INTERNATIONAL STANDARD

ISO 13784-1

First edition
2002-12-01

Reaction-to-fire tests for sandwich panel building systems —

Part 1: Test method for small rooms

Essais de réaction au feu des systèmes de fabrication de panneaux de type sandwich —

Partie 1: Méthode d'essai pour des chambres de petite taille

Reference number
ISO 13784-1:2002(E)

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Printed in Switzerland

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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 13784 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13784-1 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

ISO 13784 consists of the following parts, under the general title *Reaction-to-fire tests for sandwich panel building systems*:

— *Part 1: Test method for small rooms*

— *Part 2: Test method for large rooms*

Annexes A, B and C form a normative part of this part of ISO 13784. Annex D of this part of ISO 13784 is for information only.

Introduction

Fire is a complex phenomenon, its behaviour and effects dependent upon a number of interrelated factors. The behaviour of materials and products depends upon the characteristics of the fire, the method of use of the materials and the environment in which they are exposed (for the philosophy of reaction-to-fire tests, see ISO/TR 3814).

The need for improved insulation of buildings has led to the increased use of insulating sandwich panel systems in different parts of the building industry. Sandwich panel systems are applied as external cladding on factory buildings, in internal envelopes with controlled atmospheres and in cold stores — varying from small rooms to large, cool houses. Other applications are in modular building rooms and, sometimes, retail premises. These systems can also be used for roof applications in traditional constructions. Multi-layered panels with other facings (e.g. plasterboard) or sandwich panel systems can also be applied to walls as internal linings or insulation; however, this is not within the scope of ISO 13784.

There exist three primary fire-related threats to the walls and ceilings or roofs of a building insulated with freestanding or frame-supported types of sandwich panel systems:

a) an interior compartment fire impinging directly onto the joints of the wall, typical ignition sources being welding torches, burning items near the wall and fire in an adjacent room;

b) an external fire or combustibles (rubbish, vegetation, vehicles, etc.) accumulated near the wall;

c) fire spread to outside spaces.

Moreover, such a fire can spread in several ways:

— over a combustible exterior surface;

— by travelling vertically and horizontally through the combustible cores of cavities within the external wall or ceiling/roof;

— through combustible gases which have developed due to the pyrolysis of the combustible components and which will ignite on the surface;

— as burning debris or flaming droplets.

This part of ISO 13784 deals with a simple representation of a fire scenario involving a sandwich panel system — such as that typified by a local fire impinging directly on the internal face of a sandwich panel building construction. The test method specified can be used to provide a small-room scale, end-use evaluation of all aspects of sandwich panel systems, including constructional techniques (supporting frameworks, jointing detail, etc.)

The test method is intended for evaluating products which, by their nature, are not normally used as internal linings and are unsuitable for assessment using ISO 9705, which evaluates fire growth from a surface product. Nevertheless, this part of ISO 13784 provides a means by which a freestanding or frame-supported sandwich panel building construction can be built and evaluated.

Testing of this type can be used for comparative purposes or to ensure the existence of a certain quality of performance considered to have a bearing on fire performance generally; it does not rely on the use of asbestos-based materials.

Reaction-to-fire tests for sandwich panel building systems —

Part 1:
Test method for small rooms

SAFETY PRECAUTIONS — In order that suitable precautions can be taken to safeguard health, the attention of all concerned in fire tests is drawn to the possibility that toxic or harmful gases can be evolved during combustion of test specimens.

The test procedures concerned involve high temperatures and combustion processes — from ignition to a fully developed room fire. Therefore, hazards can exist for burns, ignition of extraneous objects or clothing. Operators should use protective clothing, helmet, face-shield and equipment for avoiding exposure to toxic gases.

Laboratory safety procedures shall be set up which ensure the safe termination of tests on sandwich panel products. Specimens with combustible content burning inside metallic facings may be difficult to extinguish with standard laboratory fire fighting equipment. Adequate means of extinguishing such a fire shall be provided.

When tests are conducted using the freestanding room construction, specimens could emit combustion products from their back face, especially if joints open up. Specimen collapse into the laboratory space can also occur. Laboratory safety procedures shall be set up to ensure safety of personnel with due consideration to such situations.

1 Scope

This part of ISO 13784 specifies a test method for evaluating the reaction-to-fire performance of sandwich panel building systems for small rooms and the resulting flame spread on or within the sandwich panel building construction when it is exposed to heat from a simulated internal fire with flames impinging directly on its internal corner. The test method is not intended for evaluating a product's fire resistance.

This part of ISO 13784 is applicable to both freestanding and self-supporting, and frame-supported, sandwich panel systems. It is not applicable to sandwich panel products that are glued, nailed, bonded or similarly supported by an underlying wall or ceiling construction.

NOTE Because of their design, some systems might be unsuitable for testing using this part of ISO 13784. Nevertheless, such systems could be suitable for testing using ISO 13784-2, in which case the field of application of the test report might be restricted. For testing of products used as internal linings, see ISO 9705.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13784. 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 13784 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 9705, *Fire tests — Full-scale room test for surface products*

ISO 13784-2, *Reaction-to-fire tests for sandwich panel building systems — Part 2: Test method for large rooms*

ISO 13943, *Fire safety — Vocabulary*

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

3 Terms and definitions

For the purposes of this part of ISO 13784, the terms and definitions given in ISO 13943 and the following apply.

3.1
composite
combination of materials generally recognized in building construction as discrete entities

EXAMPLE Coated or laminated materials.

3.2
exposed surface
surface of the product subjected to the heating conditions of the test

3.3
product
material, composite or assembly

3.4
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 by 0,1 g, whichever is greater

3.5
surface product
any part of a building constituting an exposed surface on the walls or ceiling/roof, or on both

EXAMPLE Panel or board.

3.6
insulating sandwich panel
multilayered product consisting of three or more layers bonded together

NOTE One layer is an insulating material, such as mineral or glass wool, cellular plastics or a natural material (e.g. corkboard), protected by facings on both sides. Facings can be selected from a variety of materials and can be either flat or profiled. The most widely used facing is coated steel. The composite can vary from a simple construction to a complex composite system with specific fixing joints and supports, depending on the application and on the performance requirements.

3.7
specimen
assembly representing the end-use construction

4 Principle

The reaction to fire performance of a sandwich panel assembly is assessed when it is exposed to flames impinging directly on the internal corner of a small sandwich panel assembly. The different kinds of flame spread, for example, within the internal core, on the surface or through joints, by ignited combustible gases and falling debris or melting droplets of the sandwich panel assembly. The assessment allows determination of the following possible fire hazards:

— the contribution of the system to fire development up to flashover;

— the potential for transmitting an interior fire to outside spaces or other compartments or adjacent buildings;

— the possibility of the structure's collapse;

— the development of smoke and fire gases inside the test room.

5 Types of structure

The test method is applicable to the following two types of structure, representative of those used in practice both in respect of construction and materials.

a) **Frame-supported structures**

Sandwich panel systems are mechanically fixed to the outside or the inside of a structural framework — normally steel — through the thickness of the panel. The ceiling/roof could be built traditionally or using sandwich panel systems. A widespread example is the external cladding of industrial buildings. In most cases, this kind of sandwich panel system is used on a building's exterior wall, roof or both.

Deformation of the frame can influence the fire behaviour of the sandwich panels. Where the frame is protected in practice because of fire resistance requirements, this should also be the case for the frame under test. Protection can be obtained by means of insulating boards or coatings.

b) **Freestanding structures**

Sandwich panel systems are assembled together to provide a room or enclosure that does not depend for its stability on any other structural framework (e.g. cold stores, food or clean rooms, generally constructed within a weatherproof shell). Normally situated inside a building, the ceilings of these constructions may be supported from above.

6 Test specimen

The test specimen shall consist of the requisite number of panels required for the test to be performed. In all cases, the test specimen shall be representative of that used in practice, both in construction and materials. All constructional details of joints, fixings, etc., shall be reproduced and positioned in the test specimen as in practice. If the type of sandwich panel under test is used in practice with an inside or outside structural framework, this shall be included in the test.

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

If, in practice, ceiling panels are different from wall panels, a test may be performed with the correct combination of wall and ceiling panels.

If the sandwich panel building system is intended for use with decorative paint or film facings, these shall be present on the test specimen.

7 Test room design and construction

7.1 The test method consists of a procedure by which sandwich panel assemblies are assessed in their end-use scale and with the constructional details incorporated in their end use. Products are evaluated with end-use joints and fixings; where a supporting steel framework is part of the construction, testing is done with this framework also in place. Where the panels are self-supporting, for safety reasons an unconnected external framework should be used.

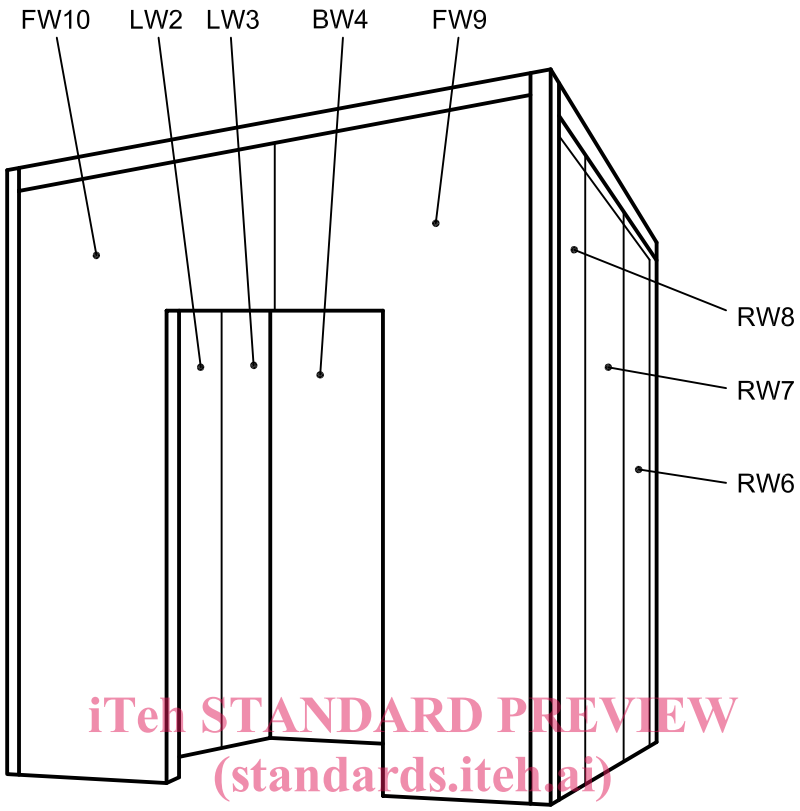
7.2 Construct a room using the components of the sandwich panel systems in accordance with clause 6. The room shall have four walls at right angles and a ceiling, and shall be located on a rigid, non-combustible floor surface. The means of securing wall panels together, and the means of attaching walls to floor and ceiling to walls, shall be representative of end use. The room shall have the following inner dimensions. See Figure 1.

Length: $(3{,}6 \pm 0{,}05)$ m

Width: $(2{,}4 \pm 0{,}05)$ m

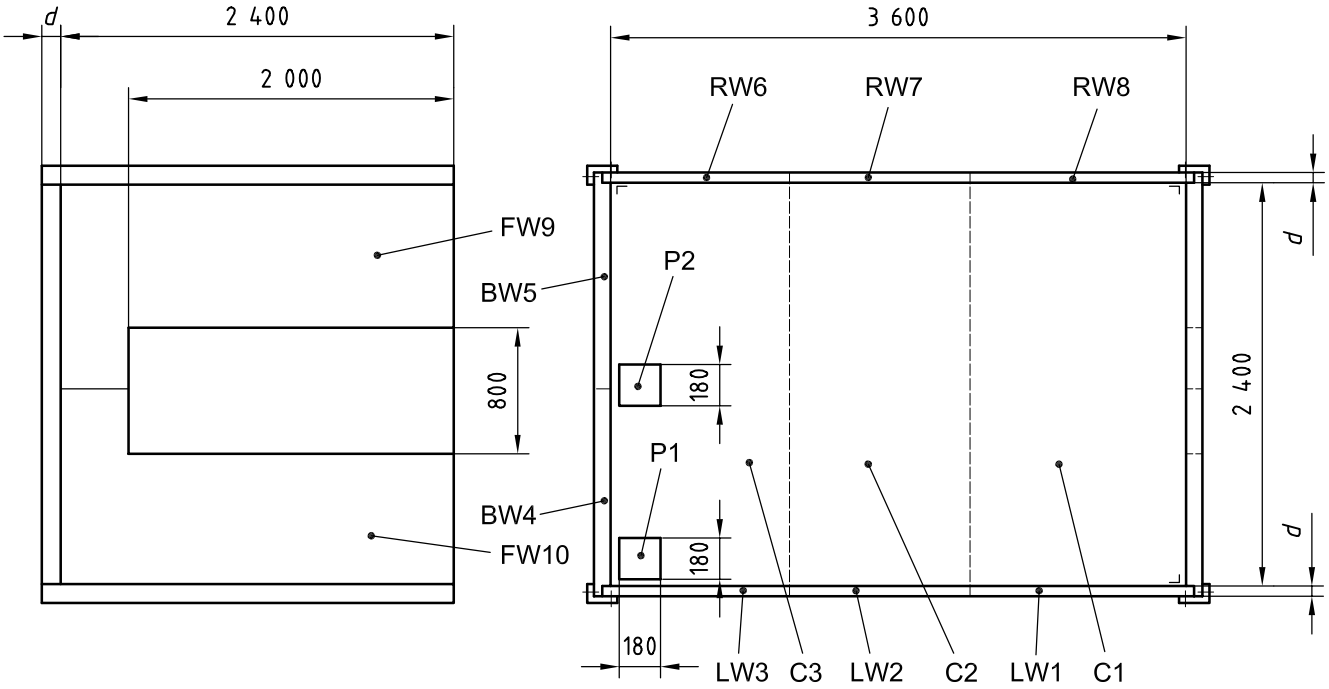
Height: $(2{,}4 \pm 0{,}05)$ m

Dimensions in millimetres



a) Isometric elevation

Figure 1 — Example of test specimen



b) Plan showing alternative burner position

Key

C	Ceiling panel
d	Thickness of panel
P1	Burner position 1, at corner
P2	Burner position 2, at joint
LW	Left wall panel
BW	Back wall panel
RW	Right wall panel
FW	Front wall panel

Figure 1 — Example of test specimen

7.3 Provide a doorway in the centre of one of the 2,4 m × 2,4 m walls; no other wall, floor or ceiling shall have any openings allowing ventilation. The doorway shall have the following dimensions.

Width: $(0{,}8 \pm 0{,}01)$ m

Height: $(2{,}0 \pm 0{,}01)$ m

7.4 The room shall be located indoors. Tests shall not be conducted unless the temperature within the room is between 10 °C and 30 °C.

7.5 The connections between the panels, and between the walls and the ceiling, shall represent those in the end-use application of the product being tested.

7.6 If the system includes any additional bracing, support members, etc., these shall also be installed in the test specimen construction. If the type of sandwich panel system under test is used in practice with an inside or outside structural framework, this shall be used in the test. See Figures 2 and 3.

NOTE The number of panels and their thickness can of course be different from those shown in the examples, depending on the type of panels tested. In addition, the type of supporting frame will depend on the practical end-use mounting. Only the inner dimensions of the room and the door opening are mandatory.

Dimensions in millimetres

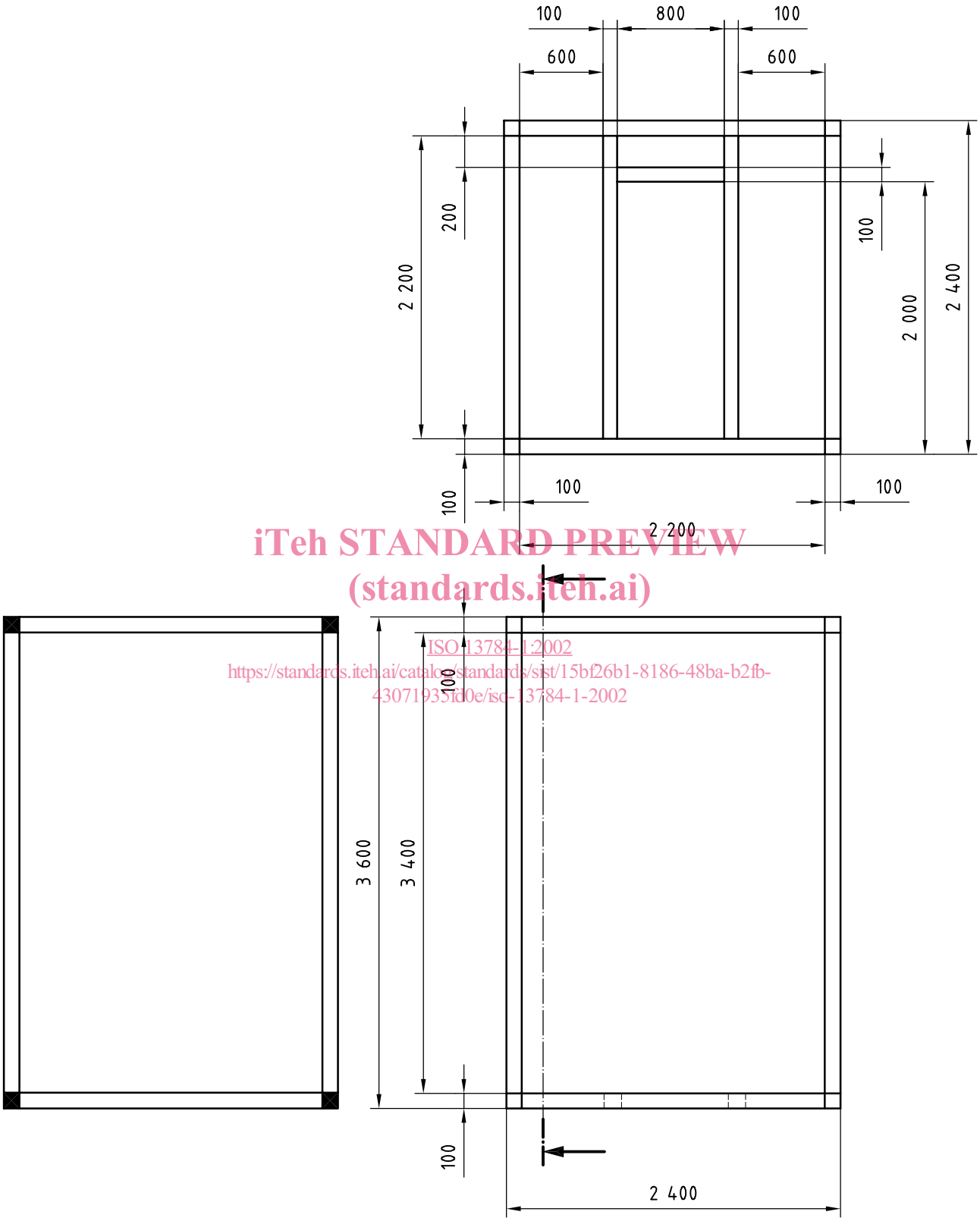


Figure 2 — Example of internal structural framework