INTERNATIONAL STANDARD

ISO 12472

First edition
2003-05-15

Fire resistance of timber door assemblies — Method of determining the efficacy of intumescent seals

Résistance au feu d'assemblages de portes en bois — Méthode de détermination de l'efficacité des joints en renflage

Reference number
ISO 12472:2003(E)

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Published in Switzerland

Contents

Page

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 12472 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 2, *Fire containment*.

Introduction

This test method has been developed for a number of reasons, the primary one being the recognition of the need to have a repeatable and reproducible test procedure by which the performance of intumescent products can be evaluated, particularly so as to ascertain any change in performance resulting from “real time” ageing.

It is a common requirement under any critical product certification scheme that durability be able to be quantified. There are no recognized accelerated ageing methods suitable for use with intumescent sealing products and, as a consequence, real time ageing tests are carried out. It was considered that over a period of twenty years, manufacturing variations would probably occur on any type of proprietary fire-resisting door. The effect of such variations would be to mask any performance changes. The testing apparatus specified here is capable of being built to reproducible and repeatable specification, which will allow even small variations in performance to be identified.

The fact that the method has eradicated most of the variables, making it repeatable and reproducible, also makes it suitable for quality control purposes. As a quality control test it has the added advantage of heating the intumescent seals in the same manner as they would be in practice; in the case of pressure-forming intumescent materials, the method also allows the pressure-forming characteristics of the materials to be characterized for their shear resistance in a comparative manner. This is not measured by any other known technique.

Finally, because the test heats the specimen in a characteristic way and applies typical movement or shear forces, repeatable product-by-product comparisons can be made. This permits a restricted amount of product interchangeability covering the least onerous door modes and configurations. Even under these conditions, the intumescent material proposed to replace the existing material must itself have been the subject of a full-scale test on another door design, if confidence is to be gained in its performance at large scale.

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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.

IMPORTANT — During fire resistance testing, the leaves shall not deflect more than half their thickness. The distortion shall be measured between the top of the opening edge and the frame of a full-sized door when tested opening into the furnace during a test in accordance with ISO 3008. If the door leaf undergoes distortion greater than this during the test, then the method is unsuitable for evaluating alternative sealing methods.

1 Scope

This International Standard specifies a test method for determining the effective sealing capability of intumescent materials or systems in the context of sealing door–to–frame clearances in timber door assemblies. Intumescent seals extend the duration for which the gap between the leaf edge and the frame will satisfy the integrity criteria of the fire resistance test, and sealing systems can be compared using this method. The method is suitable for evaluating the efficacy of exposed intumescent sealing systems used in conjunction with timber fire resisting doors of up to 1 h fire resistance. It is not suitable for comparing concealed intumescent seals. The results can be applied to proven, single-acting, single-leaf, latched, timber door assemblies of sizes up to that given in the field of direct application.

This International Standard is applicable to timber door assemblies whose intumescent seals have been tested in accordance with ISO 3008 and have satisfied the integrity and — if appropriate — the insulation criterion, whilst incorporating another form of heat-activated seal for a period appropriate to the application. The suitability of any sealing system for use on timber door assemblies of any other configuration (i.e. unlatched single doors, double leaf assemblies etc., or doors constructed of other materials) can only be evaluated by subjecting a full-sized door assembly, complete with seals, to testing in accordance with ISO 3008.

The method does not provide any measure of the ability of the seal to resist the flow of smoke (although a gap that is sealed will provide a reduction in the flow of hot products of combustion) or any information as to the additional protection that could be needed at hardware/ironmongery positions.

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

ISO 3008*, Fire resistance tests — Door and shutter assemblies*

ISO 8302, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus*

ISO 13943, *Fire safety — Vocabulary*

3 Terms and definitions

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

3.1
intumescent seal
seal comprising material or combination of materials with the property of swelling or foaming when exposed to heat, intended to improve the fire performance of the element of construction in which it is incorporated

3.2
concealed intumescent seal
seal where the material is fitted below a timber lipping of at least 4 mm thickness by a thermally softening adhesive and not visible from the outside

3.3
exposed intumescent seal
seal either set into a groove in the edge of the leaf or face of the frame, or applied directly to the face and visible when installed

3.4
integrity
ability of a separating element of building construction, when exposed to fire on one side, to prevent the passage through it of flames and hot gases or the occurrence of flames on the unexposed side

3.5
supporting construction
construction that may be required for the testing of some building elements and into which the test specimen is installed

EXAMPLE The wall into which a door is fitted.

3.6
test construction
complete assembly of the test specimen together with its supporting construction

3.7
timber fire-resisting door assembly
door assembly intended, when closed, to resist the passage of fire or combustion products or both, where the leaf edge incorporates a combustible edging not less than 5 mm thick and where the construction materials are not of metal

4 Apparatus

4.1 General

The apparatus used for the test shall generally be in accordance with ISO 834-1. Additional apparatus will be required to evaluate the contribution to the fire resistance of timber fire-resisting door assemblies provided by intumescent seals as specified in 4.2.

4.2 Additional apparatus

4.2.1 Test rig

4.2.1.1 The test rig consists of a low carbon steel angle frame (60 mm × 30 mm × 5 mm thick) with mitred welded corners forming a square with outer dimensions of 600 mm × 600 mm. A low carbon steel plate (nominally 5 mm thick), which overlaps the hardwood lipping by a depth of (10 ± 1) mm, shall be fixed centrally on a diagonally mounted 15 mm diameter round steel shaft retained in bushes at each end. The central panel shall be retained in a diagonally central position by means of locking collars bearing against the face of pivot blocks on the diagonal shaft, lightly greased, such that the gap between the central panel and the outer frame is equal on all edges (see Figure 1).

4.2.1.2 A suitable, easy-to-release mechanism such as a cam that does not disturb the panel when activated shall be mounted on the back face of the central steel panel in order to maintain the alignment of the central panel with the back of the outer frame (see Figure 2).

4.2.1.3 A steel bracket incorporating a deflection limit adjusting screw at one end shall be fixed to the panel by means of a metal block as shown in Figure 1. The screw is used to limit the deflection of the panel to that specified in Clause 7.

4.2.1.4 On the rear face of the frame, a 100 mm diameter pulley wheel shall be mounted on a steel pulley bracket to facilitate the application of a load to the central panel at the point shown in Figure 1. A wire rope shall be attached to the central panel at the position shown so that the rope passes over the pulley and hangs down below the rig for a length of approximately 300 mm. A weight, or a weight pan and weights, of 7,5 kg mass shall be attached to the lower end of this wire rope.

4.2.1.5 The flush face of the outer frame shall be clad with a non-combustible insulating board, or laminated boards, with a density of 680 kg/m^3 ± 10 % and a thermal conductivity of between 0,14 W/(m·K) and 0,18W/(m·K) determined using the ISO 8302 test method, to a thickness equal to the thickness of the door to which the results are normally to be applied. A lipping of hardwood (of density greater than 550 kg/m^3 oven-dry weight) shall be affixed to the inner edge of this cladding to the full thickness of the insulating board and to a depth of (19 ± 1) mm. Lipping shall be applied by means of high-temperature adhesive (resorcinol formaldehyde or similar).

The central panel shall be clad in a similar manner and a similar hardwood lipping shall be incorporated in the perimeter of this panel to a nominal depth of (19 ± 1) mm, but finally sized such that the gap between the lipping on the frame and the central panel is (3,5 ± 0,5) mm on all edges.

4.2.1.6 Special attention shall be paid to the method of corner jointing the timber lippings at the corners to ensure that they do not open up and burn through during the test. The method of jointing shown in Figure 3 is recommended.