



# SLOVENSKI STANDARD

## SIST-TS CEN/TS 15087:2006

01-maj-2006

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Determination of the uplift resistance of installed clay and concrete interlocking tiles for roofing - Test method for mechanical fasteners

Bestimmung des Abhebewiderstandes von verlegten Dachziegeln und Betondachsteinen - Prüfverfahren für mechanische Verbindungselemente

Détermination de la résistance au soulèvement des tuiles a emboîtement en terre cuite ou en béton mises en oeuvre sur la toiture - Méthode d'essai des fixations mécaniques

Ta slovenski standard je istoveten z: CEN/TS 15087:2005

### ICS:

91.060.20	Strehe	Roofs
91.100.30	Beton in betonski izdelki	Concrete and concrete products

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TECHNICAL SPECIFICATION  
SPÉCIFICATION TECHNIQUE  
TECHNISCHE SPEZIFIKATION

**CEN/TS 15087**

December 2005

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English Version

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concrete interlocking tiles for roofing - Test method for  
mechanical fasteners**

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Dachziegeln oder Betondachsteinen - Prüfverfahren für  
mechanische Verbindungselemente

This Technical Specification (CEN/TS) was approved by CEN on 1 March 2005 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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## Foreword

This Technical Specification (CEN/TS 15087:2005) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by IBN.

This document is applicable where the National application standards, and/or, regulations, specify a requirement for the uplift resistance of installed clay or concrete tiles for roofing.

No existing European Standard is superseded.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this CEN Technical Specification: 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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**CEN/TS 15087:2005 (E)****1 Scope**

This Technical Specification specifies a test method for determining the strength and uplift resistance of fasteners for clay and concrete interlocking tiles for roofing.

NOTE 1 The results of this test may be used to determine the uplift force which can be withstood by the fastener; e.g. to withstand wind force.

NOTE 2 When the results of the test method for mechanical fasteners have a correlation to the results of the roof system test method [EN 14437] they can be used to establish the uplift resistance of installed clay and concrete tiles for roofing.

The test method is applicable to mechanical fasteners such as clips, hooks, screws and nails. It is not applicable to fasteners which hold down more than one tile.

**2 Normative references**

Not applicable.

**3 Terms and definitions**

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

**3.1 characteristic value**

value of a material property having a prescribed probability of not being attained in a hypothetical unlimited test series; this value generally corresponds to a specific fractile of the assumed statistical distribution of the particular property of the material

**3.2 gauge**

length of the exposed part of the fixed tile, measured longitudinally; this is the same as the batten gauge

**3.3 mechanical fasteners**

screws, clips, nails and hooks

**4 Symbols and abbreviations**

$d_{\max}$	maximum displacement of tile D (mm);
$F$	test load, (N);
$F_c$	force acting on the mechanical fastener;
$F_0$	test load without a fastener fitted (N);
$F_{i, \text{MAX}}$	maximum test load at failure (N);
$k_n$	a factor depending on the number of tests n;
$L_h$	hanging length (mm);
$L_F$	distance between the pivot line and the applied uplift force (mm);

$L_C$	distance between the pivot line and the centre of the clip (mm);
$n$	number of tests;
$R_d$	maximum design value;
$R_k$	characteristic fastener uplift resistance (N);
$R_i$	individual fastener uplift resistance (N);
$R_x$	mean fastener uplift resistance (N);
$s_x$	standard deviation of the uplift resistance (N);
$\gamma$	partial safety factor for resistance, which may be defined by a national regulation;
$F_t$	is the uplift force (N) acting in the centre of the exposed area of each tile or slate;
$g$	is the acceleration due to gravity, $9,81 \text{ ms}^{-2}$ ;
$q$	is the moment arm (m) shown in Figure E.1;
$r$	is the moment arm (m) shown in Figure E.1;
$w_t$	is the mass of one tile (kg);
$p$	is the moment arm (m) shown in Figure E.1;
$\alpha$	is the angle of the tile or slate to the horizontal (degrees) when laid on the roof.

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## 5 Sampling

The clay and concrete tiles for the roofing selected shall be representative of the tiles specified by the manufacturer.

The battens selected shall be representative, i.e., in line with the tile product and instructions of the clip manufacturer.

The fasteners used for the test shall be representative of the manufactured product.

In selecting the number of elements refer to Clauses 7 and 9, taking into consideration that in each case a trial test and at least 3 tests shall be conducted.

NOTE The specification of the battens may include a reference to a national code of practice.

## 6 Test conditions

Unless specified otherwise, the roofing tiles, fasteners and test frame shall be stored for at least 24 hours in an environment of  $(20 \pm 5) \text{ }^\circ\text{C}$ , and  $(60 \pm 20) \%$  relative humidity, prior to the test. The manner of storage shall not interfere with the free exchange of moisture from or into the materials. The test shall be conducted in the same conditions as the storage.

NOTE If in practice, the moisture content of the battens is expected to be different from the standard conditions, and if it is expected that this may influence the test results, this should be taken into account; e.g. by testing under the appropriate conditions and recording the moisture content of the battens used.

**CEN/TS 15087:2005 (E)****7 Test material**

The test materials shall be randomly chosen from the samples.

**8 Apparatus****8.1 Test Rig**

An example of the apparatus is shown in Annex A, and consists of:

- a) a horizontal rigid base frame onto which is attached counter battens (to simulate rafters at the maximum intended rafter centres) and tiling battens set at the appropriate gauge. The top tiling batten shall be attached to the counter battens by hinges (see Annex B);
- b) the tiles to be tested are fastened to the battens with tail clips fixed to the tail (lower half of tile) batten and/or nails/screws /head clips fixed to the head (top part of tile) batten;
- c) a means of loading test sample via a load application device, capable of applying a loading rate of not less than 100 N/min initially in a direction normal to the tile surface at the loading point;
- d) a load application device that includes a calibrated force-measuring device e.g. load cell. The load application device shall be hinged at both ends and the length of the device between the hinges should exceed the hanging length of the tile;
- e) a rigid bar, incorporating an accurate system for locating and supporting a calibrated displacement-measuring device, the bar shall permit the tail of the fixed tile to be raised by  $d_{\max}$  (see 9.2.3 d).

**8.2 Force measuring device**

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A calibrated force-measuring device shall be used to determine the uplift force having a maximum inaccuracy in combination with the reading equipment of 1 % of the measured value or 10 N, whichever is the larger.

**8.3 Measuring device for displacement of the roofing tiles**

A calibrated displacement-measuring device shall be used to determine the displacement of the roofing tiles and shall have a maximum inaccuracy of 0,2 mm. The displacement-measuring device shall not exert forces larger than 1 % of the uplift force. The measuring device shall be able to measure displacements in excess of  $d_{\max}$ .

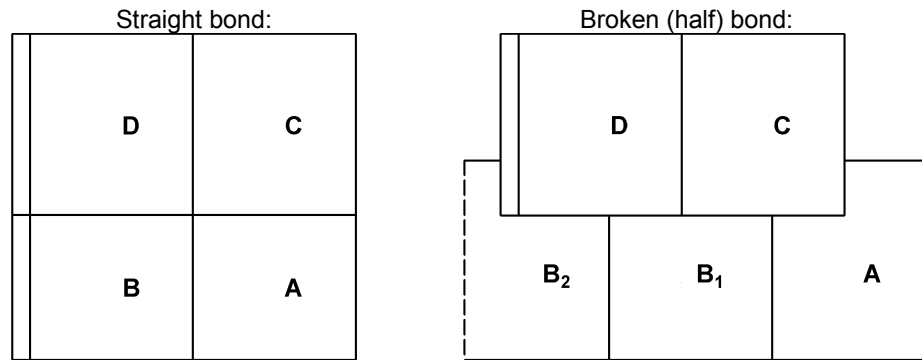
NOTE Other apparatus satisfying Clause 8 may also be used.

**9 Test Procedure****9.1 Procedure for Setting up the Test**

Fix the counter-battens (to simulate the rafters) to the base frame at 600 mm spacing. Fix the battens of appropriate dimensions to the counter-battens at the specified minimum gauge for the roofing element.

Referring to Figure 1 lay tiles A and B.





**Figure 1: Arrangement of tiles** (A, B, B<sub>1</sub>, B<sub>2</sub>, C, D are tiles)

The load application device shall be attached to tile C at the centre of its exposed area.

Lay tile C then attach and fix the fastener to the test sample in accordance with the relevant specification and normal standards of workmanship, then lay tile D without fastener.

Securely fix tiles C and D at their heads to the top (hinged) batten (e.g. by nails, screws, bolts or clamps). If the fixing configuration under test includes head fasteners then the head of tile C shall be fixed with the test head fasteners and the hinged batten replaced with a fixed batten and arrangements made to have a tile overlap tile C to allow the measurement of the residual displacement.

Attach the displacement-measuring device to its rigid support such that it measures the displacement of tile D over the fastener position and in a direction normal to the surface of tile D.

NOTE 1 The lower batten, supporting the tails of tiles A and B, will need to be of greater depth e.g. double batten than the other battens so that tiles A and B will lay parallel to tiles C and D in the final assembly.

NOTE 2 Care should be taken to ensure that the size and/or positioning of the hinges on the top batten does not interfere with the seating of the tiles.

NOTE 3 Most interlocking tiles are laid from right to left. If the test tiles are those which are laid from left to right then the arrangement shown in Annex A and Figure 1 should be treated as a mirror image with tile numbers and instructions adjusted accordingly.

NOTE 4 Most tiles can be laid in straight bond, but if they can only be laid in broken (half) bond then the alternative arrangement shown in Figure 1 should be used.

NOTE 5 For convenience, a small hole may be made through tile C at the centre of the exposed area for attaching the load application device.

NOTE 6 For preliminary tests lay tiles without fasteners (reference 9.2.1).

## 9.2 Procedure for conducting the test

### 9.2.1 Zero the measuring equipment

Carry out a preliminary test without a fastener in order to determine the test force,  $F_0$ , measured on the calibrated force-measuring device, required to lift tiles C and D by 10 mm when no fastener is fitted.

NOTE  $F_0$ , represents the influence of the self weight of the tiles C and D and eliminates the need to weigh these tiles and calculate moments.

### 9.2.2 Trial test

Carry out a trial test to determine the likely failure loads. This is carried out with a fastener fitted to tile C. The applied load  $F_i$ , is increased until one of the failure criteria a) to e) in 9.2.3 is reached. Record the maximum