BS EN 1365-2:2014

BSI Standards Publication

Fire resistance tests for loadbearing elements

Part 2: Floors and roofs

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National foreword

This British Standard is the UK implementation of EN 1365-2:2014. It supersedes BS EN 1365-2:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/22/-/7, Non loadbearing separating elements.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Contents

Page

Foreword

This document (EN 1365-2:2014) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2015, and conflicting national standards shall be withdrawn at the latest by May 2015.

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

This document supersedes EN 1365-2:1999.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, 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.

1 Scope

This European Standard specifies a method for determining the fire resistance of:

- floor constructions, without cavities or with unventilated cavities;

- roof constructions, with or without cavities (ventilated or unventilated);

- floor and roof constructions incorporating glazing;

with fire exposure from the underside.

This European Standard is used in conjunction with EN 1363-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1363-1:2012, *Fire resistance tests - Part 1: General Requirements*

EN 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*

EN ISO 13943, *Fire safety - Vocabulary (ISO 13943)*

3 Terms, definitions, symbols and designations

For the purposes of this document, the terms and definitions given in EN 1363-1 and EN ISO 13943 and the following apply.

3.1 Terms and definitions

3.1.1
floor construction
a horizontal separating element of building construction which is loadbearing

3.1.2
roof construction
a horizontal or sloped separating element of building construction which is loadbearing and includes the roof covering

3.1.3
ceiling
a lining plus any supporting framework, including hangers, fixings and any insulation material. The ceiling may be attached directly to the structural building member or be suspended from it or be self supporting (see Figure 1)

3.1.4
ceiling system
the full ceiling assembly submitted for test, including hangers and fixings, e.g. lighting and ventilation ductings and access points

3.1.5
cavity
the space between the upper surface of the ceiling and the underside of any floor, roof or its supporting construction

3.1.6
roof construction incorporating glazing
a roof construction as defined in 3.1.2 with one opening in which a glazed element is built in, with or without shared transoms or mullions

3.1.7
fire resistant glazing
a glazing system consisting of one or more transparent or translucent panes with a suitable method of mounting, with e.g. frames, seals, fixing materials, et, capable of satisfying the appropriate fire resistance criteria

3.1.8
insulated glazing
fire resistant glazing which satisfies both the integrity and insulation criteria for the anticipated fire resistance period

3.1.9
uninsulated glazing
fire resistant glazing which satisfies the integrity and, where required, the radiation criteria for the anticipated fire resistance period but which is not intended to provide insulation

3.1.10
glazed elements
building elements with one or more (light transmissive) panes, that are built in a frame with fixings and seals

3.1.11
pane
a single piece of monolithic or laminated glass, or an insulated glass unit (IGU)

3.1.12
aspect ratio
the ratio of the height of a pane to its width

3.1.13
mullion
a vertical framing member of a sloped construction, separating and supporting two adjacent panes of glass or panels

3.1.14
transom
a horizontal framing member of a sloped construction, separating and supporting two adjacent panes of glass or panels

3.2 Symbols and designations

Symbol	Unit	Description
L_{exp}	mm	Length of the test specimen exposed to heating.
L_{sup}	mm	Length of test specimen between centers of supports (this is equivalent to 'L' in EN 1363-1).
L_{spec}	mm	Length of the test specimen.

W_{exp}	mm	Width of the test specimen exposed to heating.
W_{sup}	mm	The transverse span of a two way spanning test specimen.
W_{spec}	mm	The width of the test specimen.
Am/V	m^{-1}	Section factor of steel beams
Am	m	Surface area of a member per unit length
V	m^2	Volume of a member per unit length
α	degrees	Inclination angle

4 Test equipment

The test equipment shall be as specified in EN 1363-1, and if applicable EN 1363-2.

5 Test conditions

5.1 Furnace

a) The heating and pressure conditions and the furnace atmosphere shall conform to those given in EN 1363-1 or, if applicable, EN 1363-2.

b) In addition to a) the following applies:

- The furnace pressure conditions shall be established 100 mm below the pressure reference line, see Figure 1.

- For inclined test specimen, the furnace pressure conditions shall be established 100 mm below the pressure reference line at the highest possible position, see Figures 1 and 2.

5.2 Loading conditions

The test specimen shall be subjected to loads determined in accordance with EN 1363-1. The determination of the load shall be clearly indicated in the test report.

The magnitude and the distribution of the load shall be such that the maximum moments and shear forces produced in the test specimen are representative of, or higher than those expected in practice.

The load shall be applied uniformly, e.g. by a point loading system.

Point loads shall be transferred to the test specimen through distribution plates; the total contact area between these and the floor surface shall be not more than 0,09 m^2 individually, or 16 % of the total surface area collectively.

If the plates are made of steel or of materials with a similar high conductivity, they shall be insulated from the surface of the test specimen.

The loading equipment shall not inhibit the free movement of air at the top of the test specimen and, other than at the loading points, no part of the loading equipment shall be closer than 60 mm to the unexposed surface of the test specimen.

6 Test specimen

6.1 General

Additional guidance on design of roof and floor constructions incorporating glazing is given in Annex A.

6.2 Size

a) The test specimen shall be full size unless the actual size is larger than can be accommodated in the furnace.

b) When the actual size cannot be accommodated in the furnace, the dimensions of the test construction shall be such that at least the following dimensions of the test specimen are exposed to the fire:

- exposed length (L_{exp}): 4 m;

- exposed width (W_{exp}): 3 m.

One way spanning floor or roof constructions, without ceilings, may have an exposed width between 2 m and 3 m, provided the relevant requirements given in 6.4 are accommodated.

For floor and roof constructions with suspended or self supporting ceilings, L_{exp} and W_{exp} shall be related to the surface of the ceiling.

c) For floor or roof constructions with structural members that span one way only, the following specifications with respect to the span and length of the test specimen apply:

- span (L_{sup}): L_{exp} plus up to half the length of the bearing at each end. The length of the bearing shall be selected so that the difference between [L_{sup}] and [L_{exp}] is kept to a minimum or as in practice, whichever is the smaller.

- length (L_{spec}): L_{exp} plus up to 500 mm at each end (see Figure 3).

d) For floor or roof constructions with structural members that span two ways, 6.2 c) applies to the main span. The span and width of the test specimen in the other direction shall be:

- span (W_{sup}): W_{exp} plus up to half the length of the bearing at each end;

- width (W_{spec}): W_{exp} plus up to 500 mm at each end.

6.3 Number

6.3.1 General

One test specimen shall be tested for each specified support/restraint, or exposure and loading condition.

More than one test will be necessary if one test cannot adequately cover all of the constructional variations given in 6.4.

6.3.2 Pitched roof constructions without glazing

In addition to 6.3.1 the following apply:

a) Trussed rafter roof constructions shall be tested for each inclination of the bottom member (chord) (see 13d)).

b) For apex or monopitch roof constructions with a span normal to the inclination, the number of tests depends on the tested inclination and the required validity of the test result (see 13 d)).

6.4 Design

6.4.1 General

The test specimen shall simulate the conditions of the use of the floor or roof construction in practice. It shall include all construction details, materials and components, (including water proofing) and shall be supported in accordance with 6.4.6.

An example of each type of joint or junction contained within the element for purposes of erection, construction or expansion, shall be incorporated in the test construction, even though such joints occur at greater centers than the relevant dimension of the test specimen.

Different jointing systems shall not be included in a single test specimen, unless it can be shown that they will not interfere with the performance of each other.

As the evaluation of fire spread through cavities or combustible parts within the structure is not part of the scope of this standard, all the edges of the test specimen can be protected from fire spread by suitable means for the purpose of the test. The means of protection shall not contribute to the loadbearing capacity of the construction and its size shall be kept to minimum to avoid downsizing of the fraction of the actual construction represented by the test specimen.

6.4.2 Floor or roof construction

a) The distance between the furnace wall or the associated construction and the nearest side of the beam or joist along the free edges shall be representative for the situation in practice.

b) For a construction containing beams with an exposed width greater than 3 m, the distance of both edge beams to the nearest centre beams may be reduced. In this case additional loading shall be applied on them to produce stress levels equal to those in the other beams.

c) The connections/junctions of the periphery of the floor or roof construction with the supporting construction shall be carried out in accordance with the sponsor's instructions. At the free edges of a one way spanning structure, the peripheral conditions shall allow freedom for deflection. The gaps at these edges shall be sealed with mineral wool and/or other materials according to the sponsor.

6.4.3 Ceiling system

a) The test specimen shall reproduce the conditions of use, including junctions between the ceiling, walls and edge panels, joints and jointing materials and shall be installed from below by the same method and procedures as given in the installation manual, or in written instructions, which shall be provided by the sponsor.

b) It shall be fitted with all the components for hanging, expansion and abutting, plus any other fixtures defined by the sponsor, with a frequency representative of practice. For ceilings which are suspended from the structural building member by hangers, the suspension system shall be representative of that used in practice.

c) The profiles bearing the various panels shall be installed against each other without any gap, unless a gap (or gaps) is required for design purposes. In this case the gap at the junction of the main supporting profiles shall be representative of that to be used in practice and shall be installed within the specimen and not at its perimeter. The profiles within the test assembly shall include a joint representative of joints to be used in practice in both longitudinal and transverse directions. Such junction and joints shall not be installed within 500 mm from any edge of the ceiling unless this is the recommended practice.

d) The assembly between the ceiling and the supporting construction or test frame shall reproduce that to be used in practice. Grid members shall be tightly fitted to the test frame or the supporting construction, without any gap, in order that the thermal expansion behaviour of grid members and expansion devices is correctly evaluated. However, if in practice a gap is used, this gap shall be incorporated in the test specimen.

e) If the longitudinal and transverse directions of the ceiling are constructed differently the performance of the specimen could vary depending upon which components are aligned with the longitudinal axis. The specimen shall therefore be tested in the most onerous orientation by arranging the more critical components parallel to the longitudinal axis. If the more onerous orientation cannot be identified two separate tests shall be carried out with the components arranged both parallel and perpendicular to the longitudinal axis.

f) If fixtures and fittings are to be installed, the fire resistance of the ceiling system, without such fixtures and fittings, shall have been evaluated previously. When testing with fixtures and fittings the method of installation and frequency of use of these shall be representative of that used in practice. Such fixtures and fittings shall not be installed within 500 mm from any edges of the ceiling.

g) Self supporting ceilings shall be fixed to the test frame or the supporting construction on three edges, the free edge shall be parallel to the direction of the span.

h) Suspended ceilings shall be fixed on four edges to the test frame or the supporting construction.

i) When pitched roof constructions with suspended ceilings are tested horizontally, the height of the cavity of the test construction shall be equal to half the maximum cavity height of the construction in practice, with a tolerance of ± 20 %.

6.4.4 Pitched roof constructions

a) Trussed rafter roof constructions shall be tested as complete structures for any inclination of the bottom member (chord).

b) Apex roofs when not a trussed rafter construction shall be tested as shown in Figure 2.

c) Apex and monopitch roof constructions shall be tested horizontally with the test results applicable to all angles with the exception of those specified in 6.3.2 b).

6.4.5 Floor and roof constructions incorporating glazing

a) The test specimen shall incorporate the largest pane and area of glass which is intended to be used in practice.

b) For pitched constructions in which glazing can be installed with the lowest dimension either parallel or normal to the inclination, the largest pane of glass shall be installed in the most onerous orientation. The selection of the most onerous orientation shall be explained in the test report.

c) If the glazing incorporates shared transom(s) or mullion(s), at least one of each shall be incorporated into the test specimen.

6.4.6 Support and restraint conditions

6.4.6.1 Floor constructions and roof constructions without glazed elements

a) Standard conditions

The floor or roof construction shall be tested as a simply one way spanning structure with an exposed surface and span as defined in 6.2. It shall be mounted to allow freedom for longitudinal movement and deflection.

The surface of the concrete or steel bearings shall be smooth and flat. The width of the bearings shall be the minimum representative of that used in practice and in any case not more than 200 mm.

b) Other support and restraint conditions

If the support and restraint conditions differ from the standard conditions specified in a) these conditions shall be described in the test report and the validity of the test results will be consequently restricted (see Figure 3b and Figure 4).

6.4.6.2 Floor and roof constructions incorporating glazing

a) Where the size of the glazed element is such that it can be accommodated in the test specimen with dimensions according to 6.2 and if the conditions given in 5.2 can be satisfied, only one test needs to be carried out.

The edges of the glazed element shall be fixed and restrained according to the specifications of the sponsor.

b) Where the size of the glazed element is larger than can be accommodated in the test specimen, two tests shall be carried out:

- A test on the test specimen without the glazed element

- A test on the glazed element built in a supporting construction representative of the floor or roof construction used in practice. The supporting construction shall have a minimum width of 200 mm.

6.5 Construction

The test specimen shall be constructed as described in EN 1363-1.

6.6 Verification

Verification of the test specimen shall be carried out as described in EN 1363-1.

7 Installation of test specimen

The test specimen shall be installed in a manner representative of its use in practice.

8 Conditioning

The test specimen shall be conditioned in accordance with EN 1363-1.

9 Application of instrumentation

9.1 Thermocouples

9.1.1 Furnace thermocouples (plate thermometers)

a) Test specimen with a horizontal exposed surface

Plate thermometers shall be provided in accordance with EN 1363-1. There shall be at least one for every 1,5 m^2 of the exposed surface area of the test construction. The plate thermometers shall be orientated so that side ‘A’ faces the floor of the furnace. For test specimens with less than 6 m^2 exposed area, a minimum of four plate thermometers shall be used.

b) Test specimen with an inclined exposed surface

In addition to 9.1.1 a) the plate thermometers shall be located in a plane at the level of the lowest side of the exposed surface of the test specimen (see Figure 2).

9.1.2 Unexposed surface thermocouples for constructions without glazing

9.1.2.1 General

Surface thermocouples of the type specified in EN 1363-1 shall be attached to the unexposed surface of the test specimen to measure the average and maximum temperature rise. For the location and number of these thermocouples see EN 1363-1 and the following.

9.1.2.2 Thermocouples for measuring the average temperature rise

a) The average temperature rise shall be measured with at least five thermocouples at positions specified in EN 1363-1.

b) For test specimens which contain discrete areas ≥ 0,1 m² expected to exhibit different levels of insulation performance, each discrete area shall be individually monitored for average temperature rise. The average temperature rise shall be measured by thermocouples distributed over each discrete area. One thermocouple shall be provided for every 1,5 m² or part thereof of the test specimen. A minimum of two thermocouples for each discrete area shall be provided.

c) For wooden floors or roof constructions the distance of these thermocouples to the side of the nearest joist shall be at least 50 mm (see Figure 5).

d) For wooden floors or roof constructions the distance of the thermocouples to the joints of the floor boards, panels or slabs, shall be at least 50 mm.

e) Where the test specimen is covered only with one layer of floor boards with a board width of less than 100 mm, the distance shall be half the width of the boards.

f) When the test specimen has insulated parts of differing thicknesses the number of thermocouples on the unexposed face shall be increased to six to provide equal numbers of thermocouples at the maximum and minimum thicknesses.

9.1.2.3 Thermocouples for measuring the maximum temperature rise

a) If the test specimen incorporates discrete areas of different thermal insulation which are evaluated separately as in 9.1.2.2 then the evaluation of maximum exposed face temperature of these areas shall also be undertaken separately. This may require extra unexposed surface thermocouples to be applied.

b) Additional thermocouples shall be attached to measure the maximum temperature rise at locations where higher temperature conditions are expected to exist, on locations in accordance with EN 1363-1 and with a minimum of two per type of joint. For test specimens covered with only a single layer of boards however, at least one thermocouple per 2 m^2 exposed area shall be attached near the joints.

c) For floors or roofs with wooden beams or joists the distance (e_1) to the nearest side of the beam or joist shall be at least 50 mm.

d) The distance (e_3) of the thermocouples to the joints shall be 20 mm (see Figure 5).

e) The thermocouples shall not be placed closer than 100 mm from an uninsulated glazed element or 150 mm from the free edge(s) of the test specimen.

9.2 Pressure

The furnace pressure shall be measured at locations with pressure sensors as described in EN 1363-1. For sloped roof constructions, see 5.1 b).

9.3 Deflection

Deflection shall be measured perpendicular to the test specimen.

For simply supported floor or roof specimens the deflection shall be measured at mid-span. For other supported conditions, the measurements shall be made at the location where the maximum deflections are expected to occur.

For floors or roofs supported close to one or two edges on a beam, which will deflect during the fire test, the deflection of these beams shall be measured at mid-span of the beams.

The deflection measurement shall normally be done on the top surface of the test specimen. If the surface layers do not contribute to loadbearing capacity of the construction, deflection shall be measured on the extreme fibre of the cold design compression zone (EN 1363-1:2012,11.1). The same principle applies to cases where the thickness of the test specimen can change during the test.

9.4 Radiation

If radiation is to be measured, radiometers shall be positioned as described in EN 1363-2.

10 Test procedure

10.1 General

The test shall be carried out using the equipment and procedures in accordance with EN 1363-1 and, if appropriate, EN 1363-2.

10.2 Application and control of load

Apply and control the load and restraint in accordance with EN 1363-1.

10.3 Furnace control

Measure and control the furnace temperature and pressure in accordance with EN 1363-1 or EN 1363-2.

10.4 Observations during the test

Monitor the test specimen and make observations of the behaviour of the test specimens in accordance with EN 1363-1.

10.5 Termination of the test

Terminate the test for one or more reasons given in EN 1363-1.

11 Performance criteria

The criteria by which the performance of the test specimen is judged are given in EN 1363-1.

12 Test report

In addition to the items required by EN 1363-1, the following shall also be included in the test report:

a) reference that the test was carried out in accordance with EN 1365-2;

b) the support and restraint conditions apply to the test specimen.

13 Field of direct application of test results for constructions without glazing

The test results are directly applicable to a similar untested floor or roof construction provided the following is true:

a) With respect to the structural building member:

- The maximum moments and shear forces, which when calculated on the same basis as the test load, shall not be greater than those tested.

b) With respect to the ceiling system:

- The size of panels of the ceiling lining may be increased by a maximum of 5 % but limited to a maximum of 50 mm. The length of the grid members can be increased accordingly.

- The total area occupied by fixtures and fittings relative to the area of the ceiling lining is not increased and the maximum tested opening in the lining is not exceeded.

c) With respect to the cavity:

- The height of the cavity h and the minimum distance d between the ceiling and the structural members (see Figure 1) are equal to or greater than those tested.

- No material is added to the cavity unless the same amount (in terms of both weight and fire load) of material was included in the test specimen.

d) With respect to the inclination of roof constructions:

- For trussed rafter roof construction, the inclination of the bottom member (chord) is equal to its tested inclination with a tolerance of ± 5°.

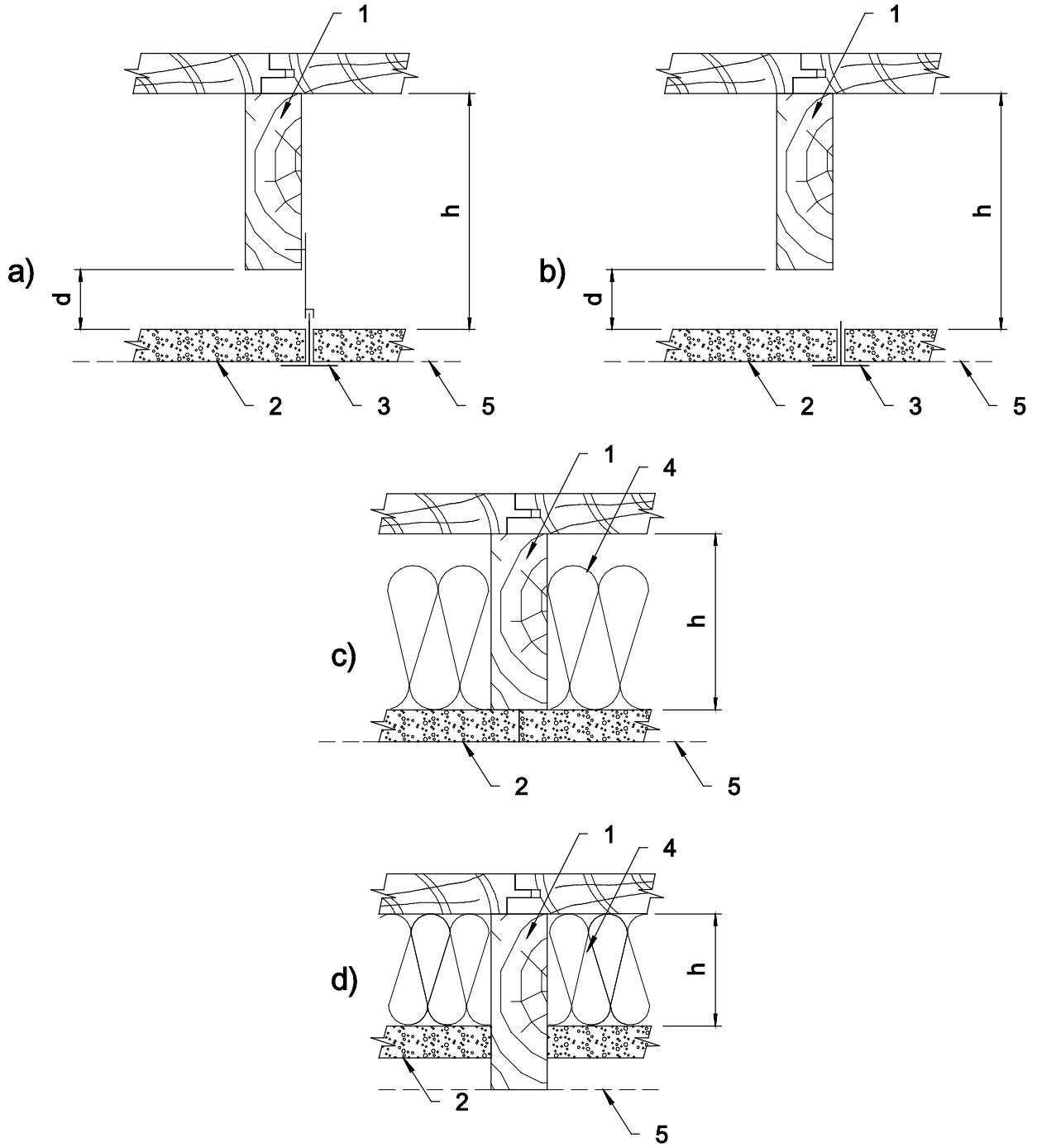
- For roofs incorporating one or more purlins, tested at an inclination angle of ≤ 10°, the results are valid for installation in practice under an angle from 0° up to 80°.

- For apex or monopitch roof construction as defined in 6.3.2 b) the inclination is ± 15° in accordance with Table 1.

Table 1 — Inclination for apex or monopitch roofs

Tested at α from the horizontal	Valid for installation in practice
≤ 10° (nominally 'horizontal') 30° Any other angles	0° up to 15° 15° up to 45° ± 10° from the angle tested up to a limit of 80°

Dimensions in mm

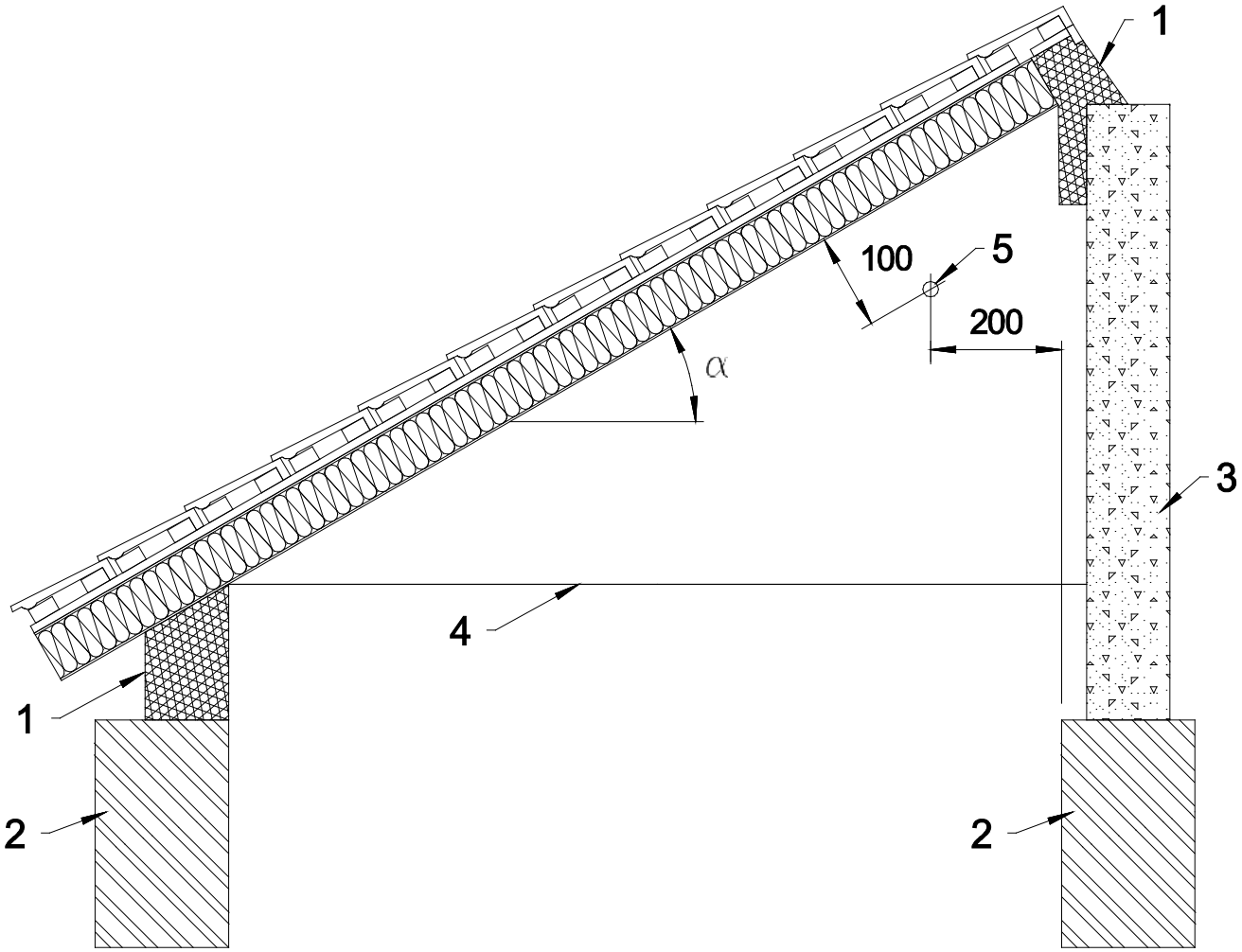


Key

a)	suspended ceiling
b)	self-supported ceiling
c) and d)	direct fixed ceiling with insulation in cavity
1	supporting construction (joist)
2	ceiling lining
3	supporting frame
4	insulation
5	pressure reference line
d	distance between ceiling and structural members
h	height of cavity

Figure 1 — Examples of ceilings

Dimensions in mm

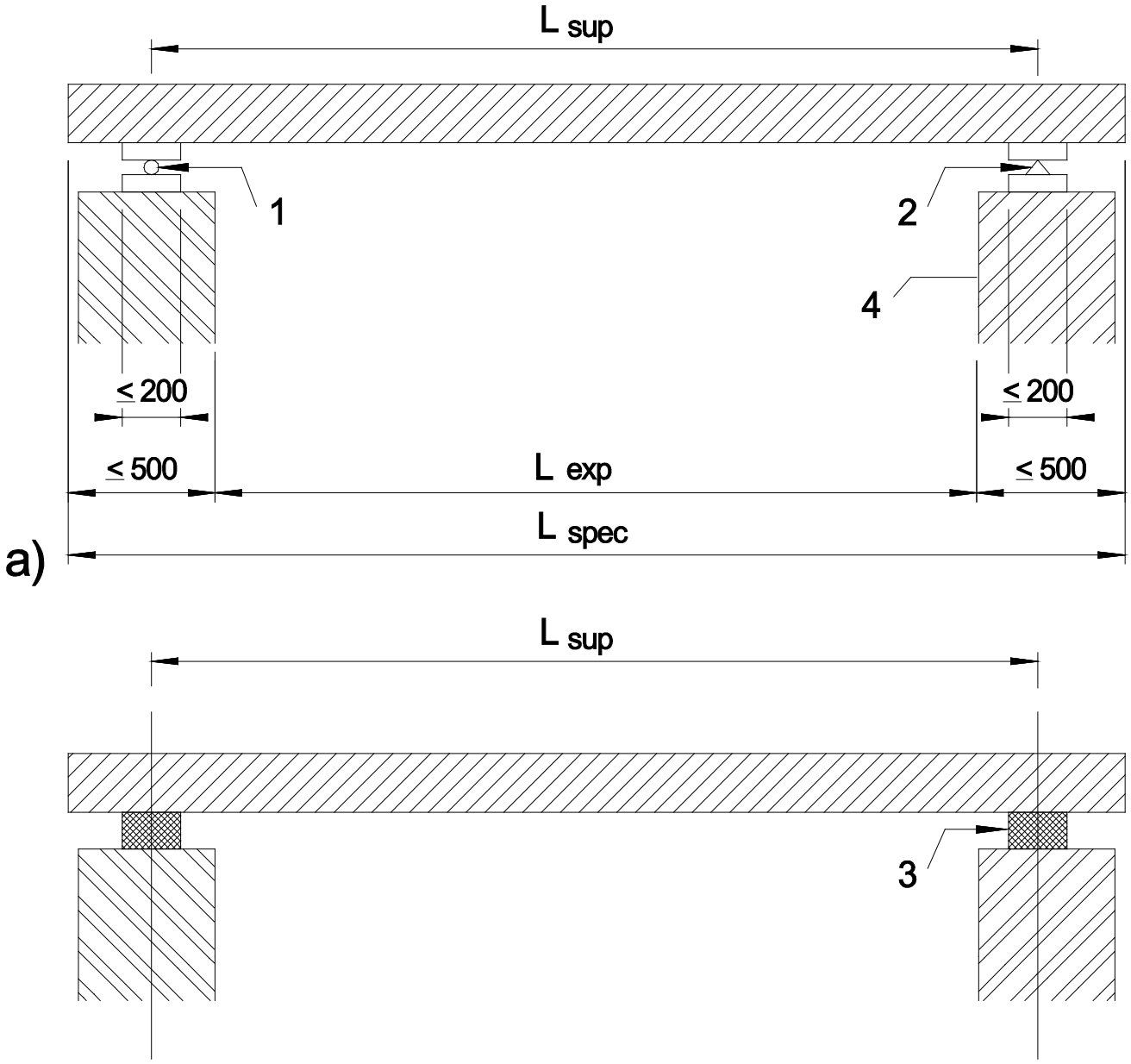


Key

1	mineral wool
2	furnace wall
3	supporting construction
4	plane of furnace thermocouples
5	location of furnace pressure condition
α	inclination angle

Figure 2 — Cross section of a one way pitched roof construction

Dimensions in mm



Key

a) standard supporting conditions

b) restrained support conditions

1 rolling support

2 hinge support

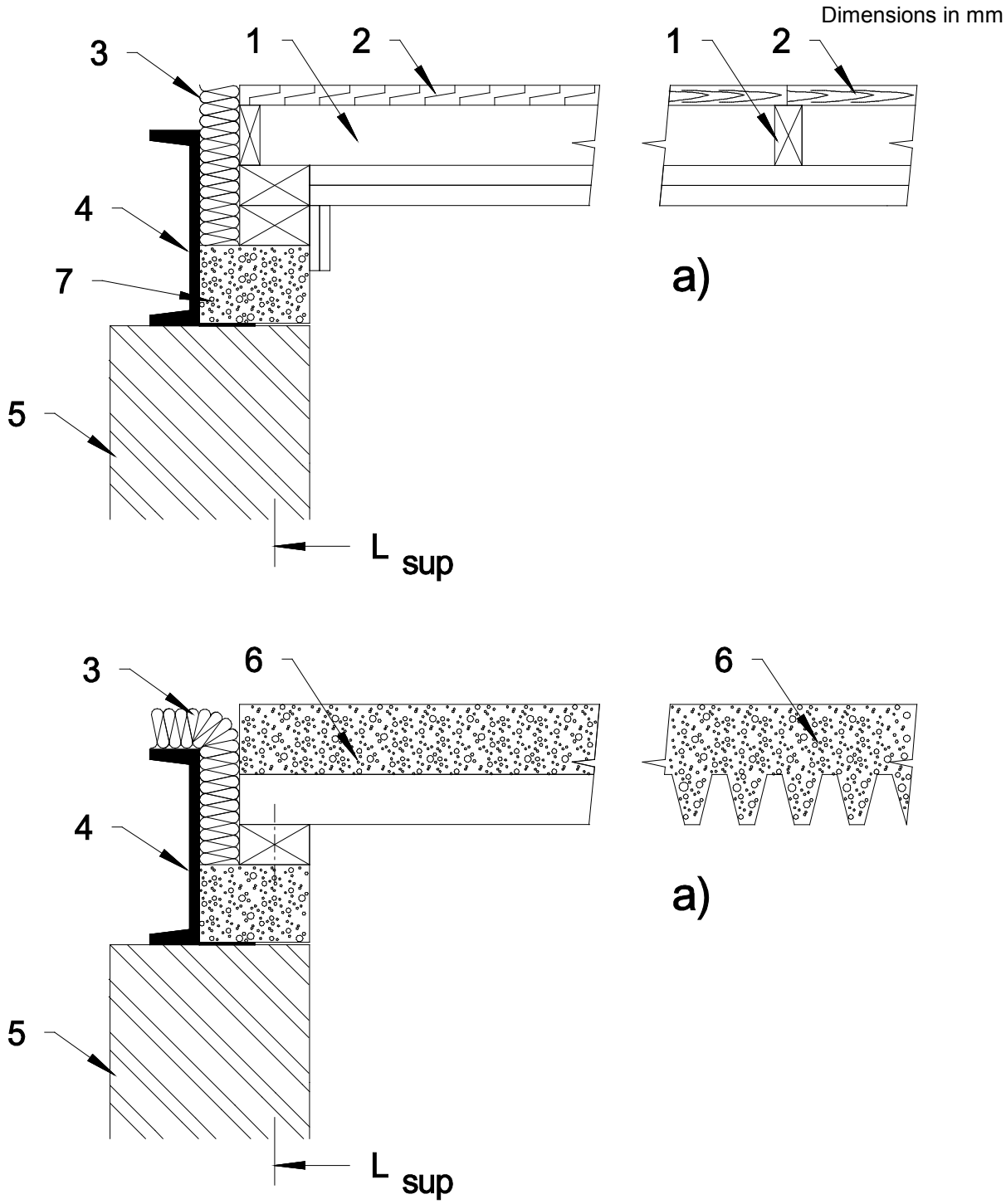
3 restrained support

4 furnace wall

L_{sup} = L_{exp} + up to half the length of the bearing at each side

L_{spec} = L_{exp} + up to 500 mm at each end

Figure 3 — Illustration of exposed length and span (longitudinal cross section of specimen)

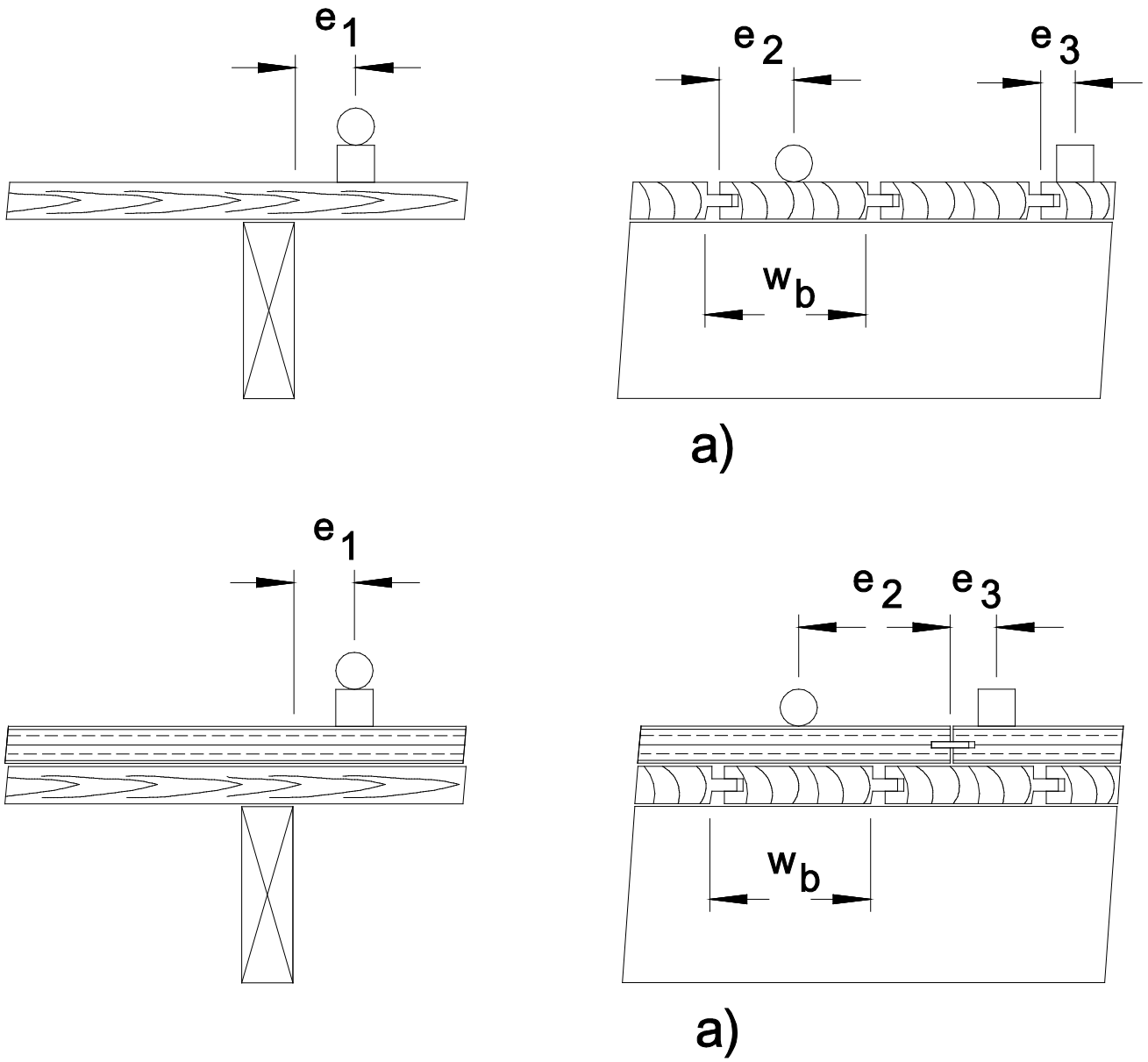


Key

1	loadbearing construction (joist)
2	timber floor
3	mineral wool
4	test frame
5	furnace wall
6	composite steel concrete floor
7	resilient insulating material
a)	cross section

Figure 4 — Example of restraint support condition

Dimensions in mm



Key

o	thermocouple for average temperature rise
□	thermocouple for maximum temperature rise
e_1	≥ 50 mm (thermocouple for average temperature rise, thermocouple for maximum temperature rise in case of timber beams or joists)
e_2	= 50 mm or $w_b/2$ whichever is smaller (thermocouple for average temperature rise)
e_3	= 20 mm (thermocouple for maximum temperature rise)
a)	cross section

Figure 5 — Example of thermocouple positions

Annex A
(normative)

Specific requirements for testing floor and roof constructions incorporating glazing

A.1 General

A floor or roof construction may contain one pane, a substantial number of such panes or it may consist almost entirely of panes. These may be small framed units or large panes with substantial frames attached to the roof or floor surround. Under fire conditions the separating element is expected to remain a satisfactory fire barrier and this requirement applies to glazed and unglazed parts of the system.

The fire resistance of a glazed system is a function of the nature of the glass, the size and aspect ratio of the panes, the characteristics of the framing members, the method of retention and the expansion provisions.

If the objective of a fire test is to obtain information on a specific system for a particular end use then the specific construction is used for the test specimen. However, if the intention is to obtain data for a wider application to other similar constructions then a single test may justify this depending on the inclusion of certain design features in the test specimen. The applicability of the result to other similar constructions is given in A.5.

A.2 Test specimen design

The test specimen shall be designed to obtain the widest applicability of the test result when considered in conjunction with the direct and extended field of application rules.

The following features can only be incorporated in similar constructions provided they were included in the test specimen.

a) Non-glazed panels;

b) Junction(s) between a transom and mullion (‘+’);

c) Junction(s) of mullion(s) terminating at a transom (‘T’);

d) Junction(s) between transom(s) and mullion(s) where the mullion(s) is (are) full height and interrupt(s) transoms;

e) Jointing systems between glazed elements or between glazed elements and other constructions;

f) Other constructional features to be evaluated e.g. structures present for safety or security reasons.

The test specimen shall not contain mixtures of different types of construction e.g. different types of glass or framing members unless this is fully representative of the construction in practice.

For framed systems, the pane with the largest linear dimension shall be located where it will be subjected to maximum deflection.

NOTE The maximum deflection is expected to occur between any unrestrained transoms or mullion without junctions.

For butt-jointed systems, the design of the test specimen shall include at least 1 joint, or at least 2 parallel joints when in practice more than 2 glass panes are adjacent to each other.

A.3 Test specimen instrumentation

A.3.1 General

If the test specimen consists entirely of uninsulated glazing it shall be treated as an uninsulated construction and no unexposed surface thermocouples need to be attached. It shall only be evaluated with respect to the integrity criteria and where required, radiation.

If the test specimen has one or more discrete panes of uninsulated glazing, it shall be treated as a partly insulated construction. The insulated part may be required to provide the necessary thermal insulation for which purpose the appropriate number of thermocouples shall be provided. No thermocouples are required to be placed on the uninsulated glass.

If all of the test specimen is made using insulating glass (and frames), it shall be treated as a fully insulated construction and its performance shall be judged on the basis of compliance with the criteria of integrity and insulation.

Thermocouples of the type specified in EN 1363-1 shall be attached to the unexposed face of the test specimen for the purpose of obtaining the average and the maximum surface temperatures. General rules for the attachment and exclusion of thermocouples given in EN 1363-1 shall apply with the following variations:

A.3.2 Average temperature rise

A.3.2.1 Uniform glazing

For the purposes of measuring the average temperature rise, one thermocouple shall be provided for every 1,5 m^2 or part thereof of the specimen. A minimum of two thermocouples for each pane of glass shall be provided. The two thermocouples shall be positioned at the centre of two quarters of each pane diagonally opposite each other. Any additional thermocouples shall be evenly distributed over the surface of the pane. Typical examples are shown in Figures A.1 to A.4.

A.3.2.2 Non-uniform glazing

For test specimens containing non-uniform glazing, i.e. those which contain different discrete areas, each area shall be individually monitored for average temperature rise as in A.3.2.1.

A.3.3 Maximum temperature rise

A.3.3.1 General

Additional thermocouples shall be attached to the framing members and panes to judge compliance with the maximum temperature rise criterion as follows.

A.3.3.2 Sloped constructions

a) at the top horizontal framing member at mid width of the specimen;

b) at the top horizontal framing member in line with a mullion;

c) at each type of junction (e.g. ‘T’- or ‘+’-junction) of framing members;

d) at the vertical framing member on the fixed edge at mid height of the specimen;

e) at mid height of each free edge, 150 mm in from the edge;

f) at mid width of a transom;

g) at mid height of a mullion;

h) at mid-height of the pane with the largest area, 20 mm from the vertical framing member or the joint. If the largest pane is not the tallest pane, then another thermocouple shall be placed at mid-height of the tallest pane, 20 mm from the vertical framing member or the joint;

i) at mid-width of the pane with the largest area, 20 mm from the horizontal framing member or the joint at the top edge of the pane. If the largest pane is not the widest pane, then another thermocouple shall be placed at mid-width of the widest pane, 20 mm from the horizontal framing member or the joint at the top edge of the pane;

j) in the top corners of the pane with the largest area, and, additionally in the top corners of the highest placed pane with the largest area, if this is not the same pane (at least 150 mm in from the free edge).

Typical examples are shown in Figures A.1 and A.2.

Where possible thermocouples shall be placed in the upper half of the test specimen.

In case a framing member is covered with glass, the corresponding thermocouple shall be placed on the glass (where relevant, 20 mm away from a discontinuity).

A.3.3.3 Horizontal constructions

a) at mid width of the outer framing members of the specimen;

b) at each centre junction of the framing members, excepting the outer framing members;

c) on the centre framing member adjacent to the largest linear glass dimension, at mid width;

d) on the centre framing member adjacent to the pane with the largest area, at mid width of the longer side;

e) at mid dimensions and in the corners of the pane with the largest area, 20 mm from the centre framing members or the joints (at least 150 mm in from the free edge). In case of a single pane, the outer framing members shall be used accordingly.

   If the largest pane is not the pane with the largest linear dimensions, then other thermocouples shall be placed at mid-height and in the corners of the pane with the largest linear dimensions, 20 mm from the centre framing members or the joints (at least 150 mm in from the free edge);

f) at mid span of the free edge, 150 mm in from the edge.

Typical examples are shown in Figures A.3 and A.4.

In case a framing member is covered with glass, the corresponding thermocouple shall be placed on the glass (where relevant, 20 mm away from a discontinuity).

A.3.4 Deflection

Deflection shall be measured perpendicular to the test specimen.

For simply supported floor or roof specimens the deflection shall be measured at mid-span. For other supported conditions, the measurements shall be made at the location where the maximum deflections are expected to occur.

For floors or roofs supported close to one or two edges on a beam, which will deflect during the fire test, the deflection of these beams shall be measured at mid-span of the beams

A.3.5 Radiation measurement

When there is a requirement to establish the radiation from the unexposed face of the glazing, provision shall be made to measure the radiation from the unexposed face as given by EN 1363-2.

A.4 Performance criteria

The criteria by which the performance of the test specimen is judged are given in EN 1363-1.

A.5 Field of direct application of test results

A.5.1 General

The results of the fire test are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and stability. Other changes are not permitted.

a) Decrease in the linear dimensions of panes

b) If, for sloped constructions, both portrait and landscape aspect ratio rectangular panes have been tested, then the height of the landscape pane may be increased and/or the width of the portrait pane may be increased, subject to:

- the area of the pane after increasing the linear dimensions shall be less or equal to the average area of the largest tested landscape and portrait panes, i.e. $A \leq ½ * (A_{portrait, max} + A_{landscape, max})$,
- all panes were tested in an identical framing and glazing system,
- the largest tested width as well as the largest tested height is not exceeded.

c) Decrease in the distance between mullions and/or transoms.

d) Decrease in distance between fixing centres (e.g. fixing of the framing system to the support construction, and fixing of glass panes in the glazing system)

e) Screwed-on glazing beads, if 'clip-on' beads were incorporated in the test specimen

f) Allowances for expansion if none were incorporated in the test specimen

A.5.2 Shapes of flat glass panes

The internal angle at each corner of the glass panes incorporated in the test may vary by up to ± 15° of the angles tested, provided the number of corners will not change. The framing members are adapted accordingly.

A.5.3 Span length

Decrease of span length is allowed but no extension of span is permitted.

A.5.4 Extension of width in direction perpendicular to the span

Test results cover rectangular glazed elements of greater width or replication (two or more glazed elements connected to each other) of the glazed element, provided:

a) the framing system is identical to the one tested;

b) the width of the specimen in the test was nominal 3 m or greater with:

- two edges (parallel to the span) unrestrained, or
- one edge (parallel to the span) unrestrained and minimum two full length mullions next to the free edge;

c) the mullions within and/or connection joints between glazed elements have been tested.

In case of elements intended to be classified for EW, the following additional provisions apply:

- the average temperature of the unexposed face of the glazed element as well as the average temperature of the unexposed face of the non-glazed area of the test specimen remained below 300 °C or
- the heat radiation measured from the complete and fully glazed test element did not exceed 13 kW/m².

NOTE The value of 13 kW/m^2 is determined such that the heat radiation from the construction with the extended dimensions is not exceeding 15 kW/m^2.

A.5.5 Inclination angle

The applicability of a test specimen tested at one angle to other angles of installation is as given in Table A.1:

Table A.1 — Inclination angle

Tested at angle α from the horizontal	Valid for installation in practice
0º	Up to 80º
45º	>15° up to 80°
Any other angles	± 15° from the angle tested up to a limit of 80^0

A.5.6 Supporting constructions

A.5.6.1 General

For specimens tested in the test frame only (no supporting construction), the result is applicable to high density rigid building elements with at least the same fire resistance as the test specimen.

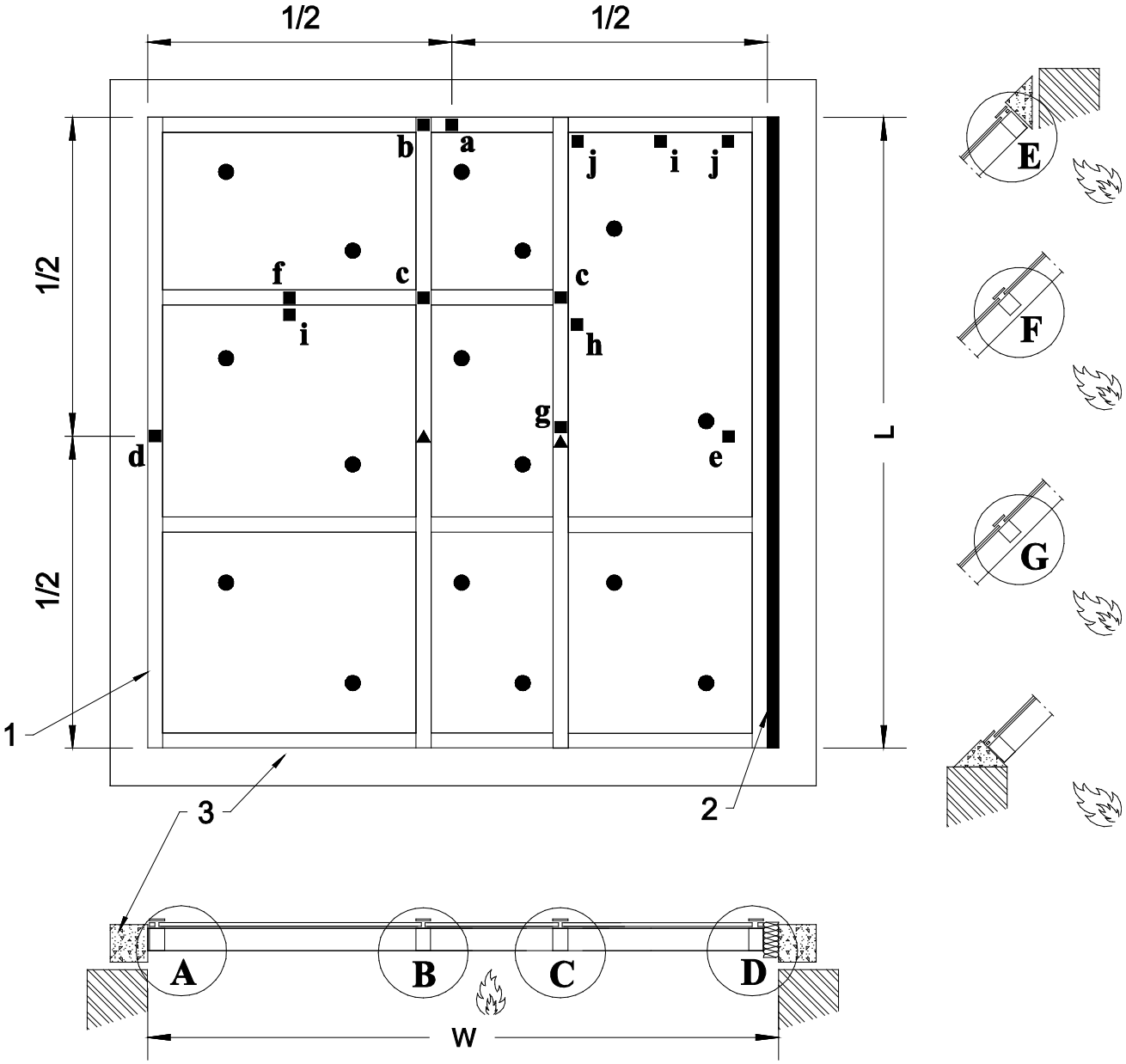
A.5.6.2 Standard supporting constructions

Test results obtained with low density rigid standard supporting constructions may be applied to high density supporting constructions (in accordance with EN 1363-1) with at least the same fire resistance classification and an overall thickness equal to or greater than that of the element used in the test.

A.5.6.3 Non-standard supporting construction

The result of a test of fire resistant glazing tested in non-standard supporting constructions is only applicable to that construction.

Dimensions in mm



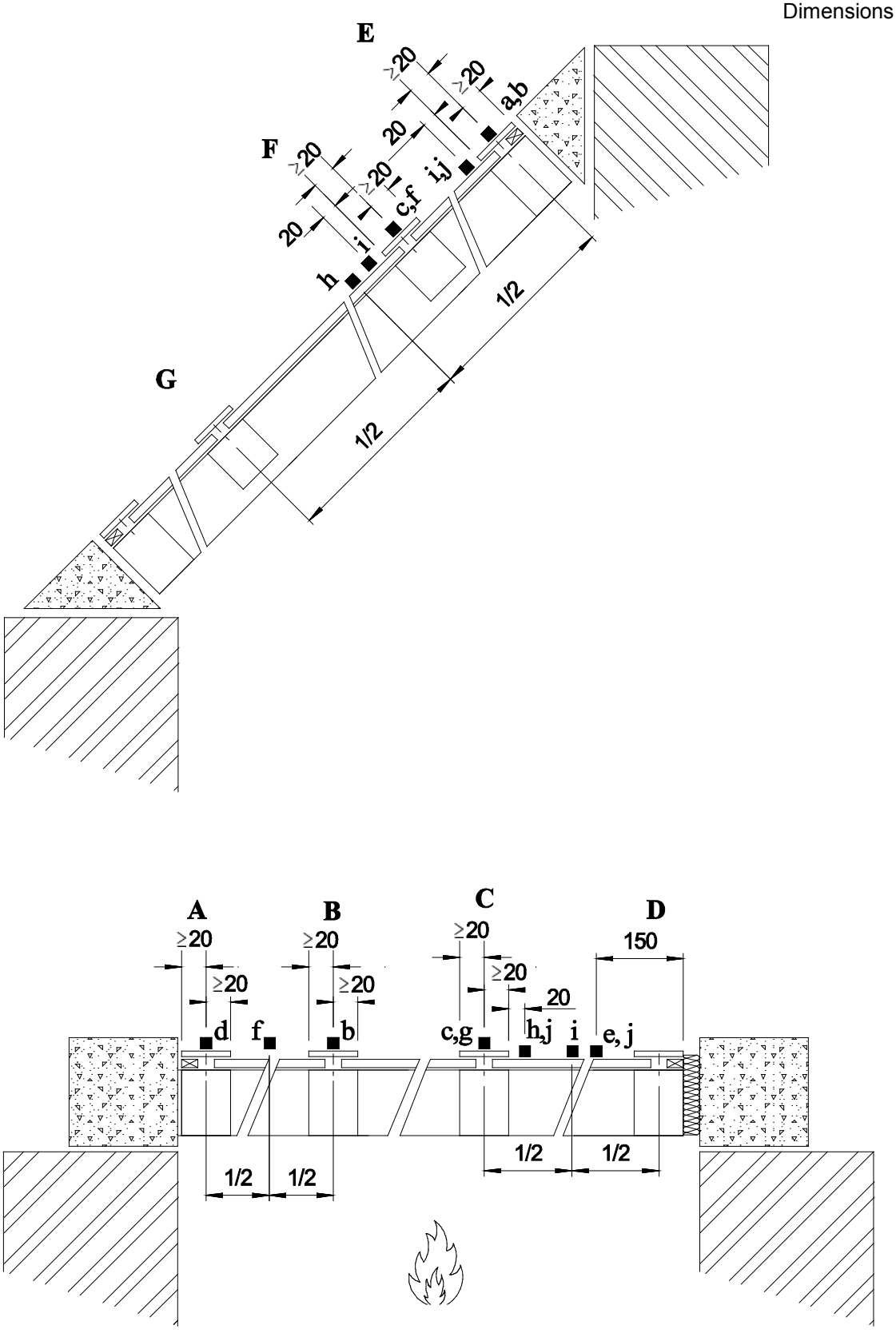
Key

- ● positions for thermocouples for average temperature rise (see A.3.2)
- ■ positions for thermocouples for maximum temperature rise (see A.3.3.2)
- ▲ positions for deflection measurements
- 1 fixed edge (or second free edge)
- 2 free edge
- 3 test frame, associated construction or supporting construction
- W width
- L span length

A, B, C, D, E, F, and G see Figure A.2

Figure A.1 — Example of location of unexposed thermocouples and deflection measurement positions for sloped roofs incorporating glazing

Dimensions in mm

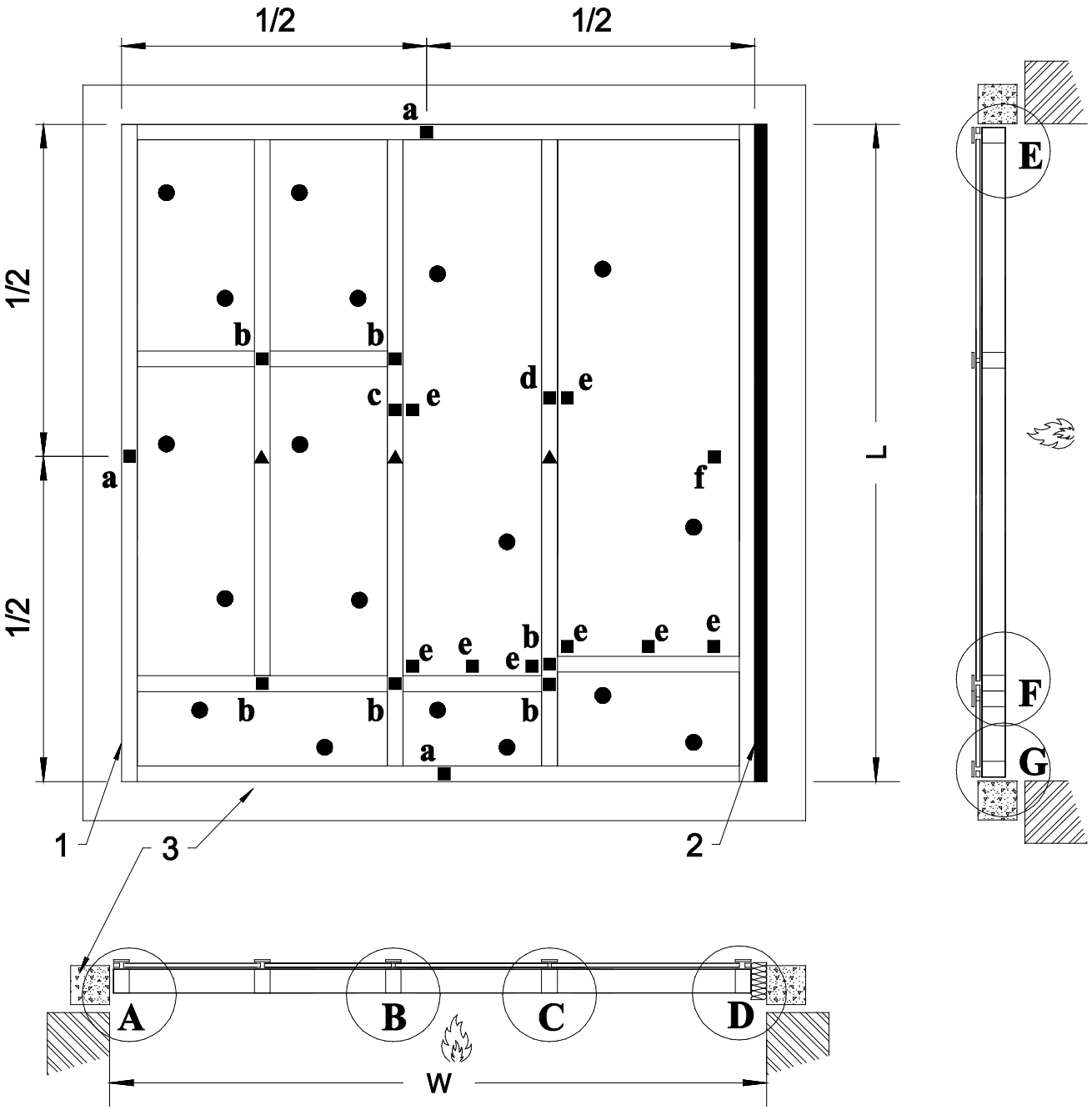


Key

- positions for thermocouples for maximum temperature rise (see A.3.3.2)
  for overall location of thermocouples see Figure A.1

Figure A.2 — Example of unexposed thermocouple positions for sloped roofs incorporating glazing

Dimensions in mm



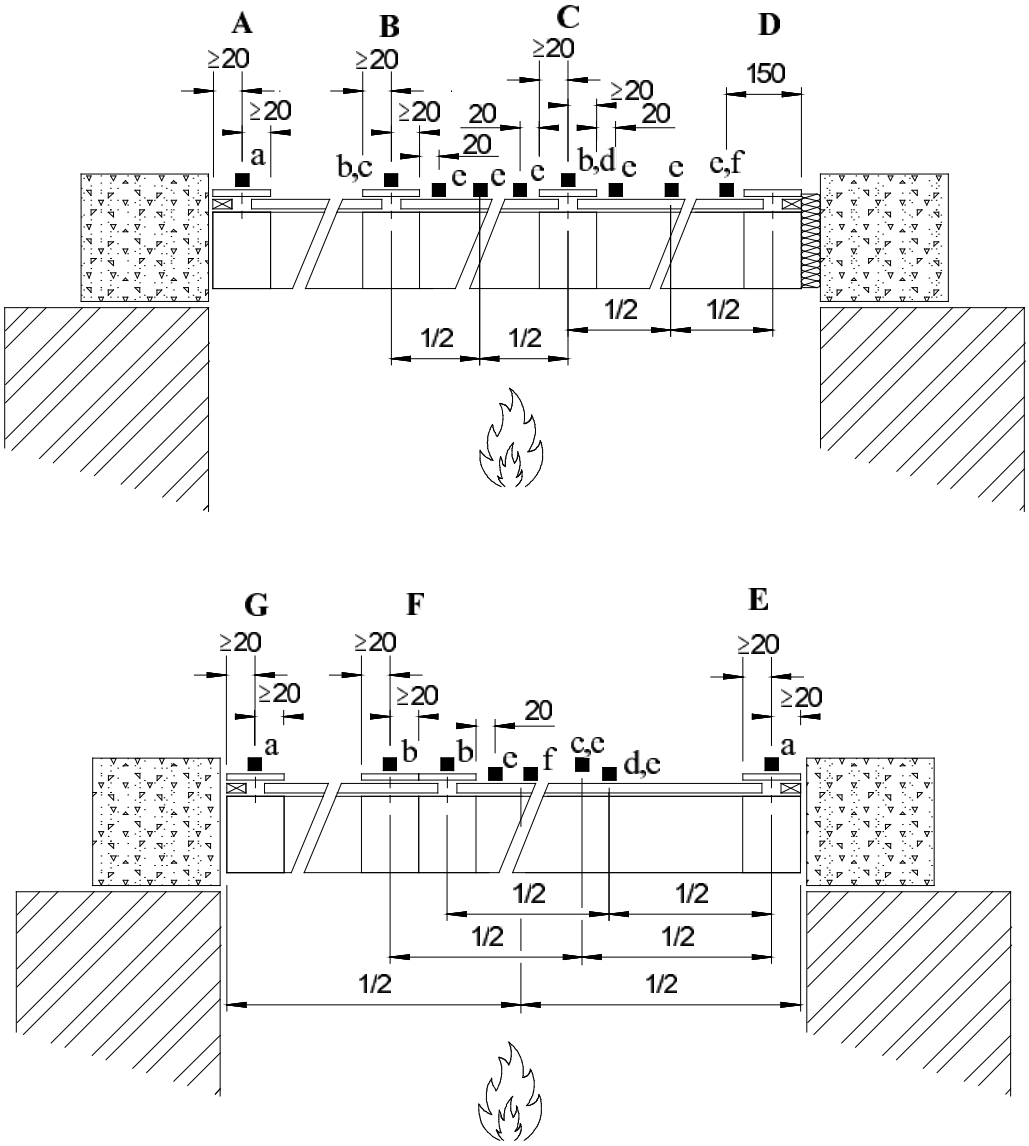
Key

- ● positions for thermocouples for average temperature rise (see A.3.2.)
- ■ positions for thermocouples for maximum temperature rise (see A.3.3.3)
- ▲ positions for deflection measurements
- 1 fixed edge (or second free edge)
- 2 free edge
- 3 test frame, associated construction or supporting construction
- W width
- L span length

A, B, C, D, E, F and G see Figure A.4

Figure A.3 — Example of location of unexposed thermocouples and deflection measurement positions for horizontal roofs or floors incorporating glazing

Dimensions in mm



Key

■ positions for thermocouples for maximum temperature rise (see A.3.3.3)
for overall location of thermocouples see Figure A.3

L span length

Figure A.4 — Example of unexposed thermocouple positions for horizontal roofs or floors incorporating glazing

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