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Reaction-to-fire tests for façades —

Part 1: Intermediate-scale test

Essais de réaction au feu des façades —

Partie 1: Essai à échelle intermédiaire

Reference number
ISO 13785-1:2002(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 13785 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13785-1 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

ISO 13785 consists of the following parts, under the general title *Reaction-to-fire tests for façades*:

— *Part 1: Intermediate-scale test*

— *Part 2: Large-scale test*

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Introduction

Fire is a complex phenomenon. Its behaviour and effects depend on a number of interrelated factors. The behaviour of materials and products depends on the characteristics of the fire, the method of use of the materials and the environment in which they are exposed. The theory of “reaction to fire tests” is explained in ISO/TR 3814[2].

The need for improved thermal insulation of buildings both for single and multi-storey dwellings and for industrial buildings has led to an increased use of insulated and often ventilated façades.

With these types of construction products, there are three primary fire threats to the walls and ceilings/roofs of a building:

a) an interior compartment fire venting through a window on to a façade;

b) an exterior fire in combustibles accumulated near a wall (e.g. rubbish, vegetation);

c) fire in an adjacent building.

Item a) is generally the most severe and substantially the most significant.

Fire can spread in several ways. The most significant is by spread over a combustible exterior surface or the fire travelling vertically and horizontally through air cavities between claddings or façades, or through the core of insulation itself.

The results may not, however, reflect the actual performance of exterior wall assemblies under all fire exposure conditions.

The test specified in this part of ISO 13785 covers a simple representation of one fire scenario with façade products, typified by a fire within a building venting through a window and impinging directly on to a façade.

The two parts of ISO 13785 provide two methods of test: an intermediate scale test specified in this part, which should only be used for screening or evaluation of sub-components or “families of products”, and a large scale test specified in Part 2, which should be used to provide the end-use evaluation of all aspects of the façade system.

These test methods are intended to evaluate assemblies that are not intended for use as an internal lining.

The test specified in this part of ISO 13785 may be used for comparative purposes or to ensure the existence of a certain quality of performance considered to have a bearing on the fire performance of the façades generally. No other meaning is attached to performance in this test. The large-scale test in Part 2 of ISO 13785 should be used to give a more realistic end-use assessment of performance.

The test specified in this part of ISO 13785 does not rely on the use of asbestos-based materials.

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Reaction-to-fire tests for façades —

Part 1:
Intermediate-scale test

WARNING — So that suitable precautions may be taken to safeguard health, all persons involved in the fire tests should be aware of the possibility that toxic or harmful gases may be evolved during exposure of test specimens.

Hazards are encountered when assessing the fire performance of any product on an intermediate-scale and it is essential that adequate precautions be taken.

Particular attention should be paid to the potential evolution of smoke and toxic gases and to the fact that extensive flaming of specimens can occur sometimes with resultant mechanical failure of fixings and joints and possible structural collapse.

An adequate means of extinguishing the specimen should be provided.

1 Scope

This part of ISO 13785 specifies a screening method for determining the reaction to fire performance of products and constructions of façades or claddings when exposed to heat from a simulated external fire with flames impinging directly upon a façade. It is intended for use by producers to reduce the burden of testing in Part 2 of ISO 13785 by eliminating those systems that fail the tests described in this part of ISO 13785.

This test method is applicable only to façades and claddings that are not free standing and that are used as an addition to an existing external wall.

This test method also is only applicable to vertical elements and is not applicable to determining the structural strength of the façade or cladding.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13785. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13785 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 13943:2000, *Fire safety — Vocabulary*

IEC 60584-2, *Thermocouples — Part 2: Tolerances*

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3 Terms and definitions

For the purposes of this part of ISO 13785, the terms and definitions given in ISO 13943:2000 and the following apply.

3.1
assembly
fabrication of materials and/or composites

EXAMPLE Sandwich panel.

NOTE An assembly may include an air gap.

3.2
composite
combination of materials that are generally recognized in building construction as discrete entities

EXAMPLE Coated or laminated product.

3.3
constant mass
state of a test specimen when two successive weighing apparatus 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 greater

3.4
exposed surface
surface of a product subjected to the heating conditions of the test

3.5
façade
cladding
products and constructions added to the external surface of an existing wall or frame

NOTE The structure can be of concrete, lightweight concrete blockwork, masonry, timber, etc. The cladding may be applied directly to the inner structure or may incorporate an air gap or an insulating layer.

3.6
material
single substance or uniformly dispersed mixture

EXAMPLE Substance made of metal, stone, timber, concrete, mineral fibre or polymers.

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

3.8
specimen
façade or cladding representing the material of the end-use façade, including joints and fixings

NOTE 1 The specimen does not include the lightweight concrete block wall of the test rig.

NOTE 2 The specimen may include an air gap.

3.9
surface product
any part of a building that constitutes an exposed surface on the walls and/or the ceiling/roof

EXAMPLE Panel or board.

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4 Principle

The reaction to fire of a façade or cladding is assessed when exposed to flames impinging directly on the face of the façade or cladding in the intermediate scale. The specimen is constructed with a re-entrant angle of 90°, with the smaller wall parallel to the draught screens. This type of construction is common in practice and creates a worst-case situation.

The flame spread and mechanical behaviour of the specimen are assessed by indirect instrumental methods within the internal cavity of the façade, or directly by observation of the front face of the façade.

5 Test facility

5.1 General

The test apparatus shall consist of a specimen support frame and an ignition source. A schematic representation of the test apparatus is shown in Figure 1.

5.2 Specimen support frame

The specimen support frame (see Figure 1) shall consist of three walls, i.e. a three-part back wall and two side walls. The side walls shall be positioned perpendicularly on both sides of the back wall and a small 0,6 m wide perpendicular side wall. The test specimen shall be attached to a sample holder that is the middle part of the back wall. The height of all parts of the walls shall be 2,8 m.

The back wall shall consist of two slabs of stone wool with a thickness of 100 mm and a density of 100 kg/m^3, and a corner configuration sample holder with a width of 1,2 m, made of a non-combustible board (thickness 12 mm, nominal density 750 kg/m^3). The side wall of the sample holder shall also be constructed of non-combustible board with a width of 0,6 m. The sample holder shall be positioned centrally between the mineral wool slabs. The total width of the back wall shall be 2,4 m.

The test specimen shall be attached to the upper part of the sample holder so that the bottom edge of the test specimen is 0,4 m above floor level when the sample holder is positioned vertically.

The side walls of the specimen support frame shall be made of a non-combustible board. The width of the side walls shall be 2,4 m. The side walls shall meet the floor, with no air gaps formed.

The specimen support frame shall be located in an open laboratory environment in which adequate ventilation and adequate means of extracting the combustion products are provided.

6 Fire source and exposure

WARNING — All equipment (tubes, couplings, flowmeters, etc.) shall be approved for propane. The installation shall be performed in accordance with existing regulations. The burner shall, for reasons of safety, be equipped with a remote-control ignition device (e.g. a pilot flame or a glow wire). There shall be a warning system for leaking gas and a valve for immediate and automatic cut-off of the gas supply in case of extinction of the ignition flame.

The fire source shall be a propane gas burner with a right-angle top surface layer of a porous, inert material (e.g. sand). The size of the burner shall be 1,2 m × 0,1 m × 0,15 m (length × width × depth). The construction shall be such that an even gas flow is achieved over the entire opening area.

The burner shall be placed on the floor lengthwise below the test specimen with the ends of the burner lined up with the edges of the test specimen. The back wall of the burner shall be in contact with the sample holder.

The burner shall be supplied with natural grade propane (95 % purity). The gas flow to the burner shall be measured with an accuracy of at least ± 3 %.

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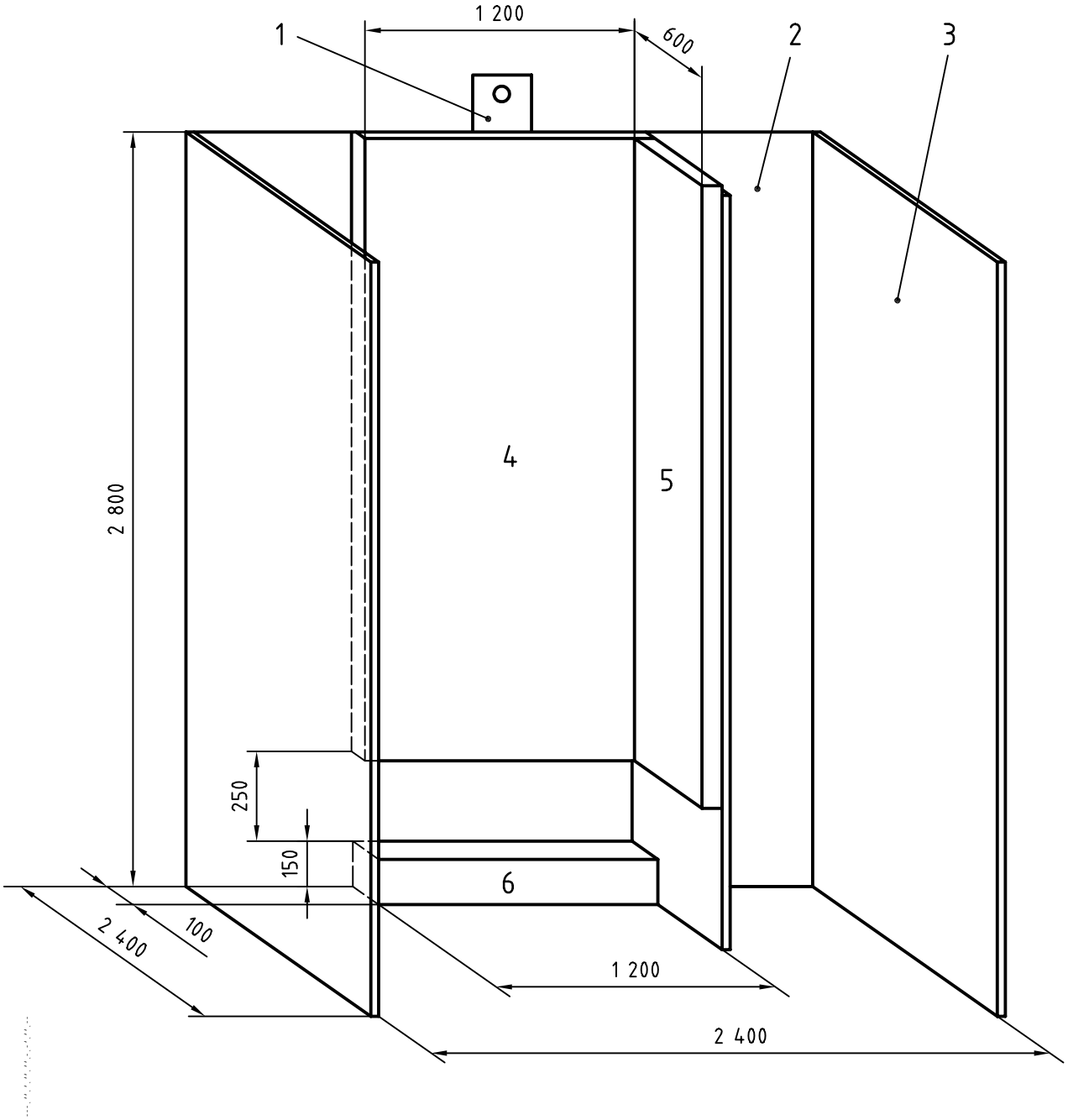
Dimensions in millimetres



Key

1 Position of heat flux meter
2 Back wall
3 Draught screen
4 Test specimen back wall
5 Test specimen side wall
6 Ignition burner

Figure 1 — Test apparatus containing test specimen

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The heat output from the burner shall be (100 ± 5) kW throughout the test. The burner heat release rate is calculated by multiplying the gas flow by the heat of combustion of propane. A value of 46,4 kJ/g shall be used.

7 Test specimen

7.1 Both in construction and materials, the test specimen shall be representative of the system used in practice. The application of the material to the test rig shall be as in practice. All constructional details of joints, fixings, etc., shall be detailed and positioned in the test specimen as in practice.

The test specimen should be built by persons suitably qualified in the construction of this type of structure in practice.

7.2 The test specimen shall consist of sufficient cladding or façade panels together with battens and insulation, where appropriate, to cover two areas: 1,2 m wide and 2,4 m high; 0,6 m wide and 2,4 m high. The joints, where used in practice, and fixings shall be installed in end-use condition into the test specimen. The test specimen shall incorporate a central horizontal joint at mid-height and a central vertical joint. The bottom edge of the specimen shall be closed by the method normally used for the incorporation of window casements.

8 Test specimen instrumentation

8.1 Thermocouples

Five surface thermocouples shall be positioned centrally on the external surface at the joint of the test specimen at distances of 0,5 m, 1,0 m, 1,5 m, 2,0 m, and 2,4 m from the bottom edge on the large perpendicular face and centrally on the surface of the smaller perpendicular face (see Figure 2).

If the test specimen includes a cavity, the inner temperature of the specimen shall be measured with two thermocouples installed in both cavities of the specimen. The positioning of these thermocouples shall be central at the distances of 1,2 m and 2,3 m from the bottom edge of the test specimen.

The thermocouples shall be either sheathed thermocouples or welded thermocouples. In the case of sheathed thermocouples, they shall be Type K chromel/alumel stainless steel sheathed thermocouples with a wire diameter of 0,3 mm and an outer diameter of $(1{,}5 \pm 0{,}1)$ mm. The hot junction shall be insulated and not earthed. In the case of welded thermocouples, they shall have a diameter of $\leqslant$ 0,3 mm. The thermocouples on the external surface of the panels shall have their hot junctions in contact with the surface of the panel. The use of surface thermocouples with a copper disc is recommended for surface temperature measurements and welded non-sheathed thermocouple for gas temperature measurements. The thermocouples shall be of tolerance class 1 in accordance with IEC 60584-2.

8.2 Heat flux instrumentation

The heat flux meter shall be of the foil (Gardon) or thermopile (Schmidt-Boelter) type with a range of 0 kW/m^2 to 50 kW/m^2. The target receiving heat flux shall be flat, circular, not more than 10 mm in diameter and coated with a durable matt black finish. The target shall be contained within a water-cooled body. The front face shall be of slightly polished metal, flat, coinciding with the plane of the target, circular and with a diameter of about 25 mm.

Heat flux shall not pass through any window before reaching the target. The instrument shall be robust, simple to set up and use, insensitive to draughts, and stable in calibration. The instrument shall have an accuracy of $\pm$ 3 % and repeatability within 0,5 %. The heat flux meter shall be calibrated over its whole range.

The heat flux meter shall be located parallel with its face in the same vertical plane as the vertical test face of the test specimen, and level with the upper edge of the test specimen (see Figure 1). The heat flux meter shall be housed in a square non-combustible insulation board 200 mm $\times$ 200 mm, of minimum thickness 25 mm, that is supported with its surface in the same plane as the specimen. The board shall contain a circular aperture along the vertical centreline, 25 mm in diameter and 30 mm above the bottom edge.

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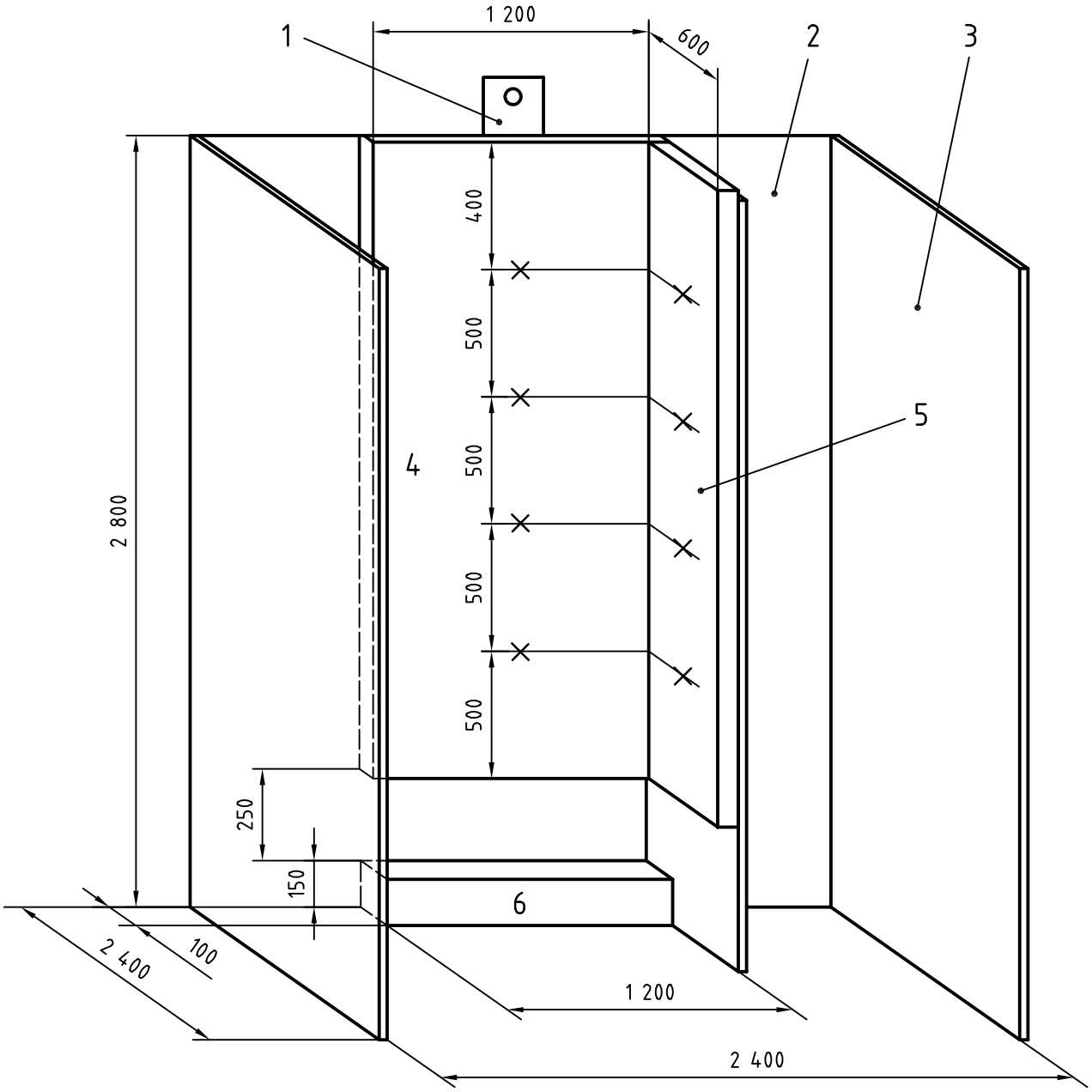
Dimensions in millimetres



Key

1 Position of heat flux meter
2 Back wall
3 Draught screen
4 Test specimen back wall
5 Test specimen side wall
6 Ignition burner: height 150 mm, depth 100 mm, width 1 200 mm
X Surface thermocouple positions

Figure 2 — Position of thermocouples

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8.3 Other equipment

8.3.1 Data acquisition

A data logger able to record and store input data from the measuring instruments shall be used. The sampling period shall not exceed 10 s.

8.3.2 Timing device

A clock with an accuracy of 1 s and division of 1 s, or an equivalent timing device, shall be used.

9 Test specimen conditioning

Specimens containing hygroscopic material shall be conditioned before the test to a constant mass at a temperature of $(23 \pm 2)\ ^{\circ}C$ and a relative humidity of (50 ± 5) %.

NOTE These requirements correspond to the recommended atmosphere given in ISO 554.

Specimens of non-hygroscopic material shall be stored in this environment for at least 48 h prior to the test.

10 Test environment

The temperature in the test environment from the start of the installation of the test specimen until the start of the test shall be $(20 \pm 10)\ ^{\circ}C$.

11 Procedure

11.1 Initial conditions

Before starting the test, the initial conditions shall be as follows.

a) The horizontal wind speed in the vicinity of the test apparatus shall not exceed 0,5 m/s.

b) The burner shall be in contact with the specimen support frame. The surface area of the burner opening shall be clean.

c) The test specimen shall be photographed or video recorded before testing.

11.2 Test

Proceed as follows for the test.

a) Mount the test specimen onto the specimen framework as specified by the manufacturer.

b) Draw visible marker lines laterally at intervals of 0,5 m on the specimen to aid visual observations of surface flame spread during the test.

c) Position the ignition source and the temperature and heat flux measurement instrumentation.

d) Start all recording and measuring devices and record data for at least 2 min prior to the burner being ignited.

e) Ignite the pilot flame and adjust the burner to the output level of 100 kW within 10 s of the ignition of the burner.

f) A photographic and/or video recording shall be made of the test. A clock shall appear in all photographs, giving time to the nearest second.

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g) During the test, record the following observations, including the time of occurrence:
   1) ignition of the test specimen;
   2) flame spread to the height of 0,5 m, 1,0 m, 1,5 m, 2,0 m, and 2,4 m on the test specimen;
   3) flames emerging from the possible cavity behind the outer surface of the test specimen.

h) Record any unusual behaviour.

i) End the test when the upper edge of the test specimen is extensively flaming or after 30 min, whichever occurs first.

j) Extinguish the burning test specimen.

12 Expression of results

12.1 The performance of the test specimen shall be assessed on the basis of visual observation and recorded data.

Averaging of total heat flux and temperature data over a 1-min period is required to eliminate momentary fluctuations in the values.

12.2 Thermocouples installed within the specimen shall provide information about fire spread within each layer of the specimen and within any cavities.

13 Precision

The precision of this test method has not been determined. Results of a planned inter-laboratory test series will be included when available.

14 Test report

The test report shall contain the following information:

a) name and address of the testing laboratory;

b) date and identification number of the report;

c) name and address of the client;

d) purpose of the test;

e) method of sampling;

f) name and address of manufacturer or supplier of the product;

g) name or other identification marks of the product;

h) description of the tested product, including:
   1) drawings;
   2) installation instructions;
   3) specification of included materials;
   4) details of the joints and fixings;

i) date of supply of the product;

j) date of test;

k) reference to this part of ISO 13785, i.e. ISO 13785-1;

l) conditioning of the test specimen and/or environmental data during the test (temperature, pressure, relative humidity, etc.);

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m) deviations from the test method, if any;

n) test results:

   1) heat flux as a function of time in a graph;

   2) thermocouple temperatures as a function of time in graphs;

   3) maximum value of heat flux;

   4) description of the fire development (photographs);

   5) observations during the test.

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Bibliography

[1] ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications*

[2] ISO/TR 3814, *Tests for measuring "reaction-to-fire" of building materials — Their development and application*

[3] ISO 9705:1993, *Fire tests — Full-scale room test for surface products*

[4] ISO 13785-2:2002, *Reaction-to-fire tests for façades — Part 2: Large-scale test*

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