BS EN 491:2011

BSI Standards Publication

Concrete roofing tiles and fittings for roof covering and wall cladding — Test methods

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National foreword

This British Standard is the UK implementation of EN 491:2011. It supersedes BS EN 491:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/542/2, Concrete roofing tiles and fittings.

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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EN 491

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English Version

Concrete roofing tiles and fittings for roof covering and wall cladding - Test methods

Tuiles et accessoires en béton pour couverture et bardage - Méthodes d'essais

Dach- und Formsteine aus Beton für Dächer und Wandbekleidungen - Prüfverfahren

This European Standard was approved by CEN on 4 August 2011.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 491:2011) 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 NBN.

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of an identical text or by endorsement, at the latest by March 2012, and conflicting national standards shall be withdrawn at the latest by March 2012.

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

This document supersedes EN 491:2004.

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1 Scope

This European Standard specifies test methods for concrete roofing tiles and fittings conforming to EN 490, for assembly into pitched roof covering or external wall cladding or internal wall lining cladding.

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 490:2004, *Concrete roofing tiles and fittings for roof covering and wall cladding — Product specifications*

EN 13162:2008, *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification*

EN 13238:2010, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*

EN 13823:2010, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 490:2004 apply.

4 Symbols and abbreviations

l_1 hanging length of a tile as defined in Figures 1a) and 1c), in millimetres;
l_2,l_3 hanging edge lengths of a tile as defined in Figure 1.b), in millimetres;
c_w cover width of one tile, in millimetres;
c_{wc} cover width closed up value of 10 tiles, in millimetres;
c_{wd} cover width drawn out value of 10 tiles, in millimetres;
d profile depth of a tile, in millimetres;
x angle at which test tiles are hung as defined in Figure 1a), in degrees.

5 Test methods

5.1 General

Where other test methods are used for factory production control (FPC) a satisfactory statistical correlation with the test methods specified in this document shall be demonstrated.

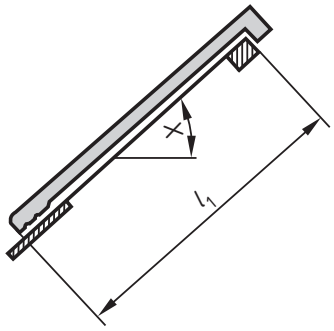
5.2 Hanging length and squareness of regular front edge tiles

5.2.1 Principle

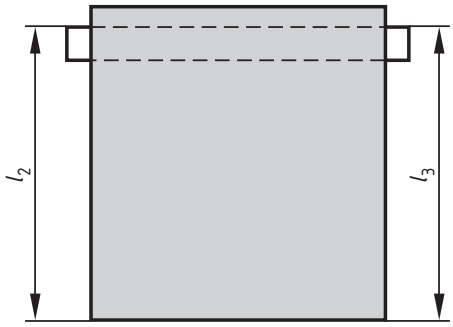
Tiles are hung from steel battens and measured to establish hanging length and also the squareness of regular front edge tiles.

5.2.2 Apparatus

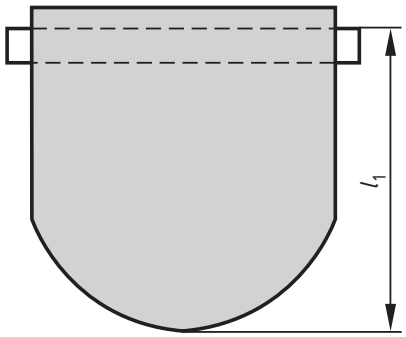
5.2.2.1 **Steel battens** to support the tile (see Figure 1).



a) x = 20° to 70°



b) Tiles with nominally constant hanging length $l_1 = (l_2 + l_3)/2$



c) Tiles with regularly varying hanging length l_1 = Hanging length measured at lowest point

Figure 1 — Test method for hanging length

5.2.3 Procedure

5.2.3.1 Tiles with nominally constant hanging length

Hang the tile at an angle of 20° to 70° on a steel batten (see Figure 1a)). After physically removing any burrs and/or other irregularities, measure from the top face of the batten to the lower front edge of the tile at the sides (see Figure 1b)), excluding the interlocking sections in the case of tiles with sidelocks.

5.2.3.2 Tiles with regularly varying hanging length

Hang the tile at an angle of 20° to 70° on a steel batten (see Figure 1a)). After physically removing any burrs and/or other irregularities, measure from the top face of the batten to the lowest point of the tile (see Figure 1c)).

5.2.4 Expression of results

5.2.4.1 Tiles with nominally constant hanging length

Record the values l_2 and l_3 to the nearest millimetre and calculate the average per tile l_1 to the nearest millimetre.

5.2.4.2 Tiles with regularly varying hanging length

Record the measured value l_1 to the nearest millimetre.

5.2.5 Test report

5.2.5.1 Tiles with nominally constant hanging length

The test report shall include the following:

a) value l_2 to the nearest millimetre;

b) value l_3 to the nearest millimetre;

c) the average per tile. l_1. to the nearest millimetre;

d) reference to this document, i.e. EN 491.

5.2.5.2 Tiles with regularly varying hanging length

The test report shall include the following:

a) value l_1 to the nearest millimetre;

b) reference to this document, i.e. EN 491.

5.3 Cover width

5.3.1 Principle

Tiles are hung or laid on a steel batten to determine their cover width.

5.3.2 Apparatus

5.3.2.1 Steel batten to support 11 tiles.

This may be horizontal or pitched up to 70°.

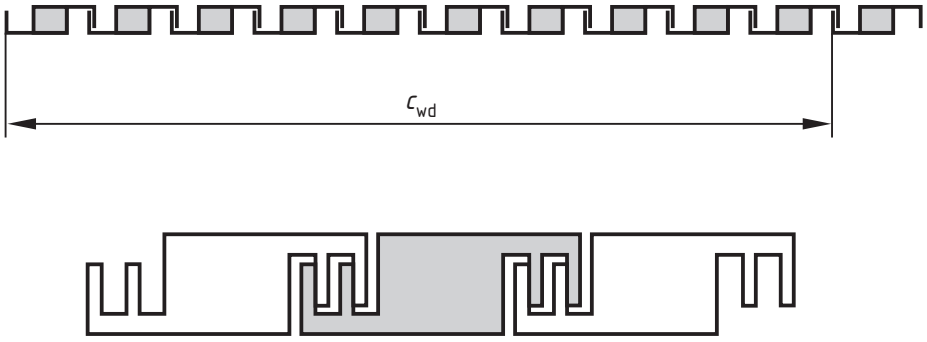
5.3.3 Procedure

5.3.3.1 Interlocking tiles

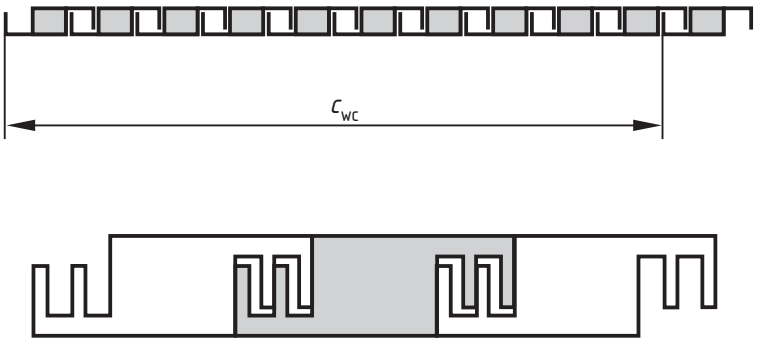
Hang or lay 11 tiles of the same cover width with their locks engaged, following the manufacturer's recommendations.

Taking care that the interlocking parts of the tiles do not lift or disengage, pull the tiles apart to their maximum coverage. Measure the drawn-out value c_{wd} over 10 tiles to the nearest millimetre (see Figure 2a)).

Taking care that the interlocking parts of the tiles do not lift or disengage, push the tiles together to their minimum coverage. Measure the closed up value c_{wc} over 10 tiles to the nearest millimetre (see Figure 2b)).



a) c_{wd} = cover width of 10 tiles drawn out



b) c_{wc} = cover width of 10 tiles closed up

Figure 2 — Testing interlocking tiles for cover width

5.3.3.2 Non-interlocking tiles

Hang or lay 10 tiles of the same nominal cover width on a batten following the manufacturer's recommendations.

Push the tiles together. Measure the width of the 10 tiles to the nearest millimetre.

5.3.4 Expression of results

5.3.4.1 Interlocking tiles

Calculate to the nearest millimetre either:

a) the mean drawn out value $c_{wd}/10$ and the mean closed up value $c_{wc}/10$; or

b) the mean cover width $(c_{wd} + c_{wc})/20$.

5.3.4.2 Non-interlocking tiles

Calculate the mean cover width $c_{wc}/10$ to the nearest millimetre.

5.3.5 Test report

5.3.5.1 Interlocking tiles

The test report shall include the following:

a) the mean drawn out value $c_{wd}/10$ and the mean closed up value $c_{wc}/10$ to the nearest millimetre; or

b) the mean cover width $(c_{wd} + c_{wc})/20$ to the nearest millimetre; and

c) reference to this document, i.e. EN 491.

5.3.5.2 Non-interlocking tiles

The test report shall include the following:

a) the mean cover width $c_{wc}/10$ to the nearest millimetre;

b) reference to this document, i.e. EN 491.

5.4 Flatness

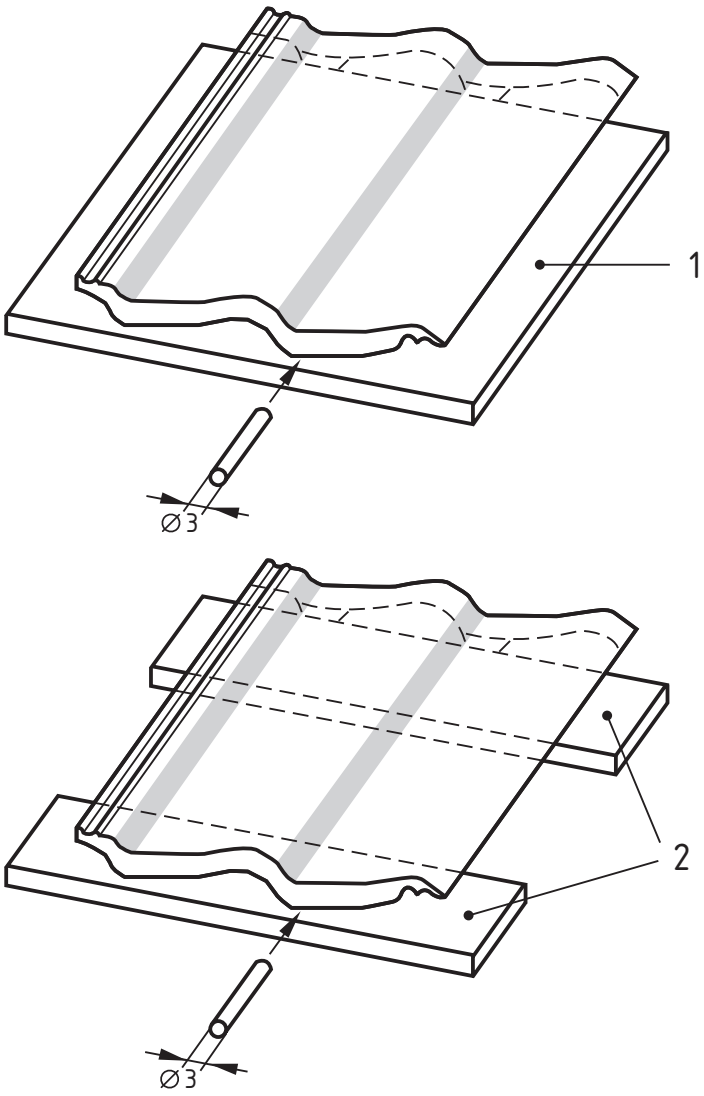
5.4.1 Principle

Tiles are laid on a flat plate to determine their flatness.

5.4.2 Apparatus

5.4.2.1 Flat metal surface or two co-planer flat metal plates (see Figure 3).

Dimensions in millimetres



Key

1 Flat surface

2 Two co-planer flat metal plates

3 Diameter 3 mm or c_w/100

Figure 3 — Testing flatness

5.4.2.2 Steel round bar, with a diameter of 3 mm or c_w/100 to the nearest millimetre, whichever is the greater.

5.4.3 Procedure

Place the tile on a flat level surface or two co-planer flat metal bars with the nibs projecting, as shown in Figure 3. Hold the tile to ensure that the head of the tile is in contact with the surface.

Using the steel bar (without lifting the tile), check whether any gap between the lower front edge of the tile and the measuring surface at any nominal contact point, is greater than the diameter of the steel bar.

5.4.4 Expression of results

Record for each tile whether there is a gap equal to or greater than the diameter of the steel bar.

5.4.5 Test report

The test report shall include the following:

a) the number of tiles for which there is a gap equal to or greater than the diameter of the steel bar;

b) reference to this document, i.e. EN 491.

5.5 Mass

5.5.1 Principle

Tiles are conditioned and then weighed to determine their mass.

5.5.2 Apparatus

5.5.2.1 Weighing device, capable of measuring to the nearest 25 g.

5.5.3 Conditioning

Store the tiles to be tested at 15 °C to 30 °C and at a minimum of 30 % relative humidity for at least 24 h in such a manner that air is free to circulate to all sides of each tile.

5.5.4 Procedure

Weigh each tile to the nearest 25 g.

5.5.5 Expression of results

Record the values measured and calculate the mean mass of the tiles in the sample to the nearest 25 g.

5.5.6 Test report

The test report shall include the following:

a) the mass of each tile to the nearest 25 g;

b) the mean mass of the tiles in the sample to the nearest 25 g;

c) reference to this document, i.e. EN 491.

5.6 Mechanical resistance (transverse strength)

5.6.1 Principle

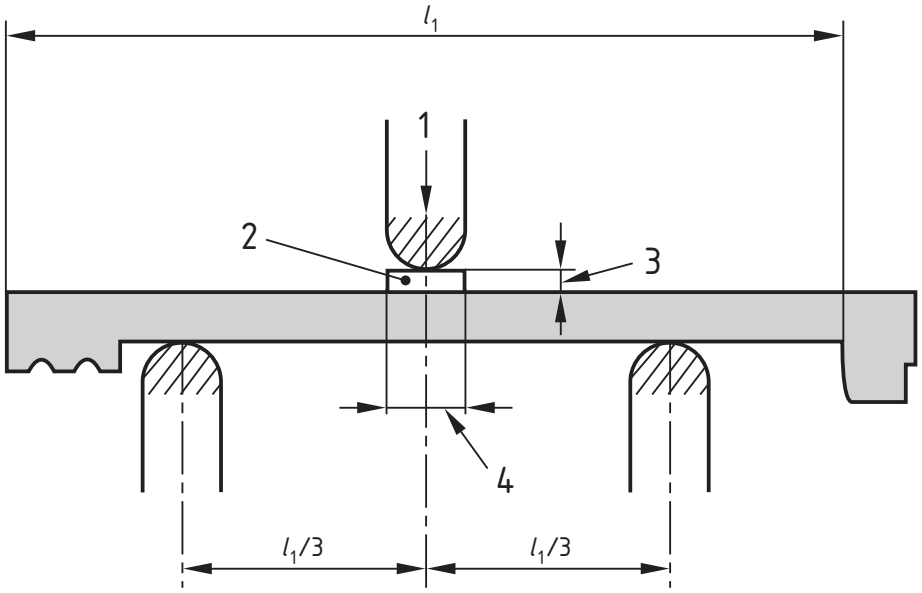
Tiles are placed in a test machine and a load is applied in order to determine the mechanical resistance of the tiles.

5.6.2 Apparatus

5.6.2.1 **Test machine** with two lower rounded metal bearers in a horizontal plane whose centres are spaced at 2/3 of the hanging length of the tile to be tested, and a single rounded metal upper bearer positioned centrally between the two lower bearers (see Figure 4).

The bearers shall be circular or rectangular with one rounded side. The rounded part of the bearers shall have a radius of 10 mm to 20 mm. The bearers shall have a minimum width of 20 mm. The upper bearer and the bearer nearest the tail of the tile shall be free to pivot perpendicularly to their long axis. The length of the bearers shall be not less than the width of the tile to be tested.

The test machine shall be calibrated so that the indicated value shall be within ± 3 % of the true value.



Key

1 Load

2 Elastomeric pad

3 (10 ± 5) mm

4 ≥ 20 mm

Figure 4 — Test machine

5.6.2.2 **Packing pieces** made of steel, of width not greater than the diameter of the rounded part of the lower bearers.

5.6.2.3 **Elastomeric pad,** of length at least the width of the tile, not less than 20 mm wide and (10 ± 5) mm thick with a hardness of 50 Shore A ± 10 Shore A.

5.6.2.4 **Contoured packing block,** made of hardwood or metal or moulded with plaster, (20 ± 1) mm wide.

NOTE Information on the determination of Shore hardness may be found in ISO 7619-1 and -2.

5.6.3 Conditioning of tiles

Store the tiles to be tested at 15 °C to 30 °C, at a minimum of 30 % relative humidity for at least 24 h, in such a manner that air is free to circulate to all sides of each tile.

5.6.4 Procedure

5.6.4.1 Measurement of profile depth *d*

If the manufacturer's declared value of *d* is < 20 mm, measure the profile depth of each tile in the sample and calculate the mean value for the sample (see Figure 5).

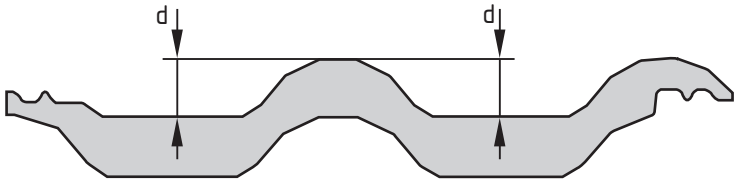


Figure 5 — Measurement of profile depth *d*

5.6.4.2 Positioning the tile in the machine

Place the tile to be tested with the top surface uppermost on the lower bearers of the test machine so that the centre line of the hanging length is midway between the lower bearers (see Figure 4). If the tile is not stable in this position, move the tile to a position such that the fixed bearer is in the position of the roof support batten.

Position the upper bearer so that in relation to the fixed lower bearer, the angle of the upper bearer is not greater than 10°. Use packing pieces as necessary to achieve this (see Figure 6).

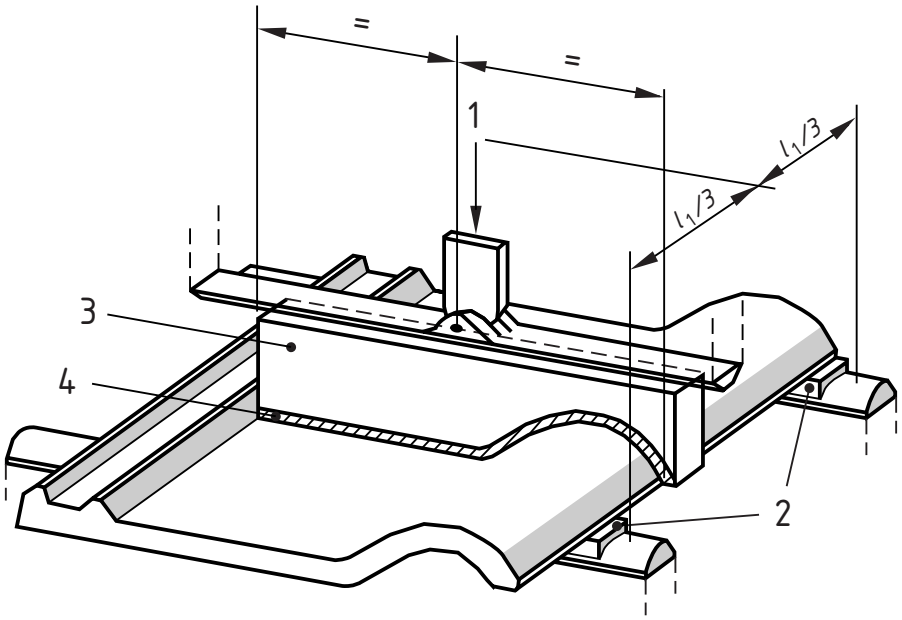
With plain and flat tiles, place an elastomeric pad between the upper bearer and the tile (see Figure 6).

With profiled tiles, arrange a contoured packing block between the upper bearer and the tile (see Figure 6). Where the contoured packing block is made of hardwood or metal, place an elastomeric pad between the contoured packing piece and the tile.

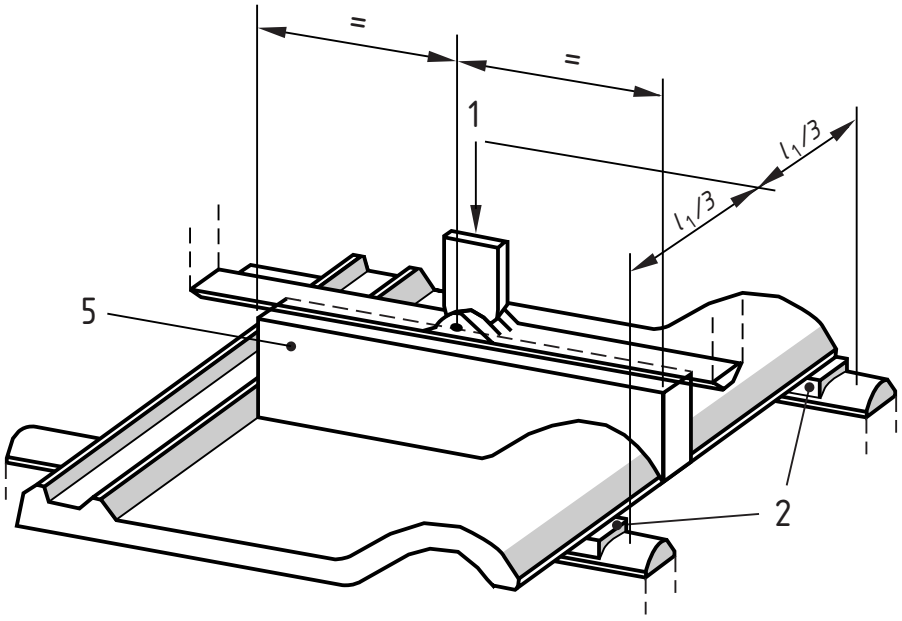
Place the tile so that the underlock (if applicable) is not loaded, and in such a way that the load can be applied centrally on the cover width (see Figure 6).

NOTE For factory production control and, if relevant, for third party control, consignment testing and surveillance, the test may be carried out without the use of the elastomeric pad or contoured packing block.

For factory production control and, if relevant, for third party control, consignment testing and surveillance, declare which test method is used.



a) Using a hardwood or metal packing



b) Using a moulded plaster packing block

Key

1 Load

2 Packing pieces

3 Hardwood or metal packing block

4 Elastomeric pad

5 Moulded plaster packing block

Figure 6 — Tile positioning for load application

5.6.4.3 Load application

Apply the load through the upper bearer at a rate of between 1 500 N/min and 6 500 N/min until failure occurs.

5.6.5 Recording of test results

Record the maximum load of each tile to the nearest 10 N. When calculating the total load, include the weight of the packing pieces used on the top surface if they exceed 5 N.

5.6.6 Test report

The test report shall include the following:

a) the maximum load of each tile to the nearest 10 N;

b) reference to this document, i.e. EN 491.

5.7 Water impermeability

5.7.1 Principle

Water is applied to the tiles in order to determine their impermeability to water.

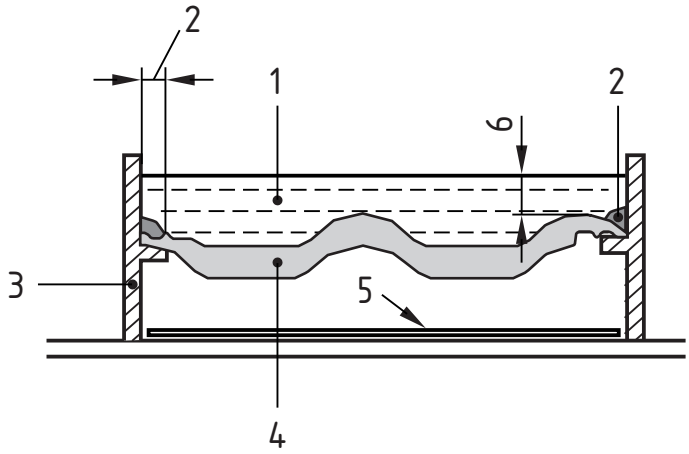
5.7.2 Apparatus and materials

5.7.2.1 Impermeable frame, on or around the tile or valley tile. Where a shelf or support points are provided to support the tile, they shall be not more than 15 mm wide.

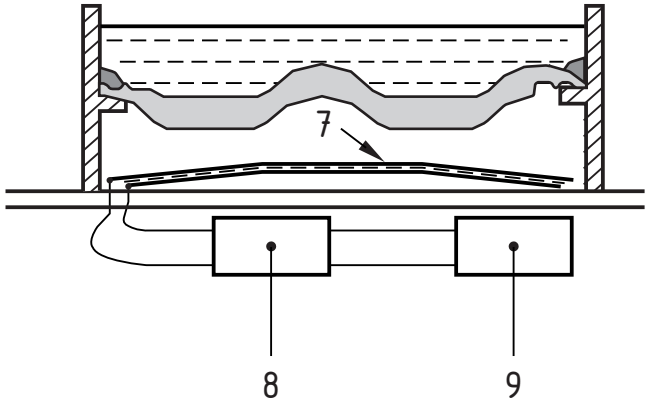
5.7.2.2 Impermeable material or sealant, to seal the joint between the impermeable frame and tile or valley tile so that it is watertight.

5.7.2.3 Suitable device for detecting falling drops of water.

NOTE Examples of suitable detection methods are illustrated in Figure 7.



a) Using a mirror



b) Using an electrically amplifying device

Key

1 Water
2 Sealant max. 15 mm wide
3 Water impermeable frame
4 Roofing tile
5 Mirror
6 10 mm to 15 mm
7 Two layers of a fine metal mesh with insulating linen between them
8 Measuring amplifier
9 Recording device

Figure 7 — Water impermeability test apparatus

5.7.3 Conditioning

Store the tile or valley tile to be tested at 15 °C to 30 °C, at a minimum of 30 % relative humidity for at least 20 h, in such a manner that air is free to circulate to all sides of each tile or valley tile.

5.7.4 Procedure

Seal the impermeable frame on or around the tile or valley tile so that no more than 15 mm from the perimeter is covered (see Figure 7). In the case of interlocking tiles with an underlock width of ≤ 30 mm, the seal width shall be not more than half of the width of the underlock on that side.

Where functional openings such as fixing holes are present, seal these with an impermeable material. Where the tile has a decorative finish, remove the decorative finish from the face around the outer edge to achieve a watertight seal between the tile and the impermeable frame.

Hold the tile or valley tile to within 10° of the horizontal. Pour water on to the tile or valley tile to a level of 10 mm to 15 mm above the highest point, place the test sample above a suitable device for detecting falling drops of water and store at 15 °C to 30 °C and at least 30 % relative humidity for 20 h ± 5 min.

5.7.5 Expression of results

Record whether or not drops of water have fallen from the underside of the tile or valley tile during the period of 20 h ± 5 min.

5.7.6 Test report

The test report shall include the following:

a) whether drops of water have fallen from the underside of the tile;

b) reference to this document, i.e. EN 491.

5.8 Freeze-thaw resistance

5.8.1 Principle

Tiles are subjected to freeze-thaw cycles to determine subsequent changes in water impermeability and transverse strength.

5.8.2 Apparatus

NOTE The test may be performed either with an automatic apparatus or by manual means.

5.8.2.1 Freeze chamber, with an air-mixing device, capable of achieving the freeze-thaw cycling characteristics given in 5.8.4.

5.8.2.2 Immersion tank, containing water.

5.8.3 Preparation of test samples

5.8.3.1 Test specimen

Test whole tiles or fittings at least 28 days old.

5.8.3.2 Conditioning

Place the tiles or fittings in the immersion tank containing water at (20 ± 5) °C for 3 days. Remove the tiles and wipe off excess surface water with a damp cloth.

5.8.4 Procedure

Immediately after conditioning the tiles or fittings, place them vertically in the freeze chamber. To provide free circulation of air, position the tiles so that:

— the distance between any two tiles or fittings is ≥ 40 mm;

— the distance between the vertical faces of the chamber and tile or fittings faces is ≥ 100 mm;

— the distance between the bottom of the chamber and the lower end of the tiles or fittings is ≥ 30 mm;

— the distance between the top of the chamber and the upper end of the tiles or fittings is ≥ 100 mm.

When a frame is used to hold the tiles or fittings in position during the test, construct it in such a manner that the free circulation of air is not restricted.

Perform 25 complete freeze–thaw cycles, each cycle consisting of a cooling phase, a freezing phase and a thawing phase.

To cool the tiles or fittings, reduce the air temperature in the freeze chamber to (–20 ± 5) °C within 2 h ± 30 min.

NOTE 1 Where tiles or fittings are placed into a pre-cooled chamber, it may be necessary to use ballast to achieve the specified rate of cooling.

To freeze the tiles or fittings, maintain the air temperature at (–20 ± 5) °C for 1 h 15 min ± 15 min.

To thaw the tiles or fittings, immerse the tiles or fittings in water for 1 h to 2 h immediately after the freezing phase. Maintain the final temperature of the water at (20 ± 5) °C.

NOTE 2 Interruption of the cycles may only take place at the end of the thawing phase.

Ensure that the tiles or fittings remain immersed during any interruption of the cycles. Do not exceed 96 h for each interruption. Record all interruptions that exceed 24 h.

For tiles or fittings, which have completed 25 freeze–thaw cycles, proceed as follows.

For tiles follow the steps below:

a) store the tiles for seven days at 15 °C to 30 °C and at a minimum of 30 % relative humidity;

b) on completion of a), test for impermeability in accordance with 5.7;

c) on completion of b), store the tiles for seven days at 15 °C to 30 °C and at a minimum of 30 % relative humidity;

d) on completion c), test for transverse strength in accordance with 5.6.

For fittings: inspect each fitting for breakage, separation of parts or cracks.

5.8.5 Expression of results

5.8.5.1 Tiles

Record the results of the impermeability and transverse strength tests in accordance with 5.7 and 5.6 respectively.

5.8.5.2 Fittings

Record any occurrence of breakage, separation of parts or cracks.

5.8.6 Test report

The test report shall include the following:

a) results in accordance with 5.8.5.1 or 5.8.5.2;

b) reference to this document, i.e. EN 491.

5.9 Nib support

5.9.1 Principle

Tiles are hung to determine nib support.

5.9.2 Apparatus

5.9.2.1 Wooden battens, the size of which shall be in accordance with the national fixing specifications or, if they do not exist, the manufacturer's recommendations for the type of tile to be tested.

5.9.2.2 Wooden packing piece of appropriate size to ensure correct hanging angle (see Figure 8).

5.9.2.3 Nails, screws or clips, to secure the lower tiles.

5.9.3 Procedure

Prepare a vertical surface (90°± 2°) by fixing wooden battens at the appropriate distance for the tiles to be tested, using a packing piece to ensure the correct hanging position (see Figure 8).

Hang the tiles on the battens and:

— if the tiles are laid straight bond, use a single column of tiles (see Figures 8a) and 8b)); or

— if the tiles are laid broken bond, set up the bottom (first) course with two tiles and place the test tile in the second course (see Figures 8a) and 8c)).

Secure the lower tile(s) where necessary. Place the test tile in its position without fixings.

5.9.4 Expression of results

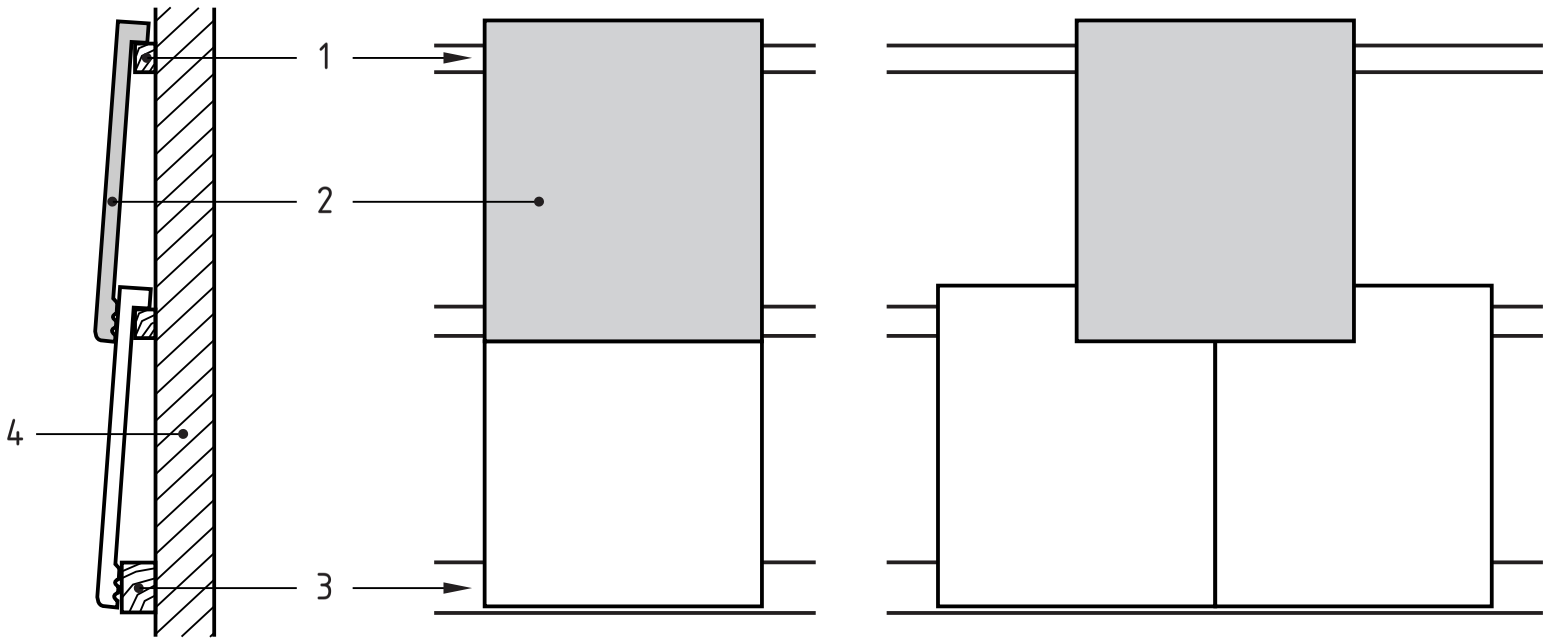
Record whether or not the tile remains in the test position without falling for at least 1 min.

5.9.5 Test report

The test report shall include the following:

a) results in accordance with 5.9.4;

b) reference to this document, i.e. EN 491.



a) Section b) Straight bond c) Broken bond

Key

1 Nib support timber batten

2 Tile test position

3 Packing piece to ensure correct hanging position

4 Vertical support

Figure 8 — Nib support

5.10 Reaction to fire performance in accordance with EN 13823

5.10.1 Principle

An agreed standard method of mounting the test specimen is provided to avoid fire penetration through the tiles at the intersection of the long and short wings of the test specimen, because of gaps in the inclined overlapping tiles.

5.10.2 Test specimen assembly

The test specimen assembly shown in Figures 9, 10 and 11 shall consist of two timber frames 1,5 m in height, forming a 90° corner. Timber frames shall be constructed using 50 mm × 50 mm timber members.

The test specimen area exposed to the burner shall have the following dimensions:

a) short wing (495 ± 5) mm × (1 500 ± 5) mm,

b) long wing (1 000 ± 5) mm × (1 500 ± 5)mm.

A non-Fire-Retarded particleboard substrate, for internal use, of thickness (12 ± 2) mm and nominal density (680 ± 50) kg/m^3, Euroclass D of EN 13501-1:2007+A1:2009 (according to EN 13238:2010) shall be nailed to the timber frames.

Vertical timber counterbattens shall be fixed to the substrate using mechanical fixings. Horizontal timber battens shall be mechanically fixed to the counterbattens. The battens shall be positioned to accommodate the manufacturer's head lap specification. Both the counterbattens and battens shall be of thickness (25 ± 1) mm and width (50 ± 1) mm. Alternatively, counterbatten and batten sizes shall be according to the tile manufacturer's recommendations provided that their combined thicknesses are not less than 40 mm.

A 75 mm × 75 mm metal angle shall be used to protect the corner joint. The angle shall extend over the height of the test specimen and be mechanically fastened to the battens at the corner. High temperature ceramic fibre blanket of density (120 ± 20) kg/m³ shall be used to fill the cavity between the metal angle and the back of the tiles. The fibres of this insulation may consist of silica (SiO_2) or of an appropriate metal silicate, e.g. alumino-silicate. Alternatively, they may be formed synthetically from appropriate refractory metal oxides, e.g. alumina, zirconia. The insulation should have a temperature classification of at least 1 100 °C (EN 1094-3:2003). The gap between the tiles abutting at the corner joint shall also be filled with high temperature ceramic fibre blanket (Figures 9 and 11). It is advisable that the insulation used has a low organic binder content, as any organic material present in the insulation may contribute to the smoke generated during the test.

Mineral wool insulation (as specified in EN 13162:2008) of density (50 ± 20) kg/m^3 and of at least Class A2-s1, d0 according to EN 13501-1:2007+A1:2009 shall be used to fill the cavity between the substrate and the calcium silicate backing board.

5.10.3 Laying the tiles in the test specimen assembly

The tiles shall be laid at their minimum headlap (as recommended by the manufacturer) and mechanically fixed onto the timber battens. Tiles shall be laid with side laps at the mean cover width.

Tiles shall be cut where necessary to fill the test frame. Single lap tiles which require to be cut in length shall be placed in the bottom row (see Figure 10).

Where the tiles are designed to be laid in broken bond only, the tiles in the specimen shall be placed with half width tiles on alternate rows at the intersection of the two wings of the test specimen, starting with half width tiles at the bottom row of each wing at the intersection.

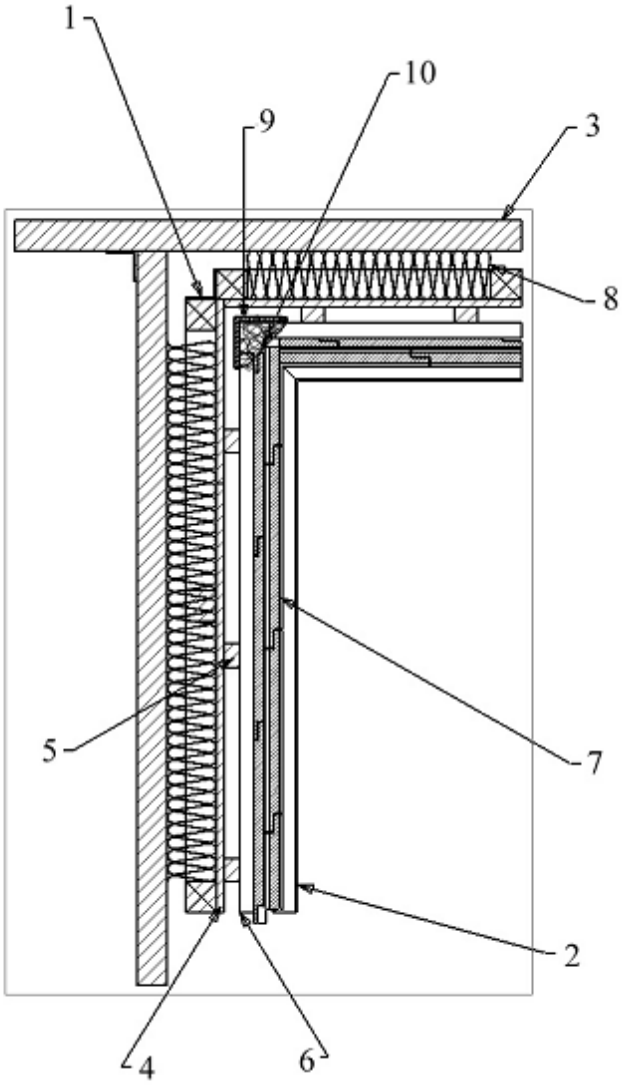
Where the tiles are designed to be laid in straight or broken bond, the tiles in the test specimen shall be laid in straight bond.

Double lap tiles laid in broken bond shall be laid to include a row of overlapping tiles at the top row, and a row of underlapping tiles in the bottom row in both wings, so as to maintain double lapping; these tiles shall be cut in length to provide the specified laps.

Profiled tiles shall be mounted in accordance with the requirements of EN 13823:2010, 5.2.2 h) including the arrangements for positioning the tile assembly in relation to the U-profile. Where the tile profile requires part of the bottom row of tiles to be cut and thereby exposing horizontal gaps, a continuous steel Z-profile cover strip shown in Figures 11 and 12 shall be provided in both wings to prevent upward fire penetration.

5.10.4 Closing the gaps between tiles at the corner of the two wings

Gaps which occur between tiles meeting at the corner of the two wings of the test specimen shall be closed to prevent fire penetration, (see Figures 9 and 11), by tightly packing with high temperature ceramic fibre blanket. The high temperature ceramic fibre blanket shall be applied progressively upwards against the metal backing angle as each row of tiles is being laid. In order to protect the ends of the battens from charring, it is permissible to extend the high temperature ceramic fibre blanket to fill the spaces between each row of tiles, and the batten faces behind the tiles, for a horizontal distance of no more than 150 mm from the corner of each wing.



Key

1	Metal profile for connecting frames	6	Timber battens
2	U-profile	7	Flat single lap tiles
3	Backing board	8	Mineral wool insulation
4	Substrate	9	Metal angle
5	Timber counterbattens	10	Compressed high temperature ceramic fibre blanket

Figure 9 — Plan section of flat single lap tiles for test

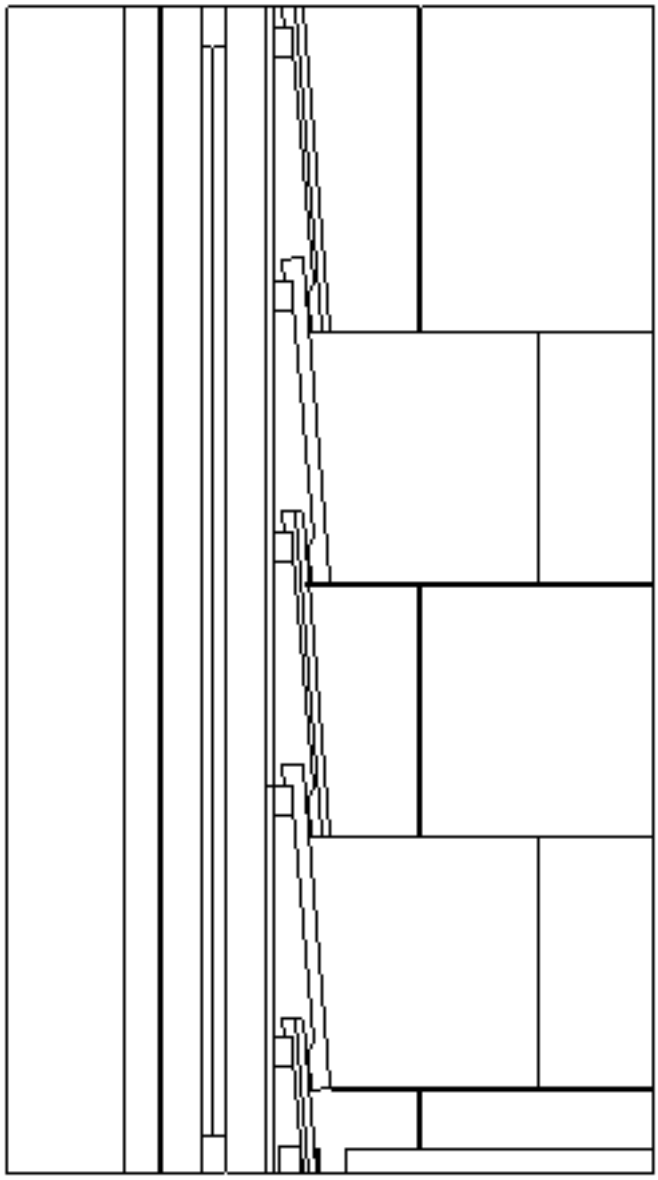
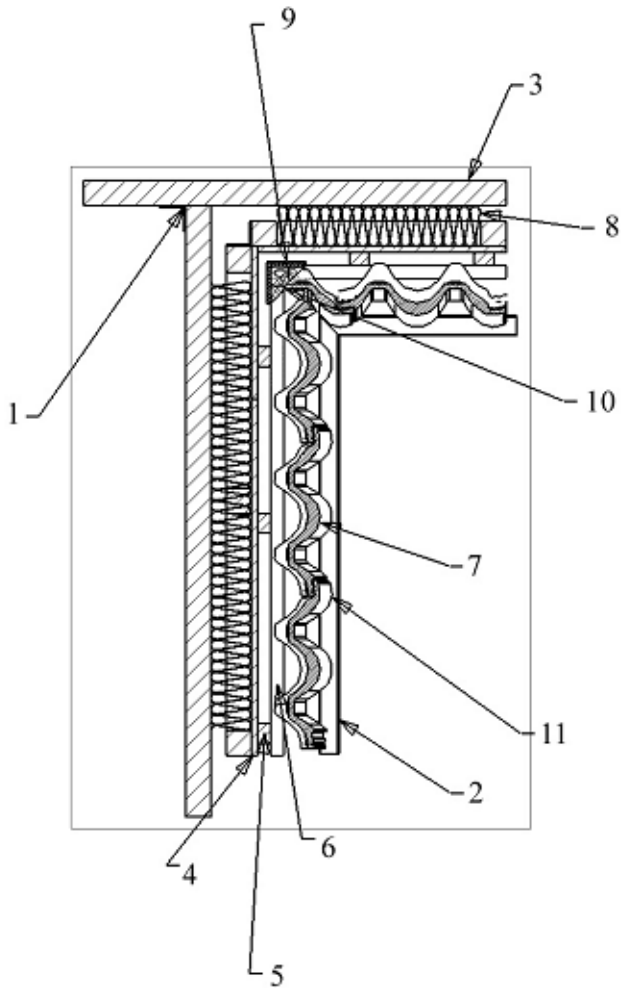


Figure 10 — Flat single lap tiles laid broken bond

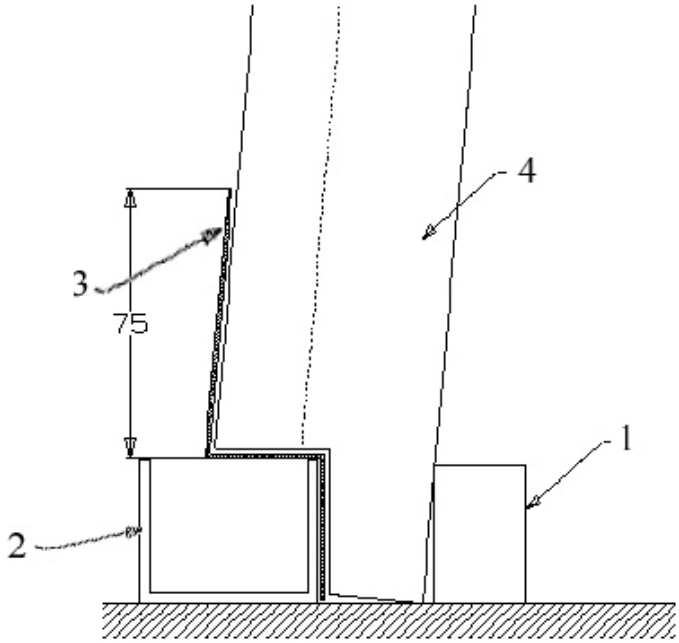


Key

1 Metal profile for connecting frames
2 U-profile
3 Backing board
4 Substrate
5 Timber counterbattens
6 Timber battens
7 Profiled concrete tiles
8 Mineral wool insulation
9 Metal angle
10 Compressed high temperature ceramic fibre blanket
11 Continuous steel Z-profile cover strip (see Figure 12)

Figure 11 — Plan section of deep profiled tiles for test

Dimensions in mm



Key

1	Positioning batten	3	Continuous steel Z-profile cover strip
2	U-profile	4	Tile

Figure 12 — Steel Z-profile cover strip to prevent upward fire penetration

Bibliography

[1] EN 1094-3:2003, *Insulating refractory products — Part 3: Classification of insulating products made from ceramic fibres*

[2] ISO 7619-1, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 1: Durometer method (Shore hardness)*.

[3] ISO 7619-2, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 2: IRHD pocket meter method*

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