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Provning av brandmotstånd för installationer i byggnader – Del 3: Tätning av genomföringar

Fire resistance tests for service installations – Part 3: Penetration seals

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The European Standard EN 1366-3:2009 has the status of a Swedish Standard. This document contains the official English version of EN 1366-3:2009.

This standard supersedes the Swedish Standard SS-EN 1366-3:2005, edition 1.

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EUROPEAN STANDARD

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English Version

Fire resistance tests for service installations - Part 3: Penetration seals

Essais de résistance au feu des installations techniques - Partie 3 : Calfeutrements de trémies

Feuerwiderstandsprüfungen für Installationen - Teil 3: Abschottungen

This European Standard was approved by CEN on 3 January 2009.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 1366:2009) has been prepared by Technical Committee CEN/TC 127 “”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2009, and conflicting national standards shall be withdrawn at the latest by August 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1366-3:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Annexes A to G are normative. Annex H is informative.

EN 1366, *Fire resistance tests for service installations* consists of the following:

Part 1: Ducts

Part 2: Fire dampers

Part 3: Penetration seals

Part 4: Linear joint seals

Part 5: Service ducts and shafts

Part 6: Raised access floors and hollow floors

Part 7: Conveyors systems and their closures

Part 8: Smoke extraction ducts

Part 9: Single compartment smoke extraction ducts

Part 10: Smoke control dampers (in course of preparation)

Part 11: Protective systems for essential services (in course of preparation)

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This part of this European Standard has been prepared to provide a method of test for assessing the contribution of a penetration seal to the fire resistance of separating elements when they have been penetrated by a service or services.

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 should be made and safety precautions should be identified and provided. Written safety instructions should be issued. Appropriate training should be given to relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

1 Scope

This Part of EN 1366 specifies a method of test and criteria for the evaluation (including field of application rules) of the ability of a penetration seal to maintain the fire resistance of a separating element at the position at which it has been penetrated by a service. Penetration seals used to seal gaps around chimneys, air ventilation systems, fire rated ventilation ducts, fire rated service ducts, shafts and smoke extraction ducts are excluded from this standard except for mixed penetration seals. The fire resistance of those services itself cannot be assessed with the methods described in this standard.

Supporting constructions are used in this standard to represent separating elements such as walls or floors. These simulate the interaction between the test specimen and the separating element into which the sealing system is to be installed in practice.

This European Standard is used in conjunction with EN 1363-1.

The purpose of this test described in this standard is to assess:

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

b) the integrity and insulation performance of the penetration seal;

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

No information can be implied by the test concerning the influence of the inclusion of such penetrations and sealing systems on the loadbearing capacity of the separating element.

It is not the intention of this test 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 only to be noted in describing the general behaviour of test specimens during the test.

This test is not intended to supply any information on the ability of the penetration seal to withstand stress caused by movements or displacements of the penetrating services.

The risk of spread of fire downwards caused by burning material, which drips through a pipe downwards to floors below, cannot be assessed with this test.

Explanatory notes to this test method are given in Annex H.

All dimensions given without tolerances are nominal ones unless otherwise stated.

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.

EN 520, *Gypsum plasterboards – Definitions, requirements and test methods*

EN 1329-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – Unplasticized poly(vinyl chloride) (PVC-U) – Part 1: Specifications for pipes, fittings and the system*

EN 1363-1:1999, *Fire resistance tests – Part 1: General requirements*

EN 1363-2, *Fire resistance tests – Part 2: Alternative and additional procedures*

EN 1452-1, *Plastics piping systems for water supply – Unplasticized poly(vinyl chloride) (PVC-U) – Part 1: General*

EN 1453-1, *Plastics piping systems with structured wall-pipes for soil and waste discharge (low and high temperature) inside buildings – Unplasticized poly(vinyl chloride) (PVC-U) – Part 1: Specifications for pipes and the system*

EN 1455-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – Acrylonitrile-butadiene-styrene (ABS) – Part 1: Requirements for pipes, fittings and the system*

EN 1519-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – Polyethylene (PE) – Part 1: Specifications for pipes, fittings and the system*

EN 1565-1, *Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings – Styrene copolymer blends (SAN+PVC) – Part 1: Specifications for pipes, fittings and the system*

EN 1566-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – Chlorinated poly(vinyl chloride) (PVC-C) – Part 1: Specifications for pipes, fittings and the system*

EN 1992-1-2, *Eurocode 2 – Design of concrete structures – Part 1-2: General rules – Structural fire design*

EN 1996-1-2, *Eurocode 6 – Design of masonry structures – Part 1-2: General rules – Structural fire design*

EN 10305-4, *Steel tubes for precision applications – Technical delivery conditions – Part 4: Seamless cold drawn tubes for hydraulic and pneumatic power systems*

EN 10305-6, *Steel tubes for precision applications – Technical delivery conditions – Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems*

EN 12201-2, *Plastics piping systems for water supply – Polyethylene (PE) - Part 2: Pipes*

EN 12449, *Copper and copper alloys – Seamless, round tubes for general purposes*

EN 12666-1, *Plastics piping systems for non-pressure underground drainage and sewerage – Polyethylene (PE) – Part 1: Specifications for pipes, fittings and the system*

EN 13501-1, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests*

EN 13501-2, *Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN 13600, *Copper and copper alloys – Seamless copper tubes for electrical purposes*

EN ISO 13943:2000, *Fire safety – Vocabulary (ISO 13943:2000)*

EN 61386-21, *Conduit systems for cable management - Part 21: Particular requirements - Rigid conduit systems (IEC 61386-21:2002)*

HD 21.3, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 3: Non-sheathed cables for fixed wiring (IEC 60227-3:1993, modified)*

HD 22.4, *Cables of rated voltages up to and including 450/750V and having crosslinked insulation — Part 4: Cords and flexible cables*

HD 603.3, *Distribution cables of rated voltage 0.6/1 kV – Part 3: PVC insulated cables – unarmoured*

HD 604.5, *0.6/1 kV power cables with special fire performance for use in power stations – Part 5: Cables with copper or aluminium conductors with or without metallic covering or screen*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1363-1:1999 and EN ISO 13943:2000 and the following apply.

3.1
blank penetration seal
aperture in the separating element which is sealed or closed by the specified seal without incorporation of penetrating services

3.2
cable box
housing with intumescent inlays that forms a channel which is normally fitted with a device to prevent the passage of cold smoke

3.3
combination frame
two or several single frames joined together to one unit

3.4
conduit
metal or plastic casing designed to accommodate cables

NOTE Normally a conduit is circular or oval in section. See also *trunking.*

3.5
flexible construction
horizontal or vertical supporting construction consisting of studs or joists, including linings and optional insulation

3.6
modular system
pre-sized frame into which are installed elastomeric insert blocks, compressed around the service

3.7
non-sheathed cable (wire)
normally a single core cable with only one layer of covering

3.8
penetration
aperture in a separating element for the passage of one or more services

3.9
penetration seal
system used to maintain the fire resistance of a separating element at the position where services pass through or where there is provision for services to pass through a separating element

3.10
penetration seal - large
penetration seal large enough to accommodate the standard configuration according to Figures A.1 or A.3B

3.11
penetration seal - small
penetration seal of an area of max 0,07 m^2, i.e. up to 300 mm diameter or equivalent rectangular up to a length to width ratio of 2,5:1

3.12
pipe closure device
reactive device in varying sizes, to seal pipe penetrations including associated pipe insulation

3.13
pipe insulation
Table 1 shows the terms used throughout the document for the various purposes of pipe insulation

3.14
service
system such as a cable, conduit, pipe (with or without insulation) or trunking

3.15
service support construction
mechanical support provided in the form of clips, ties, hangers, ladder racks or trays, or any device designed to carry the load of the penetrating services

3.16
sheathed cable
single or multi-core cable with individual covering of the cores and an additional protective covering of the assembly

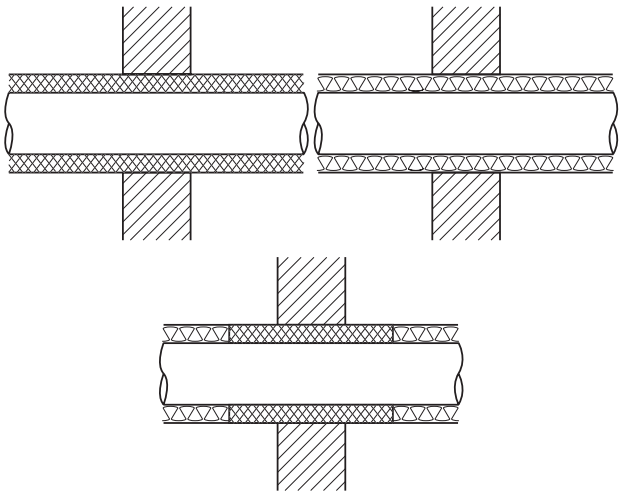
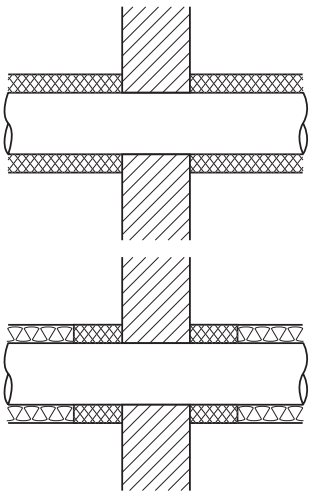
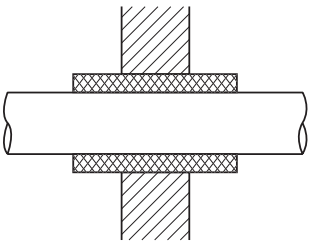
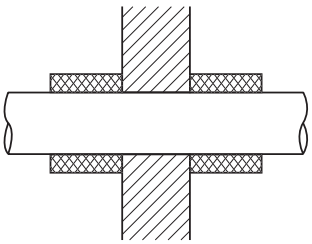
3.17
single frame
square or rectangular frame, with predefined dimensions in different sizes, to accommodate a modular penetration seal (see Figure 1)

3.18
(single) module
single block, available in different sizes, to be used inside a single frame (opening)

NOTE Adapted to seal around penetrating services in different sizes and shapes or as blanks (see Figure 1).

3.19
single opening
area of the modular system within a single frame or within each single frame of a combination frame which is available for the modules (see Figure 1)

Table 1 — Definition of pipe insulation (3.13)

	Sustained	*Interrupted*
Continued	 Case CS	 Case CI
Local	 Case LS	 Case LI

NOTE Depending on the reaction to fire classification of the insulation, the insulation may be the penetration seal / be part of the penetration seal or additional sealing means (which are not shown in the figures) may be necessary. For further explanation see Annex H.

Key

 Building element

 Pipe

 Thermal/acoustic/other pipe insulation

 Insulation acting as penetration seal or forming part of the penetration seal

3.20
standard supporting construction
form of construction of known fire resistance used to support the penetration seal being evaluated

3.21
test specimen
assembly for test consisting of the penetrating service or services and the penetration seal, materials or devices, together with any service supporting construction, designed to maintain the integrity and insulation performance of the separating element for the duration of the fire test

3.22
trunking
metal or plastic casing designed to accommodate cables

NOTE Normally trunking is square or rectangular in section. See also *conduit*.

3.23
waveguide
circular, elliptical or rectangular metal tube or pipe or a coaxial assembly of tubes/pipes through which electromagnetic waves are propagated in microwave and radio wave frequency communications

4 Test equipment

See EN 1363-1, and if applicable EN 1363-2.

5 Test conditions

5.1 Heating conditions

The heating conditions and the furnace atmosphere shall conform to those given in EN 1363-1 or, if applicable, EN 1363-2.

5.2 Pressure conditions

5.2.1 Pressure conditions including tolerances shall be as given in EN 1363-1 subject to the following:

5.2.2 A minimum pressure of 20 Pa shall be maintained at the top of the uppermost penetration seal in a vertical supporting construction. Services shall only be included in the zone where the positive pressure exceeds 10 Pa (a minimum pressure of 10 Pa shall be maintained at the lowest point of the lowest service, see Figure 2).

NOTE A pressure of 10 Pa is expected to be maintained ca. 1200 mm below the plane where a pressure of 20 Pa is maintained according to the pressure gradient given in EN 1363-1.

5.2.3 In case of a blank penetration seal in a vertical supporting construction a minimum pressure of 20 Pa shall be maintained at the top of the seal.

5.2.4 For horizontal supporting constructions a nominal pressure of 20 Pa shall be maintained in the horizontal plane (100 ± 10) mm below the underside of the supporting construction.

6 Test specimen

6.1 Size and distances

A penetration and the accompanying penetration seal shall be as in practice. In order to avoid boundary effects, the distance between the perimeter of the penetration seal and the internal surfaces of the furnace shall be not less than 200 mm at any point.

In cases where several test specimens are included in a single test construction, the minimum distance between adjacent penetration seals shall be not less than 200 mm unless it is the intention to demonstrate that a smaller distance does not have a negative effect on fire performance. Each penetration seal shall be the subject of a separate evaluation, provided the standard test conditions are maintained throughout the test with respect to the penetration being evaluated.

6.2 Number

See EN 1363-1.

For horizontal separating elements only one test specimen is required with fire exposure from the underside. Where a penetration seal is intended for use both in floors and walls, the systems shall be tested both vertically and horizontally.

6.3 Design

6.3.1 General

The test specimen shall be either:

a) fully representative of the service and penetration seal used in practice, including any special features which are unique to that installation or

b) a standard configuration which is deemed to cover a wide range of practical applications.

For standard configurations or advice for designing the specimen/test setup see the following:

1) Supporting construction: 7.2.2;

2) Large cable penetration seals: Annex A;

3) Small penetration seals: Annex B;

4) Modular systems and cable boxes: Annex C;

5) Bus bars: Annex D;

6) Pipe penetration seals: Annex E;

7) Mixed penetration seals: Annex F;

8) Critical pipe/cable approach: Annex G.

6.3.2 Penetrating services

For the purpose of this standard the following grouping applies:

a) Pipes and conduits of class A1 according to EN 13501-1 with a melting or decomposition point greater than 1000°C (e.g. steel, cast iron, copper and copper alloys, nickel alloys) either insulated or non-insulated, hereafter referred to as "metal pipes". Included in this group are the above pipes with a coating provided the overall classification is minimum A2 according to EN 13501-1.

b) Trunking of class A1 according to EN 13501-1 with a melting or decomposition point greater than 1000°C (e.g. steel, cast iron, copper and copper alloys, nickel alloys) either insulated or non-insulated, hereafter referred to as "metal trunking". Included in this group are the above trunkings with a coating provided the overall classification is minimum A2 according to EN 13501-1.

c) Pipes, trunking and conduits of class A1 or A2 according to EN 13501-1 with a melting or decomposition point equal to or less than 1000°C (e.g. lead, aluminium and aluminium alloys) and/or the risk of fracture (glass, fibre cement) either insulated or non-insulated.

d) Pipes not classified to A1 or A2 according to EN 13501-1 (e.g. made from thermoplastic or thermosetting material) including non-homogeneous materials (e.g. glass fibre reinforced plastic pipes or layered pipes), either insulated or non-insulated, hereafter referred to as "plastic pipes".

e) Trunking and conduits not classified to A1 or A2 according to EN 13501-1 (e.g. made from thermoplastic or thermosetting material) including non-homogeneous materials, either insulated or non-insulated, hereafter referred to as "plastic trunkings" and "plastic conduits".

6.3.3 Support conditions for penetrating services

6.3.3.1 General

The support conditions for the service(s) shall be chosen from the following:

a) without support;

b) standard service support construction (see Figures A.2, A.3A, A.3B, A.4, A.5, A.6, A.8 and E.10);

c) full-scale representation as in practice. A load may be applied to simulate practical conditions.

In each condition the method of support (if any) shall be fully described in the test report.

6.3.3.2 Standard service support construction

The standard support construction for cables shall comprise of steel H-studs, steel brackets, steel rod, steel ladders and trays as shown in Figure A.2, A.4 and A.6 for vertical test specimens, of steel angles, steel channels and steel ladders as shown in Figure A.3A, A.3B and A.5 for horizontal specimens. A single or a pair of horizontal supports (20 mm steel rod) may be used on each face.

Alternative constructions for the H-studs, steel brackets, steel angels and steel channels may be used (see Figure A.8 for cable supports and Figure E.10 for pipe supports).

When installing a steel ladder, positioning of a rung within the penetration seal should be avoided.

Alternative materials for cable ladders/trays, e.g. plastic, aluminium, steel with organic coatings resulting in an overall class of B to E according to EN 13501-1, shall be tested in addition to the standard ladders/trays as defined in Annex A with the cables from cable tray 1 as shown in Figure A.1.

The standard support for pipes shall consist of a strut / channel system with e.g. a steel band or pipe rings either standing on or hanging from the channel (see Figure E.10) to prevent movement in the plane of the supporting construction and perpendicular to the supporting construction.

In the case of flexible floor constructions the service support construction shall be independent of the supporting construction to allow differential movement of the services relative to the supporting construction.

6.3.4 Pipe end configuration

When pipes are to be tested, the pipe end configurations shall be chosen from Table 2 depending on the nature of the pipe material and the required field of application.

Table 2 — Pipe end configuration

Test condition	Pipe end configuration	
	Inside the furnace	Outside the furnace
U/U	Uncapped	Uncapped
C/U	Capped	Uncapped
U/C	Uncapped	Capped
C/C	Capped	Capped

Capping of pipes shall be carried out by closing the pipe end by inserting an appropriate mineral wool disc into the end of the pipe, fixed in place with an appropriate adhesive (e.g. sodium silicate adhesive). For further explanation see Annex H. In cases where vertical pipes are tested, the mineral wool shall be fixed additionally by mechanical means. For “metal pipes” the pipe may be capped by fixing a disc or cap (with a melting or decomposition point equal or greater than that of the pipe) onto the end of the pipe. For “plastic pipes”, "plastic conduits” and “plastic trunkings” the pipe may be capped using a plastic cap.

Where a flue gas recovery system is intended to be used the following rules shall be obeyed:

1) Maximum 4 pipes of a comparable diameter, i.e. mean value ± 20% (for further explanation see H.4.2.3), at the same horizontal level shall be connected to one recovery pipe made from a metallic folded spiral-seam tube of 100 mm diameter. Appropriate bushings shall be used to connect the pipes to the recovery pipe;

2) The length of the recovery pipe outside the furnace shall be 1,5 ± 0,1 m (for further explanation see H.4.2.3).

For relation between the use of a flue gas recovery system and the pipe end configuration see Annex E.

6.3.5 Cable end configuration

The heated ends of cables shall be left uncapped. Cables projecting from the unheated face of the supporting construction shall be capped using an appropriate method, e.g. acrylic sealants, to prevent hot gases escaping.

6.3.6 Blank penetration seal

If a blank penetration seal is to be evaluated, this shall be incorporated into the supporting construction. To gain the maximum field of application the largest envisaged penetration seal shall be tested.

6.3.7 Subsequent addition/removal of services

If it is the intention of the test to represent the effect of adding extra services or altering the number and/or type of service running through the seal subsequent to installation, then the following procedure shall be followed.

After installation of the penetration seal into the appropriate supporting construction, the penetration seal shall be allowed to cure according to the manufacturer's installation instructions. After this period any required modifications shall be made to the service(s) and the penetration seal as required to be evaluated and the test construction shall be conditioned in accordance with Clause 8.

Any procedures involved in the addition or removal of services shall be fully described in the test report.

6.4 Construction

The test specimen shall be constructed as described in EN 1363-1.

6.5 Verification

Verification of the test specimen(s) shall be carried out as described in EN 1363-1.

7 Installation of test specimen

7.1 General

The test specimen(s) shall be installed, as far as possible, in a manner representative of their use in practice. Care shall be taken to avoid any artificial support which could be provided to the service e.g. if it sags during the test.

7.2 Supporting construction

7.2.1 General

The supporting construction may be either one of the standard constructions listed in 7.2.2 or a specific construction. In the latter case, however, the field of direct application is limited (see 13.2).

7.2.2 Standard supporting constructions

7.2.2.1 Wall constructions

7.2.2.1.1 Rigid wall constructions

The standard supporting constructions for rigid wall separating elements shall be made of aerated concrete slabs, lightweight concrete or high density concrete and a thickness appropriate to the required fire resistance classification according to the tables given in EN 1992-1-2 for lightweight concrete and high density concrete and EN 1996-1-2 for autoclaved aerated concrete.

7.2.2.1.2 Flexible wall constructions

The standard supporting construction shall be in accordance with the provisions given in EN 1363-1, subject to the following:

1) The size of the supporting construction shall be minimum 3 m in height and minimum 1,20 m in width. The flexible wall shall contain minimum 1 vertical joint between the boards;