INTERNATIONAL STANDARD

ISO 3009

Second edition
2003-11-01

Fire-resistance tests — Elements of building construction — Glazed elements

Essais de résistance au feu — Éléments de construction — Éléments en verre

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3009 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 2, *Fire containment*.

This second edition cancels and replaces the first edition (ISO 3009:1976), which has been technically revised.

Introduction

This International Standard contains specific requirements for fire resistance testing which are unique to glazed elements used in building construction. The requirements for these glazed elements are intended to be applied, as appropriate, in conjunction with the detailed and general requirements given in ISO 834-1.

Fire-resistance tests — Elements of building construction — Glazed elements

SAFETY PRECAUTIONS — The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing can be hazardous and that there is a possibility that toxic and/or harmful smoke and gases could be evolved during the test. Mechanical and operational hazards can also arise during the construction of the test elements or structures, their testing, and disposal of test residues.

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

1 Scope

This International Standard provides a test method for determining and assessing the fire resistance performance of both insulated and uninsulated glazed elements of building construction, when those elements are exposed to heating on one face. It is applicable to glazed separating elements such as screens, walls of glass blocks and other light-transmitting assemblies used in vertical, inclined or horizontal orientations, and to all separating elements containing glazing intended to be assessed in accordance with ISO 834-1 — except for doors and shutter assemblies, which are intended to be tested in accordance with ISO 3008. It is directly applicable to planar elements, but also gives guidance on the testing of non-planar elements such as pyramids.

The application of the test results to other, untested, forms of construction is acceptable only when the construction complies with the field of direct application given in this International Standard or when it is subjected to a field of extended application analysis in accordance with ISO/TR 12470.

NOTE 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 834-1:1999, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 834-8, *Fire-resistance tests — Elements of building construction — Part 8: Specific requirements for non-loadbearing vertical separating elements*

ISO 6308, *Gypsum plasterboard — Specification*

ISO 13943, *Fire safety — Vocabulary*

3 Terms, definitions and symbols

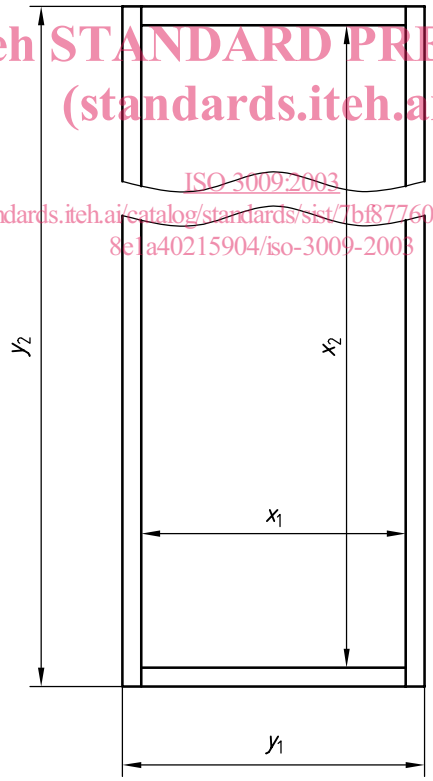
For the purposes of this document, the terms and definitions given in ISO 13943, the following terms and definitions, and the symbols given in ISO 834-1, apply.

3.1
aspect ratio
ratio of the exposed height to the exposed width of the glass

3.2
associated construction
specific construction in which the glazed element is to be installed in practice and which is used to close off the furnace and provide the levels of restraint and thermal heat transfer to be experienced in normal use

3.3
expansion allowance
difference in dimension between the pane or unit and the opening/aperture in the frame or other method of attachment into which the panes or units are mounted, available for expansion

NOTE The dimensions are measured in two directions (e.g. vertical and horizontal for a vertical glazed element). See dimension $y-x$ in Figure 1.



y_1 aperture width
y_2 aperture height
x_1 visible glass width
x_2 visible glass height

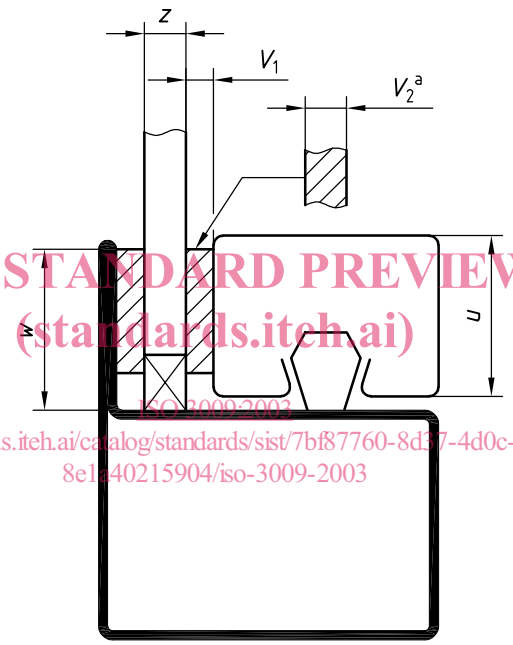
Figure 1 — Elevation of glazed pane

3.4
fire-resistant gypsum board
gypsum board with increased fire resistance as a result of additives to the formulation as specified in ISO 6308

3.5
glass
rigid transparent or translucent material installed in elements of construction for the purpose of vision or to allow the passage of light

3.6
glass edge cover
depth of glass retained by the glazing system

NOTE Half the difference between the pane dimension and the exposed dimension, assuming that the pane is centrally glazed into the opening. See dimension w in Figure 2.



z glass thickness
w edge cover
V_2 pre-installed (for gaskets and strips)
V_1 post-installed (for gaskets and strips)
u depth

a Uncompressed.

Figure 2 — Cross-section through framing/glazing system

3.7
glazed element
element containing transparent or translucent panes or units retained in frames or other methods of attachment or units mounted or attached together to provide a barrier

3.8
horizontal glazed element
glazed element intended for installations with inclinations of from 0° up to and including 25°

3.9
inclination
angle of installation relative to a horizontal plane (between 0° and 90°)

3.10
inclined glazed element
glazed element intended for installation with inclinations of from greater than 25° up to and including 80°

3.11
insulated glazing
fire-resistant glazing that satisfies both the integrity and insulation criteria for the anticipated fire-resistance period

3.12
mullion
vertical framing member separating and supporting two adjacent panes of glass or panels

3.13
orientation
direction of fire exposure with respect to the face of the specimen

EXAMPLE For inclined specimens, orientation is from underneath when using a floor furnace for conducting the test.

3.14
screen
vertical glazed separating element with multiple panes, which can also incorporate a door assembly

3.15
supporting construction
construction that could be required for the testing of some glazed elements into which the test specimen is assembled

EXAMPLE The wall into which a screen is fitted.

3.16
transom
horizontal framing member separating and supporting two adjacent panes of glass or panels

3.17
uninsulated glazing
fire-resistant glazing that satisfies the integrity of, and, where required, the radiation criteria for, the anticipated fire resistance period, but which is not intended to provide insulation

3.18
vertical glazed element
glazed element intended for installation with inclinations of from greater than 80° up to and including 90°

4 Test equipment

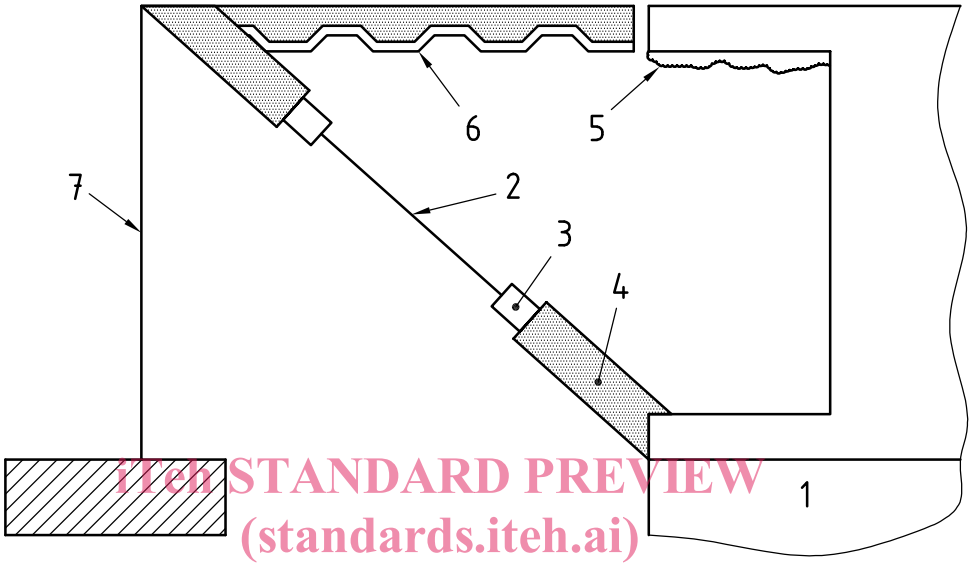
The test equipment shall be as specified in ISO 834-1. The furnace used will be related to the orientation of the test specimen. For vertical specimens, the wall testing furnace is suitable; for horizontal specimens the floor furnace is applicable; for inclined specimens, either of these may be used depending upon the anticipated exposure conditions.

A test frame or supporting construction is required for the mounting or erection of the specimen. It shall be designed so that it possesses sufficient stiffness in relation to the test construction. The rigidity of the test frame shall be evaluated by applying an expansion force within the frame mid-way between two opposite members of the frame and measuring the increase in the internal dimensions at these positions. This

evaluation shall be conducted in both directions of the frame and the increase of the internal dimension shall be measured.

The increase in the internal dimensions of the test frame shall not exceed 5 mm with an applied force of 25 kN.

For tests on inclined elements, the furnace could need to be altered to allow for the test specimen's installation. In these cases, the thermal properties of the furnace extensions shall be equivalent to those of the furnace. See Figure 3 for an example of inclined sample installation.



Key

1 vertical furnace
2 glazing
3 glazing frame
4 supporting construction
5 furnace lining
6 furnace extension
7 furnace extension support

NOTE The thermal properties of the furnace lining are the same as those of the furnace extension.

Figure 3 — Inclined sample installation from above — Example

Measurements of heat flux from the unexposed surface of a specimen shall be made by an instrument complying with the following specifications.

— The target of the instrument shall not be shielded by a window or subject to a gas purge, i.e. it shall be subject to convection as well as radiation.

— Suggested range: (0 to 50) kW/m^2.

— Accuracy: ± 5 % of maximum in range.

— Time constant (time to reach 64 % of target value): < 10 s.

— View angle: (180 ± 5)°.

5 Test conditions

The heating and pressure conditions and furnace atmosphere shall be in accordance with ISO 834-1.

For inclined elements, the furnace shall be operated such that the pressure 100 mm below the top of the exposed face of the test specimen is (20 ± 3) Pa.

6 Test specimen preparation

6.1 General

6.1.1 The test specimen shall be fully representative of the construction on which information is required and as intended to be used in practice.

6.1.2 The inclination of the specimen shall be selected according to the field of application. The orientation of the specimen shall be based on how the glazed element is to be used in practice — i.e. fire exposure from above or below.

6.2 Number of specimens

6.2.1 For vertical elements, the number of specimens shall follow the general principle of ISO 834-1.

6.2.2 For horizontal or inclined elements, tests shall be conducted with exposure from the underside, unless for inclined specimens it can be demonstrated that exposure may occur from either side, in which case both sides shall be tested (where the side of fire exposure is known, only exposure from that side is necessary).

NOTE For inclinations between 0° and 45°, fire exposure from above is not covered by this International Standard.

6.3 Size of specimen

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

For specimens tested in a horizontal furnace, the exposed dimensions of the test specimen shall be at least 4 m × 3 m, unless the construction it represents is designed to have exposed dimensions of less than 4 m × 3 m, in which case the actual size shall be tested.

6.4 Test construction

6.4.1 General

Where the test specimen is the same size as the opening in the support/restraint frame, the specimen shall be installed directly into the specimen support/restraint frame. The method of fixing shall be appropriate to the nature of the materials used to line this specimen support/restraint frame.

Where the element is smaller than the opening in the specimen support/restraint frame, the space between the specimen and the frame shall be filled with associated or supporting construction.

6.4.2 Associated construction

When the glazed construction to be tested is always installed in a specific — normally proprietary — form of construction, the specimen shall be installed in a sample of this associated construction with appropriate fixings.