from the body of the test-sample with a mean dimension of over 7 mm.

3.2
hair crack
damage which is deemed to be harmless in form of superficial crack having a width of not more than 0,15 mm.

3.3
nascent crack
damage which is deemed to be harmless in form of crack formation at the edge, only crack penetrating slightly into the interior of the test sample.

3.4
surface crack
damage caused by crack of more than 0,15 mm width which does not pass through the test sample.

3.5
scaling
damage caused by surface raising, nascent chipping, or crack, which initiates damage.

3.6
peeling
damage characterised by the loss of part of the superficial layer of the test sample.

3.7
surface damage
damage caused by breaking off (detachment) a part of the surface of the test sample; the surface area of the test sample remains unchanged.

3.8
flaking
damage characterised by a progressive loss of material affecting the whole, or part of the thickness of the sample.

3.9
structural crack
structural damage consisting of a more or less regular crack running throughout the entire thickness of the test sample and visible to the naked eye.

3.10
break
structural damage consisting of a separation of the test sample into two or more fragments.

3.11
delamination
damage in the form of lamellar flaking in a succession of parallel layers.

4 Freeze thaw resistance test

4.1 Apparatus

The apparatus for performance test shall have following equipment:

a) freeze-thaw chamber where test specimens can repeatedly be frozen to –15 °C and thawed in potable tap water or circulated water at an equal or higher temperature than 10 °C,

b) device to support the test sample (e.g. triangular shaped battens, masts) arranged to allow free circulation of air and water, and to keep the test samples out of ice that may form in the bottom of the chamber,

c) equipment suitable for the continuous monitoring of temperatures,

d) container for immersing the test sample,

e) balance with an accuracy of ± 1 g,

f) ventilated oven capable maintaining a temperature of 110 ° C ± 5 ° C .

4.2 Test samples

The test samples should be whole components. Where it is not possible for the whole component to fit (upright) into the freezing chamber, then the test sample may be prepared by cutting off a test sample of suitable size. The test sample shall have a minimum size of 250 mm if possible in one dimensions.

The minimum number of test samples shall be 6. If compressive strength testing after freeze/thaw testing is required in the relevant product standard 6 further samples shall be retained.

The test samples shall be examined prior to the test. Only samples without damages shall be selected. Test samples with damage shall be replaced. If test samples with damage cannot be replaced any small damage shall be marked with waterproof ink. Any damage shall be recorded using the definitions given in table 1.

Condition concrete products to the age of 28 days, or according to the manufacturer's instructions. Undertake conditioning at ambient temperature at a relative humidity between 30% and 70 %.

Drill a hole in one test sample to locate the temperature sensor in the middle of the thickest part of the sample.

4.3 Test Procedure

4.3.1 Immersion of test samples in a water bath

Dry the test samples at (110 ± 5) °C for 48 h. Allow the test sample to cool down to (25 ± 5) °C before weighing.

Weigh the test sample within 1g.

Place the test samples in an open container of water so that ¼ of the height of the test samples is under water. After two hours add sufficient water so that ½ of the height of the test samples is under water. After a further 2 h add sufficient water so that ¾ of the height of the test sample is under water. After a further 24 h add sufficient water to totally immerse the test samples.

Leave the test samples submerged during 7 days. Maintain the temperature of the water between + 10 °C and + 25 °C.

4.3.2 Determination of water absorption

After removal from the water bath, remove excess water from the surface of the test sample.

NOTE: An acceptable means is by dabbing the surface with a moist sponge.

Weigh the test sample. Determine the water absorption for each test sample, as a percentage, from the following equation.

$W = ((m_w - m_{tr})/(m_{tr} \times 100)$ (1)

where:

W water absorption, in %

m_w wet mass, in g

m_{tr} dry mass, in g

4.3.3 Freeze-thaw cycling

Attach a temperature sensor to the middle of the test sample in a hole drilled in the thickest part of the test sample. Cover the sensor.

NOTE. A gypsum binder mixed with water may be used.

Place the test sample in the freeze/thaw testing chamber immediately after weighing on top of the triangular shaped battens so that air can freely circulate through the test samples and around them. Measure the temperature of the middle of the test sample equipped with the temperature sensor. This test sample shall be placed in the middle of the test sample set. Lower the temperature of the testing chamber to ensure that the temperature of the test sample, as measured by the sensor, reaches – 15 ºC and maintain this value for at least 2 h. The air in the test chamber shall reach a temperature of at least – 20 °C between 2 h and 3 h as evenly as possible. This is the freezing phase of the freeze/thaw cycle.

NOTE : Previous test results on the same components can be used to calibrate the chamber temperature profile in order to undertake repeat tests with out the need to fit a temperature sensor into the test sample. The mass of the test sample used for the actual freeze-thaw test should be the same as that used to calibrate the freeze-thaw chamber. When calibrating the freeze/thaw chamber and adjusting the cooling units the reference test sample should also be placed in the middle of the test sample set.

Stop the freezing phase. Raise the temperature of the test samples to at least + 10 °C. This is achieved by filling the chamber with water – filling time: between 10 and 40 min - to totally immerse the test sample, or by spraying the test samples with water to completely cover the surface of the test samples. This is the thawing phase of the test cycle.

After the thawing phase, when the test sample temperature is at least +10 °C, remove the water or stop the spray and restart the freezing phase.

Continue the freeze/thaw cycling according to the number of cycles specified in the specific product standard, but at least 25 cycles.

Inspect the test samples for clearly visible irregularities after every 25th freeze-thaw cycle and upon completion of the test.

Terminate the test at the end of the cycles specified or when unacceptable irregularities are observed specified in relevant product standards.

NOTE Examples for unacceptable damages are given in 3.3.4.

Record any damage, which may have occurred according to its position and size, stating the number of freeze/thaw cycles completed at observation. Ignore all previously marked irregularities, and any damage on the sides of the test sample that were created by cutting.

In the event that the cycles are unavoidably interrupted, ensure that either the test samples remain frozen or that they do not dry out.

After removal from the freeze thaw chamber, remove excess water from the surface of the test sample and weigh the test sample where appropriate..

4.3.4 Evaluation of test results

After having specified the freeze/thaw cycles damages in accordance with Table 1 shall be recorded.

Table 1 — Example for recording damages to the test sample

Nr	Damage	Number of faults
1	pit	
2	hair crack	
3	nascent crack	
4	surface crack	
5	scaling	
6	peeling	
7	surface damage	
8	structural crack	
9	break	
10	delamination	

The deterioration of product strength may need to be determined according to individual product standards.

5 Test report

The test report should include the following information:

a) number, date and title of this document,
b) method and place of sampling,
c) sampling and testing date,
d) identification of samples,
e) number of freeze/thaw cycles,
f) visual description of test specimens after the test,
g) water absorption before and after the test,
h) strength results when required,
i) whether the test sample passed the test in accordance with the relevant product standard.

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