



SWEDISH
STANDARDS
INSTITUTE

**SVENSK STANDARD
SS-EN 14437:2004**

Fastställd 2004-12-17

Utgåva 1

**Takprodukter – Bestämning av lyftmotståndet
hos installerade tegel- eller betongtakpannor –
Provningsmetod för taksystem**

**Determination of the uplift resistance of installed
clay or concrete tiles for roofing – Roof system
test method**

ICS 91.060.20; 91.100.25; 91.100.30

Språk: engelska

Publicerad: februari 2005

Europastandarden EN 14437:2004 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 14437:2004.

The European Standard EN 14437:2004 has the status of a Swedish Standard. This document contains the official English version of EN 14437:2004.

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EUROPEAN STANDARD

EN 14437

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2004

ICS 91.060.20; 91.100.25; 91.100.30

English version

Determination of the uplift resistance of installed clay or concrete tiles for roofing - Roof system test method

Détermination de la résistance au soulèvement des tuiles
terre cuite ou béton mises en oeuvre sur la toiture -
Methode d'essai par système de toiture

Bestimmung des Abhebewiderstandes von verlegten
Dachziegeln oder Dachsteinen - Prüfverfahren für
Dachsysteme

This European Standard was approved by CEN on 13 September 2004.

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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.

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Foreword

This document (EN 14437:2004) 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/BIN.

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of an identical text or by endorsement, at the latest by May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

This standard 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.

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.

Introduction

This document gives a test method and failure criteria for determining the uplift resistance of clay or concrete tiles for roofing.

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

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1 Scope

This document specifies a test method to establish the uplift resistance of installed clay or concrete tiles for roofing, complying with the relevant product standard, EN 490 or EN 1304, which are unfixed or mechanically fixed to the substructure.

NOTE The test method has been developed for clay or concrete tiles for roofing but may apply to other discontinuously laid small elements, such as: slates; fibre cement slates; and, stones.

The test method is applicable to mechanical fixings such as clips, hooks, screws and nails.

In case of mechanically fixed tiles, at least every third tile shall be fixed. The method is not applicable for fixed tiles with fixing patterns with less than every third tile fixed.

The test method is not applicable to under and over tiles. Examples of these tiles are given in Annex H.

2 Normative references

Not applicable.

3 Terms and definitions

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

3.1 discontinuously laid small elements
elements to be used for roof covering and wall cladding which are installed as separate elements and collectively form the roof covering

3.2 roof pitch
pitch of the roof structure, e.g. the rafters, counter battens, panels

3.3 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 specified fractile of the assumed statistical distribution of the particular property of the material

3.4 roof system
comprises the structure of the battens, mechanical fixings (clips, hooks, nails and screws) as well as the laying specification for the roof covering products (clay and concrete tiles for roofing)

4 Symbols and abbreviations

d_{\max} the maximum permissible displacement;
 F_t force exerted on 16 tiles;
 k_n a factor depending on the number of tests n ;
 L_h the hanging length of the tile;
 L_t total length of tile;

m	number of fixings on 16 roofing tiles;
n	number of tests;
R_d	design uplift resistance of 16 roofing tiles;
R_k	characteristic uplift resistance of 16 roofing tiles;
$R_{r,i}$	uplift resistance of 16 tiles in test i ;
R_t	uplift resistance of 16 tiles in a trial test;
R_x	mean uplift resistance of 16 roofing tiles;
s_x	standard deviation of the uplift resistance of 16 roofing tiles;
W_i	weight of a roofing tile;
W_k	characteristic weight of a roofing tile at a roof pitch of 45° ;
W_x	mean weight of a roofing tile;
α	roof pitch;
γ	partial safety factor for resistance, which may be defined by a national regulation.

5 Sampling

The clay or concrete tiles for roofing selected shall be representative of the intended use.

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

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

In selecting the number of elements, refer to 7 and 9, taking into consideration the number of fixing patterns and 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, fixings and the test frame shall be conditioned for at least 24 h in an environment of $(20 \pm 5)^\circ\text{C}$, 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.

7 Test material

The test materials shall be randomly chosen from the samples.

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8 Apparatus

8.1 Test rig

The test rig consists of a roof structure and auxiliary equipment to exert a force on the clay or concrete tiles for roofing. The roof structure shall have a roof pitch of $(45 \pm 2)^\circ$.

The test rig shall be able to exert an equal uplift force on 16 roofing tiles from a minimum distance of 1,0 m to the surface of the roof covering and at an angle of $(90 \pm 2)^\circ$ to the roof structure, at the start of the test.

The test rig shall have sufficient capacity and stiffness for the test as not to influence the test result. The test rig shall be capable of applying an uplift force at a rate of not more than 50 N/s.

NOTE 1 The test results obtained at 45° may be used for pitches up to 60° . For pitches greater than 60° tests at the appropriate roof pitch are advised.

NOTE 2 Annex A includes an example of the test rig.

8.2 Cables

The uplift force shall be exerted by using a cable. The cable shall be flexible, such that it minimises any overturning moment on the connection point, where the force is applied.

8.3 Force measuring device

A calibrated force measuring device shall be used to determine the total uplift force on the 16 roofing tiles (refer to 9.3), having a maximum inaccuracy in combination with the reading equipment of 1 % of the measured value or 10 N, whichever is larger.

8.4 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 measured on the 16 roofing tiles.

The measuring device shall ensure that any displacement or twist of the roofing tiles is taken into account.

NOTE This may be achieved by rigidly attaching a small flat plate to the measuring head, such that it always contacts the highest point on the roofing tile.

8.5 Measuring device for weight

A calibrated weighing device shall be used to determine the weight of roofing tiles with a maximum inaccuracy of 1 % of the measured value.

9 Test procedure

9.1 Measurement of the weight

Determine the individual weight W_i of at least 10 roofing tiles, where i indicates the number of the roofing tile weighed, after conditioning described in 6.

9.2 Installation of battens, roofing tiles and fixings

The battens shall be fitted to the test rig.

The roofing tiles shall be installed on the battens in a lay-out intended to be tested. The overlap of the roofing tiles shall be the maximum specified for the intended use in the national regulations or codes of practice or by the manufacturer.

The boundary conditions for the installed roofing tiles on the test rig shall be representative of the intended application. For roofing tiles surrounded in the intended application by at least 2 courses and 2 columns of identical roofing tiles, the test requires a set of roofing tiles, sufficient to cover at least 8 courses high and 8 columns wide, or at least 1,5 m high and 1,5 m wide, whichever is larger.

NOTE 1 For interlocking, single lap clay or concrete tiles, the lowest course on the test rig may be omitted without loss of accuracy of the test result.

The fixings shall be installed representatively of the intended use of the fixings and shall take into account the lay-out of the roofing tiles.

NOTE 2 For roofing tiles that are within 2 courses or columns distance of eaves, verge, ridge or valley or within 1 course or column distance of special tiles for eaves, verge, ridge or valley, additional guidance on the application of the test is given in Annex F.

NOTE 3 Various fixing patterns may need to be tested, refer to Annex C.

9.3 Determination of the location of the forces on the test roof

A total of 16 roofing tiles to be lifted shall be selected on the test roof. These 16 elements shall be located adjacent to each other in an area of 4 courses high and 4 columns wide, as defined in Annex B. The fixing pattern shall be chosen such that the roofing tile in the lower right corner is fixed. Annex C gives examples of suitable fixing patterns.

The connection point is within 5 mm of the centre of the projected visible area of the roofing tile, normal to the roof surface taking into account the geometric peculiarities of the tile (see Figure 1).

NOTE 1 The cable may be connected to the tile by feeding the cable through a hole to be made at the location of the connection point and locking the cable at the back-side of the roofing tile.

NOTE 2 Figure 1 shows a typical example of a tile in the centre of the roof, overlapping along its edge and head regions. Some tiles may not have a side lap e.g., double lap tiles and some single lap verge tiles.