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Fire tests for building elements and components — Integrity and insulation performance testing of service installations —

Part 1: Penetration seals

Essais au feu pour les éléments et composants de bâtiment — Essai de performance d'intégrité et d'isolation des installations de service —

Partie 1: Pénétration au travers de joints d'étanchéité

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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 10295-1 was prepared by Technical Committee ISO/TC 2, *Fire safety*, Subcommittee SC 2, *Fire containment*.

ISO 10295 consists of the following parts, under the general title *Fire tests for building elements and components — Fire testing of service installations*:

— *Part 1: Penetration seals*

— *Part 2: Linear gap seals*

Note: There is a document being developed titled: *Penetration seals. Guidance on the use of test configurations to establish direct and extended fields of application*, with two subsections: Single component penetration seals and Multi-component penetration seals.

Introduction

This part of this International Standard has been prepared to provide a method of test for assessing the contribution of a penetration sealing system to the fire resistance of separating elements when they have been penetrated by a service of services. It should be read in conjunction with ISO 834: Part 1. This document contains specific requirements for fire resistance testing which are unique to the elements of building construction described as a penetration sealing system. The requirements for these penetration sealing systems are intended to be applied in appropriate conjunction with the detailed and general requirements contained in Part 1 of the ISO 834-1.

Fire tests for building elements and components — Integrity and insulation performance testing of service installations —

Part 1:
Penetration seals

CAUTION — The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing may be hazardous and that there is a possibility that toxic and/or harmful smoke and gases may be evolved during the test. Mechanical and operational hazards may 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

1.1 This Part of this International Standard specifies the heating condition, method of test and criteria for the evaluation of the ability of a penetration sealing system to maintain the integrity and insulation of fire separating element at the position at which it has been penetrated, for example by a service.

1.2 This International Standard assess

a) the effect of such penetrations on the integrity and insulation performance of the element concerned;

b) the integrity and insulation performance of the penetration sealing system;

c) the insulation performance of the penetrating service or services, and where necessary, the integrity failure of a service.

1.3 This Part of this International Standard does not provide information concerning the influence of the inclusion of such penetrations and sealing systems on the loadbearing capacity of the element.

1.4 It is possible that a penetration seal is a component of, or contributes to the performance of, a system to which special requirements apply. In such cases additional tests, relevant to the system and its function, may be necessary. Examples are chimneys and fire rated ducts in air distribution systems.

1.5 This Part of this International Standard is not intended to provide quantitative information on the rate of leakage of smoke and/or hot gases or on the transmission or generation of fumes. Such phenomena are to be noted in describing the general behaviour of specimens during test.

1.6 This Part of this International Standard does not provide information on the ability of the seal to withstand stresses that might be caused by the movement or displacement of the penetration services in practice.

Explanatory notes are included in Annex A.

2 Normative references

The following standards contain provisions, which through references in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of the IEC and ISO maintain registers of currently valid International Standards.

ISO 13943, *Fire tests — Vocabulary*

ISO 834-1, *Fire resistance tests — Elements of building construction – Part 1: General requirement for fire resistance testing*

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

3 Terms and definitions

For the purposes of this part of ISO 10295-1, the terms and definitions given in ISO 13943 and ISO 834-1 and the following apply.

3.1
fire separating element
floors, walls and other separating elements of construction having a period of fire resistance determined in accordance with ISO 834: Part 1

3.2
penetration
an aperture within a fire separating element usually present to accommodate the passage of a service through that element

3.3
service
a penetrating item for example a cable, conduit, pipe with or without any insulation, duct, chimney, or trunking; excluding air ventilation systems and fire rated ventilation ducts, smoke extract ducts and fire rated service ducts and shafts

3.4
penetration seal
the system used to maintain the fire resistance of the fire separating element at the position where there is provision for services to pass through the element

3.5
penetration sealing system
the assembly for test consisting of the penetrating service or services and the penetration seal, materials or devices, together with any service support construction, designed to maintain the integrity and insulation performance of the separating element for the duration of the fire test

3.6
service support construction
mechanical support provided in the form of clips, ties, hangers, ladder racks of trays, or any device designed to carry the load of the penetrating services

3.7
blank penetration seal
the system where an aperture of specified size in the fire separating element is sealed or closed by the specified seal without incorporation of penetrating services

3.8
test construction
the complete assembly, consisting of the separating element and penetration sealing system

4 Symbols and abbreviated terms

Symbols and designations appropriate to this test are given in ISO 834-1.

5 Test equipment

5.1 Equipment employed in the conduct of this test consists of a furnace, restraint and support frames and instrumentation as specified in ISO 834-1 and this international standard.

5.2 The internal dimensions of the test furnace shall have a minimum size of 1 m x 1 m x 1 m and shall be such that a distance of at least 200 mm exists between any point of the periphery of any penetration seal and the wall of the furnace.

6 Test conditions

6.1 The heating conditions and the furnace atmosphere shall conform to those given in ISO 834-1.

6.2 Where a penetration sealing system is intended for use in both floors and walls then each orientation shall be tested.

6.3 A pressure of (20 ± 2) Pa shall be established at the lowest point of the lowest vertical penetration.

6.4 For horizontal elements a static pressure of (20 ± 2) Pa in the horizontal plane (100 ± 10) mm below the underside of the separating element shall exist.

7 Instrumentation

The control, monitoring and recording equipment necessary to carry out tests in accordance with this Standard shall be as described in ISO 834: Part 1.

8 Test construction

8.1 Number of specimens

8.1.1 In the case of vertical elements, two tests shall be carried out; one from each direction of exposure. If in practice the fire risk can be identified as from one side only, or where the penetration sealing system is fully symmetrical, only one specimen is required to be tested with the appropriate face exposed to the heating regime.

8.1.2 Where it can be established clearly in a non-symmetrical construction that there is a weaker direction of exposure, only the weaker is required to be tested. A full justification for the procedure adopted shall be included in the report.

8.1.3 In the case of horizontal elements, the test specimen shall be exposed to heating from the underside.

8.2 Size of specimen

8.2.1 A penetration and the accompanying penetration seal shall be full size. In order to avoid boundary effects, the distance between the perimeter of the penetration sealing system and the outer perimeter of the heated part of the separating element shall be not less than 200 mm at any point.

8.2.2 In cases where multiple penetrations are included in a single test construction, the minimum distance between adjacent fire seals shall be not less than 200 mm. Each penetration with its associated service(s) and penetration sealing system(s) shall be the subject of a separate evaluation providing the specified conditions are maintained with respect to the penetration being evaluated.

8.3 Separating element

8.3.1 The separating elements shall be of known fire resistance and representative of that used in practice. A rating obtained on such a specific separating element shall apply only to that particular type of separating element.

8.3.4 Standard separating elements

8.3.4.1 Wall constructions

The constructions depend on the period of fire resistance required. For concrete and masonry elements the wall shall be constructed from materials having a density of 650 ± 200 kg/m^3 and a thickness of not less than 70 mm.

8.3.4.2 Floor constructions

The floor constructions for concrete elements should have a density of (650 ± 200) kg/m^3 or (2200 ± 250) kg/m^3 and a thickness ‘d’ of not less than 100 mm.

8.4 Penetrating service

8.4.1 Selection of service

8.4.1.1 The type of service of services passing through the penetration in the fire resisting element shall be selected so as to be representative of the services which the penetration seal is designed to accommodate. Standard service configurations for various applications are the subject of a separate document, which is in preparation.

8.4.1.2 When more than one penetration is incorporated into a test on a single separating element whilst remaining within the requirements of 6.3, 6.4, 6.5, 6.6 and 8.2, care shall be taken to ensure that there is no interaction between different penetrations. Examples are where, for instance, the early failure at one of the penetrations invalidates the time-temperature or pressure conditions specified; or where on penetration sealing system directly influences another, e.g. by flaming or melting.

8.4.2 Installation of service

8.4.2.1 The service(s) shall be installed so that it projects 500 mm on each side of the supporting construction with a minimum of 300 mm extending beyond the extremities of the penetration sealing system. In this context the penetration sealing system shall include any coating, wrapping or other protection to the services. In addition, the length of unprotected service on the unexposed face shall be not greater than 500 mm.

8.4.2.2 At the start of the test there shall be a minimum separation of 200 mm between extremities adjacent penetrations and between any penetration and the internal surface of the furnace.

8.4.2.3 For the purpose of test, the possibilities for support provided to the services are as follows:

a) unsupported condition;

b) notional support, agreed between the sponsor and the laboratory;

c) either full scale simulation (representative of practical conditions); or

d) the calculation and application of a load to simulate practical conditions. This will determine the field of direct application.

8.4.2.4 In each case the procedure adopted and the validity of the test result shall be fully described in the report.

8.4.2.5 In the case of pipes, pipe end situations may be selected according to table 1 and the conditions used shall be considered in the corresponding classification of the test result.

Table 1 — Pipe end situation

Test Condition	Pipe end situation	
	inside the furnace	outside the furnace
A	uncapped	uncapped
B	capped	uncapped
C	uncapped	capped
D	capped	capped

8.4.2.6 The capping of pipes shall be carried out by closing the pipe end with a mineral wool or ceramic fibre disc of a thickness of (50 ± 10) mm and a density of (150 ± 50) kg^3 fixed in place with an appropriate adhesive (eg sodium silicate adhesive, ceramic adhesive). Alternatively, pipes may be sealed by welding a disc of the same material as the pipe to the end. In cases where vertical pipes are tested the mineral wool or ceramic fibre discs shall be fixed additionally by mechanical means.

8.5 Penetration seal

8.5.1 Installation of penetration seal

The penetration sealing system shall be installed, together with chosen services, in accordance with the manufacturer's instructions or in a manner representative of site practice. The installation procedures shall be described in the test report.

8.5.2 Addition of services

In the case where a penetration sealing system is designed to allow for the alteration of the service content after first installation, a representative penetration sealing system shall be prepared and fully conditioned. After this period any required modifications shall be made to the service loading and a further conditioning period shall be allowed if necessary. Such procedures shall be fully described in the report.

8.5.3 Blank seal

When it is believed that a seal may perform adversely in the absence of a service then the integrity of insulation of the blank seal shall be determined.