DD CEN/TS 1187:2012

BSI Standards Publication

Test methods for external fire exposure to roofs

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National foreword

This Draft for Development is the UK implementation of CEN/TS 1187:2012. It supersedes DDENV1187:2002 which is withdrawn.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature. It should be applied on this provisional basis, so that information and experience of its practical application can be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the international organization responsible for its conversion to an international standard. A review of this publication will be initiated not later than 3 years after its publication by the international organization so that a decision can be taken on its status. Notification of the start of the review period will be made in an announcement in the appropriate issue of *Update Standards.*

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into an international Standard, to extend the life of the Technical Specification or to withdraw it. Comments should be sent to the Secretary of the responsible BSI Technical Committee at British Standards House, 389 Chiswick High Road, London W4 4AL.

The UK participation in its preparation was entrusted to Technical Committee FSH/22/-/8, Fire resistance tests for external fire exposure for roofs.

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

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English Version

Test methods for external fire exposure to roofs

Méthodes d'essai pour l'exposition des toitures à un feu extérieur

Prüfverfahren zur Beanspruchung von Bedachungen durch Feuer von außen

This Technical Specification (CEN/TS) was approved by CEN on 23 August 2011 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 document (CEN/TS 1187:2012) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

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 ENV 1187:2002.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, 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, Turkey and the United Kingdom.

Introduction

The first mandate given to CEN/TC 127 on fire resistance testing (Mandate No. 117) in support of the Construction Products Directive required two test methods for external fire exposure to roofs. One test method was to include the effect of a burning brand, the other was to include the effect of a burning brand together with wind and supplementary radiant heat. These two draft methods were circulated for the CEN 6-month enquiry, but many countries did not support the two and several countries requested that only one method should be prepared by CEN.

The topic was referred to the EC Fire Regulators' Group. Discussions took place in both the Fire Regulators' Group and the Standing Committee on Construction, and in April 1997 CEN/TC 127 was requested to produce a standard incorporating the two existing draft methods and the Nordtest method.

The Standing Committee accepted this as a short-term solution and strongly expressed the view that a truly harmonised test procedure should be developed in the long term, i.e. a single test procedure for this characteristic.

Realizing that the three test method document (ENV 1187:2002 dated May 2002) and the Amendment A1 (ENV 1187:2002/A1 dated August 2005) did not have the same time scale, it was decided to consider all four methods under the same procedure.

This Technical Specification will be followed by a single test procedure required by the European Commission.

CAUTION — The attention of all persons concerned with managing and carrying out these tests is drawn to the fact that fire testing can be hazardous and that there is a possibility that toxic and/or harmful smoke and gases can be evolved during the test.

An assessment of all potential hazards and risks to health should be made and safety precautions should be identified and provided. Written safety instructions should be issued. Appropriate training should be given to all relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

1 Scope

This Technical Specification specifies four methods for determining the performance of roofs to external fire exposure. The four methods assess the performance of roofs under the following conditions:

a) test 1 – with burning brands;

b) test 2 – with burning brands and wind;

c) test 3 – with burning brands, wind and supplementary radiant heat;

d) test 4 – with two stages incorporating burning brands, wind and supplementary radiant heat.

The tests assess the fire spread across the external surface of the roof, the fire spread within the roof (tests 1, 2 and 3), the fire penetration (tests 1, 3 and 4) and the production of flaming droplets or debris falling from the underside of the roof or from the exposed surface (tests 1, 3 and 4).

Tests 2 and 3 are not applicable to geometrically irregular roofs or roof mounted appliances, e.g. ventilators and roof lights.

NOTE The four tests listed above do not imply any ranking order. Each test stands on its own without the possibility to substitute or exchange one for another.

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 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 13501-5:2005+A1:2009, *Fire classification of construction products and building elements — Part 5: Classification using data from external fire exposure to roofs tests*

EN ISO 13943:2010, *Fire safety — Vocabulary (ISO 13943:2008)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 13943:2000 and the following apply.

3.1
roof
covering and sealing system including any insulating layers or vapour barriers normally provided together with their supporting elements including attachment (glued, mechanically fastened, etc.), and roof lights or other closures for roof apertures that are intended to provide a weatherproof surface

3.2
material
basic single substance or uniformly dispersed mixture of substances (e.g. metal, stone, wood, bitumen, concrete, mineral wool)

3.3
damaged material

3.3.1
damaged material including melting
material that has been burnt, charred, melted or otherwise visually changed by heat

NOTE Discolouration and soot deposits should not be regarded as damage. Areas of the roof covering surface in which combustion has not occurred should not be regarded as damaged (e.g. areas which have only become shiny or only have tiny occasional holes or bubbles).

3.3.2
damaged material not including melting
material that has been burnt or otherwise visually changed by heat, excluding melting

NOTE Discolouration and soot deposits should not be regarded as damage. Areas of the roof covering which have only become shiny or only have tiny occasional holes or bubbles should not be regarded as damaged.

3.4
burnt material
material that has been destroyed by combustion or pyrolysis

3.5
composite
combination of materials which is generally recognized in building construction as a discrete entity

EXAMPLE Coated or laminated products such as roofing felts.

3.6
assembly
fabrication of materials and/or composites

EXAMPLE Sandwich panels.

3.7
product
material, composite or assembly about which information is required

3.8
specimen
representative section of the roof/roof covering prepared for the purpose of the test

3.9
continuous deck
element with a continuous supporting function in which the gap between adjacent elements is not greater than 0,5 mm ((5,0 ± 0,5) mm in the case of wooden planks with plain edges)

3.10
exposed surface
external surface of the specimen which is subject to the heating conditions of the test

3.11
measuring zone
area of the specimen within which measurements are made

3.12
underside
bottom surface of the specimen

3.13
sustained flaming
flames arising from an observed location, which persist for 5 s or longer

3.14
external fire spread
progression and extent of sustained flaming across the exposed surface of the specimen

3.15
fire penetration
appearance on the underside of the specimen of any sustained flaming or glowing due to combustion including the occurrence of any flaming droplets falling from the underside

NOTE Charring and/or discolouration should not be regarded as fire penetration (for test 1 and test 3).

3.16
opening
appearance during the test of any hole greater than 25 mm^2 in area or any crack greater than 2 mm wide, which penetrates completely through the specimen and which would allow burning material to fall through the roof

3.17
internal damage
extent of damaged material in each layer inside the specimen, measured from the edges of the projection of the ignition source in the upwards and downwards directions with respect to the pitch of the roof

3.18
fire spread within the roof
internal fire spread
maximum burnt length measured from the upper edge of the projection of the ignition source in the upward direction and from the lower edge in the downward direction of each layer for sloped roofs, and in any direction for horizontal roofs

NOTE See 4.8.1.

3.19
flaming droplets or debris
burning material falling from the specimen that continues to burn on the floor for at least 5 s

3.20
joint
kind of connection or link within a layer in the roof, such as overlap or seams

3.21
roof covering
uppermost layer of a roof

NOTE This layer can comprise single layer or multiple layer coverings.

3.22
damaged length
length of damaged material of the roof covering and the substrate respectively, expressed in millimetres as measured from the centre of the wood crib position (for test 2)

3.23
substrate
product which is used immediately beneath the roof covering, about which information is required (for test 2)

3.24
roof pitch
inclination of the roof surface to the horizontal

3.25
non-combustible product
product which satisfies reaction to fire class A1 or A2-s1,d0 according to EN 13501-1:2007+A1:2009

3.26
combustible product
product not satisfying the definition of non-combustible product

3.27
penetration by fire
appearance on the underside of the specimen of any flaming or glowing other than that of the test flame, disregarding any test flame appearing through pre-existing openings in the test specimen (for test 4)

4 Test 1: Method with burning brands

4.1 Test equipment

4.1.1 Basket, as shown in Figure 1.

The basket shall be made from 3 mm diameter mild steel wire forming a mesh of approximately 50 mm × 50 mm. The basket shall be open at the top and bottom and have four projecting feet 10 mm long, one at each corner. The outer dimensions of the basket shall be 300 mm × 300 mm × 200 mm deep. The mass of the basket shall be (650 ± 50) g.

4.1.2 Wood wool.

Wood wool shall consist of fibres approximately 2 mm wide × 0,2 mm to 0,3 mm thick and be manufactured from softwood, e.g. spruce, pine or fir.

4.1.3 Balance.

The balance is used to weigh the wood wool. It shall have a nominal capacity of at least 2 kg and an accuracy of ± 1 g.

4.1.4 Timing device.

A timing device with an accuracy of ± 5 s over 24 h shall be used.

4.2 Calibration

Each new batch of wood wool shall be checked by carrying out a control test as follows: A sample of calcium silicate board as described in 4.4.2.2, c), measuring 1 m × 1 m shall be supported horizontally at a height of about 1 m above the floor. A basket filled with conditioned wood wool as described in 4.5.1 and 4.7.1 shall be placed at the centre of the board and ignited as described in 4.7.3. The burning time shall be measured from the commencement of ignition until the final flame extinguishes.

Three separate tests shall be carried out. The calcium silicate board used shall be cooled down between the tests. If the range of the burning times recorded is greater than 2 min, a further three tests shall be conducted. The mean burning time for all performed tests shall be calculated and shall lie within the range of 4 min to 5 min.

4.3 Test conditions (roof pitch)

Roofs intended to be installed with pitches up to 20° in practice shall be tested at a pitch of 15°. Roofs intended to be installed with pitches greater than 20° shall be tested at a pitch of 45°.

In special cases (e.g. where proof for a specific type of roof is to be provided), by way of departure from the specifications regarding roof pitches, verification of the resistance of a roof to burning brands may also be carried out by testing at the actual intended roof pitch. The test results so obtained shall then be valid only for the roof pitch tested.

4.4 Test specimen

4.4.1 General

Four specimens with minimum dimensions 0,8 m in width × 1,8 m in length shall be prepared under appropriate supervision by the laboratory for each roof pitch to be tested.

Roof lights shall be tested in the original size, with a waterproofing system attached as in practice.

The specimens shall be representative, in all details of practical application (except for the standard supporting deck), with regard to both the support, and the type and number of layers of roofing materials (including any insulation, vapour barriers, etc.), and with regard to the joining of those layers. An example specimen section is shown in Figure 2.

Joints have to be provided in the several layers forming the specimen. The positioning of the joints shall follow 4.4.3.

4.4.2 Selection of standard supporting decks

4.4.2.1 General

When the product being evaluated is a roof covering system intended for general application over a variety of decks (see 4.10), the test deck shall be selected in accordance with either 4.4.2.2, b) or 4.4.2.2, c).

4.4.2.2 Roof coverings intended to be installed over continuous decks

a) In the case of roof coverings intended to be installed over a continuous deck which is not profiled, a roof deck in accordance with either 4.4.2.2, b) or 4.4.2.2, c) shall be used. If the materials are to be laid over a profiled steel deck, then a trapezoidal profiled steel deck, in accordance with 4.4.2.2, d) shall be used.

b) If it is intended to simulate a wooden continuous deck with a gap not exceeding 0,5 mm, the wood particle board deck shall be constructed from planks 250 mm wide × 16 mm thick running parallel to the eaves with plain edges and tightly butt jointed so that the gaps between planks do not exceed 0,5 mm.

   If it is intended to simulate a deck made of narrow solid wood planks, the gaps between the particle board panels shall be (5,0 ± 0,5) mm.

   The wood particle board shall consist of wood particles bonded with polymer adhesive (e.g. ureaformaldehyde); it shall have a density of (680 ± 50) kg/m^3 and shall not be treated with fire retardants.

c) If roofing materials are intended to be laid only on continuous, non combustible deck with a minimum thickness of 10 mm, then the deck shall consists of a (11 ± 2) mm thick reinforced calcium silicate board, density (870 ± 50) kg/m^3 (EN 13238:2010, 5.3, Table 1).

d) The trapezoidal profiled steel deck shall have the width of the crown approximately equal to 50 % of the pitch and a trough depth of approximately 100 mm. The corrugations shall run parallel to the eaves and be open at the ends.

4.4.2.3 Roof coverings intended to be installed without a continuous deck

The spacing of roof supports of any type shall be in accordance with the maximum permissible spans proposed by the manufacturer for the particular application but not exceeding the minimum dimensions prescribed for the specimen in 4.4.1.

4.4.3 Positioning of joints

4.4.3.1 Specimen types

The five types are illustrated in Figure 3.

Type 1: Single central joint in the top layer parallel to the roof pitch. No joints are required in any other layer (including insulation).

Type 2: Single joint in the top layer at 90° to the roof pitch 100 mm above the lower edge of the basket. No joints are required in any other weathering layer. A single central joint in the insulation parallel to the roof pitch shall be provided, where applicable (see Table 1). The joint shall extend from 100 mm below the lower edge of the basket to 800 mm above the upper edge of the basket.

Type 3: No joint is required in any of the weathering layers. A single central joint in the insulation parallel to the roof pitch shall be provided, where applicable.

Type 4: A single central joint in the weathering layer parallel to the roof pitch next to the insulation. No joints are required in any other layer (including insulation).

Type 5: A single central joint in the weathering layer parallel to the roof pitch next to the top layer. No joints are required in any other layer (including insulation).

Where there are overlapping layers, the position of the joints shall be considered to be the edge of the upper layer.

4.4.3.2 Types to be tested

According to the different compositions of roofs, test specimens described in Table 1 shall be tested.

Table 1 — Test specimens

	Specimen type			
Roof covering	**1st spec.**	**2nd spec.**	**3rd spec.**	**4th spec.**
three or more layers	1	2	4	5
two layers	1	2	3	4
one layer	1	2	3	3

Where the dimensions of the elements of any of the layers are such that it requires more than four pieces to cover the specimen, or if any of the layers are jointless, then the specimens shall be fabricated in such a way

that those layers are representative. In the first instance, at least one joint in the layer(s) concerned shall be located underneath the basket.

4.4.4 Edge detailing

No special measures shall be taken by the sponsor to protect the edge of the specimen.

4.5 Conditioning

4.5.1 Wood wool

Before being stored, any compressed wood wool shall be loosened by pulling apart, but not to the extent that the fibres are separated. Large pieces of unshredded wood shall be removed.

The wood wool shall not be selected for tests until the stabilized moisture content of a representative sample lies within the range of 8 % to 12 % of the dry mass. This shall be determined by drying a 10 g to 20 g sample in an oven at (105 ± 5) °C to constant mass. Wood wool used for this moisture content determination shall not be used for the test.

A suitable amount of wood wool selected for the test shall be stored for at least 12 h in a room at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

The wood wool shall not be exposed to a different atmosphere for a period of more than 1 h before the test is carried out.

4.5.2 Test specimen

At the time of test, the test specimen shall be in equilibrium with the laboratory environment.

If the materials involved are likely to absorb or contain a significant amount of moisture (liable to influence the test results), then extra care shall be exercised to ensure that the specimen is at this stable equilibrium. The moisture content of these materials shall be measured and recorded at the time of test. Special samples may be used for moisture content determination and may be conditioned with the test specimens. These special samples shall be fabricated so as to represent the loss of water vapour from the specimen by having similar thicknesses and exposed faces.

NOTE Normally the test specimen should be stored in the laboratory environment for at least 12 h before the start of the test.

4.6 Test environment

Testing shall be carried out in a draught-free area, in an enclosure of not less than 150 m^3 in volume. The lower edge of the top surface of the specimen shall be (0,75 ± 0,25) m above the laboratory floor. The temperature in the enclosure shall be (20 ± 10) °C prior to the fire test.

NOTE An exhaust hood can be fitted above the specimen provided it does not create a draught over the specimen.

4.7 Test procedure

4.7.1 Filling the basket

Wood wool specified in 4.1.2 and conditioned in accordance with 4.5.1 shall be uniformly pressed into the wire frame basket, in at least six layers, until the mass of wood wool in the basket is (600 ± 10) g. The packed volume of the wood wool shall correspond to the internal dimensions of the basket, excluding the feet.

4.7.2 Positioning of the brand

4.7.2.1 The basket filled with wood wool (the brand), shall be suspended with its base (excluding the feet) parallel to the nominal slope of the specimen 10 mm from the surface of the specimen so that this position is maintained throughout the test. On a curved surface the centre of the base of the basket shall be 10 mm above the surface.

In cases where the weight of the basket will not affect the deformation of the roof or roof covering during the test, the basket may be placed directly on the roof surface. Any device used to retain the basket shall not interfere with the burning behaviour of the wood wool.

The brand shall be placed in accordance with Figure 4.

4.7.2.2 Roof lights shall be tested with the basket placed in turn at:

a) the upper edge of the roof light, where the slope is smallest (see position **a**, Figure 5);

b) the centre of the roof light (see position **b**, Figure 5);

c) the lower edge of the roof light, where the slope is greatest (see position **c**, Figure 5);

d) on the waterproofing attached to the lower side of the roof light and as close as possible to the upstand of the roof light (see position **d**, Figure 5).

If the roof light consists of several segments joined together, the basket shall be positioned over the joint closest to the centre in one of the tests.

A new specimen shall be used for each test if interference could exist between successive tests.

4.7.3 Start of the test

For each fire test, the brand shall be positioned on the specimen before ignition. The wood wool shall be ignited with a small gas burner along the bottom of all four sides within a period of 10 s, commencing with the upper side. The timing device shall be started at the commencement of the ignition of the wood wool.

4.7.4 End of the test

The duration of the test is 60 min, measured from the commencement of the ignition of the wood wool, unless a longer test duration is requested by the sponsor. Surface flames still existing 30 min after the start of the test shall be extinguished e.g. by applying a fire blanket, gaseous extinguishing agent, etc., taking care not to influence any internal constructions. At the end of the test, the roof shall be opened and checked for non-flaming fire propagation (glowing combustion) and any penetration. The result shall be reported, including the time at which the roof was opened.

A test may be terminated earlier, if:

a) evidently there is no occurrence of fire (flames, glowing combustion, smoke);

b) the flames reached an edge of the sample;

c) penetration occurs; or

d) there is a risk to safety of personnel or impending damage to equipment.

4.8 Observations and measurements

4.8.1 General

The classification criteria are provided in EN 13501-5:2005+A1:2009, Table 1. Observations and measurements related to the classification criteria shall be undertaken during and/or after the test.

During and/or after the test, the following parameters (see 4.8.2 to 4.8.4) shall be observed, measured and recorded. Dimensions shall be measured in millimetres.

Progress of sustained flaming shall be estimated with respect to the base of the flame, in contact with the exposed surface, and not with respect to the flame envelope.

If the roof is a flat roof with a pitch of zero degrees, then the relevant flame spread is that in any direction. This is determined by reference to concentric circles using the centre of the basket as a nominal origin. In such cases, if the maximum radius of spread is L mm, the result shall be expressed as (L − 150) mm, as an approximation to the distance of fire spread.

4.8.2 External fire spread

4.8.2.1 The time when the sustained flaming has progressed upwards 100 mm, 300 mm, 500 mm and 700 mm from the upper edge of the projection of the brand onto the exposed specimen surface and when reaching the upper edge of the measuring zone, as defined in 3.11 and Figure 4.

4.8.2.2 The time when the sustained flaming has progressed downwards 100 mm, 300 mm and 500 mm from the lower edge of the projection of the brand onto the exposed specimen surface and when reaching the lower edge of the measuring zone, as defined in 3.11 and Figure 4.

4.8.2.3 The time of occurrence and description of any burning material (flaming droplets or debris) falling from the exposed surface, as defined in 3.19.

4.8.2.4 The extent during the test of the external fire spread upwards and downwards, as defined in 3.14, expressed as the maximum burnt length from the edges of the projection of the brand onto the exposed surface, measured at the end of the test.

4.8.3 Fire penetration and openings

4.8.3.1 The time and nature of fire penetration, if this has occurred, as defined in 3.15.

4.8.3.2 The time of occurrence and description of any burning material (flaming droplets or debris) falling from the visible underside of the specimen, as defined in 3.19.

4.8.3.3 The time of occurrence of openings and their dimensions, as defined in 3.16.

4.8.4 Damage

4.8.4.1 The extent and nature of internal damage upwards and downwards, measured after the test from the edges of the projection of the brand, as defined in 3.17 and amended by 3.3.2.

4.8.4.2 The maximum length of burnt material upwards and downwards in each layer, measured after the test from the edges of the projection of the brand, as defined in 3.18 and 3.4.

4.8.4.3 The extent of internal damage, as defined in 3.17 and amended by 3.3.2.

4.9 Test report

The report shall provide all the information relevant to the selected procedures, the products tested and the results obtained. Photographs are strongly recommended to illustrate the test results.

The test report shall include the following:

a) reference to this test method TS 1187 test 1;

b) the name of the test laboratory, the address where the test has been performed, and the date of the test;

c) the names of the sponsor, the product and the manufacturer of the specimen and its component parts, if known. If unknown, this shall be stated;

d) a statement concerning the degree of supervision exercised by the laboratory during specimen fabrication. If there was no supervision, this shall be mentioned in the report, together with the reason why this requirement was not complied with;

e) a full description of the product tested with a description of the test roof deck. This shall include the method of attaching the roof covering (nails, fixings, spacing, adhesives, etc.), the density or mass per unit area of materials and, where applicable, moisture content of the materials used. Building material classes (e.g. with reference to standards), the nature and quantity of adhesives or their rate of application may also be necessary to define the product uniquely;

f) description of any actions taken to prevent the flames passing around the edges. If no actions were taken, this shall be stated;

g) for each tested specimen, information concerning:

    1) the roof pitch;

    2) the room temperature at the beginning of the test, in degrees Celsius;

h) for each tested specimen observations recorded on its behaviour during and after the test including:

    1) external fire spread, expressed by the time of occurrence, in minutes and seconds, and description where applicable:

        i) for the fire to spread distances of 100 mm, 300 mm, 500 mm and 700 mm, and to the edge of the measuring zone, in an upwards direction (see 4.8.2.4);

        ii) for the fire to spread distances of 100 mm, 300 mm and 500 mm, and to the edge of the measuring zone, in a downwards direction (see 4.8.2.4);

        iii) whether the fire spreads laterally to the edges of the measurement zone;

        iv) any falling flaming materials (see 3.19) from the surface of the roof;

        v) the burnt length upwards and downwards (see 4.8.2.4);

        vi) the damaged area;

        vii) the maximum radius of fire spread on horizontal roofs;

    2) fire penetration, expressed by the time of occurrence in minutes and seconds and description:

        i) any falling flaming materials (see 3.19) from the underside of the specimen;

ii) openings (see 3.16) formed;

iii) any fire penetration (see 3.15) if it occurs;

3) damage:

i) non-flaming propagation (smouldering or glowing combustion) in any layer;

ii) the extent of internal damage (see 3.17) upwards and downwards;

iii) the maximum length of burnt material (see 3.4) upwards and downwards in each layer;

iv) the damaged area;

4) time at which the test is terminated and the cause of the termination (see 4.7.4);

NOTE For classification purposes, not all measurements taken might be needed but they can be useful for the extension of the field of application, direct or extended.

5) time at which the test specimen was opened (see 4.7.4);

6) the range of roof pitches for which the product has been evaluated and the types of deck for which the report is valid (see 4.10).

4.10 Direct field of application of test results

4.10.1 Roof pitch

Test results obtained at 15° apply to roofs with pitches < 20°.

Test results obtained at 45° apply to roofs with pitches ≥ 20°.

Test results obtained at a single specified roof pitch other than 15° or 45° apply to roofs for that pitch only.

4.10.2 Nature of the deck

4.10.2.1 Test with standard supporting decks

Test results obtained with standard supporting decks shall apply to all systems with the same components (including the thicknesses) installed in the same way, but with different decks as follows.

a) Test results obtained with a wood particle board deck as defined in 4.4.2.2, b) with gaps between planks not exceeding 0,5 mm shall apply to:

1) any wooden continuous deck with a minimum thickness of 16 mm and with gaps not exceeding 0,5 mm;

2) any non-combustible continuous deck with a minimum thickness of 10 mm.

b) Test results obtained with a wood particle board deck as defined in 4.4.2.2, b) with gaps of (5,0 ± 0,5) mm between planks, shall apply to:

1) any wooden continuous deck (see 3.7);

2) any non-combustible deck with gaps not exceeding 5 mm (including non-perforated steel deck).

c) Test results obtained with a reinforced calcium silicate board as described in 4.4.2.2, c) shall apply to any non-combustible continuous deck with a minimum thickness of 10 mm.

d) Test results obtained with a trapezoidal profiled steel deck as defined in 4.4.2.2, d) apply to:

1) any profiled and non perforated steel deck;

2) any non-combustible continuous deck with a minimum thickness of 10 mm.

4.10.2.2 Test with alternative supporting deck

Test results obtained with an alternative supporting deck shall apply only to that roof system (i.e. the constitution, materials, dimensions of components, thickness etc. are identical).

5 Test 2: Method with burning brands and wind

5.1 Test equipment

5.1.1 Air channels, equipped with fans.

The equipment shall be built according to Figure 6 to Figure 11. The dimensions given are nominal unless tolerances are given. The air channels shall be made of 1,0 mm thick steel plates. The wall channel section placed between the lower and the upper air channels shall be made of steel plates and non-combustible fibre reinforced calcium silicate boards with a thickness of (11 ± 2) mm and a density of (680 ± 50) kg/m^3. A lid, which is hinged to the lower end of the upper air channel, covers the top of this wall channel section (Figure 10). The wall channel section may be firmly mounted between the channels or removable as long as it is assured that the upper surface of the test specimen can be mounted well in contact with the underside of the bottom of the lower and upper air channels.

The lower air channel shall be built according to Figure 7 to Figure 9. No flexible material is allowed in the connections. The connection between the fan and the channel shall be equipped with a perforated steel plate in the upper half of the opening and a steel plate without perforation in the lower half of the opening. A corrugated perforated steel plate shall be mounted in the lower air channel according to Figure 7 and Figure 9. The fan shall be of the centrifugal type and have a single air-inlet. The blades of the fan shall be backward curved. The wheel diameter shall be 280 mm. The outlet of the fan shall have dimensions to fit the inlet dimensions of the lower air channel shown in Figure 7. The fan shall be speed controlled.

The upper air channel shall be connected to the exhaust system in such a way that the air velocity in the narrow pass (Figure 11) can be kept according to 5.2.1.1.

There shall be arrangements for applying and securing the test specimen in its test position under the air channels (no. 2 in Figure 6). This can be made by means of a sliding platform and pneumatic lifts. A non-combustible fibre reinforced calcium silicate board with a thickness of (11 ± 2) mm and a density of (680 ± 50) kg/m^3 shall be placed under the test specimen when the substrate is an insulating material such as expanded polystyrene (EPS) or mineral wool.

There shall be a closable lid on the air inlet channel (no. 4 in Figure 6). The channel may be equipped with a sound damper.

5.1.2 Crib ignition stand.

The crib ignition stand (see Figure 12) consists of a support for the wood crib and a line burner with five vertically oriented burner tubes. The line burner is mounted centrally on the support with the axes of the burner tubes and the lowest edge of the crib in the same plane. The distance from the top of the burner tubes to the lowest edge of the crib is 30 mm. The crib ignition stand shall be protected from air currents. This can be achieved by the use of a shield in the form of a box 600 mm square and with a height of 700 mm with an open top. The front side consists of a threshold 100 mm high. The ignition stand shall be placed centrally in

the bottom of the box. Alternatively, the crib ignition stand may be placed in a fume cupboard according to similar principles.

5.1.3 Wood crib.

The source of fire is a wood crib made of eight pieces of pine wood containing no knots and having the dimensions of 10 mm × 10 mm and a length of 100 mm. Six of these pieces of wood are nailed to the remaining two pieces at a distance of 8 mm between each of them. The nailing shall be done from the underside of the crib only (see Figure 12). Steel nails with a diameter of 1,0 mm and a length of 15 mm are suitable. The overall dimensions of the crib will then be 100 mm × 100 mm.

5.1.4 Oven.

An oven is used to dry the wood cribs. It shall be ventilated and capable of maintaining a constant temperature of (105 ± 5) °C.

5.1.5 Desiccator.

The desiccator is used for storing the dried wood cribs.

5.1.6 Balance.

The balance is used to weigh the wood cribs. It shall have a nominal capacity of at least 100 g and an accuracy of ± 0,1g.

5.1.7 Timing device.

A stopwatch with an accuracy of ± 1 s/h is used.

5.1.8 Air velocity measuring devices.

A vane-wheel anemometer and a hot-wire anemometer or a pitot tube are used for measuring air velocities.

The vane-wheel anemometer shall have an accuracy of ± 0,1 m/s at a velocity of 2 m/s and ± 0,2 m/s at a velocity of 4 m/s. The diameter of the vane-wheel shall be 100 mm.

The hot-wire anemometer and the pitot tube shall have an accuracy of ± 0,2 m/s at a velocity of 6 m/s.

5.1.9 Flow meter.

The propane consumption of the line burner in the crib ignition stand shall be measured with a flow meter. This shall have an accuracy of ± 3 %.

5.2 Calibration

5.2.1 Air velocity

5.2.1.1 Basic calibration

The basic calibration shall be carried out following the installation of the apparatus and whenever changes occur which could affect the performance of the apparatus.

a) With the dummy specimen (see 5.2.1.1, b)) properly inserted in the specimen holder (see 5.7.1), with the lid (see Figure 10) closed and with the apparatus running and properly adjusted in accordance with 5.2.1.2 the air velocity on the dummy specimen as measured with the vane wheel anemometer (see 5.2.1.2,a)) in the direction of the flow shall be within the limits given in Table 2 and Table 3. The air velocity at the central line of the narrow pass (60 ± 2) mm in the upper air channel (see 5.2.1.2, a)) shall be (6,0 ± 0,5) m/s. Furthermore the air velocities shall be verified with the hot-wire anemometer mounted

through the left and right anemometer probe insertion holes, respectively. These are located in the bottom of the channel.

Table 2 — Allowed deviation from nominal air velocity at 2,0 m/s

Lengthwise position (see 5.2.1.1, b))	**Allowed deviation** m/s	
	At centre line	**At lines 100 mm from centre line**
S0	± 0,1	± 0,1
S500	± 0,1	± 0,2
S800	± 0,2	± 0,3

Table 3 — Allowed deviation from nominal air velocity at 4,0 m/s

Lengthwise position (see 5.2.1.1, b))	**Allowed deviation** m/s	
	At centre line	**At lines 100 mm from centre line**
S0	± 0,1	± 0,1
S500	± 0,3	± 0,5
S800	± 0,6	± 1,0

b) A dummy specimen shall be made of an ordinary particleboard with a thickness of (19 ± 2) mm and density of (680 ± 50) kg/m^3 at normal conditioning atmosphere (see 5.5.2) and cut to the size of the test specimen (400 mm × 1 000 mm). It shall be plane and marked at the following points along the centre line and along longitudinal lines on each side of and 100 mm from the centre line.

1) S0: 100 mm from the bottom edge;

2) S500: 600 mm from the bottom edge;

3) S800: 900 mm from the bottom edge.

5.2.1.2 Calibration prior to testing

The following calibration procedure shall be done daily or more frequently if necessary. The actual specimen shall be properly inserted (see 5.7.1) and both fans shall be running.

a) Calibration for testing at an air velocity of 2 m/s:

Adjust the air velocity above the specimen surface and in the air channel.

Step 1: Measure the air velocity above the specimen in the direction of the flow with the vane-wheel anemometer (see 5.1.8) at the point where the centre of the wooden crib is to be placed (see 5.7.6). The measured air velocity shall be (2,0 ± 0,1) m/s.

Step 2: Measure the air velocity in the upper air channel in the direction of the flow with the hot-wire anemometer or with the pitot tube (see 5.1.8) at the central point of the (60 ± 2) mm narrow pass of the upper air channel. The probe is inserted through a hole in the bottom of the upper air channel. The measured air velocity shall be (6,0 ± 0,5) m/s.

Step 3: Adjust the air velocity and repeat steps 1 and 2 until further adjustments are no longer necessary.

b) Calibration for testing at an air velocity of 4 m/s:

Step 4: First, ensure that the procedure in a) is followed. Adjust the air velocity above the specimen and in the air channel. Then measure the air velocity above the specimen in the direction of the flow with the vane-wheel anemometer (see 5.1.8) at the point where the centre of the wooden crib is to be placed (see 5.7.6). The measured air velocity shall be (4,0 ± 0,1) m/s.

5.2.2 Propane supply

The rate of propane supply to the line burner of the crib ignition stand shall be (145 ± 10) g/h (1,3 l/min at 101 kPa and 20 °C). Propane having a purity of at least 95 % shall be used. The air supply through the holes in the burner tubes shall not be restricted. The blue flames with small yellow tips thus obtained shall be equal and approximately 120 mm high as measured from the top of the burner tubes.

5.2.3 Mechanical alignment

The following shall be carried out following installation of the apparatus and at all other times as necessary.

a) Lower air channel

The level near the outlet of the channel is verified crosswise and lengthwise, and necessary adjustments are carried out.

b) Specimen holder

The dummy specimen is inserted, and the level and the roof pitch (30°) are verified crosswise and lengthwise, respectively. Necessary adjustments are carried out.

c) Upper air channel

The height of the narrow pass located in the upper air channel approximately 2 000 mm from the lower edge of the specimen is verified. The height shall be (60 ± 2) mm, and the measurements of the height are done at the three anemometer probe insertion holes in the bottom of the channel.

5.3 Test conditions

The specimen is mounted at a roof pitch of 30° to the horizontal plane, and a forced airflow is passing over the exposed surface. A burning wood crib is placed on the surface of the specimen.

5.4 Test specimen

5.4.1 Sampling

The sample of the product to be tested shall be sufficiently large to be representative of the bulk product, particularly in the case of non-homogeneous products.

A product amount for at least ten tests should be available, each test requiring one specimen.

5.4.2 Preparation of test specimens

5.4.2.1 Specimens shall be rectangular with the dimensions of 400 mm × 1 000 mm.

5.4.2.2 The specimens are normally prepared by attaching the product to a standard substrate.

Standard substrates are:

a) Combustible but not treated with fire retardant

Wood particle board of density (680 ± 50) kg/m^3 and thickness (19 ± 2) mm or expanded polystyrene (EPS) of density of (20 ± 5) kg/m^3 and thickness (50 ± 10) mm.

b) Non-combustible

Fibre reinforced calcium silicate board of density (680 ± 50) kg/m^3 and thickness (10 ± 2) mm or mineral wool of density (150 ± 20) kg/m^3 and thickness (50 ± 10) mm.

The specimen may also be tested on a non-standard substrate, in which case the results are valid for that substrate only (see 5.10.4).

5.4.2.3 The specimens shall as far as possible conform to the end use of the product (see 5.4.2.4).

5.4.2.4 The product shall be attached to the substrate (e.g. glueing, nailing) in accordance with the directions given by the sponsor.

If in practice the substrate is made of any material other than wood (e.g. concrete, cellular plastic, cork) the product shall be attached to this substrate according to the directions given by the sponsor.

For roof coverings, which in practice are built up in situ (sprayed or cast systems), the specimens are made by use of the appropriate substrate and with a dry film thickness according to the directions given by the sponsor.

5.5 Conditioning

5.5.1 Crib

Before testing, the crib is dried for 24 h in a ventilated oven at (105 ± 5) °C. After drying the crib, it shall be kept in a desiccator where it is cooled to ambient temperature before use. The mass of the crib shall then be (40 ± 2) g excluding nails.

5.5.2 Test specimen

Before testing, the specimens shall be conditioned to constant mass[1)] at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %. The specimens are kept in the conditioning atmosphere until the tests are carried out.

5.6 Test environment

The test shall be carried out indoors in an environment essentially free of air currents. The room temperature shall be (20 ± 10) °C.

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1) Constant mass is considered to be reached when two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0,1 % of the mass of the specimen or 0,1 g, whichever is the greater.

The test apparatus may be mounted in a fume cupboard. The extraction of fumes shall be provided in such a way that the conditions given in 5.2 can be kept.

5.7 Test procedure

5.7.1 The test specimen is mounted in test position so that the upper surface of the test specimen is in contact with the underside of the bottom of the lower and upper air channels. Care shall be taken so that the joint between the test specimen and the wall channel section is airtight and so that the joint between the lower edge of the test specimen and the bottom of the lower air channel is airtight. In practice, the bottom plate of the lower air channel should overlap the lower end of the test specimen by (3 ± 1) mm In some cases it may be necessary to pack air gaps with mineral wool. The position where the burning wood crib is to be placed shall be marked on the test specimen.

5.7.2 The two fans are started, and the line burner in the crib ignition stand is ignited. The two fans yield a constant airflow through the apparatus.

5.7.3 The wall channel section (if it is removable) is placed on the test specimen and the lid is closed. The air velocity is controlled (see 5.2.1.2).

5.7.4 The air supply to the lower fan is shut off by closing the lid attached to the fan inlet. The fan shall not be turned off.

5.7.5 A wood crib is removed from the desiccator, weighed and placed on the crib ignition stand. The crib is ignited and allowed to burn for 30 s.

5.7.6 Immediately thereupon the burning wood crib is placed centrally on the specimen with its centre 100 mm from the bottom edge and in such a way that the airflow can pass freely under the upper six wood pieces. Measures shall be taken to ensure that the wood crib remains in position during the test. Immediately after this the stopwatch is started. After a period of 15 s, the air supply to the lower fan is opened again. The line burner may now be turned off.

5.7.7 During the test the following observations shall be recorded:

— the time at which the specimen ignites;

— the time at which the flames die out; and

— the time at which the glow dies out.

5.7.8 The test is terminated by extinguishing of the fire on the specimen:

— 15 min after the start of the test, i.e. the moment when the burning wood crib is placed on the specimen; or

— when the flame front has reached the upper end of the specimen.

After the termination of the test, the specimen shall be kept in the apparatus for some minutes with the fans still running. During this period the specimen is allowed to cool and to give off fumes. Alternatively, the specimen may be removed from the apparatus and placed in a fume cupboard.

5.7.9 The behaviour of the specimen during the test shall be recorded. This includes melting, foaming, charring, expansion, shrinkage, delamination or any other behaviour.

5.7.10 After the test the specimen shall be examined and the extent of damage (as defined in 3.3.1 and 3.22) done to both the roof covering and the substrate shall be measured.

5.7.11 Three tests shall be performed with air velocities along the specimen of 2 m/s and 4 m/s, respectively.

5.7.12 The main apparatus shall be allowed to cool off between two successive tests.

5.8 Observations and measurements

5.8.1 The classification criteria are provided in EN 13501-5:2005+A1:2009, Table 1. Observations and measurements related to the classification criteria shall be undertaken during and/or after the test.

All time observations are expressed in minutes and seconds elapsed from the start of the test. The test results include:

— the length of damaged material of the roof covering and the substrate, respectively, expressed in millimetres as measured from the centre of the wood crib position;

— where required for regulatory purposes or for classification, the damaged area of the roof covering and the substrate, respectively, expressed in square millimetres;

— where required for regulatory purposes or for classification, the maximum depth of the damage on the specimen, expressed in millimetres.

5.8.2 The results obtained from each individual test shall be reported separately as well as the mean values.

5.9 Test report

The test report shall be as comprehensive as possible. Any observations made during and after the test and comments on any difficulties experienced during the testing shall be reported. The following essential information shall be included in the report:

a) reference to this test method TS 1187 test 2;

b) name and address of the testing laboratory;

c) date and identification number of the report;

d) name and address of the sponsor;

e) purpose of the test;

f) method of sampling;

g) name of manufacturer or supplier of the product;

h) name or other identification marks of the product;

i) density or mass per unit area and thickness of the product;

j) date of supply of the product;

k) description of the specimens, including substrate and attachment;

l) conditioning of the specimens;

m) date of test;

n) when not identified in the test method, equipment and instruments used;

o) deviations from the test method, if any;

p) test results.

5.10 Direct field of application of test results

5.10.1 Test results obtained for a product attached to a substrate shall apply only for the use of the product on substrates having a density greater than or equal to 0,75 times the density used in the test.

When the test is carried out with a standard substrate (see 5.4.2.2) this rule is related to the nominal density of that substrate.

5.10.2 Test results obtained with a non-combustible standard substrate (see 5.4.2.2) shall apply only for non-combustible substrates which also comply with 5.10.1.

5.10.3 Test results obtained with a combustible standard substrate (see 5.4.2.2) shall apply for combustible and non-combustible substrates which also comply with 5.10.1.

5.10.4 When the test is carried out with a specific substrate (i.e. not one of the standard substrates), the test results obtained shall be valid only for the product used on a substrate with composition identical to that used in the test. This applies for densities that comply with 5.10.1.

5.10.5 The test results obtained are applicable to any roof pitch.

6 Test 3: Method with burning brands, wind and supplementary radiant heat

6.1 Test equipment

6.1.1 Brands

The test brands shall be constructed from wood fibreboard having an oven dried density of (250 ± 25) kg/m^3. They are made of four pieces, each 55 mm × 16 mm × 25 mm, nailed together to form a grid 55 mm square and 32 mm deep, as shown in Figure 13.

The brands shall be stored for at least seven days in a room at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

The brands shall not be exposed to a different atmosphere for a period of more than 1 h before the test ignition.

Before use the brands shall be soaked with n-heptane (see 6.7.1).

Two brands are utilized for each test.

6.1.2 Wind

6.1.2.1 Apparatus

Apparatus shall be provided, capable of applying an airflow across the surface of the calibration element at a temperature of (20 ± 10) °C and at a velocity as defined in 6.1.2.2, parallel to the surface and in the direction of the longitudinal axis, at any of the required test pitches, at each of the locations detailed in 6.1.2.2 (see Figure 14).

The fan shall have a control for the volume flow rate. The outlet section of the nozzle shall have dimensions of (0,25 ± 0,01) m height and a minimum of 1,0 m width. The minimum length of the nozzle shall be 1,2 m. Baffles and flow smootheners shall be used to avoid vorticity of the flow pattern.

6.1.2.2 Air velocity

The velocity shall be established by measuring the air velocity to an accuracy equal to or better than 0,1 m/s, in planes parallel to the surface of the calibration element as follows:

— at a height of 100 mm and 200 mm from the calibration element, at 500 mm above the bottom edge, on the central axis and at 300 mm at either side (see Figure 15): (3,0 ± 0,2) m/s (V_A);

— at a height of 100 mm from the calibration element, at 1 700 mm above the bottom edge, on the central axis (V_B) and at 300 mm at either side (V_C and V_D) (see Figure 15):

$$V_{A\,axis} > V_B > 2{,}0 \text{ m/s}$$

$$V_D = V_C \pm 0{,}2 \text{ m/s}$$

The measurement shall be done by an integrating instrument giving the average value of wind speed at the respective position for a period between 10 s and 30 s.

The respective positioning of the measuring probe shall be simplified by a handling device that does not disturb the flow pattern in the region of the measuring zone.

The air velocity shall be controlled using an anemometer of wheel type of approximately 20 mm diameter.

6.1.2.3 Eave

A simulated eave shall be installed in front of the specimen to prevent air from flowing underneath the specimen.

This shall be done in such a way so as not to interfere with or obstruct material flowing or falling from the roof surface (see Figure 14).

6.1.3 Radiant panel

A radiant panel shall be provided capable of being mounted in a plane parallel to the surface of the calibration element and at a distance of (500 ± 20) mm above it. The radiant panel shall be constructed from four single gas-fired radiators as a minimum, with separate flow controls to ensure a symmetrical heat flux pattern on the surface of the test specimen. The dimensions of the radiant panel shall be as specified in Figure 18.

The radiant panel shall be capable of providing a total heat flux distribution on the surface of the calibration element, with wind, such that the flux at the centre is (12,5 ± 0,5) kW/m^2 and at the four locations on the major axes, as shown in Figure 16, is (10 ± 0,5) kW/m^2.

The heat flux meter to be used shall have a design range of about 0 kW/m² to 50 kW/m^2. The target receiving radiation from the radiant panel shall be flat, circular and coated with a durable matt black finish. The target shall be water-cooled.

Radiation shall not pass through any window before reaching the target. The instrument shall be robust, simple to set up and use, and stable in calibration. The instrument shall have an accuracy of within ± 3 % and a repeatability within 0,5 %.

The calibration of the heat flux meter shall be checked by comparison with two instruments of the same type as the working heat flux meter and of similar range, held as reference standards and not used for any other purpose. One of the reference standards shall be fully calibrated at a competent laboratory at yearly intervals.

6.1.4 Timing device

A timing device with an accuracy of ± 5 s over 24 h shall be used.

6.1.5 Calibration element

The calibration element consists of a smooth, flat (12 ± 2) mm thick board of calcium silicate material having the dimensions 1,2 m × 2,0 m, and a density of (870 ± 100) kg/m³.

6.1.6 Specimen holder

The specimen holder shall be capable of presenting the specimen to the air flow at the required pitch and also provide for the required displacement of the specimen with respect to the radiant panel and wind apparatus, as shown in Figure 14. The lower edge of the test specimen shall be (0,75 ± 0,25) m above the floor. A system of stops or guides to ensure repeatability of the positioning of the specimen shall be used.

6.2 Calibration

6.2.1 General

Each time the radiant panel is ignited, stable conditions shall be achieved and verified according to the following procedure.

6.2.2 Specimen holder

With the non-combustible calibration element placed on it, the specimen holder shall be elevated to its required pitch with respect to the horizontal.

6.2.3 Wind

A uniform airflow shall be established in accordance with 6.1.2.1 and 6.1.2.2.

6.2.4 Radiant level

With the calibration element in position and the wind speed correctly set, the radiant panel shall be adjusted to obtain the heat flux levels specified in 6.1.3. The minimum period of time of stabilization for calibration of the radiant panel is 10 min.

6.3 Test conditions

Roofs intended to be installed with pitches up to 10° in practice shall be tested at a pitch of 5°. Roofs intended to be installed with pitches greater than 10° shall be tested at a pitch of 30°.

In special cases (e.g. where proof for a specific type of roof is to be provided), by way of departure from the specifications regarding roof pitches, verification of the resistance of a roof to burning brands may also be carried out by testing at the actual intended roof pitch. The test results so obtained shall then be valid only for the roof pitch tested.

6.4 Test specimen

6.4.1 General

Two specimens shall be tested with minimum dimensions measuring 1,2 m wide × 3,0 m in length for each test roof pitch.

The specimens shall be representative, in all details of practical application with regard to both the support and also the type and number of layers of roofing materials (including any insulation, vapour barriers, etc.), and with regard to the joining of those layers.

When the system of roofing includes joints for installation, the specimens shall incorporate a vertical joint in the top layer and at least one specimen a horizontal joint.

In the case of a roof with jointed thermal insulation, a vertical joint in the insulation shall be included in each of the specimens. This joint shall be located on the longitudinal axis of the test specimen.

Additional requirements for joints are given in 6.4.3.

6.4.2 Selection of standard supporting decks

6.4.2.1 General

When the product being evaluated is a roof covering system intended for general application over a variety of decks (see 6.10), the test deck may be selected in accordance with the following procedure.

6.4.2.2 Roof coverings intended to be installed over continuous decks

a) In the case of roof coverings intended to be installed over a continuous deck which is not profiled, a roof deck in accordance with either 6.4.2.2, b) or 6.4.2.2, c) shall be used. If the materials are to be laid over a profiled steel deck, then a trapezoidal profiled steel deck, in accordance with 6.4.2.2, d) shall be used.

b) If it is intended to simulate a wooden continuous deck with a gap not exceeding 0,5 mm, the wood particle board deck shall be constructed from planks 250 mm wide × 16 mm thick running parallel to the eaves with plain edges and tightly butt jointed so that the gaps between planks do not exceed 0,5 mm.

   If it is intended to simulate a deck made of narrow solid wood planks, the gaps between the particle board panels shall be (5,0 ± 0,5) mm.

   The wood particle board shall consist of wood particles bonded with polymer adhesive (e.g. ureaformaldehyde); it shall have a density of (680 ± 50) kg/m^3 and shall not be treated with fire retardants.

c) If roofing materials are intended to be laid only on continuous, non-combustible decks with a minimum thickness of 10 mm, then the deck shall consist of 10 mm thick reinforced calcium silicate board, dry density (680 ± 50) kg/m³.

d) The trapezoidal profiled steel deck shall have the width of the crown approximately equal to 50 % of the pitch and a trough depth of approximately 100 mm. The corrugations shall run parallel to the eaves and be open at the ends.

6.4.2.3 Roof coverings intended to be installed without a continuous deck

The spacing of roof supports of any type shall be in accordance with the maximum permissible spans proposed by the manufacturer for the particular application but not exceeding the minimum dimensions prescribed for the specimen in 6.4.1.

6.4.3 Positioning of joints

6.4.3.1 Joints

The joints shall be representative of practical application.

Where the dimensions of the elements of any of the layers are such that it requires more than four pieces to cover the specimen, or if any of the layers are jointless, then the specimens shall be fabricated in such a way that those layers are representative. In the first instance, if a vertical joint exists, this shall be located

underneath the radiant panel. If a horizontal joint exists, a second specimen with the horizontal joint under the panel shall be prepared.

In the case of overlapping layers, the position of the joints shall be considered to be the edge of the upper layer.

6.4.3.2 Specimen types (see Figure 17)

Type 1: Single central joint in the top layer parallel to the roof pitch. Single joint in the top layer at 90° to the roof pitch, under position of left brand. Single joint in layer next to top layer under position of right brand parallel to the roof pitch. Single joint in insulation under position of left brand, parallel to the roof pitch.

Type 2: Single joint in the top layer parallel to the roof pitch, under position of right brand. Single joint in layer next to insulation parallel to the roof pitch, under position of left brand.

6.4.4 Edge detailing

No special measures shall be taken by the sponsor to protect the edges of the specimen.

6.4.5 Protection of the edges

It may be necessary for the laboratory to take measures to prevent failure due to flames passing around the edges of the specimen. These measures shall not affect the fire behaviour within the measuring zone and shall be fully described in the test report. If it is necessary to protect the lower edge, this shall be done in a way so as not to interfere with or obstruct material flowing or falling from the roof surface.

6.5 Conditioning

At the time of test, the test specimen shall be in equilibrium with the laboratory environment.

If the materials involved are likely to absorb or contain a significant amount of moisture (liable to influence the test results) then extra care shall be exercised to ensure that the specimen is at this stable equilibrium. The moisture content of these materials shall be measured and recorded at the time of test.

Accelerated conditioning of component materials is permissible provided the method does not alter the properties of these materials.

Special samples may be used for moisture content determination and conditioned with the specimens. These shall be fabricated so as to represent the loss of water vapour from the specimen by having similar thicknesses and exposed faces.

NOTE Normally the tests specimen should be stored in the laboratory environment for at least 12 h before the start of the test.

6.6 Test environment

Testing shall be carried out in a draught free area in an enclosure of not less than 150 m^3 in volume. The temperature in the enclosure shall be (20 ± 10) °C prior to the fire test.

If any measures are taken to remove products of combustion from the test laboratory, they shall be in operation during the calibration period and maintained during the test.

6.7 Test procedure

6.7.1 Preparation of brands

3 min to 5 min before the test pour (50 ± 1) ml of n-heptane over the brands.

6.7.2 Start of the test

Before the specimen is put in position of testing, the wind is established and the radiant panel is adjusted according to 6.2.4. The specimen resting on the specimen holder is then put in position of testing. The test period commences when the exposed surface of the specimen is in the correct position with respect to the radiant panel and wind apparatus. That position shall be such that the exposed surface of the specimen is at the same distance and level as the exposed surface of the calibrated element.

6.7.3 Positioning of the brands

At time 2 min 30 s after the specimen has been correctly placed (see 6.7.2) the two brands shall be simultaneously ignited with a gas burner and 30 s later, the two brands shall be placed on the specimen (see Figure 18).

The brands shall be positioned with their centres 500 mm from the lower edge of the specimen and 370 mm apart and equidistant from the specimen longitudinal centre line. The position of the brands may be maintained by wires anchored to the edges of the specimen.

6.7.4 End of the test

The test shall be terminated and the fire extinguished when any of the following events occurs:

a) fire spreads on the underside of the specimen following penetration;

b) a period of 30 min has elapsed;

c) there is a risk to safety of personnel or impending damage to equipment.

6.7.5 Post test examination

Post-test examination of the specimen shall be commenced (30 ± 5) min after the end of the test.

6.8 Observations and measurements

6.8.1 General

The classification criteria are provided in EN 13501-5:2005+A1:2009, Table 1. Observations and measurements related to the classification criteria shall be undertaken during and/or after the test.

During and/or after the test, the following parameters shall be observed, measured and recorded. Dimensions shall be expressed in millimetres.

Progress of sustained flaming shall be estimated with respect to the base of the flame, in contact with the exposed surface, and not with respect to the flame envelope.

If the roof is a flat roof with a pitch of zero degrees, then the concept of upwards and downwards directions is replaced by the direction of the wind and the opposite direction respectively.

6.8.2 External fire spread

6.8.2.1 The time when the sustained flaming has progressed upwards 100 mm, 300 mm, 500 mm, 700 mm, 900 mm, 1 100 mm, 1 300 mm and 2 000 mm from the edges of the projection of the brands on the exposed surface and when reaching the upper edge of the measuring zone, as defined in 3.11.

6.8.2.2 The time when the sustained flaming has progressed downwards 100 mm, 300 mm and 500 mm from the edges of the projection of the brands on the exposed surface and when reaching the lower edge of the measuring zone, as defined in 3.11.

6.8.2.3 The time of occurrence and description of any burning material (flaming droplets or debris) falling from the exposed surface, as defined in 3.19.

6.8.2.4 The extent during the test of external fire spread upwards and downwards, expressed as the maximum burnt length from the edges of the projection of the brands onto the exposed surface, as defined in 3.14.

6.8.3 Fire penetration and openings

6.8.3.1 The time and nature of fire penetration, if this has occurred, as defined in 3.15.

6.8.3.2 The time of occurrence and description of any flaming material falling from the underside of the specimen, as defined in 3.19.

6.8.3.3 The time of occurrence of openings and their dimensions, as defined in 3.16.

6.8.4 Damage

6.8.4.1 The extent and nature of internal damage upwards and downwards, measured after the test from the edges of the projection of the brands, as defined in 3.3 (3.3.1 or 3.3.2) and 3.17.

6.8.4.2 The maximum length of burnt material upwards and downwards in each functional layer, measured after the test from the edges of the projection of the brands, as defined in 3.4 and 3.18.

6.9 Test report

The test report shall provide all information relevant to the selected procedures, the products tested and the results obtained. Photographs are strongly recommended to illustrate the test results.

The report shall include the following:

a) reference to this test method TS 1187 test 3;

b) the name and address of the test laboratory and the date of the test;

c) the names of the sponsor, the product and the manufacturer of the specimen and its component parts, if known. If unknown, this shall be stated;

d) a statement concerning the degree of supervision exercised by the laboratory during specimen fabrication. If there was no supervision, this shall be mentioned in the test report, together with the reason why this requirement was not complied with;

e) a full description of the product tested with, if applicable, a description of the test roof deck. This shall include, if applicable, the method of attaching the roof covering (nails, fixings, spacing, adhesives, etc.), the density or mass per unit area of materials and, where applicable, moisture content of the materials used. Building material classes (e.g. with reference to standards), the nature and quantity of adhesives or their rate of application may also be necessary to define the product uniquely;

f) description of any measures taken to prevent the flames passing around the edges (see 6.4.5);

g) for each tested specimen, information concerning:

   1) the roof pitch;

   2) room temperature at the beginning of the test, in degrees Celsius;

h) for each tested specimen observations recorded on its behaviour during and after the test including:

1) external fire spread, expressed by the time of occurrence, in minutes and seconds, and description where applicable:

   i) for the fire to spread distances of 100 mm, 300 mm , 500 mm, 700 mm, 900 mm, 1 100 mm, 1 300 mm, 2 000 mm and to the upper edge of the measuring zone, in an upwards direction;

   ii) for the fire to spread distances of 100 mm, 300 mm and 500 mm and the lower edge of the measuring zone, in a downwards direction;

   iii) any falling flaming materials (see 3.19) from the surface of the roof;

   iv) the burnt length upwards and downwards (see 6.8.2.4);

2) fire penetration, expressed by the time of occurrence, in minutes and seconds, and description where applicable:

   i) any falling flaming materials (see 3.19) from the underside;

   ii) openings (see 3.16) formed;

   iii) any fire penetration (see 3.15) if it occurs;

3) damage:

   i) non-flaming propagation (smouldering and glowing combustion);

   ii) the extent of internal damage (3.17) upwards and downwards;

   iii) the maximum length of burnt material (see 3.18) upwards and downwards in each functional layer;

4) time at which the test is terminated and the cause of the termination (see 6.7.4);

5) the range of roof pitches for which the product has been evaluated and the types of deck for which the report is valid as described in 6.10.

6.10 Direct field of application of test results

6.10.1 Roof pitch

Test results obtained at 5° apply to roofs with pitches < 10°.

Test results obtained at 30° apply to roofs with pitches from 10° to 70° (both included).

Test results obtained at an alternative specified pitch apply to roofs for that pitch only.

6.10.2 Nature of the deck

6.10.2.1 Test with standard supporting decks

Test results obtained with standard supporting decks shall apply to all systems with the same components (including the thicknesses) installed in the same way, but with different decks as follows.

a) Test results obtained with a wood particle board deck as defined in 6.4.2.2, b) with gaps between the planks not exceeding 0,5 mm, shall apply to:

1) any wooden continuous deck with a minimum thickness of 12 mm and with gaps not exceeding 0,5 mm;

2) any non-combustible continuous deck with a minimum thickness of 10 mm.

b) Test results obtained with a wood particle board deck as defined in 6.4.2.2, b) with gaps of (5,0 ± 0,5) mm between planks, shall apply to:

1) any wooden continuous deck (see 3.9);

2) any deck made from wooden planks with plain edges;

3) any non-combustible deck with gaps not exceeding 5,0 mm.

c) Test results obtained with a reinforced calcium silicate board as defined in 6.4.2.2 c) shall apply to: any non-combustible continuous deck with a minimum thickness of 10 mm.

d) Test results obtained with a trapezoidal profiled steel deck as defined in 6.4.2.2, d) shall apply to:

1) any profiled and non perforated steel deck;

2) any non-combustible continuous deck with a minimum thickness of 10 mm.

6.10.2.2 Test with alternative supporting deck

Test results obtained with an alternative supporting deck shall apply only to that roof system (e.g. the constitution, materials, dimensions of components, thickness, etc. are identical).

7 Test 4 – Method with two stages incorporating burning brands, wind and supplementary radiant heat

7.1 Test equipment

7.1.1 Brands

The free standing test brand shall comprise a simulated town gas flame (55,2 % Hydrogen, 27,4 % Natural Gas, 17,4 % Nitrogen) (230 ± 10) mm long from a (9,5 ± 0,1) mm diameter orifice which shall be set prior to application on the test specimen.

7.1.2 Wind

Provision is made in the test to simulate the effect of a wind of 6,7 m/s by applying suction to the lower side of the roof specimen. Apparatus shall be provided, capable of reducing the pressure on the underside of the specimen by (15 ± 1) Pa below that on the upper side, for the duration of the test. The suction under the specimen shall be measured. An inclined tube manometer may be used for this purpose.

7.1.3 Radiant panel

A (915 ± 5) mm square radiant panel shall be provided, capable of being supported either at an angle of 45° or horizontal according to the test required, and shall comprise four (300 ± 5) mm square surface combustion panels with their centres arranged at the corners of a square of (480 ± 5) mm side (see Figure 19).

The radiation incident on the specimen is established with the radiant panel in the horizontal test position and the calibration element set at a perpendicular distance of (585 ± 5) mm from the radiant panels. The radiant

panels shall be capable of providing an incident radiant heat flux distribution on the surface of the calibration element such that the heat flux at the four major axes, as shown in Figure 20, is (12 ± 1,5) kW/m^2.

A 25 mm diameter Schmidt Boelter heat flux meter with a range of 0 kW/m² to 50 kW/m^2 shall be used. The centre of the heat flux meter receiving radiation from the radiant panels shall be flat, circular and coated with a durable matt black finish. It shall be water cooled. Radiation shall not pass through any window before reaching the target. The instrument shall be robust, simple to set up and use, and stable in calibration.

The calibration of the heat flux meter shall be checked by comparison with two instruments of the same type as the working heat flux meter and of a similar range, held as references and not used for any other purpose. One of the reference standards shall be fully calibrated to yield the incident flux measured in an appropriate configuration. The calibration should be carried out by an appropriate calibration body at an interval of no more than twelve months.

7.1.4 Calibration element

The calibration element consists of a smooth, flat (20 ± 2) mm thick board of calcium silicate material having the dimensions (840 ± 10) mm square and a density of (870 ± 100) kg/m^3.

7.1.5 Timing device

A timing device with an accuracy of ± 5 s over 24 h shall be used.

7.1.6 Specimen holder

A metal specimen cover with a observation window is fixed to the framing (Figure 19) and a material with a reaction to fire classification of A1 is laid around the sides of the specimen frame to provide an air seal when the specimen is placed in position. Any small holes around the edges of specimen and its frame shall be sealed with mortar (3:1 sand:cement mix).

7.2 Calibration

Each time the radiant panel is ignited, stable conditions shall be achieved and the radiant panel adjusted to obtain a total heat flux distribution on the surface of the calibration element as specified in 7.1.3. The minimum period of time of stabilization for calibration of the radiant panel is 60 min.

7.3 Test conditions

Test specimens shall be mounted at an angle of 45° in all tests except where test specimens represent flat roofs (with a pitch up to 10°), in this case the specimens shall be tested horizontally.

Any "special pitch" is to be selected by the sponsor, such that the results obtained are unique to that "special pitch" as tested.

7.4 Test specimen

7.4.1 Number of test specimens

7.4.1.1 Preliminary ignition test with burning brands (stage 1)

One specimen shall be tested.

7.4.1.2 Penetration test with burning brands, wind and supplementary radiant heat (stage 2)

Three specimens shall be tested.

7.4.2 Construction of specimens

7.4.2.1 General

Each test shall be applied to a specimen of the roof structure (840 ± 10) mm square. The specimens shall be representative of the complete "end use" roof construction including:

a) the deck and supporting structure; and

b) at least one specimen containing any joints used in each of the products to be tested;

c) location of joints:

1) the joint in the insulation shall be on the centre line of the specimen. When tested as a pitched roof, the joint shall run down (in parallel to) the line of fall of the roof;

2) one specimen shall have a lap-joint in the top layer on the centre line of the specimen. When tested horizontally the joint may run in either direction. When tested at 45°, the joint shall run across the roof specimen.

Where necessary the specimen shall be made rigid by providing a frame at the boundaries of the specimen constructed from materials with a reaction to fire classification of A1. Any gaps between the specimen and the frame shall be sealed with mortar (3:1 sand:cement mix) to provide an air seal. The specimen and its frame shall also form an air seal with the specimen cover of the test apparatus, see Figure 21.

7.4.2.2 Testing for classification of roof lights, roof windows and integrated panels for external fire exposure

7.4.2.2.1 Installation into the test specimen holder

Where roof lights, roof windows and integrated panels cannot be produced to the test specimen size as required, the roof lights, roof windows and integrated glass faced panels with the dimensions nearest to those required by the test standard shall be used.

Where the specimens do not fit the existing test frames, they shall be constructed and fitted to the specimen holder such that the required reduction in pressure to the underside of the test specimen shall be maintained for the duration of the test

7.4.2.2.2 General

All roof lights, roof windows and integrated panels shall be tested in the closed position.

The preliminary ignition test shall be applied for 1 min to the upper surface of the test specimen, and repeated at various locations, such that the different principal elements and/or materials are investigated.

NOTE 1 This should typically involve no more than three locations.

NOTE 2 This ensures that items such as joints, edge details and ventilation grilles will be investigated.

7.4.2.2.3 Number and exposure conditions for the test specimens

If the surface of the test specimen has more than a 50 mm height variation/surface irregularity in the exposed plane, the thermal exposure conditions shall be set such that a minimum of 70 % of the exposed surface area achieves (12 ± 1,5) kW/m^2.

As an alternative where the height variation is significant, or a minimum of 70 % of the exposed surface area cannot meet (12 ± 1,5) kW/m^2, the surface/joint shall be mounted so that any surrounding exposed areas

subject to exposure conditions greater or less than (12 ± 1,5) kW/m^2 shall be tested alone for penetration with the high exposed surface area protected by a non combustible board (Euro class A1) and an extra test of the specimen itself shall be made.

The centre point of the test specimen shall be identified and this shall be used as the central reference point for the radiant heat exposure of the specimen. The reference points for the flame application shall be in relation to the centre point of the exposed specimen.

Two specimens shall be tested for fire penetration. The test conditions shall be applied and maintained at the application rate as specified.

NOTE 1 The above might lead to a change in the total exposure period due to the need for flame application along any larger specimen being tested.

Then the corner/edge detail shall be located such that the corner detail is within the radiant heat exposure zone to ensure the maximum radiant heat coverage of the joint detail between the specimen and the surrounding roof.

— Flame application in the penetration test shall be applied and maintained at the application rate as specified.

NOTE 2 The above may lead to a change in the total exposure period due to the need for flame application along any larger specimen being tested.

Where the specimen includes a joint between the roof lights, roof windows or integrated glass faced panels and the roof system including any kerb details.

— A third test specimen shall be tested for fire penetration.

Where a difference in classification arises based on individual test results for surface and joint exposure conditions, a further specimen(s) shall be tested to repeat the worst performing configuration(s). The average of the two poorest results shall be used for the purpose of classification.

7.4.2.2.4 Direct Application

The classification obtained from this test procedure shall cover all sizes of roof lights, roof windows and integrated panels having identical construction when used as an element of a roofing system subjected to external fire exposure to CEN/TS 1187:2010, Method 4.

7.5 Conditioning

At the time of test, the specimens shall be conditioned in accordance with Clause 4 of EN 13238:2010. The specimen shall be mounted in the test frame and tested as soon as possible after leaving the conditioning atmosphere. The time between leaving the conditioning atmosphere and testing shall not exceed 4 h.

7.6 Test environment

Testing shall be carried out in a draught free area. The ambient temperature within the laboratory shall be (20 ± 10) °C prior to the start of each fire test. If any measures are taken to remove products of combustion from the test laboratory, they shall be in operation during the calibration period and maintained during the test.

7.7 Test procedure

7.7.1 Preliminary ignition test with burning brands (stage 1)

The test brand (see 7.1.1) shall be applied for 1 min starting at the centre of the upper surface of the specimen and directed up the slope with the nozzle resting on the centre line of the specimen and inclined at

an angle of approximately 5° to its slope (or fall line). For specimens which are tested horizontally the direction of the flame will correspond to that used for a sloping roof as indicated by the arrow in Figure 19. For the purposes of this stage, the specimen shall be mounted in the specimen holder but not exposed to any radiant heat.

7.7.2 Penetration test with burning brands, wind and supplementary radiant heat (stage 2)

The specimen, after mounting for test, shall be brought, in not longer than 5 s, from a position at room temperature to a position where its upper surface is exposed to radiated heat. Immediately the specimen is exposed to the radiated heat, the pressure on the underside shall be reduced as detailed in 7.1.2.

At 5 min from the start of the test the burning brand shall be applied to the surface of the specimen, in the direction shown by the arrow in Figure 19 for 1 min, moving once up and once down the centre of the specimen at a rate of 0,29 m per 10 s.

The specimen shall remain exposed to the radiant panels for a period of 1 h unless the criteria set in 7.7.3 are exceeded.

7.7.3 End of test

The test shall be terminated and the fire extinguished if there is a risk to the safety of personnel or impending damage to equipment, or if any of the following occurs:

a) preliminary ignition test with burning brands (stage 1):

   At 1 min, in the event of no ignition or penetration of the specimen occurs. If ignition occurs, the test is continued until all flaming ceases or the criteria in 7.8.2 are exceeded;

b) penetration test with burning brands, wind and supplementary radiant heat (stage 2):

   At 1 h, in the event that no penetration occurs, or earlier if penetration occurs as defined in 3.27.

7.8 Observations and measurements

7.8.1 General

The classification criteria are provided in EN 13501-5:2005+A1:2009, Table 1. Observations and measurements related to the classification criteria shall be undertaken during and/or after the test.

During the test, the following parameters shall be observed, measured and recorded. Dimensions shall be expressed in millimetres.

Progress of all flaming, regardless of duration, shall be estimated with respect to the base of the flame, in contact with the exposed surface, and not with respect to the flame envelope.

7.8.2 Preliminary ignition test with burning brands (stage 1)

— Duration of flaming, if this has occurred and exceeds 5 min;

— extent of flame spread in any direction and whether the maximum distance in any direction exceeds 381 mm; and

— the time and nature of penetration as defined in 3.27, if this has occurred.

7.8.3 Penetration test with burning brands, wind and supplementary radiant heat (stage 2)

— The time at which any penetration, as defined in 3.27, occurs;

— occurrence of melting of the test specimens and the production of molten droplets or debris (flaming and/or non-flaming);

— any mechanical failure, or the development of holes, without penetration by fire.

7.9 Test report

The test report shall provide all information relevant to the selected procedures, the products tested and the results obtained. Photographs are strongly recommended to illustrate the test results.

The report shall include the following:

a) reference to this test method TS 1187 Test 4;

b) name and address of the test laboratory and the date of the test;

c) names of the sponsor, the product and the manufacturer of the specimen and its component parts, if known. If unknown, this shall be stated;

d) full description of the product as tested. This shall include, if applicable, the method of attaching the roof covering (nails, fixings, spacing, adhesives, etc.), the density or mass per unit area of materials, the building material classes (e.g. with reference to standards), the nature and quantity of adhesives or their rate of application, may also be necessary to define the product uniquely;

e) for each tested specimen, information concerning:

   1) the roof pitch;

   2) the room temperature at the beginning of the test, in degrees Celsius;

f) for each tested specimen, any observations and the measurements recorded during the test as specified in 7.8.

7.10 Direct field of application of test results – Roof pitch

Test results obtained at a pitch of 45° apply to roofs with pitches > 10°.

Test results obtained at a pitch of 0° (horizontal) apply to roofs with pitches up to 10°.

Test results obtained at a single specified roof pitch other than 0° or 45° apply to roofs for that special pitch only.

8 Figures

8.1 Test 1

Dimensions in millimetres

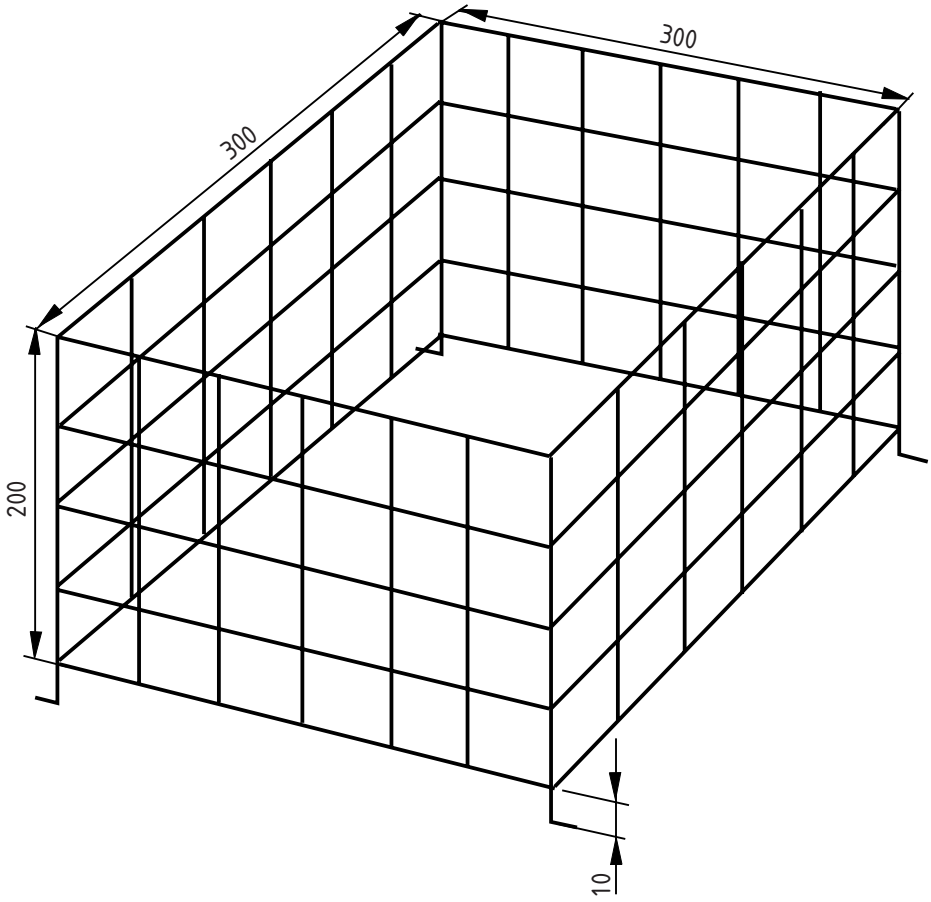
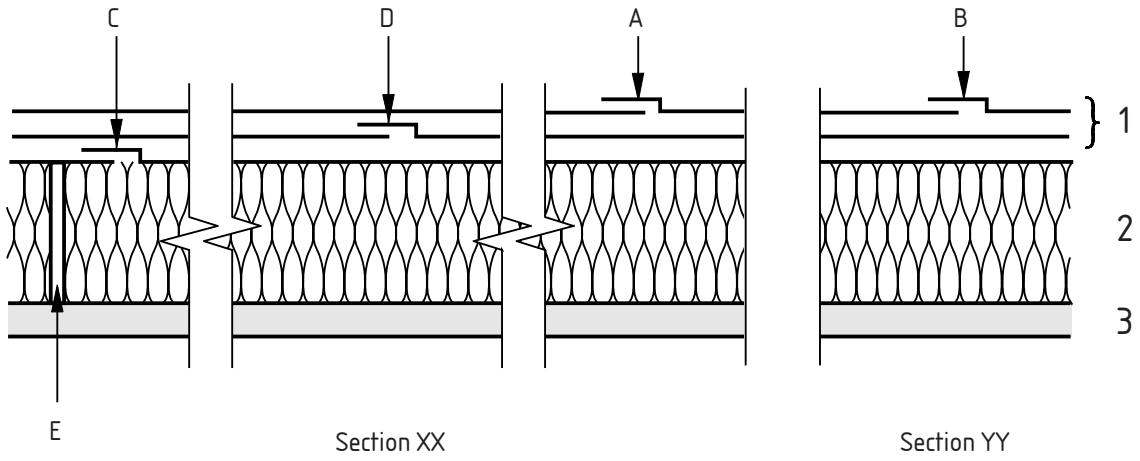


Figure 1 — Wire frame basket (test 1)



a) **b)**

a) Section XX', see Figure 3

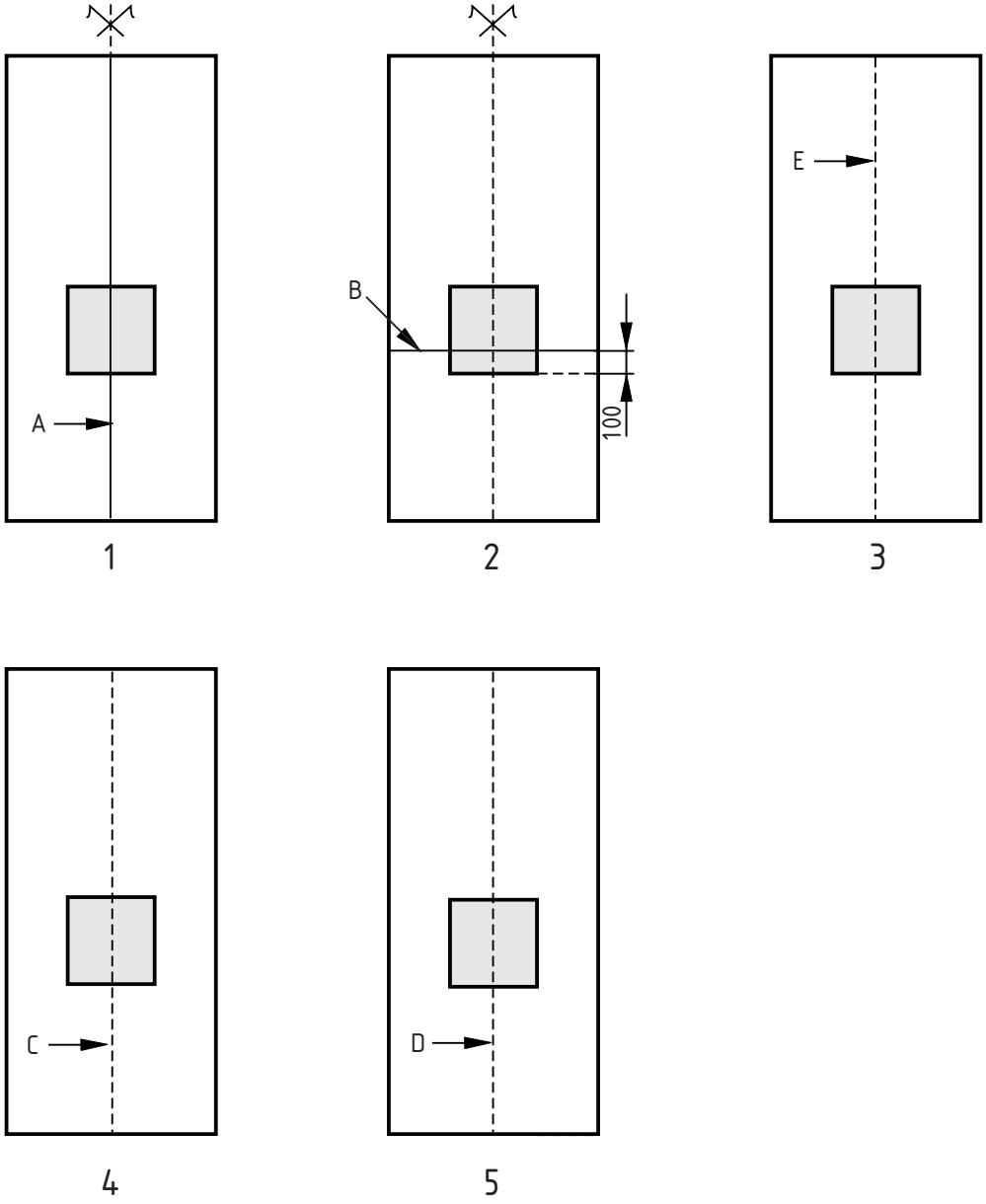
b) Section YY', see Figure 3

Key

A	Vertical joint in the top layer	1	Weathering layer
B	Horizontal joint in top layer	2	Insulation
C	Joint in layer next to insulation	3	Roof deck
D	Joint in layer next to top layer		
E	Joint in insulation		

Figure 2 — Example of a specimen (test 1)

Dimensions in millimetres

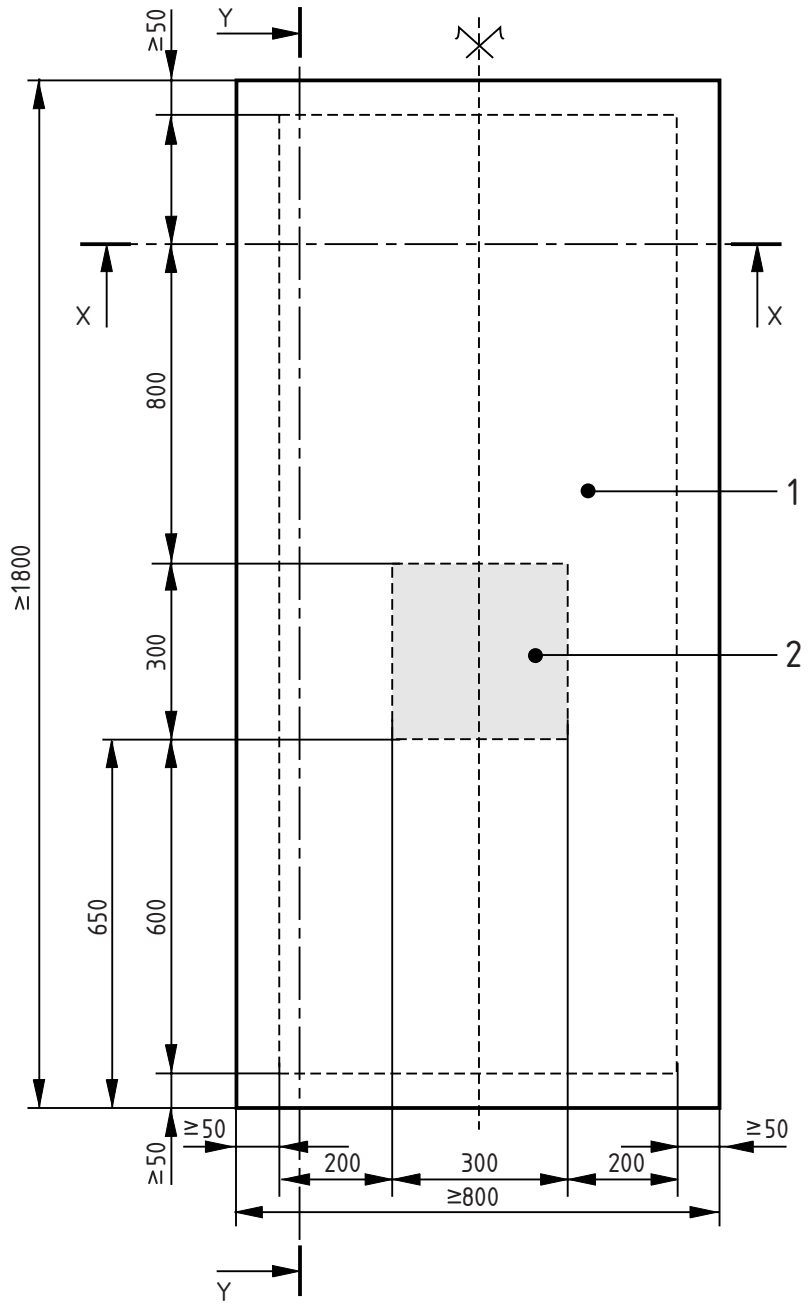


Key

1 Joint A in top layer
2 Joint B in top layer
3 Joint E in top insulation
4 Joint C in first layer adjacent to insulation
5 Joint D

Figure 3 — Position of joint – Type of specimens (test 1)

Dimensions in millimetres

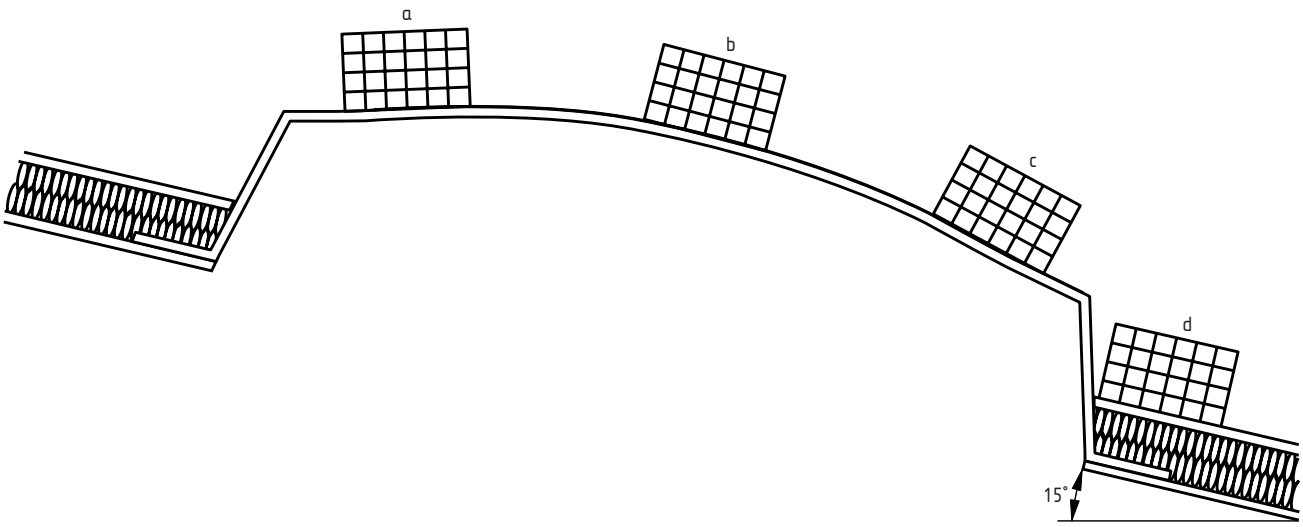


NOTE For sections XX' and YY' see Figure 2.

Key

1 Measuring zone
2 Brand

Figure 4 — Measuring zone and position of the brand (test 1)

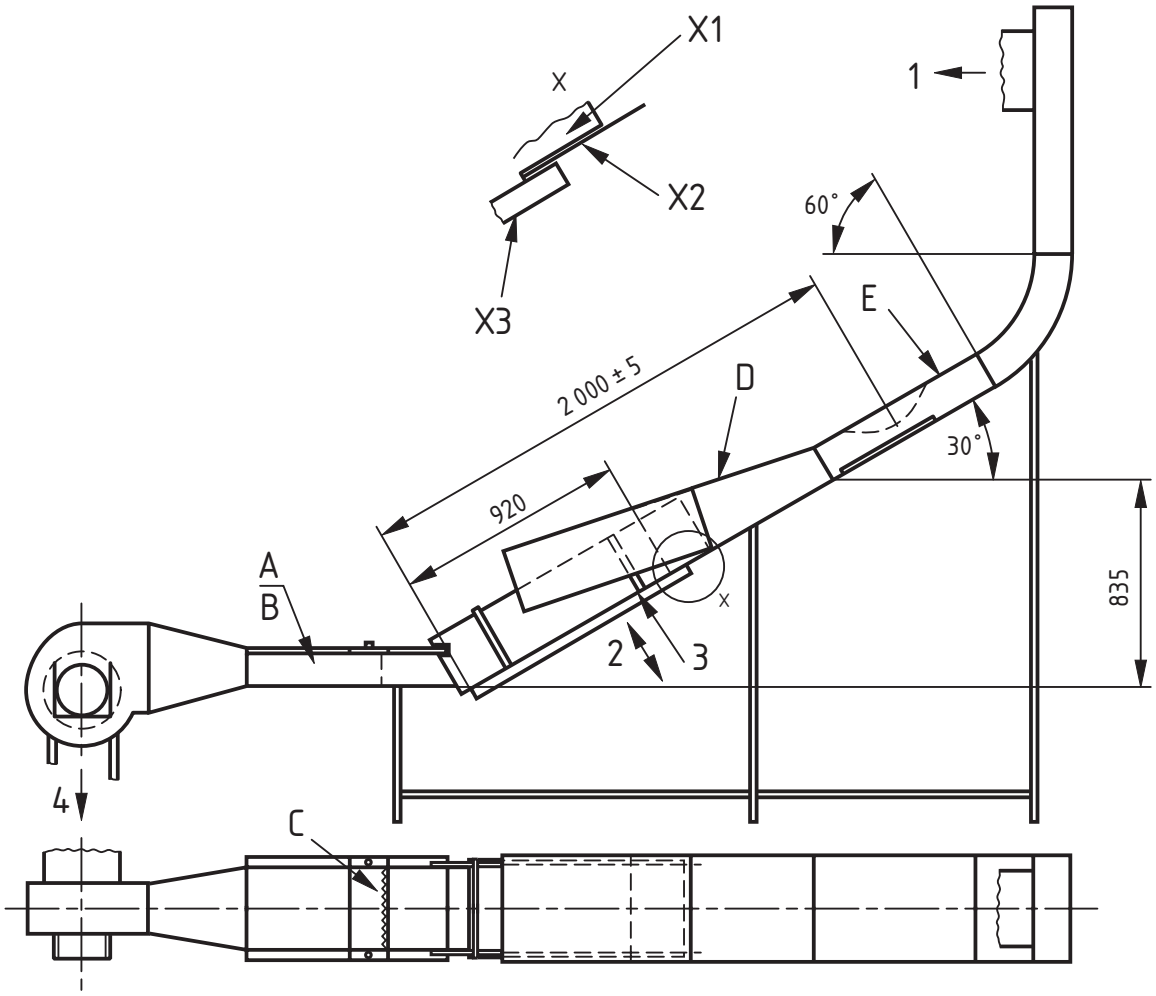


NOTE Positions a to d are referenced in 4.7.3.2.

Figure 5 — Positioning of brands for testing roof lights (test 1)

8.2 Test 2

Dimensions in millimetres



Key

Detail drawings, Figures 7 – 11.

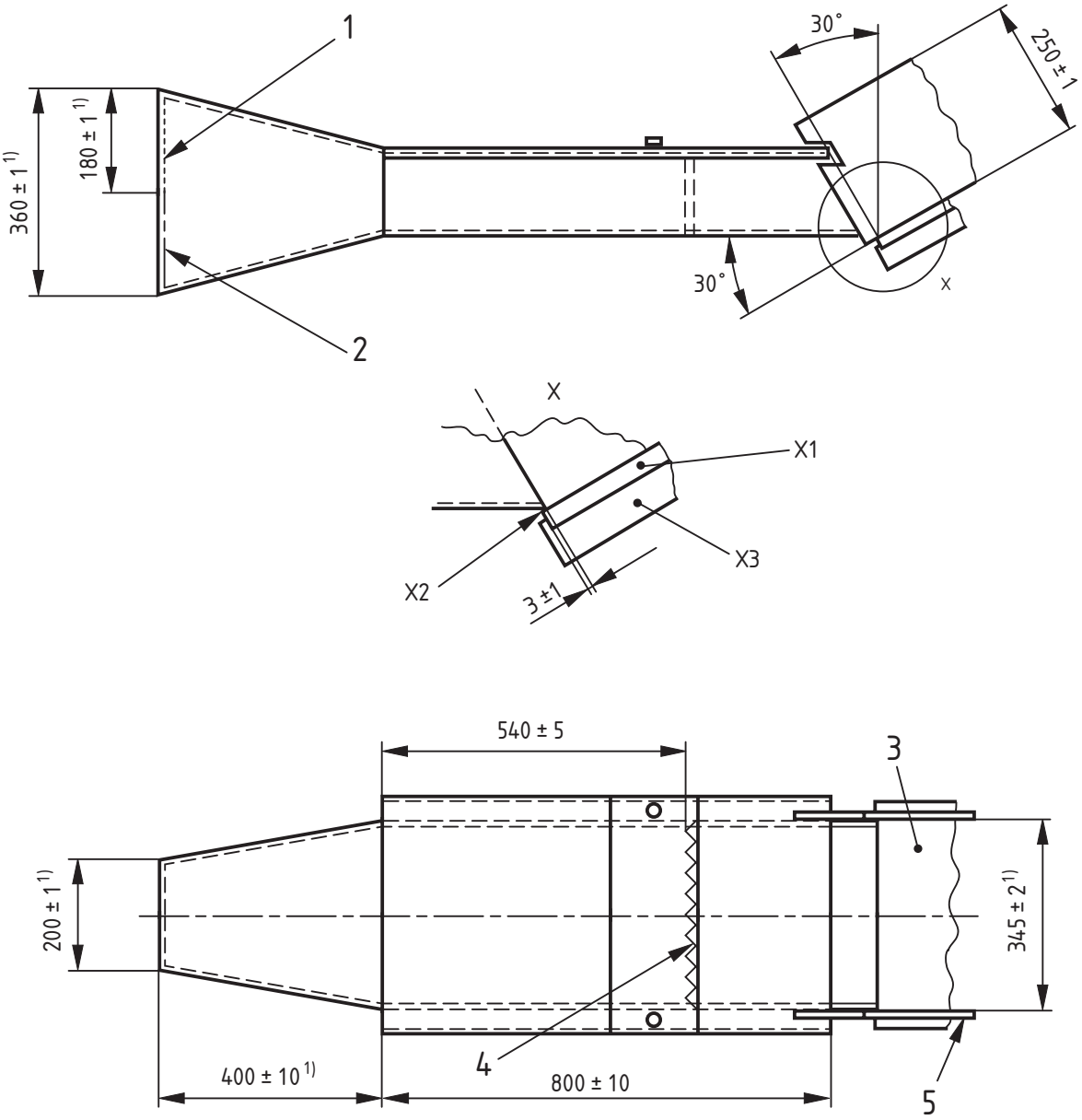
A	Lower air channel, side and top view	X1	Wall channel section
B	Lower air channel, end view	X2	Lower end of upper air channel bottom plate
C	Corrugated perforated plate near test specimen	X3	Test specimen
D	Lid section		
E	Narrow pass section of upper air channel		

NOTES

1	To exhaust system	3	Test specimen
2	Arrangements to raise test specimen into testing position	4	Air inlet

Figure 6 — General view of apparatus (test 2)

Dimensions in millimetres



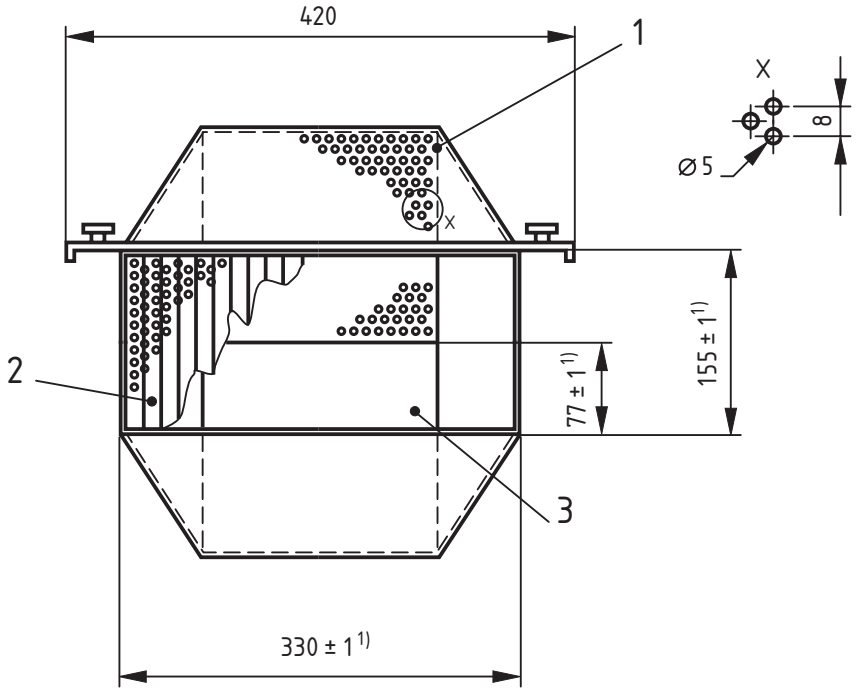
1) This measure refers to inner dimension.

Key

1	Perforated plate, see Figure 8	X1	Test specimen
2	Solid plate, see Figure 8	X2	Overlap of bottom plate of lower air channel on end of test specimen
3	Test specimen	X3	Holder (sliding platform) for test specimen
4	Corrugated perforated plate, see Figure 9		
5	Side wall of wall channel section		

Figure 7 — Detail drawing A − Lower air channel, side and top view

Dimensions in millimetres



1) This measure refers to inner dimension.

Key

1 Perforated plate placed at top of opening of fan

2 Corrugated perforated plate near to test specimen (detail drawing see Figure 9)

3 Solid plate placed at bottom of opening of fan

Figure 8 — Detail drawing B − Lower air channel, end view (test specimen and side walls not shown)

Dimensions in millimetres

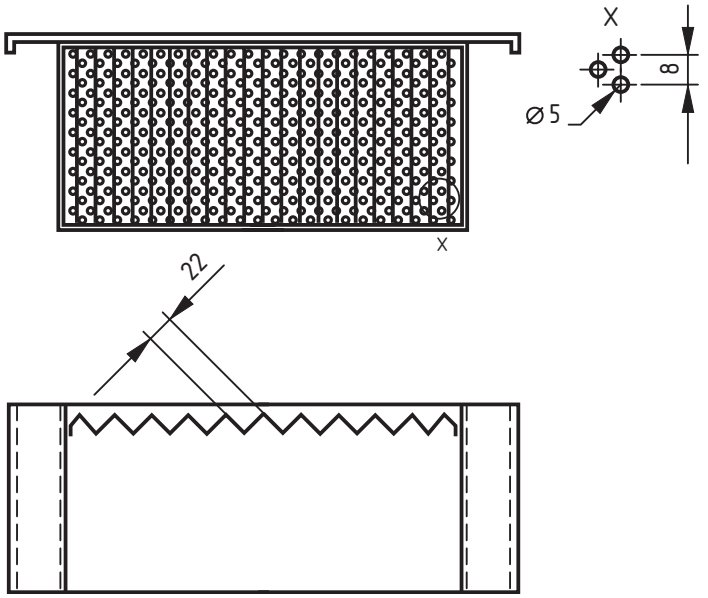
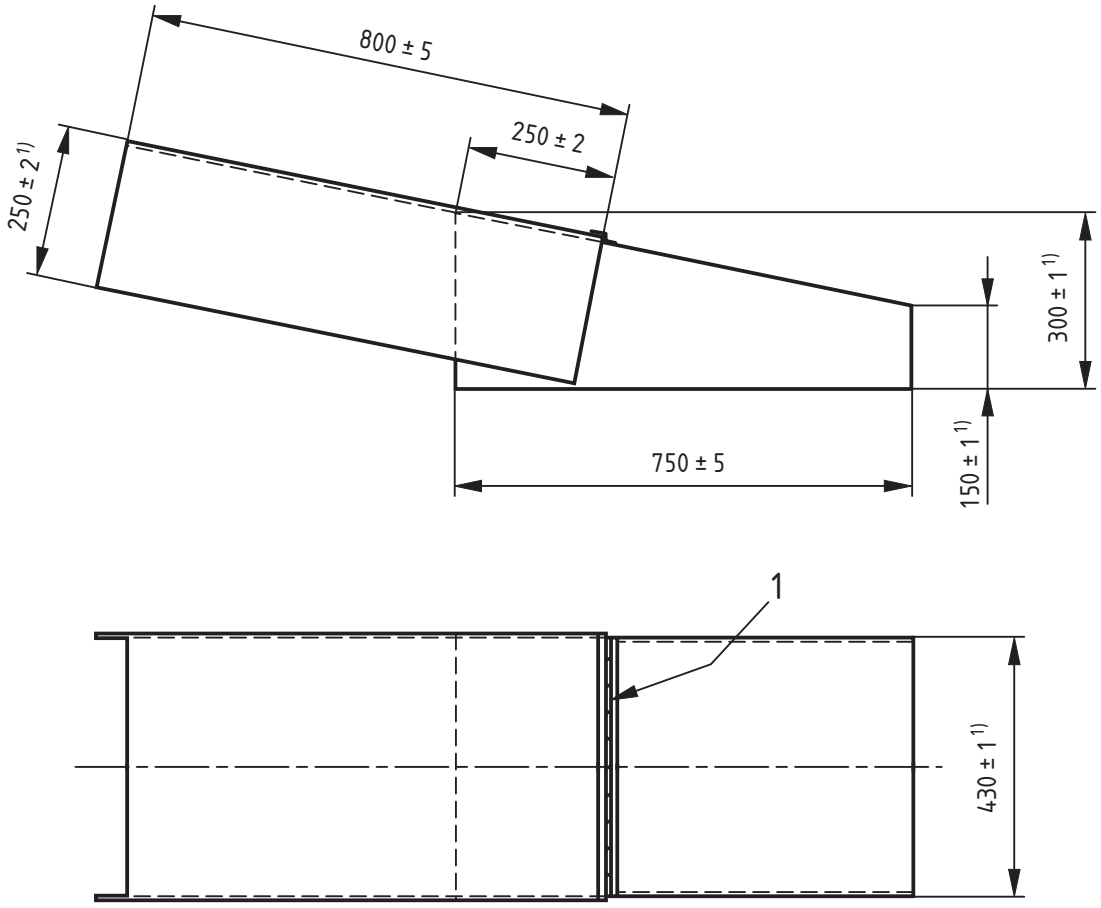


Figure 9 — Detail drawing C – Corrugated perforated plate near test specimen

Dimensions in millimetres



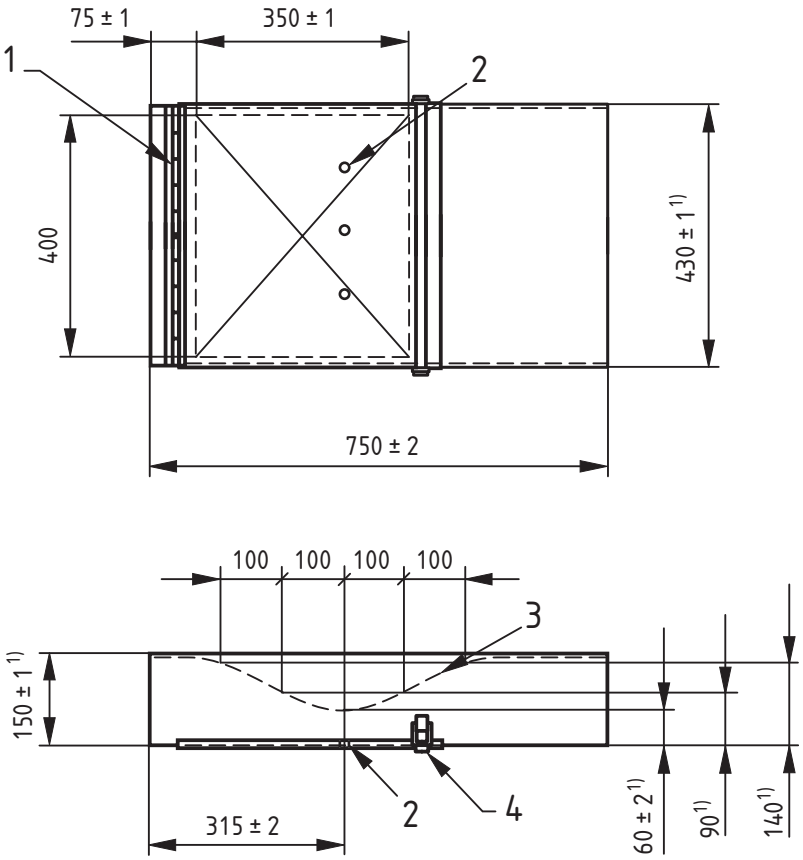
1) This measure refers to inner dimension.

Key

1 Hinge

Figure 10 — Detail drawing D − Lid section

Dimensions in millimetres



1) This measure refers to inner dimension.

Key

1 Hinge

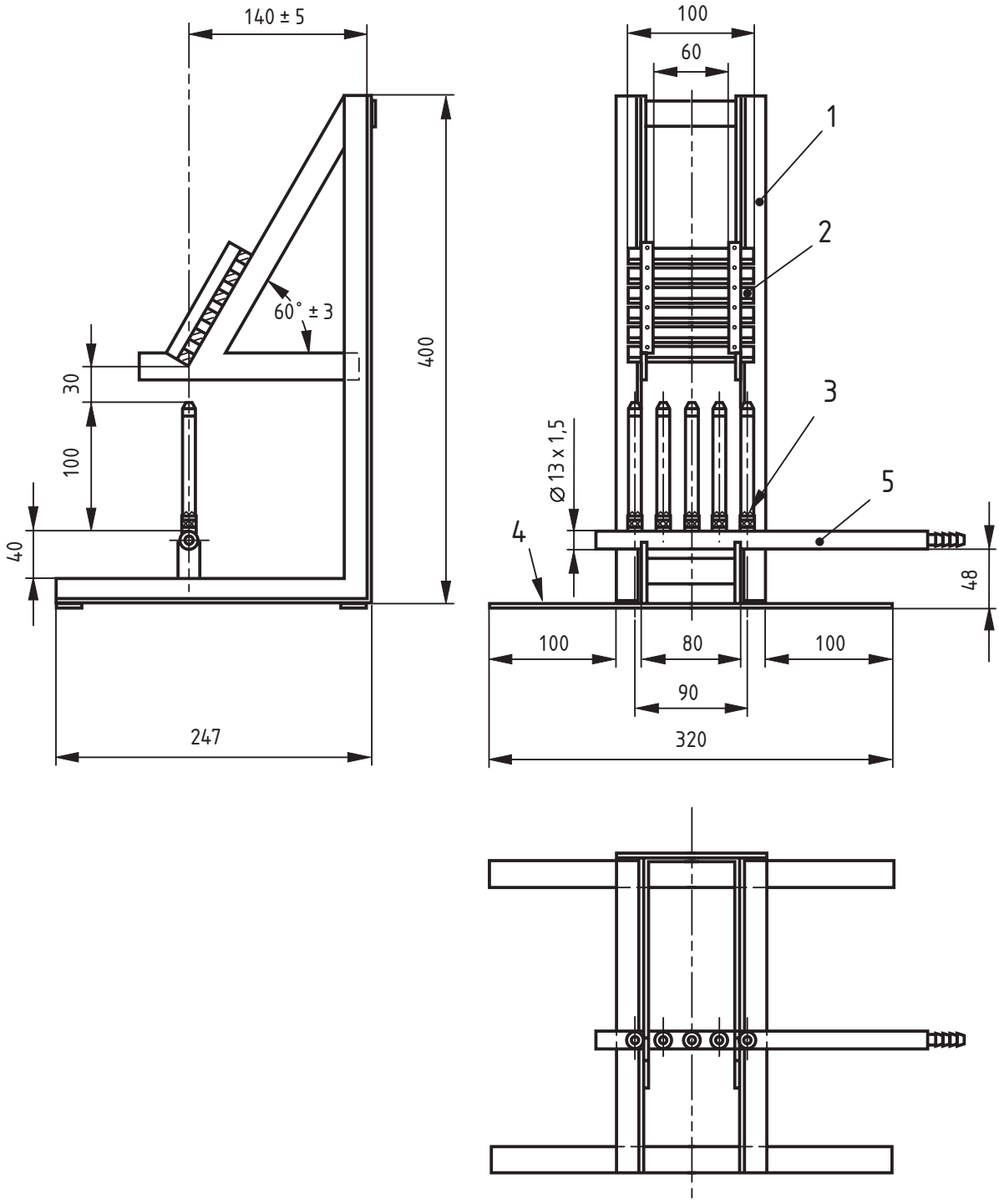
2 Ø 8mm, holes for air velocity measurements

3 Restricting plate

4 Lock

Figure 11 — Detail drawing E − Narrow pass section of upper air channel

Dimensions in millimetres



Key

1 20 mm × 20 mm × 3 mm, angle iron (or bar)
2 Wood crib
3 Ø 3,8 mm, four holes
4 20 mm × 3 mm, flat iron (or bar)
5 Brass supply pipe

Figure 12 — Crib ignition stand, positioning of wood crib (test 2)

8.3 Test 3

Dimensions in millimetres

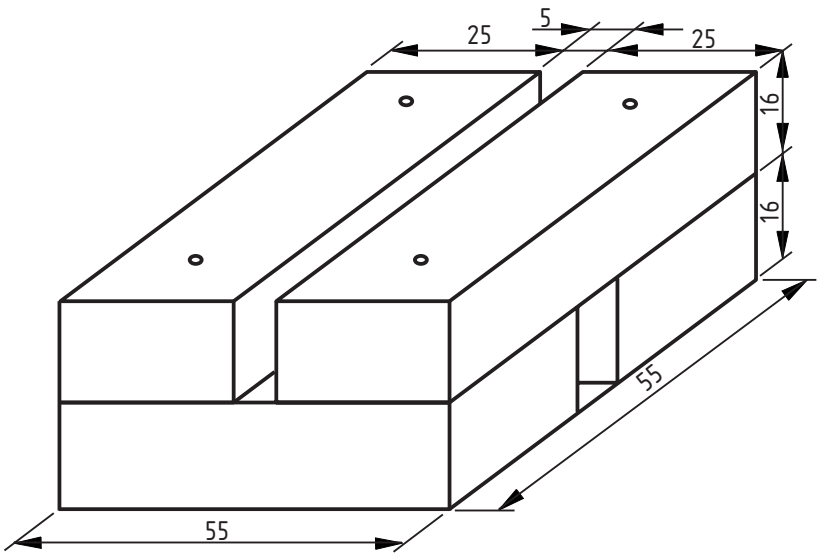
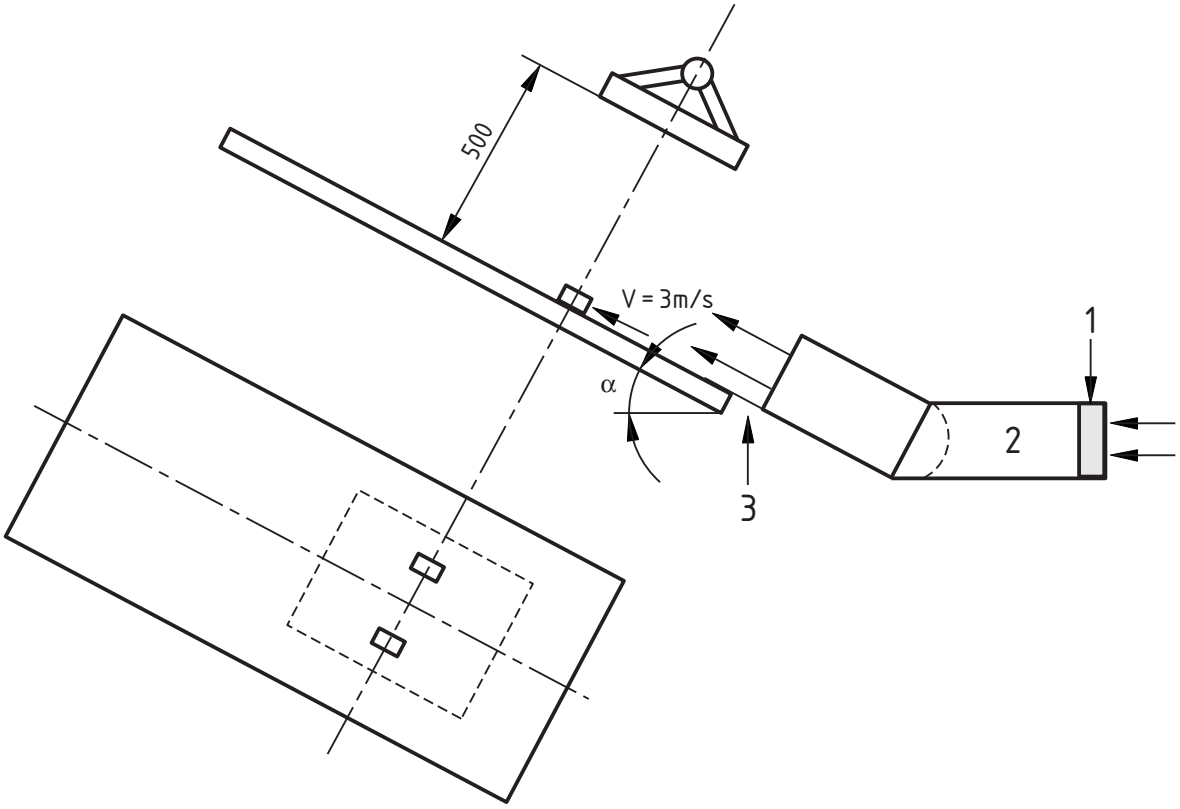


Figure 13 — Brand (test 3)

Dimensions in millimetres

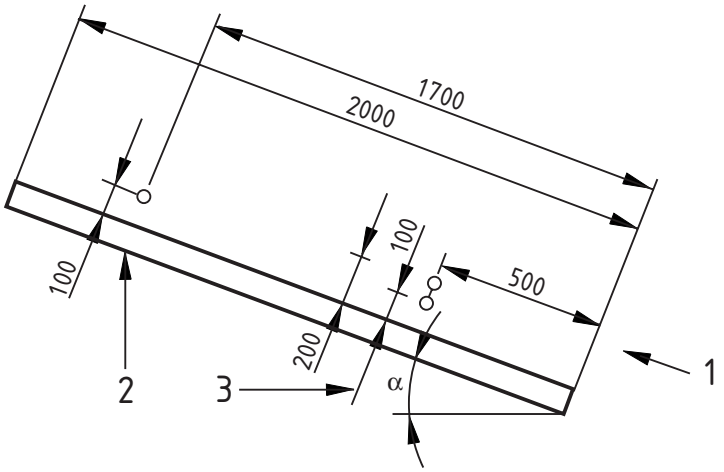


Key

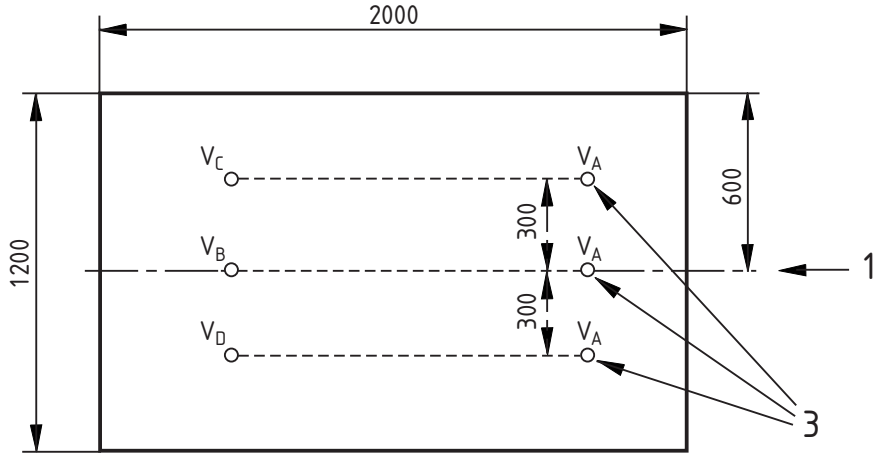
1 Filter
2 Wind apparatus
3 Eave

Figure 14 — Examples for general test arrangement (test 3)

Dimensions in millimetres



a)



b)

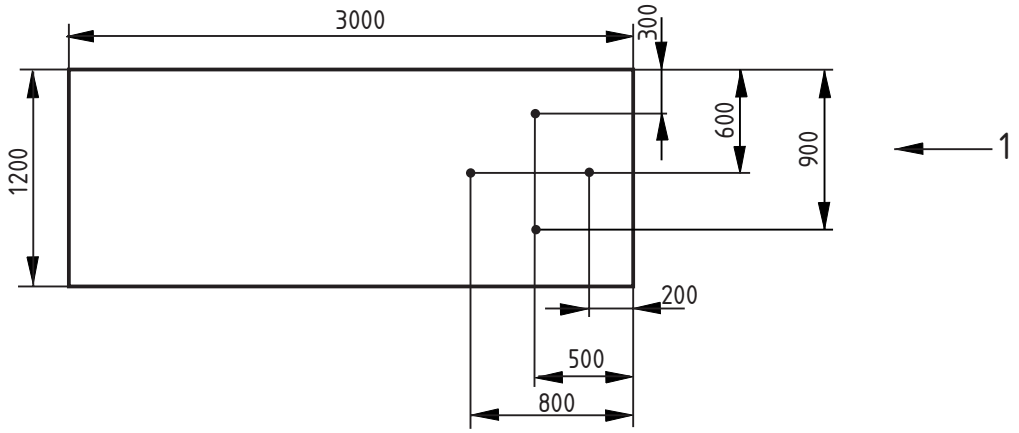
Key

a) side view
b) plan view

1 Airflow
2 Calibration element
3 Anemometer locations

Figure 15 — Position for air velocity measurements (test 3)

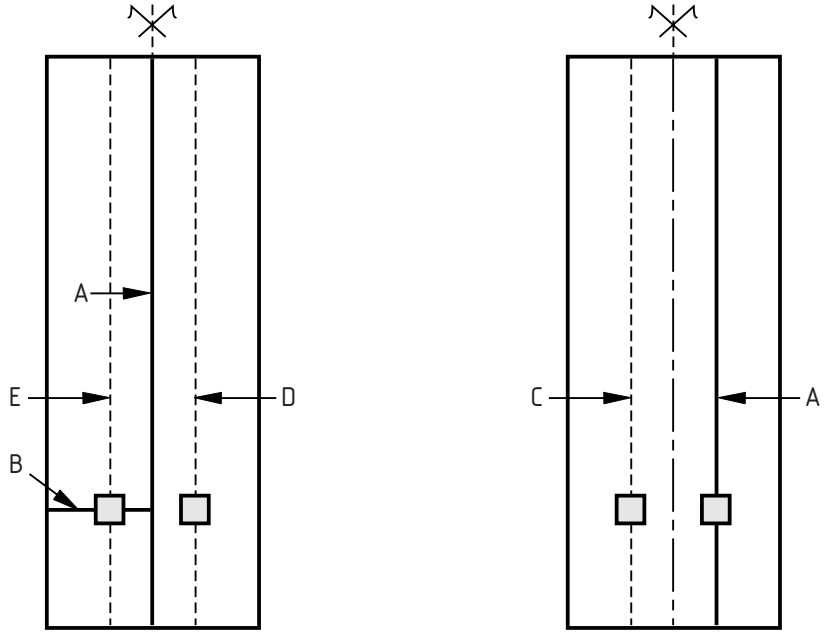
Dimensions in millimetres



Key

1 Airflow

Figure 16 — Plan view of flux measurements locations (test 3)



a) Type 1 **b) Type 2**

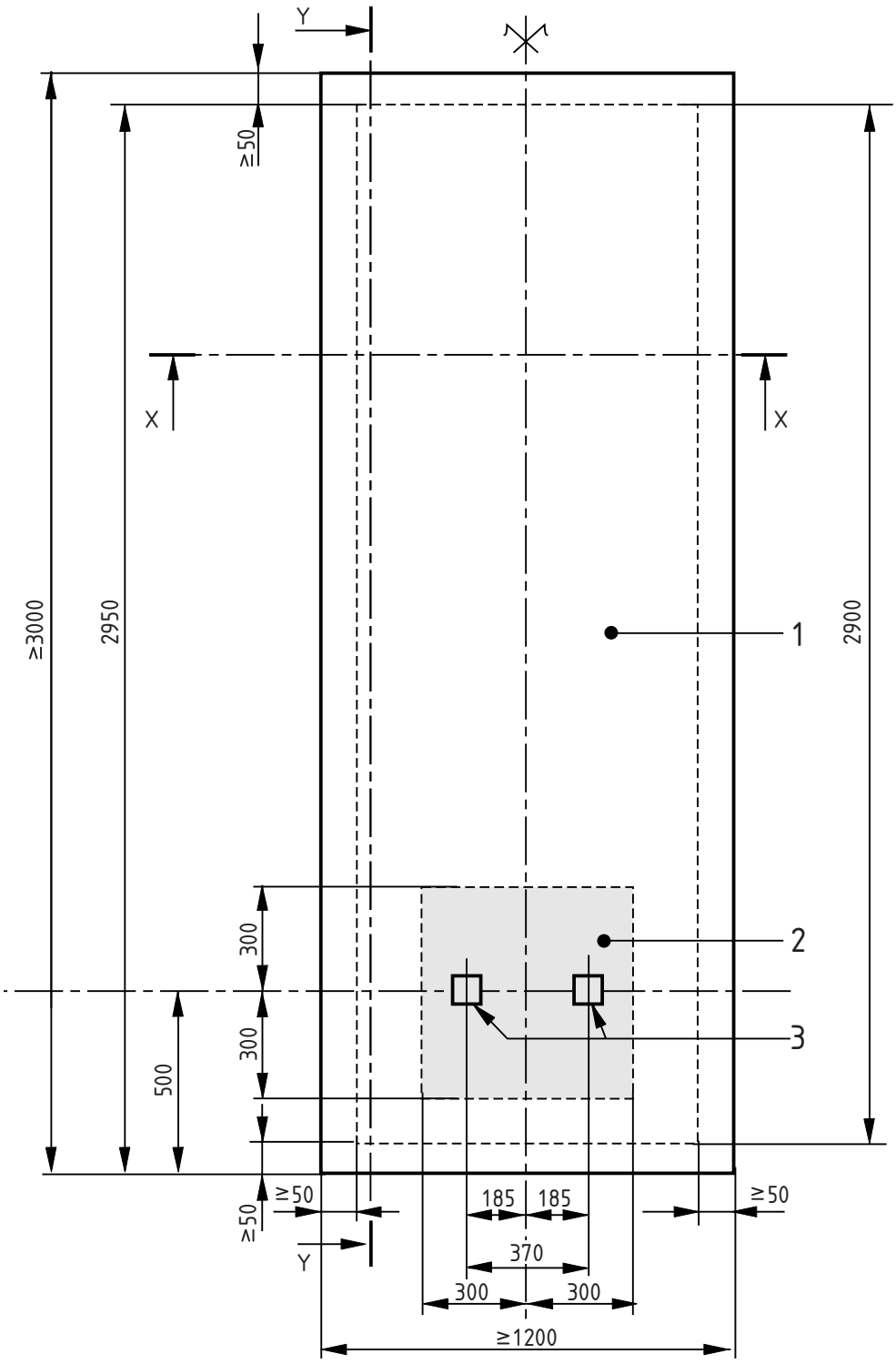
Key

Type 1:
- A Joint A in top layer
- B Joint B in top layer
- D Joint D in layer next to top layer
- E Joint E in insulation

Type 2:
- A Joint A in top layer
- C Joint C in layer next to insulation

Figure 17 — Position of joints (test 3)

Dimensions in millimetres

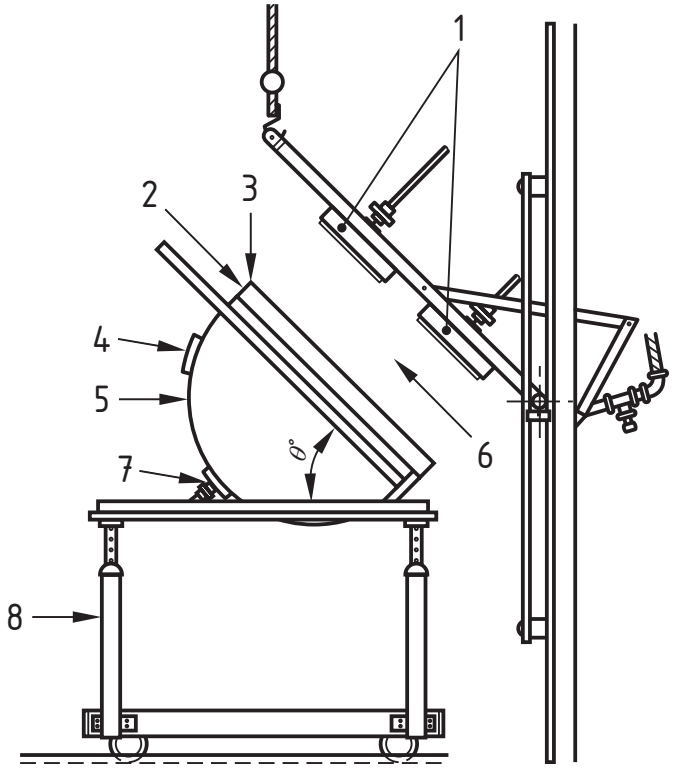


Key

1 Measuring point
2 Radiant panel
3 Brands

Figure 18 — Measuring zone and position of brands (test 3)

8.4 Test 4



Key

1	Surface combustion heaters	5	Specimen cover
2	Roof specimen	6	Direction of flame
3	Edge "A"	7	Suction pipe
4	Mica window	8	Trolley

Angle θ = 45° for inclined test
θ = 0° for horizontal test

Figure 19 — Roof test apparatus (test 4)

Dimensions in millimetres

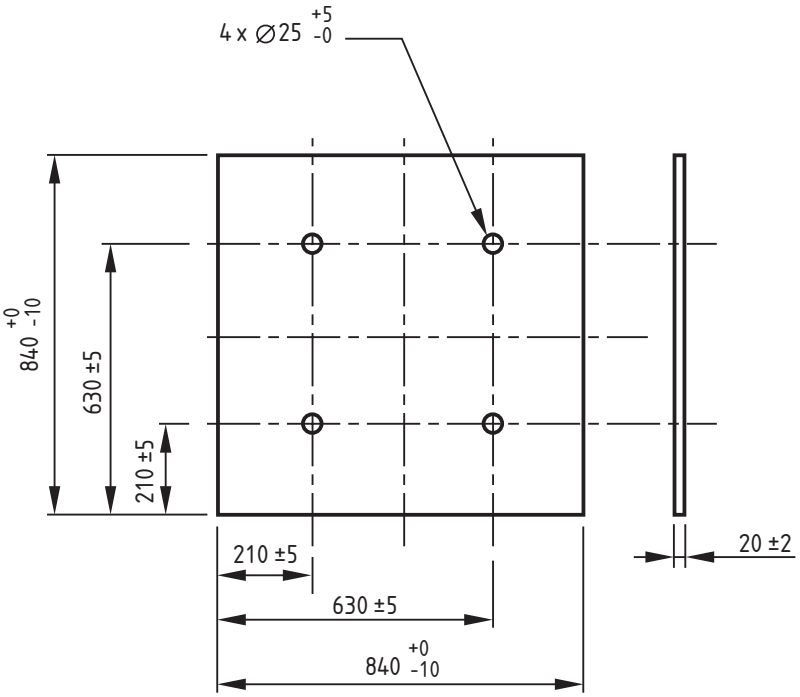
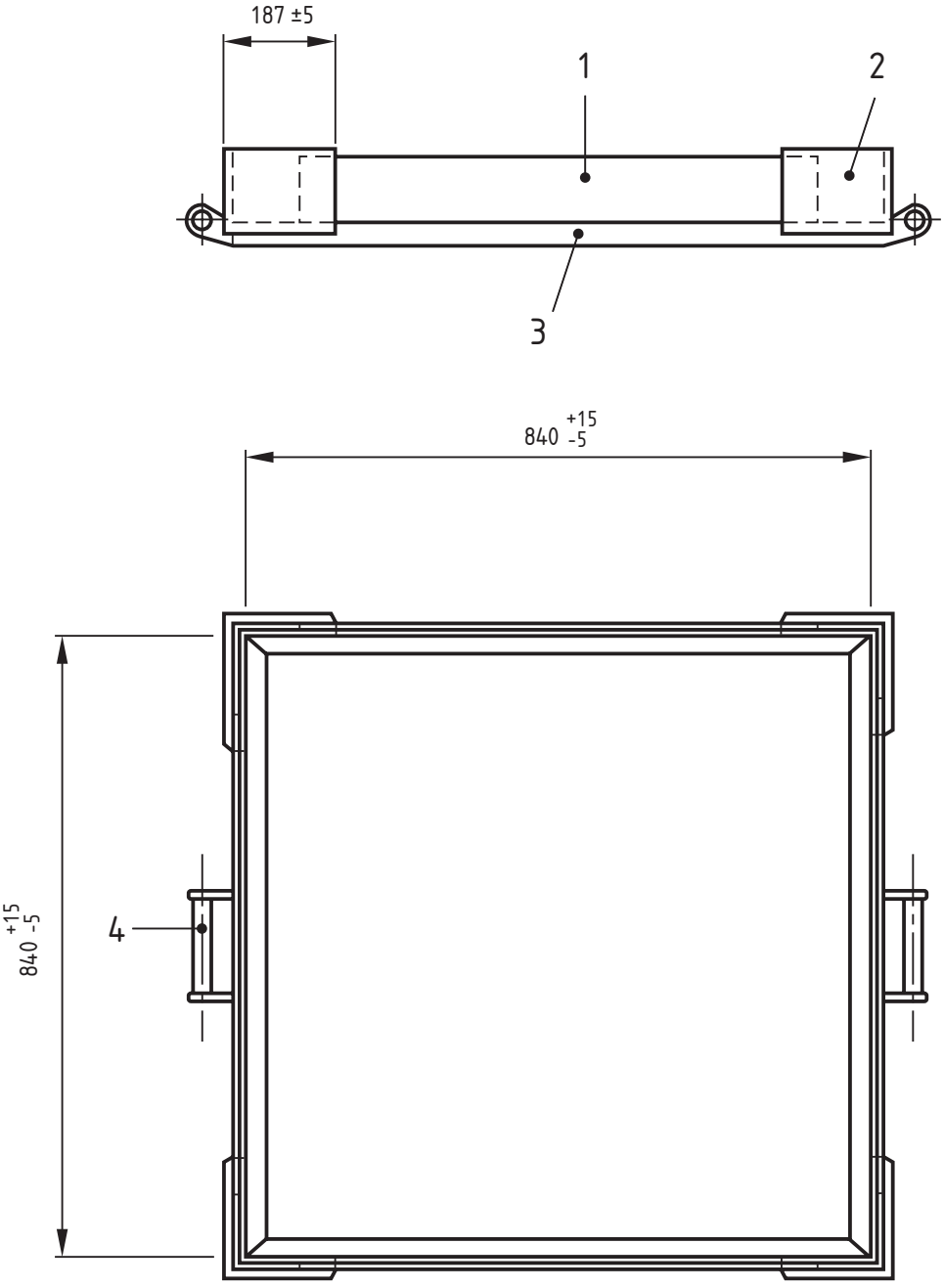


Figure 20 — Instrument locations for the calibration element (test 4)

Dimensions in millimetres



Key

1 Class A1 board
2 Steel
3 Base frame
4 Handle

Figure 21 — Specimen holder (test 4)

Bibliography

For Clause 4, method 1 is an adaptation of the German standard:

[1] DIN 4102-7, *Fire behaviour of building materials and components; roofing; definitions, requirements and testing*

For Clause 5, method 2 is an adaptation of the Nordic method:

[2] NORDTEST METHOD NT FIRE 006: "Roofings: Fire spread"

For Clause 6, method 3 is an adaptation of the French method:

[3] Departemental Order dated September 10, 1970, relative to the classification of roof coverings made of combustible materials with regard to the danger of conflagration resulting from an external fire

For Clause 7, method 4 is an adaptation of the British Standard:

[4] BS 476-3:2004, *Fire tests on building materials and structures — Part 3: Classification and method of test for external exposure to roofs*

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

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