

English Version

**Adhesives for tiles - Determination of tensile adhesion strength  
for cementitious adhesives**

Colles à carrelage - Détermination de l'adhérence par  
traction des mortiers-colles

Mörtel und Klebstoffe für Fliesen und Platten - Bestimmung  
der Haftfestigkeit zementhaltiger Mörtel für innen und  
außen

This European Standard was approved by CEN on 21 January 2007.

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## Foreword

This document (EN 1348:2007) 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of an identical text or by endorsement, at the latest by February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

This document supersedes EN 1348:1997.

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

This European Standard specifies a method for the determination of the tensile adhesion strength of cementitious ceramic tile adhesives.

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

## 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 1067, Adhesives — Examination and preparation of samples for testing

EN 12004, *Adhesives for tiles — Requirements, evaluation of conformity, classification and designation*

EN ISO 15605, *Adhesives — Sampling (ISO 15605:2000)*

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

Standard conditions shall be  $(23 \pm 2) ^\circ\text{C}$  and  $(50 \pm 5) \%$  relative humidity and a speed of air in the testing area of less than 0,2 m/s.

## 5.1 General

Condition all test materials (adhesive etc.) to be tested 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 new, clean, dry and of the following type of tile: type V1: dry pressed ceramic tile in accordance with EN 14411, group BI<sub>a</sub>, with a water absorption  $\leq 0,5$  % by mass, unglazed and with a plain, matt, adhering surface, with facial dimensions of  $(50 \pm 1)$  mm  $\times$   $(50 \pm 1)$  mm.

## 5.3 Concrete slab

The concrete slab shall comply with EN 1323.

# 6 Apparatus

## 6.1 Weight

A mass capable of exerting a force of  $(20 \pm 0,05)$  N, with a cross sectional area of less than 50 mm  $\times$  50 mm.

## 6.2 Pull-head plates

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

## 6.3 Tensile testing 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  $(250 \pm 50)$  N/s through a suitable fitting that does not exert any bending force.

## 6.4 Air-circulating oven

An air-circulating oven capable of controlling the temperature to within  $\pm 3$  °C.

## 6.5 Notched trowel

A notched trowel having 6 mm  $\times$  6 mm notches at 12 mm centres.

# 7 Mixing of the adhesive

The amount of water and/or liquid admix, required for preparing the adhesive, shall be as stated by the manufacturer in parts by mass (e.g. the amount of liquid, in kilos and the amount of powder, in kilos, to be mixed, shall be declared). If a range of values is given, the average shall be used.

A minimum quantity of 2 kg of the adhesive shall be prepared in a mixer of the type described in 4.4 of EN 196-1:2005, using the slow speed settings  $(140 \pm 5)$  r/min and  $(62 \pm 5)$  r/min 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 in accordance with the adhesive manufacturer's instructions, followed by further mixing for 15 s.

## **8 Procedure**

### **8.1 Preparation of test units**

Apply a thin layer of the adhesive, mixed in accordance with Clause 7, to the concrete slab with a straight edge trowel. Then apply a thicker layer and comb with a notched trowel (6.5).

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 place ten type V1 tiles on the adhesive at a distance apart of 50 mm and load each tile with  $(20 \pm 0,05)$  N for 30 s.

### **8.2 Initial adhesion strength**

Prepare the test units in accordance with 8.1.

After 27 days storage under standard conditions bond the pull-head plates (see 6.2) to the tiles with a suitably high strength adhesive (e.g. epoxide).

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

If fast-setting properties of adhesives are to be tested, also determine the tensile adhesion strength 6 h after bonding, under standard conditions (see Clause 4).

Report the results in Newtons.

### **8.3 Tensile adhesion strength after water immersion**

Prepare the test units in accordance with 8.1.

Condition the test units under standard conditions for 7 days, and immerse in water at the standard temperature.

After 20 days remove the test units from the water, wipe with a cloth and bond the pull-head plates (6.2) to the tiles. After a further 7 h immerse the test units in water at the standard temperature.

The following day remove the test units from water and immediately carry out the tensile adhesion test in accordance with 8.2.

Report the results in Newtons.

## 8.4 Tensile adhesion strength after heat ageing

Prepare the test units in accordance with 8.1.

Condition the test units under standard conditions for 14 days and then place the units in an air-circulating oven at  $(70 \pm 3) ^\circ\text{C}$  for a further 14 days. Remove from the oven and bond the pull-head plates (6.2) to the tiles with a suitable high strength adhesive (e.g. epoxide).

Condition the test units for a further 24 h under standard conditions. Determine the tensile adhesion strength in accordance with 8.2.

Report the results in Newtons.

## 8.5 Tension adhesion strength after freeze-thaw cycle

Prepare the test units in accordance with 8.1. In addition a layer of the adhesive approximately 1 mm thick shall be applied with a straight edged trowel to the back face of the type V1 tile before placing.

Condition the test units for 7 days under standard conditions and immerse in water for 21 days before carrying out 25 freeze-thaw cycles.

For each freeze-thaw cycle:

- 1) remove the test units from the water and place in a cold chamber to achieve a steady cabinet temperature of  $(-15 \pm 3) ^\circ\text{C}$  within  $2 \text{ h} \pm 20 \text{ min}$ ;
- 2) maintain the test units at  $(-15 \pm 3) ^\circ\text{C}$  for  $2 \text{ h} \pm 20 \text{ min}$ ;
- 3) immerse the test units in water at  $(20 \pm 3) ^\circ\text{C}$  and raise the temperature to  $(15 \pm 3) ^\circ\text{C}$ ;
- 4) maintain the test units at  $(15 \pm 3) ^\circ\text{C}$  for a minimum 2 h before commencing the next freeze-thaw cycle.

Repeat the cycle 25 times.

After the last cycle remove the test units from water, wipe with a cloth and bond the pull-head plates (6.2) to the tiles. Condition the test units for a further 24 h under standard conditions and determine the tensile adhesion strength in accordance with 8.2.

Report the results in Newtons.

## 9 Evaluation and expression of results

The individual tensile adhesion strength shall be determined to an accuracy of  $0,1 \text{ N/mm}^2$  using the following equation:

$$A_s = L / A$$

where

$A_s$  is the individual tensile adhesion strength in Newtons per square millimetre;

$L$  is the total load in Newtons;

$A$  is the bonding area in square millimetres ( $2\,500 \text{ mm}^2$ ).

The tensile adhesion strength for each set of conditions shall be determined as follows:

- determine the mean of the ten values;
- discard the values falling outside the range of  $\pm 20\%$  from the mean value;
- if five or more than five values remain, determine the new mean value;
- if less than five values remain, repeat the test;
- determine the mode of failure of the test units according to EN 12004 as the predominant mode.

## **10 Test report**

The test report shall provide the following information:

- a) number and year of issue of this European Standard, i.e. EN 1348:2007;
- b) 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;
- i) test results (individual and mean values and the mode of failure);
- j) tensile adhesion strength for each condition in Newtons per square millimetre;
- k) any other factor that could have influenced the result.



