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Fire-resistance tests — Elements of building construction —

Part 4: Specific requirements for loadbearing vertical separating elements

Essais de résistance au feu — Éléments de construction —

Partie 4: Exigences spécifiques relatives aux éléments porteurs verticaux de séparation

Reference number
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Contents

Page

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

International Standard ISO 834-4 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 2, *Fire resistance*.

ISO 834 consists of the following parts, under the general title *Fire-resistance tests — Elements of building construction*:

— *Part 1: General requirements*

— *Part 3: Commentary on test method and test data application*

— *Part 4: Specific requirements for loadbearing vertical separating elements*

— *Part 5: Specific requirements for loadbearing horizontal separating elements*

— *Part 6: Specific requirements for beams*

— *Part 7: Specific requirements for columns*

— *Part 8: Specific requirements for non-loadbearing vertical separating elements*

— *Part 9: Specific requirements for non-loadbearing horizontal separating elements*

— *Part 10: Method to determine the contribution of applied protection materials to structural metallic elements*

— *Part 11: Method to assess the contribution of applied protection materials to structural metallic elements*

Annex A of this part of ISO 834 is for information only.

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Introduction

This part of ISO 834 contains specific requirements for fire-resistance testing which are unique to the elements of building construction described as vertical separating loadbearing elements. The requirements for these load-bearing elements are intended to be applied in appropriate conjunction with the detailed and general requirements contained in ISO 834-1.

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Fire-resistance tests — Elements of building construction —

Part 4: Specific requirements for loadbearing vertical separating elements

1 Scope

This part of ISO 834 specifies the procedures to be followed for determining the fire resistance of loadbearing vertical separating elements when exposed to heating on one face.

The application of this test to other untested forms of construction is acceptable when the construction complies with the direct field of application as given in this part of ISO 834 or when subjected to an extended application analysis in accordance with ISO/TR 12470. Since ISO/TR 12470 gives only general guidelines, specific extended application analyses are to be performed only by persons expert in fire-resistant constructions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 834. 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 834 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 834-1:1999, *Fire-resistance tests — Elements of building construction — Part 1: General requirements.*

ISO/TR 834-3, *Fire-resistance tests — Elements of building construction — Part 3: Commentary on test method and test data application.*

ISO/TR 12470, *Fire resistance tests — Guidance on the application and extension of results.*

ISO/IEC 13943, *Fire safety — Vocabulary.*

3 Terms and definitions

For the purposes of this part of ISO 834, the terms and definitions given in ISO 834-1, ISO 13943 and the following apply.

3.1
vertical separating elements
loadbearing, vertically oriented building elements, such as walls which are required to act as fire separations or fire barriers; which divide buildings into fire compartments or fire zones, or which separate a building from adjoining buildings in order to resist the spread of fire to or from adjoining compartments or buildings

3.2
wall
vertical separating element of a building construction which is loadbearing

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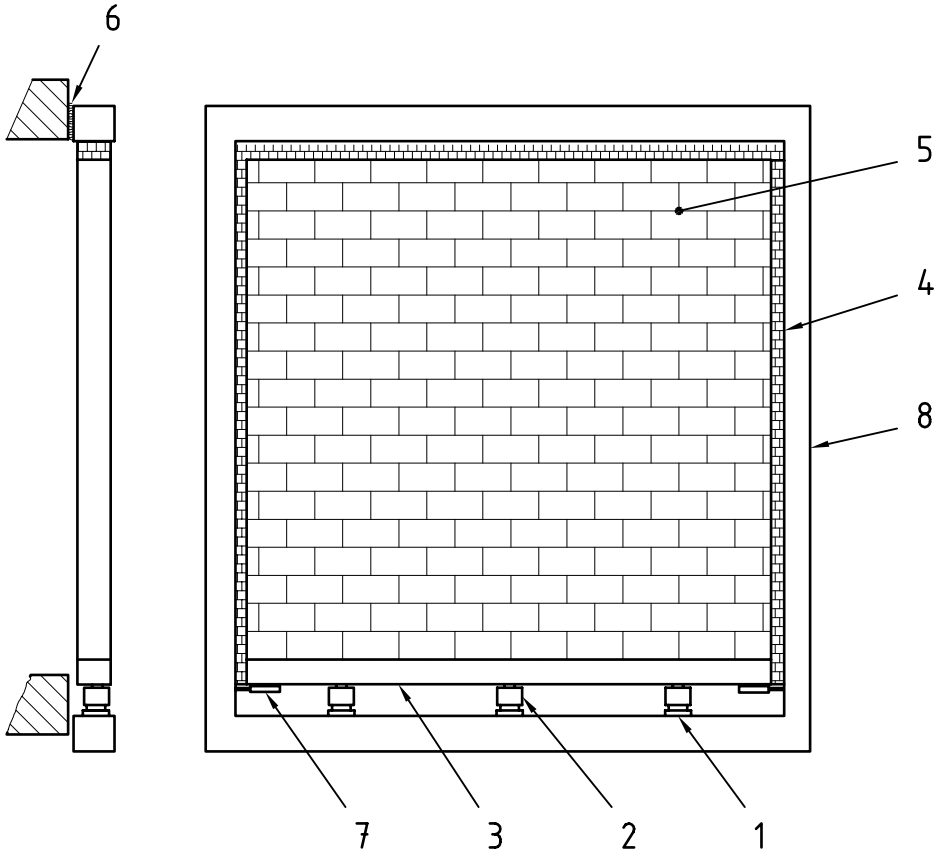
4 Symbols and abbreviated terms

Refer to ISO 834-1 for symbols and abbreviated terms appropriate for this test.

5 Test equipment

Equipment employed in the conduct of this test consists of a furnace, loading equipment, restraint and support frames and instrumentation as specified in ISO 834-1. An example of the test equipment is illustrated in Figure 1.



Key

1	Hydraulic ram	5	Test specimen
2	Load cell	6	Fibre insulation
3	Load-distribution beam	7	Linear transducer
4	Bedding material	8	Test frame

Figure 1 — Example of set-up for loaded vertical assembly test

6 Test conditions

6.1 General

The heating and pressure conditions, the furnace atmosphere and the loading conditions shall conform to those specified in ISO 834-1.

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6.2 Restraint and boundary conditions

Restraint and boundary conditions shall comply with the requirements given in ISO 834-1 and the requirements of this part of ISO 834.

6.3 Loading

6.3.1 All loadbearing vertical separating elements shall be tested when subjected to loads, calculated in accordance with subclause 6.3 a), b) or c) of ISO 834-1:1999, in consultation with the sponsor to produce the conditions the structure is designed to accommodate. The material properties utilized in the calculation of the load shall be clearly indicated and their source given. For vertical separating elements which contain discreet loadbearing members, the load shall be proportional to the number of these members.

6.3.2 When the height of the proposed test specimen is greater than can be accommodated in the test furnace, the load shall be adjusted to be compatible with the slenderness ratio of the loadbearing elements of the specimen being tested, so that the load level of the full size construction is provided.

6.3.3 Vertical load shall be applied to either the top or bottom edge. Any unrestrained edges shall be sealed with non-restraining and non-combustible material.

6.3.4 The load shall be applied either uniformly along the whole width of the specimen by a loading beam or by individual loading jacks at selected points, when this is more representative of the use of the construction. When the test specimen is designed to be eccentrically loaded, or when only one leaf of a cavity construction is to be loaded, these conditions shall be reproduced in the specimen.

6.3.5 When uniformly loaded, the test specimen shall be erected within a loading frame having appropriate stiffness in relation to the test construction and to the loads which will be imposed upon it during the test. As a guide, the load distribution members should not deflect more than 1 mm under a force of 10 kN applied at the centre span, in the plane of the frame.

6.3.6 The loading system shall be capable of compensating for the maximum allowable deformation of the specimen.

6.3.7 Where both leaves of a double leaf wall are to be loaded, provisions shall be made to load each leaf independently. The loading equipment shall be able to apply a load of different magnitude to one leaf from the other when this is appropriate.

7 Test specimen preparation

7.1 Specimen design

The test specimen shall be designed to characterize the many aspects of the construction for which the desired rating is sought.

When vertical separating elements incorporate services (such as electrical junction boxes or surface finishes) which are an integral part of the design of the element, these shall be included in the test specimen.

7.2 Specimen size

The specimen size shall be full size when the construction in practice is less than 3 m high or 3 m wide. For elements that are larger than that which can be accommodated in at least a 3 m × 3 m furnace, the minimum specimen size exposed to the heating shall not be less than 3 m × 3 m.

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7.3 Number of test specimens

For symmetrical constructions, only one test specimen is required unless otherwise specified in this part of ISO 834. For asymmetrical constructions, the number of test specimens shall comply with the requirements given herein and in ISO 834-1.

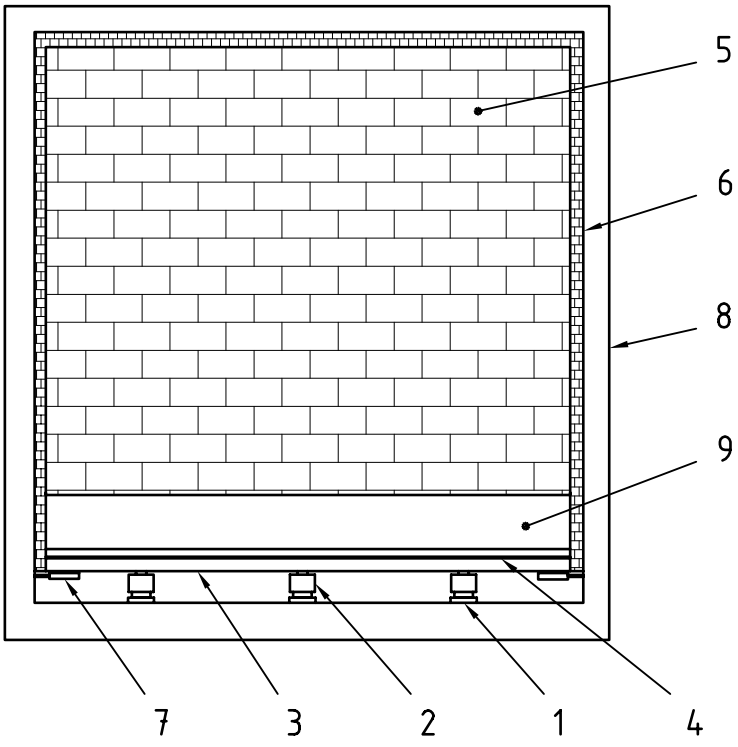
7.4 Specimen conditioning

At the time of the test, the strength and moisture content of the test specimens shall approximate the conditions expected in normal service. This includes any infills and jointing materials. Guidance on conditioning is given in ISO 834-1. After equilibrium has been achieved, the moisture content or state of cure shall be determined and recorded. Any supporting construction, including the lining to the test frame, is exempt from this requirement.

7.5 Specimen installation and restraint

The specimen shall be installed with the vertical edges left free to deform, unless the sponsor requests otherwise.

When the specimen is smaller than the test frame opening, a supporting construction shall be used to reduce the opening to the required dimension. Supporting construction shall not be subject to the specimen conditioning requirements unless there is a contribution from it to the performance of the test specimen. When a supporting construction is used, the design of the connection between the separating element and the supporting construction, including any fixings and materials used to make the junction, shall be as used in practice and shall be regarded as part of the test specimen. The supporting construction is to be considered part of the test frame. An example of supporting construction in the test design is illustrated in Figure 2.



Key

1	Hydraulic ram	6	Fibre insulation
2	Load cell	7	Linear transducer
3	Load distribution beam	8	Test frame
4	Bedding material	9	Support construction
5	Test specimen		

Figure 2 — Example of supporting construction in the loaded assembly test

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All connections between the test specimen and the supporting construction, including the test frame when applicable, shall reproduce the normal levels of restraint. The stiffness of the supporting construction shall also sufficiently reproduce normal levels of restraint.

8 Application of instrumentation

8.1 **Furnace thermocouples** (plate thermometer)

Plate thermometers shall be provided to measure the temperature of the furnace and shall be distributed to give a reliable indication of the temperature across the exposed face of the test specimen. These plate thermometers shall be constructed and located in accordance with ISO 834-1.

The number of plate thermometers shall not be fewer than one for every 1,5 m^2 of the exposed surface area of the test specimen. There shall be a minimum of four plate thermometers for any test and each shall be oriented so that side “A” faces the back wall of the furnace.

8.2 Unexposed surface thermocouples

Unexposed surface thermocouples shall be constructed and located in accordance with ISO 834-1. For determination of maximum temperature, thermocouples may be applied to the unexposed face not closer than 100 mm to any edge as follows:

a) at the head of the specimen at mid-width;

b) at the head of the specimen in line with a stud/mullion;

c) at the junction of a stud and a rail in a non-loadbearing wall system;

d) at mid-height of the fixed edge;

e) at mid-height of the free edge;

f) at mid-width, where possible, adjacent to a horizontal joint (positive pressure zone);

g) at mid-height, where possible, adjacent to a vertical joint (positive pressure zone).

8.3 Deformation measurement

The zero point for the test is the deflection and axial deformation measured after the load has been applied at the beginning of the test before commencement of heating and after the deflection has stabilized.

For single-leaf specimens, the vertical axial deformation shall be measured. For double-leaf specimens, the vertical axial deformation for each loaded leaf shall be measured independently.

Horizontal deflection measurements shall be taken on the unexposed face at multiple positions to determine maximum movement.

9 Test procedure

9.1 Load application

Apply and control the load to the vertical element in accordance with ISO 834-1 and 6.3 of this part of ISO 834.

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9.2 Furnace control

Measure and control the furnace temperature and pressure conditions in accordance with ISO 834-1.

9.3 Measurements and observations

Monitor the specimen for compliance with the criteria of loadbearing capacity, integrity and insulation and make relevant measurements and observations in accordance with ISO 834-1.

10 Performance criteria

The fire resistance of loadbearing vertical separating elements shall be judged against the loadbearing capacity, integrity and insulation criteria as specified in ISO 834-1.

11 Validity of the test

The test shall be considered to be valid when it has been conducted within all of the specified limits of the requirements pertaining to: the test equipment, test conditions, test specimen preparation, instrument application and test procedure according to this part of ISO 834.

The test shall also be considered for acceptance when the fire exposure conditions relating to furnace temperature, pressure and ambient temperature are in excess of the upper limits of the tolerances specified in this part of ISO 834 and ISO 834-1.

12 Expression of test results

The results of the fire resistance test shall be expressed in accordance with ISO 834-1.

When a test has been performed on a specimen which has been subjected to a service load specified by a sponsor, which is intended for a specific application and which is less than the maximum which would be applied in consideration of a recognized structural code, the loadbearing capacity shall be qualified in the result by the term “restricted”. Full details shall be provided in the test report concerning its derivation.

13 Test report

The report shall be in accordance with ISO 834-1.

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Annex A
(informative)

Direct application of results

The results of a fire-resistance test are applicable to a similar untested loadbearing vertical separating element provided that all the following are true.

a) The height is not increased.

b) The load is not increased, its eccentricity is not increased and the location of the load is unchanged.

c) The edge conditions are unchanged.

d) The thickness is not reduced.

e) Characteristic strength and density of any materials are unchanged.

f) Thermal insulation is not reduced at any point.

g) There is no change in the design of the cross-section (e.g. location of reinforcing bars, etc.).

h) The size of any openings is not increased.

i) The method of protecting the opening (e.g. glazing, door, sealing systems, etc.) is not changed.

j) The position of any opening is unchanged.

k) The length is not increased when the specimen tested includes restrained vertical edges.

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