BRITISH STANDARD

BS EN
14470-1:2004

Fire safety storage cabinets —

Part 1: Safety storage cabinets for flammable liquids

The European Standard EN 14470-1:2004:2000 has the status of a British Standard

ICS 13.220.40; 71.040.10

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee LBI/18, Laboratory furniture and fittings, which has the responsibility to:

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— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

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EUROPEAN STANDARD

NORME EUROPÉENNE

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English version

Fire safety storage cabinets - Part 1: Safety storage cabinets for flammable liquids

Armoires de stockage de sécurité incendie - Partie 1: Armoires de stockage de sécurité pour liquides inflammables

Feuerwiderstandsfähige Lagerschränke - Teil 1: Sicherheitsschränke für brennbare Flüssigkeiten

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Foreword

This document (EN 14470-1:2004) has been prepared by Technical Committee CEN/TC 332 “Laboratory equipment”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2004, and conflicting national standards shall be withdrawn at the latest by October 2004.

Annexes A and B are normative.

This document includes a Bibliography.

EN 14470, *Fire safety storage cabinets,* consists of the following parts:

Part 1 — Safety storage cabinets for flammable liquids

Part 2 — Safety storage cabinets for pressurised gas cylinders (in 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

This European Standard describes the design and testing criteria for safety cabinets to be used in laboratories to store flammable liquids in closed containers at normal room temperatures.

Primarily, this European Standard covers the three major safety requirements for storage of flammable liquids, which are:

a) minimising the fire risks associated with the storage of flammable substances and protection of the cabinet's contents in the event of fire for a known (tested) minimum length of time (fire rating);

b) minimising the amount of vapour released into the working environment;

c) retention of accidental spillage within the cabinet.

Testing of the cabinet [see a) above] under fire conditions is a normative part of the standard and the procedures and interpretation of the tests are described in detail.

The fire test [see a) above] provides for four categories of fire protection / ratings. In practice the degree of fire protection/rating allows the user to select, depending on individual circumstances, a cabinet which will allow sufficient time for personnel to leave, and fire fighters to enter the laboratory before it is likely to that the flammables stored turn a possible minor / extinguishable fire into an uncontrollable one. The methods of achieving b) and c) above are sufficiently flexible to allow for local/national needs.

Caution should be exercised when determining the appropriate cabinet fire rating when flammables having auto-ignition temperatures below 200 °C and/or having high vapour pressures at room temperature are involved. When such flammable materials are being stored, expert advice should be sought.

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1 Scope

This European Standard is a product specification, giving performance requirements for fire safety cabinets to be used for the storage of flammable liquids in laboratories. It is applicable to cabinets with a total internal volume of not greater than 1 m^3, which may be free standing, restrained to a wall or mounted on wheels or castors. It is not applicable to brick enclosures or walk-in storage rooms.

This European Standard is not applicable to cabinets which do not take their weight on their base.

Requirements are given in respect of the construction of the cabinet and its capacity to resist fire conditions on the outside. A classification of cabinets is given, according to the level of fire resistance offered, and a type test is included, which draws on already existing fire resistance tests, such as those given in ISO 834-1 [1] and EN 1363-1.

The tests described in this European Standard are type tests.

NOTE 1 This European Standard does not discriminate between different flammable liquids, which may have considerably different physical properties. The suitability of the standard in respect of any given flammable liquid should be ascertained by the user.

NOTE 2 Attention is drawn to national regulations which may apply with regard to the storage of flammable liquids.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

EN ISO 4796-2, *Laboratory glassware — Bottles — Part 2: Conical neck bottles (ISO 4796-2:2000).*

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

ISO 3864 (all Parts), *Safety colours and safety signs.*

3 Terms and definitions

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

3.1
type
specimen of a design manufactured with the characteristics intended for series production

3.2
type testing
conformity testing on the basis of one or more specimens of product representative of the production

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4 Classification

A fire safety storage cabinet shall be classified as one of the Types listed in Table 1.

Table 1 — Fire safety storage cabinet Type classification

Type	Time taken for T to rise by 180 K (min)	Test according to EN 1363-1	Ventilation connection facility required	Self-closing doors
15	≥ 15	✓	✓	✓
30	≥ 30	✓	✓	✓
60	≥ 60	✓	✓	✓
90	≥ 90	✓	✓	✓

5 Construction

5.1 Fire protection

In the case of a fire, the cabinet shall assure that, for at least 15 min, the contents of the cabinet do not contribute any additional risks or spread of fire.

5.2 Doors

5.2.1 The doors of the cabinet shall be fully self-closing from any position.

The closing time of the doors, from the time of door release, shall not exceed 20 s. The time for closing doors from their completely open position or from the position given by a hold open feature shall be measured with a stopwatch, at a temperature of (20 ± 5) °C.

If a hold-open feature is included, the doors shall close fully in the event of a temperature of $(50\ ^{0}_{10})$ °C being reached in the vicinity of the front of the cabinet. The temperature release sensor for this shall be positioned in freely circulating air, so that it can heat up rapidly.

5.2.2 The temperature release component of the closing device shall be confirmed as conforming to the requirements specified in 5.2.1, by the manufacturer's declaration of conformity.

5.2.3 Doors and their surroundings shall be designed such that the risk of injuries by pinching is minimised. To minimise injuries by closure of the doors, the static force shall not exceed 100 N between the main closing edge and the counter closing edge.

5.2.4 It shall be possible to operate each door single-handedly.

5.2.5 If the doors are lockable, the locking device shall not compromise the self-closing performance required in 5.2.1.

5.3 Side and back walls

The side and back walls of the cabinet shall be of the same thickness and comparable construction.

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5.4 Ventilation

5.4.1 Cabinets shall be equipped with openings for inlet and exhaust air, enabling the connection of the cabinet to an exhaust air system.

NOTE 1 Attention is drawn to national regulations regarding the connection of safety storage cabinets to exhaust air systems.

In a cabinet in which ventilation is taking place, with the doors closed, air exchange at a rate of at least 10 times the volumetric capacity of the cabinet per hour shall take place, with a pressure drop not exceeding 150 Pa. The ventilation system shall maintain a lower pressure in the cabinet than that outside. The ventilation shall be effective immediately above the bottom tray of the cabinet.

This shall be tested by visual inspection of the openings and measurement of the air exchange and pressure drop with the cabinet empty of containers.

NOTE 2 An air exchange rate of greater than 10 h^{-1} can be necessary for the reduction of smell.

5.4.2 The ventilation openings for inlet and exhaust air shall close automatically when subjected to a temperature of (70 ± 10) °C.

5.5 Shelves

The shelves and their fastenings shall be of non-absorbent material and shall carry the load specified in the user information to be supplied (see clause 7) without any damaging distortion at the testing temperature according to annex A. The shelves shall not hinder the automatic closure of the doors. This shall be tested by visual inspection.

NOTE For better ventilation, perforated shelves can be useful.

The highest shelf shall be not higher than 1,75 m from the floor.

5.6 Spill containment sump

A spill containment sump shall be installed underneath the lowest storage level. The sump shall be designed such that liquids spilled from higher shelves are collected in the sump. The sump shall have a minimum capacity of 10 % of the volume of all the containers stored in the cabinet, or at least 110 % of the volume of the largest single container, whichever is the greater. All spillages or condensation up to this volume shall be retained. This shall be tested by comparison with user information and, in case of doubt, by measurement of the sump capacity.

NOTE National regulations can require higher capacities than are specified here, e.g. for environmental protection.

The sump shall perform its function after the fire resistance test described in clause 6. This shall be verified by visual inspection after filling the sump with water.

6 Fire resistance

The fire resistance capability of the cabinet shall be investigated by a type test. This test is performed by heating the cabinet in a furnace according to the temperature-time curve described in 5.1.1 of EN 1363-1:1999 and measuring the temperature increase inside the cabinet. The cabinet shall then be classified as Type 15, 30, 60 or 90, according to the time for which the interior does not rise by more than 180 K, at any point of measurement, from a starting temperature of (20 ± 5) °C. The test is given in annex A.

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Annex B specifies the approval of cabinets with construction alterations compared to a model already tested.

7 Information to be supplied

The cabinet manufacturer shall supply with the cabinet a manual of information, which includes at least the following:

a) the maximum load capacity of each shelf (see 5.5) and of the whole cabinet;

b) the maximum volume, in litres, of the largest single container that may be stored in the cabinet (see 5.6);

c) the sump capacity, in litres;

d) a warning stating that extreme caution should be exercised before opening a cabinet after a fire;

e) a list of parts which have to be checked and / or replaced on a routine basis;

f) instruction to the user to mark on the cabinet if the cabinet is to be operated without connection to an exhaust air system;

g) instruction to the user to check that the connection to the ventilation system, if fitted, is correctly made, for example by using a smoke tube;

h) notification to the user that, if forced ventilation is not connected, the immediate area around the cabinet could become a hazardous zone;

NOTE Attention is drawn to regulations in respect of ventilation, which will apply whether the cabinet has forced ventilation or not.

i) instruction to the user not to use the sump for storage;

j) recommendation to the user to undertake regular inspection and maintenance and recommendations for the maintenance intervals;

k) the supplier's declaration of conformity or the certificate(s) of conformity from a test house.

8 Marking and labelling

The following inscriptions shall be mounted on the front of the cabinet in a suitable and visible place:

a) advice that the door(s) must remain closed when not in use;

b) the appropriate warning sign for 'Caution: risk of fire' and the appropriate prohibition sign for 'Fire: open light and smoking', according to ISO 3864 (all Parts);

c) the fire resistance capability, specified in minutes, e.g. Type 15, 30, 60 or 90;

d) name and/or trademark of the manufacturer;

e) model number and year of production;

f) maximum volume of a single container, in relation to the sump capacity, to be stored in the cabinet;

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g) maximum shelf load, evenly distributed.

NOTE The size of all markings should be adequate for the size of the cabinet.

The openings for the inlet and exhaust air shall be labelled so that it is possible to differentiate between them.

The manufacturer shall indicate conformity of the cabinet to this standard by the inscription EN 14470-1.

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Annex A
(normative)

Type testing to determine protection level, hence classification

A.1 Principle

The fire safety storage cabinet is exposed to flames in a suitable furnace, such that the standard time-temperature curve specified in 5.1.1 of EN 1363-1:1999 is generated. The temperature increase inside the cabinet is measured, as well as the time taken until the temperature increase reaches more than 180 K. The cabinet Type is then ascertained by reference to the criteria set out in clause 4.

A.2 Testing apparatus and means

A.2.1 The furnace shall be arranged so that the doors, walls and roof of the tested cabinet receive equal heat conditions, without flames directly touching the cabinet body.

A.2.2 Measuring equipment for monitoring the ambient temperature, the furnace temperature and the temperature inside the test cabinet shall be in accordance with the requirements of EN 1363-1.

A.2.3 The means of heating shall be in accordance with the requirements of EN 1363-1.

A.2.4 The following additional apparatus is required:

- balance with a maximum permitted load of 500 g and a maximum possible reading error of 1 %;
- weighing apparatus capable of weighing a cabinet, with a maximum possible reading error of 1 %;
- narrow necked bottles with glass stoppers. The bottles shall conform to EN ISO 4796-2 and shall have a nominal volume of 2 l. They shall be filled approximately half full with water;
- plain steel weight(s), to load uniformly the highest shelf of the cabinet to the maximum of the manufacturer's specification.

A.3 Test models

A.3.1 Quantity and description of test models

For testing the fire resistance capability, there shall be two cabinets of the same model provided. One cabinet shall be used to conduct the fire test and the second for humidity determination of the insulation material and to verify the diagram specifications of the cabinet.

Detailed construction drawings with specifications shall be provided, which include the following:

- inner and outer dimensions;
- sheet steel thickness;

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- gap dimensions around and between the doors;
- material specifications;
- closing mechanisms;
- inlet and exhaust air openings;
- welded and other seals and their design and workmanship;
- the hold-open device, if provided;
- manufacturer's information on the materials or components that have a bearing on the fire performance of the cabinet.

A.3.2 Preliminary examination of the test model

Before actual fire testing, the test model shall be checked for conformity with drawing specifications. Possible differences shall be added to the drawings. The weight of each test model shall be determined.

Photographic documentation shall be performed both before and after testing, with views of the open and closed cabinet, as well as detailed views of the doors, conditions of seals, etc.

The self-closing mechanism of the doors shall be demonstrated to meet the requirements of 5.2.1 by a function test.

Before fire testing begins, insulation material, if present, shall be taken, approximately 250 g in each sample, from each of three different areas (e.g. door and wall) of one of the cabinets. The three samples shall be weighed and then dried for 24 h at (40 1) °C and a relative air humidity of 50 %. None of the three samples shall weigh less than 95 % of the original weight.

A.4 Preparation of fire test

A.4.1 Installation of test model

All cabinets are to be tested as free standing single cabinets. The model shall be positioned with its back wall at a minimum of 100 mm from the furnace wall. The resulting space shall not be sealed or packed. The test shall be performed:

- with open inlet and exhaust openings (see 5.4), but without connection to an exhaust air system;
- with the doors closed, but not locked manually;
- with the highest shelf loaded according to the manufacturer's specification with plain steel weights (see A.2.4);
- with a narrow necked bottle (see A.2.4) on both the lowest and the highest shelves;
- with control points for the testing of stability of the maximum loaded shelf until the end of the fire test.

If the cabinet is intended to be used mounted on wheels or castors, the fire resistance capability shall (additionally) be determined in that configuration.

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A.4.2 Temperature measuring device placement in the test model

Temperature measuring devices shall be installed as follows:

- ¾ four air temperature measuring devices in the upper four corners, each 25 mm away from the wall, door and ceiling surfaces;
- ¾ contact temperature measuring devices fixed to the ceiling, floor, walls and door(s), each in the middle of the surface;
- ¾ a fluid temperature measuring device in the narrow necked bottles on the lowest and highest shelves.

NOTE The purpose of the fluid temperature measuring devices is to know the time at which a breakdown of a shelf takes place, if this happens.

For cabinets with two doors, at least two extra air temperature measurement devices shall be installed 25 mm away from the join of the two doors, at positions which are also:

- ¾ 25 mm away from the inner ceiling;
- ¾ in the middle of the cabinet.

See Figure A.1.

A.4.3 Temperature measuring device placement in the furnace

At least four temperature measuring locations are required, each 100 mm away from the wall, ceiling and door surfaces of the cabinet. They shall be located centrally with respect to each surface. The measurement locations shall be at least 400 mm deep into the fire room.

See Figure A.2.

A.5 Fire testing procedure

The cabinet front wall, side walls and ceiling shall be heated with flames, according to the standard temperature-time curve given in EN 1363-1. During the time of temperature increase, the temperatures at all the measured locations within the cabinet shall be recorded continuously.

A.6 Test report

The test report shall include at least the following:

a) reference to this standard;

b) name of the testing laboratory, test report number, place and date of type testing;

c) name of the manufacturer;

d) product brand of test model;

e) weight of both test models;

f) description and drawings of test model, including all pertinent dimensions, building materials, seals, shutters, etc.;

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g) results of humidity testing of insulation (see A.3.2);

h) details regarding the positioning of temperature measuring devices and procedures;

i) which type of fuel was used in the test;

j) observations during test;

k) comment regarding the ease with which the test model could be opened after the type test;

l) comment about the sturdiness of shelves during the heating process, insofar as information is available;

m) indication of the fire resistance capability in minutes and resulting classification;

n) expiry date of the certificate held by the test house for the manufacturer's cabinet;

o) photographs taken before and after the test;

p) details of the temperature measurements;

q) time taken until and place where the temperature increase of 180 K was reached;

r) result of the sump test (see 5.6).

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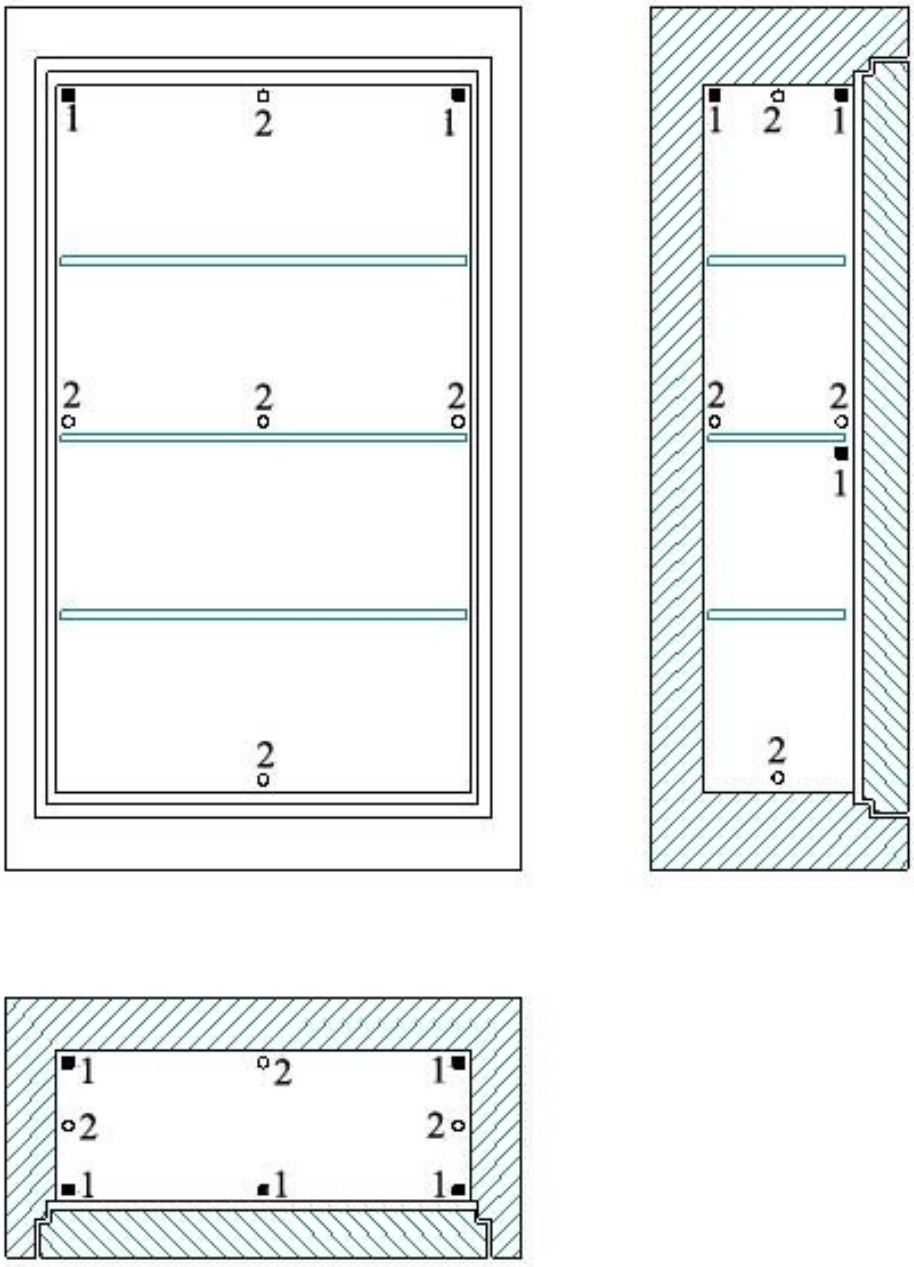

Key
1 Air temperature measuring device
2 Surface temperature measuring device

Figure A.1 - Positions for temperature measuring devices inside the cabinet (front elevation, side elevation and plan shown)

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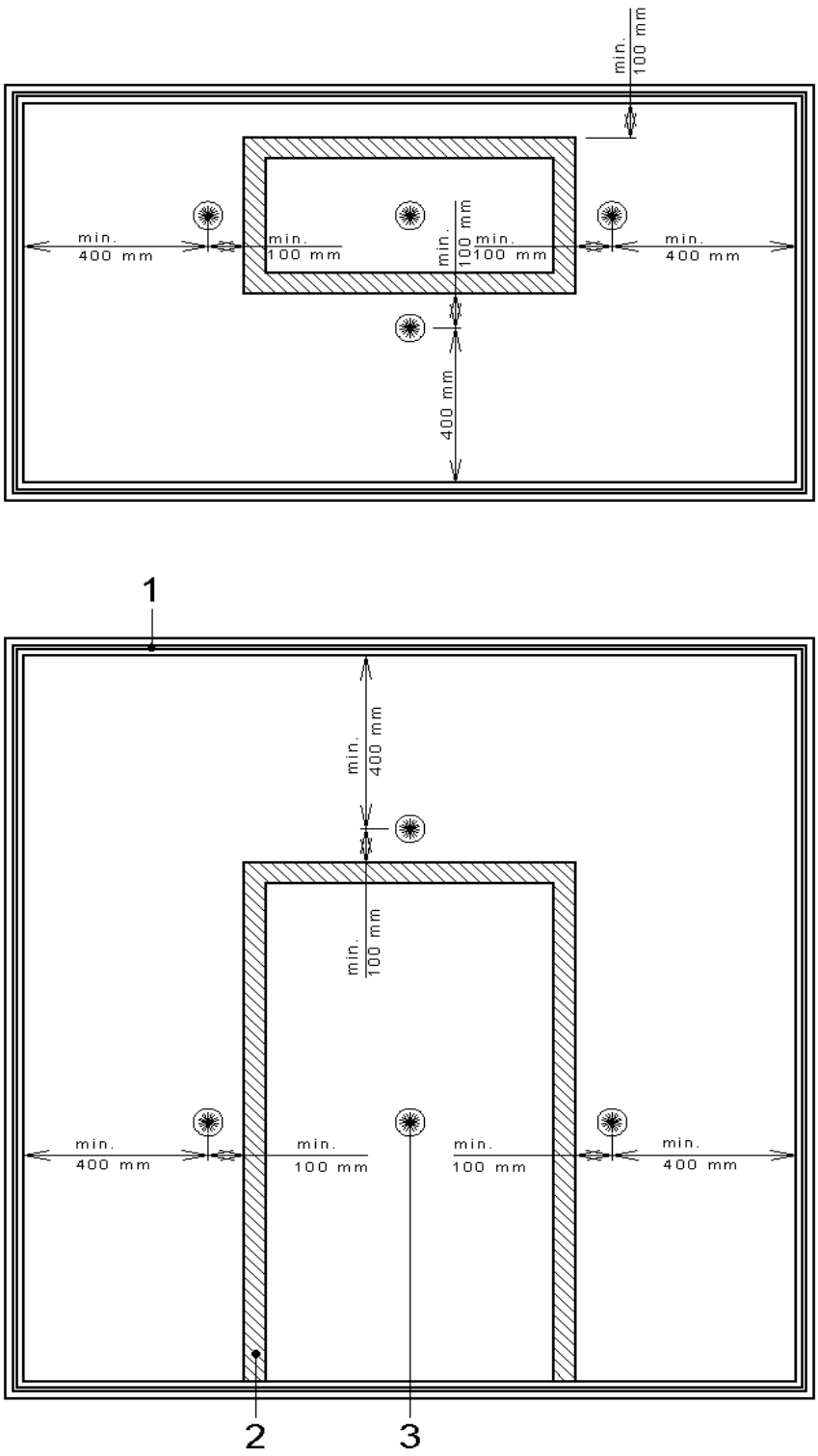

Key

1 Fire test room
2 Fire safety storage cabinet
3 Temperature measurement location

Figure A.2 - Positions for temperature measuring devices outside the cabinet (plan and front elevation shown).

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Annex B
(normative)

Approval following construction alterations

Construction alterations at the test model can be evaluated by the body performing the test. However, comparison tests may be necessary, according to circumstances.

Safety cabinets of the same design and protection level (such as material and thickness of the insulation, arrangement of folded joints and sealings, number of doors, door locking devices) can only receive the same approval (without another test) when they have similar outer dimensions.

Dimension tolerances shall be evaluated in the framework of an expert opinion by the testing laboratory.

Only a reduction in height or width not exceeding 100 mm or a reduction in depth not exceeding 150 mm may be accepted. Safety cabinets exceeding these tolerances or differing in more than one outer dimension shall require testing according to annex A before classification.

Bibliography

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

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