BS EN 12004-2:2017

BSI Standards Publication

Adhesives for ceramic tiles

Part 2: Test methods

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National foreword

This British Standard is the UK implementation of EN 12004-2:2017. It supersedes BS EN 1308:2007, BS EN 1323:2007, BS EN 1324:2007, BS EN 1346:2007, BS EN 1348:2007, BS EN 12003:2008 and BS EN 12002:2008 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/539, Ceramic tiles and other rigid tiling.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Published by BSI Standards Limited 2017

ISBN 978 0 580 88363 7

ICS 83.180; 91.100.10; 91.100.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2017.

Amendments/corrigenda issued since publication

Date	Text affected

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12004-2

February 2017

ICS 83.180; 91.100.10; 91.100.30

Supersedes EN 12002:2008, EN 12003:2008, EN 1308:2007, EN 1323:2007, EN 1324:2007, EN 1346:2007, EN 1348:2007

English Version

Adhesives for ceramic tiles - Part 2: Test methods

Colles à carrelage - Partie 2 : Méthodes d'essai

Mörtel und Klebstoffe für Fliesen und Platten - Teil 2: Prüfverfahren

This European Standard was approved by CEN on 15 July 2016.

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Full document details: BS EN 12004-2:2017

Contents

Page

European foreword ... 4
1 Scope ... 5
2 Normative references ... 5
3 Sampling ... 6
4 Test conditions ... 6
5 Test materials ... 6
5.1 General ... 6
5.2 Ceramic tiles ... 6
5.3 Test substrate ... 6
5.3.1 Concrete slab ... 6
5.3.2 Other substrates ... 6
6 Mixing of the adhesive ... 7
7 Test report ... 7
8 Test methods ... 8
8.1 Determination of open time ... 8
8.1.1 Test materials ... 8
8.1.2 Apparatus ... 8
8.1.3 Procedure ... 8
8.1.4 Evaluation and expression of results ... 9
8.1.5 Test report ... 9
8.2 Determination of slip ... 9
8.2.1 Test materials ... 9
8.2.2 Apparatus ... 9
8.2.3 Procedure ... 10
8.2.4 Test report ... 10
8.3 Determination of tensile adhesion strength for cementitious adhesives (C) ... 11
8.3.1 Test materials ... 11
8.3.2 Apparatus ... 11
8.3.3 Procedure ... 12
8.3.4 Evaluation and expression of results ... 13
8.3.5 Test report ... 14
8.4 Determination of shear adhesion strength of dispersion adhesives (D) ... 14
8.4.1 Test materials ... 14
8.4.2 Apparatus ... 14
8.4.3 Procedure ... 17
8.4.4 Evaluation and expression of results ... 19
8.4.5 Test report ... 19
8.5 Determination of shear adhesion strength of reaction resin adhesives (R) ... 19
8.5.1 Test materials ... 19
8.5.2 Apparatus ... 19
8.5.3 Procedure ... 20
8.5.4 Evaluation and expression of results ... 22
8.5.5 Test report ... 22
8.6 Determination of transverse deformation of cementitious adhesives (C) ... 22
8.6.1 Principle ... 22
8.6.2 Test materials ... 22

Documents
Document Sharing Hub
Full document details: BS EN 12004-2:2017

8.6.3 Apparatus 23
8.6.4 Procedure 25
8.6.5 Test report 26

Annex A (normative) Concrete slab for test 27
A.1 General information 27
A.2 Test conditions 27
A.3 Apparatus 27
A.4 Concrete slab 27
A.4.1 Manufacture of the concrete slab 27
A.4.2 Conditioning of the concrete slab 28
A.4.3 Water absorption at the surface 28
A.4.4 Tensile adhesion strength 28
A.4.5 Data recorded 28

Annex B (normative) Failure patterns 31
B.1 Adhesion failure (AF-S or AF-T) 31
B.2 Cohesive failure within the adhesive (CF-A) 32
B.3 Cohesive failure in the substrate or in the tile (CF-S or CF-T) 33

Bibliography 35

Documents
Document Sharing Hub

Full document details: BS EN 12004-2:2017

European foreword

This document (EN 12004-2:2017) has been prepared by Technical Committee CEN/TC 67 "Ceramic tiles", 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 August 2017, and conflicting national standards shall be withdrawn at the latest by August 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1308:2007, EN 1323:2007, EN 1324:2007, EN 1346:2007, EN 1348:2007, EN 12002:2008, EN 12003:2008.

EN 12004, Adhesives for tiles, is composed with the following parts:

— Part 1: Requirements, evaluation of conformity, classification and designation;

— Part 2: Test methods.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

This European Standard specifies the methods for determining characteristics for adhesives used in internal and external installation of ceramic tiles.

This European Standard does not contain performance requirements or recommendations for the design and installation of ceramic tiles.

The following test methods are described:

— determination of open time (8.1);

— determination of slip (8.2);

— determination of tensile adhesion strength for cementitious adhesives (8.3);

— determination of shear adhesion strength of dispersion adhesives (8.4);

— determination of shear adhesion strength of reaction resin adhesives (8.5);

— determination of transverse deformation of cementitious adhesives (8.6).

NOTE Ceramic tile adhesives can be used also for other kinds of tiles (natural and agglomerated stones, etc.), if they do not adversely affect the stones.

WARNING — This European Standard can involve hazardous materials and operations. Persons using this standard should be familiar with normal laboratory practice. This European Standard does not purport to address all the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any European and national regulatory conditions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 196-1:2016, *Methods of testing cement — Part 1: Determination of strength*

EN 459-2, *Building lime - Part 2: Test methods*

EN 1067, *Adhesives - Examination and preparation of samples for testing*

EN 12004-1, *Adhesives for ceramic tiles - Part 1: Requirements, assessment and verification of constancy of performance, classification and marking*

EN 14411, *Ceramic tiles - Definition, classification, characteristics, assessment and verification of constancy of performance and marking*

EN ISO 15605, *Adhesives - Sampling (ISO 15605)*

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Full document details: BS EN 12004-2:2017

3 Sampling

Take at least 2 kg sample of the adhesive in accordance with EN ISO 15605 and EN 1067.

4 Test conditions

Standard conditions shall be (23 ± 2) °C and (50 ± 5) % relative humidity and the speed of air in the testing area less than 0,2 m/s.

The tolerance in the time of conditioning for all test specimens shall be as shown in Table 1 below:

Table 1 — Allowed tolerance in testing time for all samples requiring conditioning

Sample Conditioning Time	Allowed tolerance for testing
6 h	±15 min
7 d	±3 h
14 d	±6 h
21 d	±9 h
28 d	±12 h

Testing shall be performed within the specified time window.

5 Test materials

5.1 General

Condition all test materials for at least 24 h under standard conditions.

The adhesive to be tested shall be within its shelf life, where this is specified.

5.2 Ceramic tiles

The tiles shall be checked prior to conditioning to ensure that they are unused, clean and dry.

The type of tile shall be as specified under the specific test procedures found in Clause 8.

5.3 Test substrate

5.3.1 Concrete slab

The concrete slab shall be at least 35 mm thick, have a moisture content of less than 3 % by mass (carbide method) and have a water absorption at the surface after 4 h in the range of 0,5 cm^3 to 1,5 cm^3.

The tensile adhesion strength shall be at least 1,5 N/mm^2.

The test surface shall have a finish similar to that obtained by using a wooden float and be clean and dust-free at the time of the test.

A method for manufacturing a suitable concrete test slab and the procedures for measuring the performances are given in Annex A.

5.3.2 Other substrates

Other substrates may be used upon agreement if the substrate is recommended for ceramic tile application by the adhesive manufacturer. To demonstrate compatibility with other optional substrates, the adhesive shall be applied to the selected substrate in accordance with the open time test method (8.1). When the result of > 0,5 N/mm^2 is achieved or cohesive failure occurs in the substrate, the requirement is considered satisfied.

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Full document details: BS EN 12004-2:2017

6 Mixing of the adhesive

The amount of water and/or liquid admix required for preparing the cementitious adhesive shall be as stated by the manufacturer in parts by mass, i.e. liquid to dry powder (in the case where a range of values is given, the average shall be used).

Prepare a minimum quantity of 2 kg of the adhesive in a mixer of the type described in EN 196-1:2016, 4.4, using the slow speed settings (140 ± 5) rotations per min and (62 ± 5) revolution planetary movement.

Carry out the following procedure:

— pour the liquid into the pan;

— scatter the dry powder over the liquid;

— mix for 30 s;

— take out the mixing paddle;

— scrape down the paddle and pan within 1 min;

— replace the paddle and mix for 1 min.

Let the adhesive mature as specified in the manufacturer's instructions, and then mix for a further 15 s.

Where ready-to-use dispersion adhesives or reaction resin adhesives are to be used, the manufacturer's instructions shall be followed.

7 Test report

The test report shall provide the following information:

a) the number and year of issue of this European Standard, i.e. EN 12004-2, and date of issue;

b) the place, date and time of sampling;

c) type of adhesive, commercial designation and manufacturer;

d) identification of test sample;

e) handling and storage of samples before testing;

f) test conditions;

g) date of test;

h) amount of water or liquid used for preparing the adhesive (for cementitious adhesives);

i) any other factor that could have influenced the result;

j) test results (individual and mean values and mode of failure where required):

   1) open time;

   2) slip;

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Full document details: BS EN 12004-2:2017

3) tensile adhesion strength;

4) shear adhesion strength;

5) transverse deformation.

8 Test methods

8.1 Determination of open time

8.1.1 Test materials

8.1.1.1 Ceramic tiles

The tiles used for this method shall be glazed porous body tile complying with EN 14411, group BIII, of water absorption (15 ± 3) % by mass, with a thickness in the range 7 mm to 10 mm and a profile back pattern less than 0,25 mm deep, cut to facial dimensions of (50 ± 1) mm x (50 ± 1) mm.

8.1.1.2 Test substrate

The concrete slab shall comply with the requirements given in 5.3.1.

8.1.2 Apparatus

8.1.2.1 Notched trowel.

A notched trowel having 6 mm x 6 mm notches at 12 mm centres.

8.1.2.2 Weight (Mass).

A mass capable of exerting a force of (20 ± 0,05) N, with a cross-sectional area of less than 50 mm x 50 mm.

8.1.2.3 Pull-head plates.

Square metallic plates, with dimensions of (50 ± 1) mm x (50 ± 1) mm and a minimum thickness of 10 mm with a suitable fitting for connection to the test machine.

8.1.2.4 Test machine.

A test machine for direct pull tensile force test and with suitable capacity and sensitivity for the test. The machine shall be capable of applying the load to the pull-head plate at the rate of (250 ± 50) N/s through a suitable fitting that does not exert any bending force.

8.1.3 Procedure

Apply a thin layer of the adhesive, mixed in accordance with Clause 6, to the concrete slab with a straight edge trowel. Then apply a thicker layer and comb with the notched trowel (8.1.2.1).

The trowel shall be held at an angle of approximately 60° to the substrate at a right angle to one edge of the slab and drawn across the slab parallel to that edge (in a straight line).

After 5 min, 10 min, 20 min and 30 min place at least 10 test tiles (8.1.1.1) 50 mm apart, on the adhesive within 30 s. The tiles are placed on no more than four ribs for all adhesives. Load each tile with (20 ± 0,05) N for 30 s (8.1.2.2).

After 27 d storage under standard conditions, bond the pull-head plates (8.1.2.3) to the tiles with a suitable high strength adhesive (e.g. epoxide adhesive).

After a further 24 h storage under standard conditions determine the tensile adhesion strength of the adhesive by applying a force increasing at a constant rate of (250 ± 50) N/s.

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Full document details: BS EN 12004-2:2017

8.1.4 Evaluation and expression of results

The individual tensile adhesion strengths are quoted to the nearest 0,1 N/mm² using the following formula:

$$A_S = L/A \quad (1)$$

where

A_S is the individual tensile adhesion strength in Newton per square millimetre;

L is the total tensile load in Newton;

A is the bonding area in square millimetre (2 500 mm²).

The tensile adhesion strength for each time interval is determined as follows:

— determine the mean of the 10 values;

— discard the values falling outside the range of ± 20 % of the mean value;

— if five or more values remain, determine the new mean;

— if less than five values remain repeat the test;

— determine the mode of failure of the test units according to Annex B as the predominant mode.

The open time in minutes, is the maximum time interval at which the adhesive meets the tensile adhesion strength requirement defined in EN 12004-1.

8.1.5 Test report

The information listed in Clause 7, items a) to i) shall be provided plus item j) 1: open time in minutes.

8.2 Determination of slip

8.2.1 Test materials

8.2.1.1 Ceramic tiles

The tiles used for this method shall be dry pressed ceramic tile in accordance with EN 14411, group BI_a, with a water absorption ≤ 0,5 % by mass, unglazed, with plane adhering surface and with facial dimensions of (100 ± 1) mm x (100 ± 1) mm, a mass of (200 ± 10) g and a thickness in the range of 8 mm to 10 mm.

8.2.1.2 Test substrate

The concrete slab shall comply with the requirements given in 5.3.1.

8.2.2 Apparatus

8.2.2.1 Steel straight edge.

8.2.2.2 Clamps.

Documents
Document Sharing Hub
Full document details: BS EN 12004-2:2017

8.2.2.3 Masking tape.

A 25 mm wide masking tape.

8.2.2.4 Notched trowel.

A notched trowel having 6 mm x 6 mm notches at 12 mm centres.

8.2.2.5 Spacers.

Two (25 ± 0,5) mm x (25 ± 0,5) mm x (10 ± 0,5) mm thick spacers made from stainless steel.

8.2.2.6 Weight (Mass).

A mass capable of exerting a force of (50 ± 0,1) N with a cross-sectional area of less than (100 ± 1) mm x (100 ± 1) mm.

8.2.2.7 Vernier caliper.

A Vernier caliper accurate to 0,01 mm.

8.2.3 Procedure

Secure the steel straight edge (8.2.2.1), with the clamps (8.2.2.2), at the top of the concrete slab so that its bottom edge is horizontal when the slab is raised to its vertical position.

Position 25 mm wide masking tape (8.2.2.3) immediately below the steel straight edge and apply a thin layer of the adhesive mixed in accordance with Clause 6 to the concrete slab with a straight edge trowel.

Then apply a thicker layer of adhesive to the surface of the concrete slab so that it just overlaps the bottom edge of the masking tape. Comb the adhesive at right angles to the straight-edge with the notched trowel (8.2.2.4).

The trowel shall be held at an angle of approximately 60° to the substrate and parallel to the straight edge.

Immediately remove the masking tape, position 25 mm spacers (8.2.2.5) against the straight edge and after two minutes place the tile (8.2.1.1) against the spacers, as shown in Figure 1, and load with the mass of (50 ± 0,1) N (8.2.2.6).

Measure the gap between the straight edge and the tile, in three points, with the Vernier caliper (8.2.2.7) to within ± 0,1 mm.

After (30 ± 5) s remove the weight and the spacers and immediately and carefully lift the slab into a vertical position. After (20 ± 2) min re-measure the gap, as before, in the same three points.

The maximum slip of the tile under its own mass is the difference between the two readings.

Carry out the test for each of 3 tiles, for each adhesive.

Report the results in millimetres and the mean value.

8.2.4 Test report

The information listed in Clause 7, items a) to i) shall be provided plus item j) 2: Slip in millimetre (individual and mean values).

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