BRITISH STANDARD

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81-58:2003

Safety rules for the construction and installation of lifts — Examination and tests —

Part 58: Landing doors fire resistance test

The European Standard EN 81-58:2003 has the status of a British Standard

ICS 91.140.90

National foreword

This British Standard is the official English language version of EN 81-58:2003.

The UK participation in its preparation was entrusted to Technical Committee MHE/4, Lift, hoists and escalators, which has the responsibility to:

— aid enquirers to understand the text;

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

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Règles de sécurité pour la construction et l'installation des élévateurs - Examen et essais - Partie 58: Essais de résistance au feu des portes palières

Sicherheitsregeln für die Konstruktion und den Einbau von Aufzügen - Überprüfung und Prüfverfahren - Teil 58: Prüfung der Feuerwiderstandsfähigkeit von Fahrschachttüren

This European Standard was approved by CEN on 18 March 2003.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Foreword

This document EN 81-58:2003 has been prepared by Technical Committee CEN/TC 10 “Lifts, escalators and moving walks”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

Annexes A to D are normative.

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

Introduction

This document is a type C standard as stated in EN 1070.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards for lift landing doors that have been designed and built according to the provisions of this type C standard.

EN 81 has identified the need for certain lift doors to act as fire barriers against the transfer of a fire via the lift well. This European Standard specifies a procedure for this purpose. It follows the general principle of EN 1363-1, Fire resistance tests – Part 1: General requirements, and where appropriate the procedure of EN 1634-1, Fire resistance tests for door and shutter assemblies – Part 1: Fire doors and shutters. Additionally a tracer gas technique for establishing the integrity of a lift landing door is used.

Lift landing doors are not included in the scope of EN 1634-1.

Lift landing doors, with additional applications, that may already have been tested for other than passenger lift landing door use to EN 1634-1, are considered to satisfy the corresponding classification according to this European standard.

1 Scope

This European Standard specifies the method of test for determining the fire resistance of lift landing doors which may be exposed to a fire from the landing side. The procedure applies to all types of lift landing doors used as a means of access to lifts in buildings and which are intended to provide a fire barrier to the spread of fire via the lift well.

The procedure allows for the measurement of integrity and if required the measurement of radiation and thermal insulation.

No requirements other than the verification that the specimen is operational, are included for mechanical conditioning before the test as these are included in the relevant product standard.

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 81-1, *Safety rules for the construction and installation of lifts – Part 1: Electric lifts*.

EN 81-2, *Safety rules for the construction and installation of lifts – Part 2: Hydraulic lifts*.

EN 1070:1998, *Safety of machinery - Terminology*

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

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

EN 1634-1, *Fire resistance tests for door and shutter assemblies – Part 1: Fire doors and shutters.*

EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full – Part 1: General principles and requirements* (ISO 5167-1:2003)

ISO 5221, *Air distribution and air diffusion – Rules to methods of measuring air flow rates in an air handling duct.*

ISO 9705, *Fire tests – Full scale room test for surface products*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1070:1998 and in EN 1363-1:1999 apply.

Additional definitions specifically needed for this document are added below:

3.1
lift landing door
door designed to be installed in the lift well opening on a landing to provide access to the lift

3.2
thermally uninsulated lift landing door
lift landing door which is not intended to satisfy the insulation criteria of EN 1363-1 and 15.2 of this standard.

NOTE Most lift landing doors fall in this category

3.3
thermally insulated lift landing door
lift landing door which is intended to satisfy the insulation criteria of EN 1363-1 and 15.2 of this standard

3.4
door opening
width of the clear opening allowing free passage through the open lift landing door

3.5
door assembly
complete assembly, including any frame or guide, door leaf or leaves, which is provided for access to and from the lift and the landing. It includes all panels, hardware, sealing materials and any operating components

3.6
supporting construction
construction provided in the opening of the test frame or the furnace front in order to accommodate the test specimen

3.7
leakage rate
total flow rate of hot gases passing through openings and gaps of the door assembly, due to overpressure on the landing side

4 Test principle

4.1 EN 1634-1 contains a procedure for the determination of fire resistance of doors which may be exposed to a fire in a building from either side and are required to prevent the transfer of fire from one side to the other. Lift landing doors represent a special use of doors where the fire exposure is expected to be from a specified direction, i.e. the landing side, and where the hazard exists only subsequent to the entry of a fire into the lift well. Such a door is generally not designed to possess the same resistance to the passage of hot gases as a door separating adjacent spaces on the same floor.

4.2 The test consists of exposing the landing side of a lift landing door to the heating conditions specified in EN 1363-1 for the period for which the door has to be assessed for its fire resistance. During the test, positive pressure exists over the whole height of the door on the exposed side, inducing the leakage of furnace gases to the unheated side. A canopy is provided on the unexposed side which collects the leaked gases and a suction fan draws these through a duct provided with a system for measuring the volume flow (see annex A). The concentration of CO_2, used as a tracer gas, is measured in the furnace and at the airflow measuring point, and by monitoring the gas flow rate and its temperature it is possible to calculate the leakage rate of hot gases through the test door. The method gives a record of the hot gas leakage as a function of time which is corrected for normal conditions. This provides a basis for assessing the ability of the door to act as an effective fire barrier.

5 Test equipment

5.1 The test furnace shall be as described in EN 1363-1.

5.2 The canopy shall be as specified in annex A.

5.3 The measuring system for leakage rate shall be as specified in annex A.

6 Test conditions

6.1 The furnace shall be controlled to follow the temperature/time curve as specified in EN 1363-1.

6.2 The furnace shall maintain positive pressure on the exposed side over the whole height of the specimen such that the pressure at sill level is in the range of (2 ± 2) Pa.

NOTE It is found that the pressure gradient over the height of the specimen is around 8,5 pascals per meter height.

7 Test specimen

7.1 Construction

The test specimen shall be fully representative of the door assembly on which information is required.

7.2 Number of specimens

As information is required when the door is exposed to heating from the landing side only, one specimen is tested. A second specimen may be required according to 10.2 to verify the door construction.

7.3 Size of specimen

The specimen shall be full size or the maximum size that can be accommodated in the furnace. The typical size of the front opening of the furnace is 3 m $\times$ 3 m. In order to expose a required minimum width of 200 mm of supporting construction for a typical 3 m $\times$ 3 m furnace, the opening in the supporting construction is restricted to 2,6 m $\times$ 2,8 m (width x height).

7.4 Installation of specimen

The specimen shall be mounted in a supporting construction having adequate fire resistance. The supporting construction shall be built first within the test frame leaving an aperture of the specified size. The width of the supporting construction on the two vertical sides and the top shall be not less than 200 mm.

The design of the connection between the door and the supporting construction, including any materials used to make the junction, shall be as used in practice with the type of the supporting construction. The position of the door assembly in relation to the supporting construction shall be as in practice.

The clearances shall correspond to the maximum that is permissible by EN 81-1 and EN 81-2 when the lift landing doors are put into service, unless designed for another maximum gap size, which shall then apply.

8 Supporting construction

In view of the field of direct application of test results, the lift landing doors shall be erected in the standard supporting construction as described in annex B.

NOTE In special cases the supporting construction may be of a type with which the door is intended to be used in practice. In such cases the field of application of the test results is restricted to that construction.

9 Conditioning

9.1 The test specimen as well as the supporting construction and any sealing materials used, shall be conditioned in accordance with the requirements of EN 1363-1 and EN 1634-1. No special conditioning procedures are required where the specimen is constructed primarily from non-hygroscopic materials. Full conditioning of the supporting construction may not be required if it is known that there will be no effect on the behaviour of the specimen or the fixing system.

9.2 Samples of materials used in the test door shall be supplied to determine moisture content when necessary.

10 Pre-test examination

10.1 General

Before the test, it shall be verified that the constructional details and clearance gap measurements and depth of penetration conform to the production and assembly drawings for the door system. It shall also be verified that the test specimen is operational.

10.2 Constructional details

A full detailed specification of the test specimen shall be provided by the test sponsor prior to its installation at the laboratory. This specification shall be to a level of detail sufficient to allow the laboratory to conduct a detailed examination of the specimen before the test and to agree the accuracy of the information supplied. The verification of the test specimen shall be carried out in accordance with the guidance given in EN 1363-1.

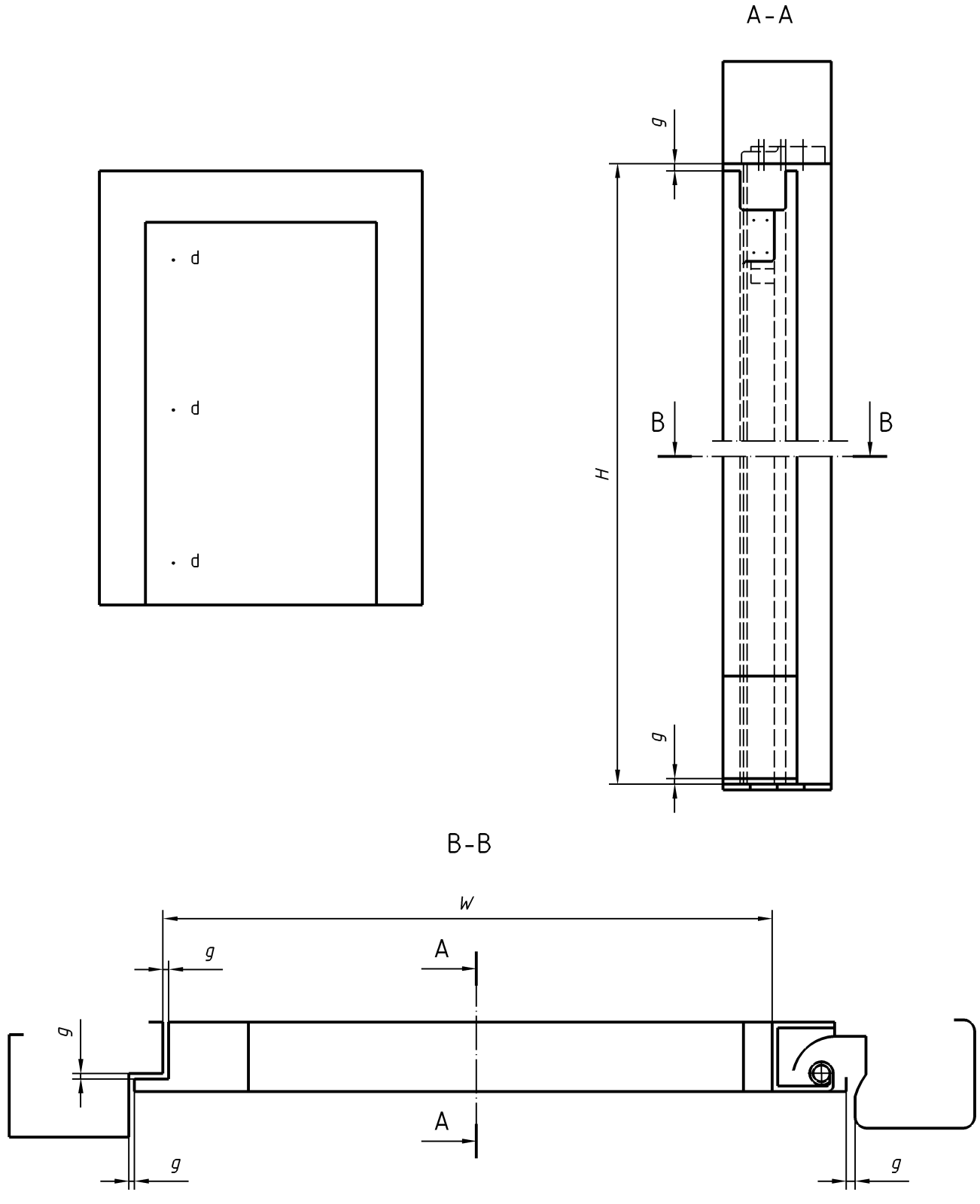
When the method of construction precludes a detailed survey of the specimen, without having to permanently damage it or if it is considered that it will subsequently be impossible to evaluate construction details from post test examination, then one of two options shall be exercised by the laboratory, either:

a) the laboratory shall request to oversee the manufacturing of the door or shutter assembly(ies) which is to be the subject of the test; or

b) the sponsor shall be requested to supply an additional assembly or part of the assembly (e.g. a door leaf) to the number required for test. The laboratory shall then choose freely which of these shall be submitted to the test and which shall be used to verify the construction.

10.3 Clearance gap measurements and depth of penetration

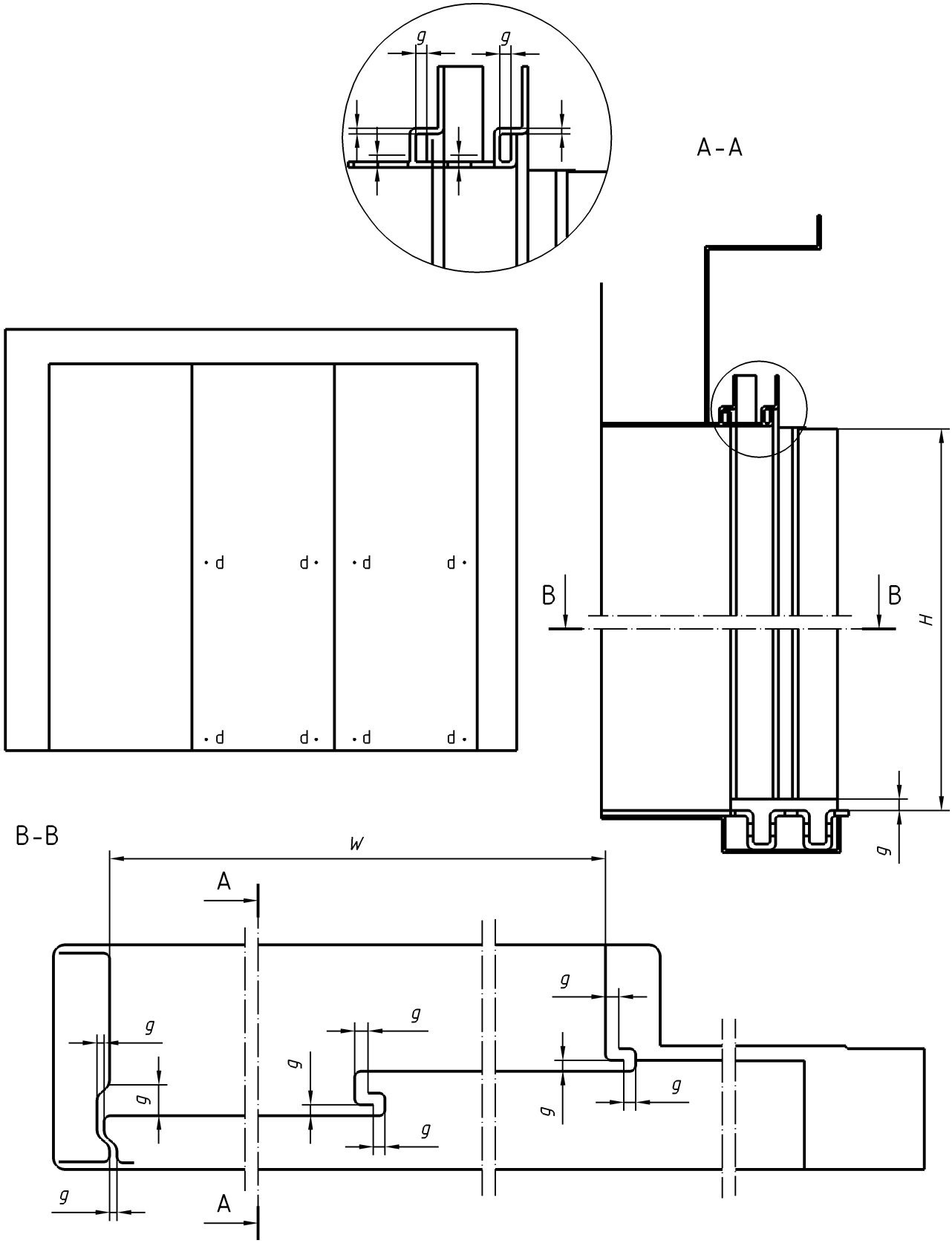
The clearances between the moving components and the fixed parts of the door assembly shall be measured prior to the test. Sufficient measurements shall be made to adequately describe the nature of the gaps and there shall be a minimum of three measurements along each side or edge. The gap sizes shall be described to an accuracy of ± 0,5 mm. Figure 1 to Figure 4 show different types of lift landing doors and indicate the gaps (g) which need to be recorded. The depth of penetration and safety guides (if any) shall be measured and recorded.



Key

g	Gap measurement location	H	Clear height
d	Deformation measurement location	W	Clear width

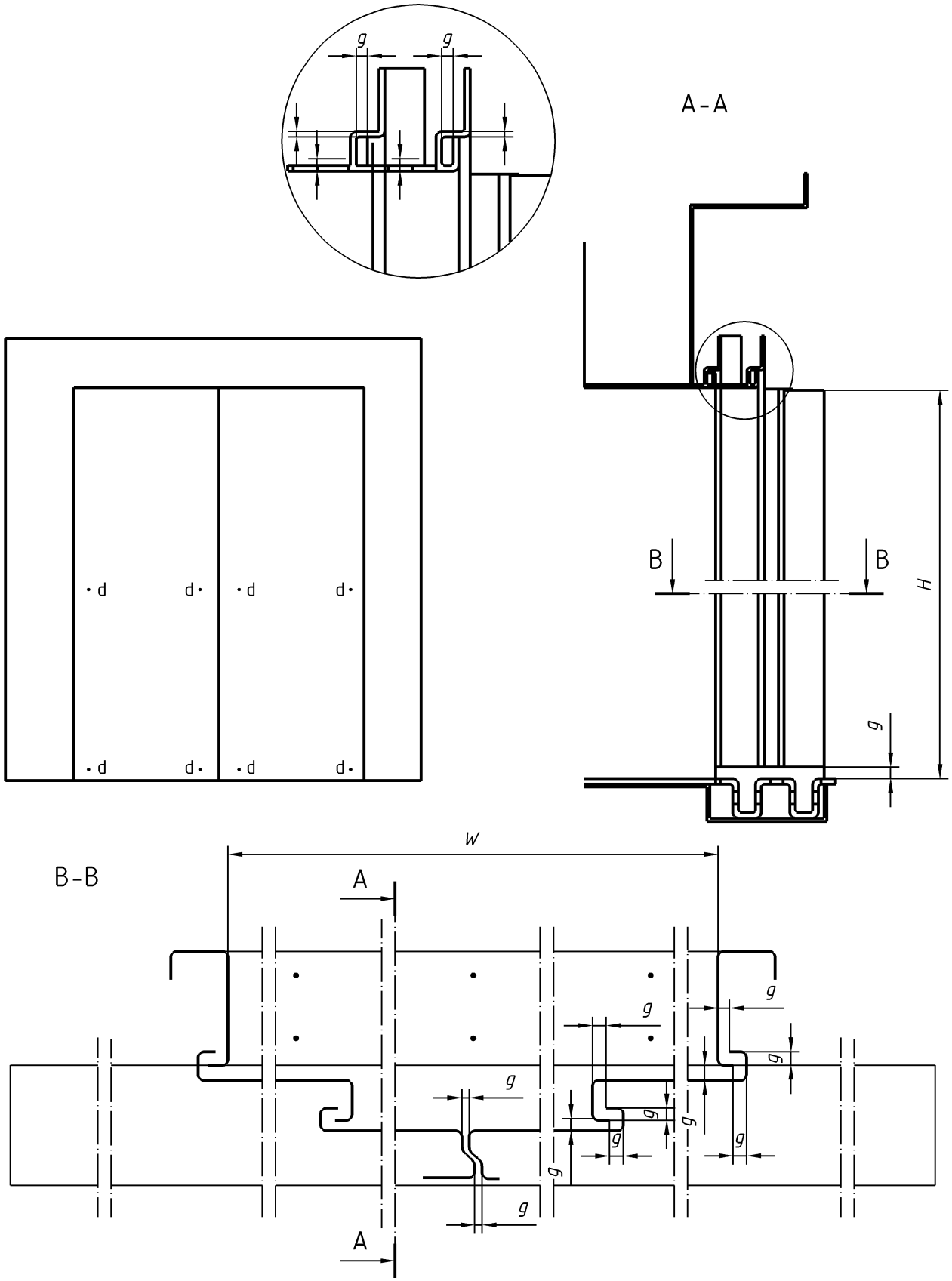
Figure 1 — Clearance gaps (g) and deformation measurements (d) – Single panel swing door



Key

g	Gap measurement location	H	Clear height
d	Deformation measurement location	W	Clear width

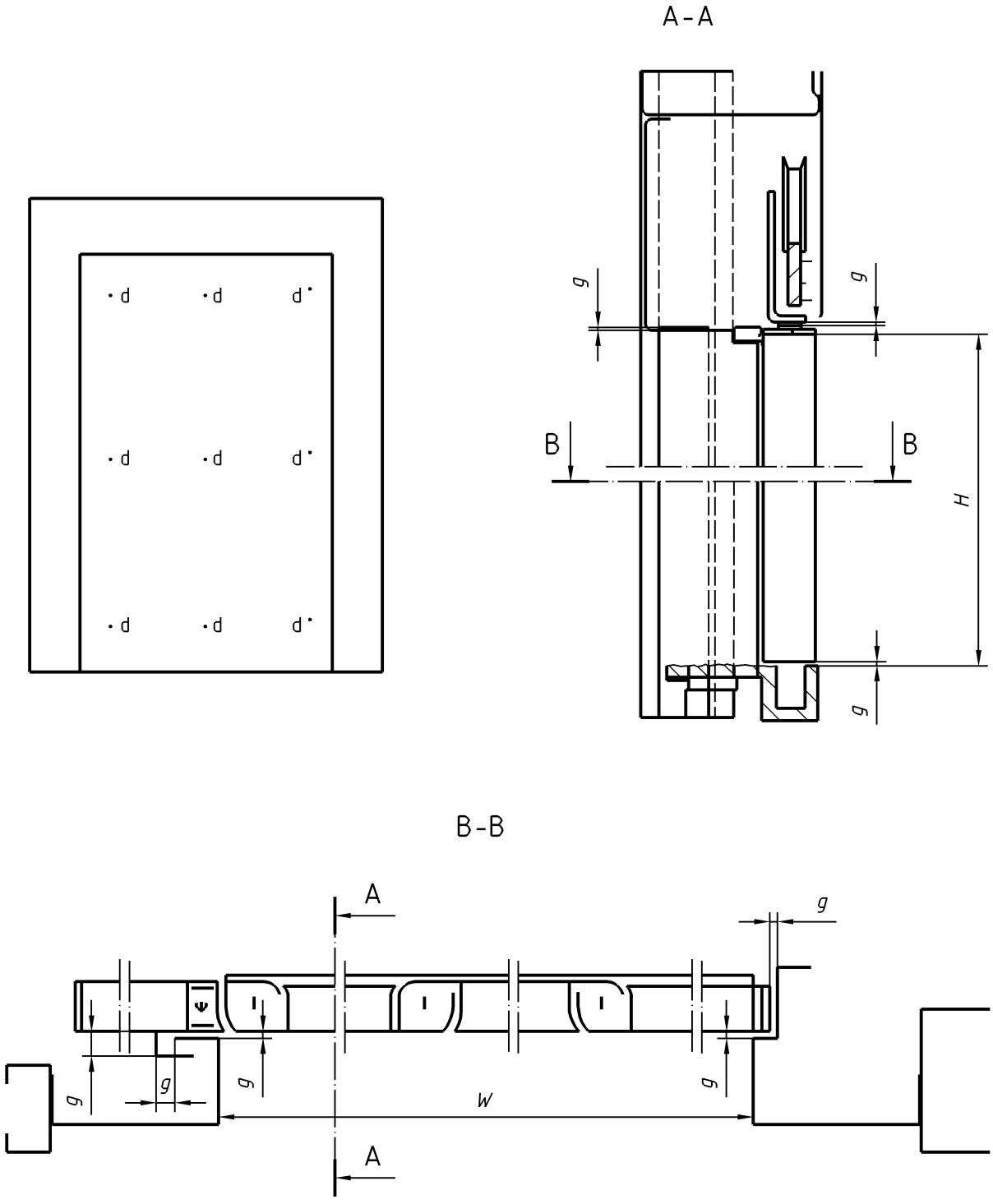
Figure 2 — Clearance gaps (g) and deformation measurements (d) – Double leaf telescopic door



Key

g	Gap measurement location	H	Clear height
d	Deformation measurement location	W	Clear width

Figure 3 — Clearance gaps (g) and deformation measurements (d) – Central opening door



Key

g	Gap measurement location	H	Clear height
d	Deformation measurement location	W	Clear width

Figure 4 — Clearance gaps (g) and deformation measurements (d) – Multi sliding door

10.4 Functionality test

Prior to the test, the door shall be checked for functionality by opening and closing to the maximum possible, with a minimum opening of width 150 mm.

11 Test instrumentation

11.1 Furnace thermocouples

The nature, number and the location of furnace thermocouples shall be in agreement with the specification given in EN 1634-1 for tests on doors.

11.2 Furnace CO_2 concentration

There shall be provision for continuous monitoring of CO_2 concentration in the furnace during the test. The instrument shall have a range of 0 % to 20 % CO_2 concentration and the calibration shall be established prior to the test by using a sample of known concentration. The accuracy of measurement for CO_2, i.e. the instruments and the measurement system shall be within ± 0,5 % CO_2.

11.3 Gas flow measuring system instrumentation

One or more thermocouples shall be provided close to the gas flow measuring system, within a distance of 100 mm, to measure the temperature of the exhaust gases drawn from the canopy.

Gas sample shall be drawn from the vicinity of the measuring system to monitor continuously the CO_2 concentration. The instrument is expected to have a range of 0 % to 2,5 % and the accuracy of measurement shall be within 0,05 % CO_2, it shall be checked prior to the test by using a sample of known concentration of CO_2 in the range of 1 % to 2,5 %.

Provision shall be made at the gas flow measuring system to monitor the pressure differential of the flow measuring device and the absolute pressure in relation to the ambient conditions. The range of the instrument shall be compatible with the flow rate generated by the suction fan.

The accuracy of determination of leakage rate shall be within 10 %.

11.4 Furnace pressure

Furnace pressure shall be measured continuously at a minimum of two locations over the height of the furnace to ensure that the pressure conforms to the specification in 6.2.

11.5 Unexposed face temperature

11.5.1 General

This clause specifies additional details for testing insulating capacity of lift landing doors designed for installation within openings incorporated in vertical lift shafts.

Where compliance with the insulation criteria is required to be evaluated, thermocouples of the type specified in EN 1363-1 shall be attached to the unexposed face as indicated below for the purpose of obtaining the average and maximum surface temperatures. General principles for the attachment of thermocouples given in EN 1363-1 shall apply.

NOTE Where no evaluation against the insulation criteria is required of the door, or any part thereof, no temperature measurements are required.

11.5.2 Position of the thermocouples to determine the average temperature

11.5.2.1 Door leaf (leaves)

Position five thermocouples per door leaf, one as close as possible to the centre of the door leaf (leaves) and one as close as possible to the centre of each quarter section. These shall not be located closer than 100 mm to any joint, stiffener or through component, nor closer than 100 mm to the edge of the leaf (leaves).

The number of thermocouples on the door leaves may be restricted to 12, evenly distributed over all door leaves .

In the event the door leaf (leaves) are of small size (i.e. less than 400 mm wide) such that the conventional five thermocouples cannot be fixed and/or the 100 mm minimum cannot be respected or the number of thermocouples is exceeding the maximum, then a limited number of thermocouples will be evenly distributed on the centre and diagonals of the clear entrance surface of the door.

When the total area of a single part of the door assembly is equal or smaller than 0,2 m^2, it shall be disregarded for the purpose of ascertaining the mean unexposed face temperature.

11.5.2.2 Door frame

The door frame of lift landing doors can include the following parts; the horizontal top member which may include the door mechanism (on sliding and folding doors), two vertical members and an over panel. No thermocouples shall be placed on the horizontal top member including the door mechanism.

The side panels and over panels of more than 300 mm width or height shall be provided with one thermocouple for each square meter or part thereof, subject to a minimum of two thermocouples.

These thermocouples shall not be located closer than 100 mm to any joint, stiffener or through component, nor closer than 100 mm to the edge of the side/over panel.

If the height of the over panels or width of the side panels are smaller than 300 mm no thermocouples are required for determining the mean temperature rise.

The average insulation performance of each area shall be determined.

11.5.3 Position of the thermocouples to determine the maximum temperature

11.5.3.1 Door leaf (leaves)

The maximum temperature shall be determined from the thermocouples fixed to determine the mean temperature rise (as given in 11.5.2.1).

11.5.3.2 Door frame

The maximum temperature shall be determined from the thermocouples fixed to determine the mean temperature rise (as given in 11.5.2.2). For vertical or horizontal members with width or height between 300 mm and 100 mm only one thermocouple shall be fixed at the centre of each member.

For vertical or horizontal members with width or height lower than 100 mm no temperature measurements are required.

11.6 Radiation measurement

If there is a requirement for the specimen door to satisfy the radiation criteria, appropriate instrumentation, as described in EN 1363-2 shall be provided to measure radiation from the unexposed face. In order to allow the location of the radiometer at 1 m from the exposed face, as specified in EN 1363-2, an adapted aperture may need to be cut in the curtain.

11.7 Deformation measurement

For wider application of test data it may be necessary to establish the deformation of the specimen during the test. Provision shall be made for such measurements to be made at specified locations, see locations “d” in Figure 1 to Figure 4.

11.8 Flow measurement verification

The reliability and the adequacy of the leakage rate measurement system shall be established prior tot the start of the furnace test according to annex C using the CO_2 generator shown in Figure C.1.

12 Test procedure

The test specimen shall be located in front of the furnace to provide a sealed furnace chamber. The accuracy of the CO_2 measuring system checked and the flow measurement verification of 11.8 undertaken.

On satisfactory completion of this check the exhaust fan shall remain in operation and the furnace ignited. It shall be controlled to follow the standard heating curve of EN 1363-1.

At the commencement of the test, the plate thermometers shall be 100 mm from the nearest plane of the exposed face of the test construction.

The data from the flow measuring instrumentation and the CO_2 concentration in the furnace shall be recorded for analysis during the test, including the flow measurement verification (11.8). If the unexposed face temperatures, radiation from this face and door deformation is being measured, these data shall also be recorded. The time of the occurrence of flaming, and its duration shall be recorded.

Observations shall be made of the general behaviour of the door specimen during the course of the test and notes made concerning deformation, opening of the gaps, melting or softening of materials, charring of surface finishes etc. If quantities of smoke are emitted from the unexposed face this shall be noted although the test is not designed to evaluate this hazard.

13 Test termination

The test shall be terminated at the end of the period selected by the sponsor or if the specimen is in a condition which is no longer satisfying any of the performance criteria.

14 Assessment of performance

14.1 The performance of the specimen door shall be expressed on the basis of its ability to remain in place as a fire barrier, its ability to control the leakage of hot gases from the landing side to the lift well and to satisfy any additional criteria for insulation and radiation which may be specified.

14.2 The leakage through the door shall be corrected to normal temperature and pressure conditions and expressed as m^3/min, following the procedure in annex D. Clause 15 defines the limiting values for acceptable leakage rates.

NOTE Transient peaks in the observed leakage rate curve can be ignored if they are due to fluctuations in the measuring chain and do not correspond to any real increase in leakage rate as a result of increasing gaps or further dislocations in the specimen.

The presence of combustible materials (coatings, paint) which pyrolise at a given temperature after a certain time may give rise to a temporary increase in the observed CO_2-production which does not correspond to an increase of the leakage rate and shall therefore be disregarded for the data used for classification.

14.3 The insulation of the door, where required to be established, shall be judged on the basis of either temperature rise of the unexposed face or radiation emitted from this face. The appropriate criteria are given in 15.2 and 15.3.

15 Criteria of performance

15.1 Integrity (E)

The main criterion for judging the performance of the test specimen is that of integrity. For lift landing doors the integrity criterion is satisfied as long as the leakage rate per meter width of the door opening does not exceed 3 m^3/(min.m), not taking into account the first 14 min of the test

Integrity shall be considered to have been lost by the occurrence of sustained flaming. Sustained flaming is flaming for more than 10 s.

15.2 Thermal insulation (I)

If insulation requirements apply the insulation criterion I is no longer satisfied when the average temperature rise exceeds 140 °C.

The maximum temperature rise on the door leaf, over panel and side panel with a width ≥ 300 mm shall not exceed 180 °C. When vertical members and/or over panels have a width (vertical members) or height (over panels) of between 100 mm and 300 mm then the maximum temperature rise of these members shall not exceed 360 °C.

15.3 Radiation (W)

If radiation requirements apply the radiation criterion is satisfied until the measured radiation exceeds the value of 15 kW/m^2, measured as specified in EN 1363-2.

16 Direct field of application

Test results in terms of Integrity, and Thermal Insulation are considered to be applicable to doors of sizes different from those of the test specimens, all other constructional details being the same, within the following limitations:

a) without correction to be applied on the measured leakage rate;

- a similar door of lower height than the tested specimen;
- a similar door with a door opening or an opening width in the wall equal to the one tested within a range of ± 30 %.

b) after correcting the measured leakage rate as a function of the increase in height, as specified in annex D;

- a similar door with increased height of up to 15 %.

The allowance given in a) and b) can be applied together..

If tested in a standard supporting construction, the results are valid for all constructions with a density equal to or greater than 600 kg/m^3 and thickness equal to or greater than 100 mm.

The results of doors tested with a supporting construction different from the standard supporting constructions as described in annex B are restricted to that specific supporting construction.

17 Classification procedure and declaration of performance

17.1 Performance criteria

The performance of the lift landing door shall be expressed in minutes, according to 15.1, 15.2 and 15.3, for one or more of the following criteria:

— Integrity : xx minutes;

— Insulation : yy minutes;

— Radiation : zz minutes.

17.2 Classification periods

For the purpose of classification the results in minutes, as specified in 17.1 shall be rounded down to the nearest classification period hereafter: 15, 20, 30, 45, 60, 90 or 120 minutes.

17.3 Designatory letters

For the classification of lift landing doors use shall be made of the following designatory letters:

— E for integrity;

— I for insulation;

— W for radiation.

17.4 Declaration of performance

The classes shall be expressed as follows:

— E *tt* : *tt* being the classification period during which the criterion integrity is satisfied;

— EI *tt* : *tt* being the classification period during which the criteria integrity and insulation are satisfied;

— EW *tt* : *tt* being the classification period during which the criteria integrity and radiation are satisfied.

When criteria are combined, the time declared shall be that of the criterion having the shortest time. So a lift landing door with E: 47 min., W: 25 min. and I: 18 min. shall be classified E 45 and/or EW 20 and/or EI 15.

17.5 Classes

Only the following classes of table 1 shall be used:

Table 1 classes

E	15		30	45	60	90	120
EI	15	20	30	45	60	90	120
EW		20	30		60		

18 Test report

The test report shall provide the general information required according to the relevant provisions of EN 1363-1 and EN 1634-1. In addition the following data shall be provided:

a) the leakage rate through the door during the course of the test;

b) the time and duration of the occurrence of flaming;

c) the deformation of the door, as a function of time;

d) radiation emission when measured, as a function of time;

e) unexposed face temperature curves when measured, as a function of time;

f) the classification of the door and the field of application of this classification.

Annex A
(normative)

Description of the canopy and measuring system

The canopy shall take the form of a sheet metal box, open at the bottom and fixed on the unexposed side of the furnace to provide a collector for the escape gases emitted from the door under test. Glass fibre curtains shall be located at the front and the side to minimise mixing of the gases with the surrounding air.

A fan shall be provided to extract the gases collecting near the top of the canopy. A monitoring system utilising an orifice plate or other equivalent system shall provide a means for measuring the flow rate of gases, their temperature and the CO_2 concentration. The leakage rate from the door shall be calculated by comparison with the CO_2 concentration of the furnace atmosphere.

The general arrangement of the system shall conform to Figure A.1 and canopy details shall conform to Figure A.2. The canopy shall be fabricated from sheet metal, 1,0 mm to 1,5 mm in thickness, with suitable facilities for attaching it to the face of the furnace or the supporting construction such that the junction is gas tight. Inside the canopy, at a distance of 150 mm below the top, a (15 ± 5) mm thick calcium silicate sheet shall be attached to act as a baffle. There shall be a clearance of 50 mm on three sides between the baffle and the canopy shell for the flow of the gases. At the top of the canopy, in a central position, an outlet for a metal duct, at least 200 mm in diameter, shall be provided to connect to a suitable exhaust fan.

NOTE 1 For a normal two leaf door a fan of 2 500 m^3/h capacity is found to be adequate.

Adjustable glass fibre fabric screens shall be attached to the front and two sides of the canopy.

The depth of the screens shall be adjusted such that the front screen drops 1 500 mm below the front lower edge of the canopy and the side screens shall be down to the sill level of the door under test. Small weights shall be located at the lower edge of the screen to prevent its flapping during a test.

The canopy shall be positioned so that the underside of the baffle is 300 mm above the top edge of the door including any fixing. The door shall be located in its frame to be central in relation to the canopy width.

NOTE 2 A 3 000 mm wide canopy is adequate for door sizes up to 2 600 mm wide.

The extract ducting shall be provided with a device for measuring mass gas flow, of a design complying with the specifications in EN ISO 5167-1 and ISO 5221 or equivalent, to measure the velocity of gases passing through the duct. Instrumentation shall be provided to make the following measurements:

a) in the furnace – CO_2 concentration, usually up to 10 % concentration;

b) at the gas flow measuring point:

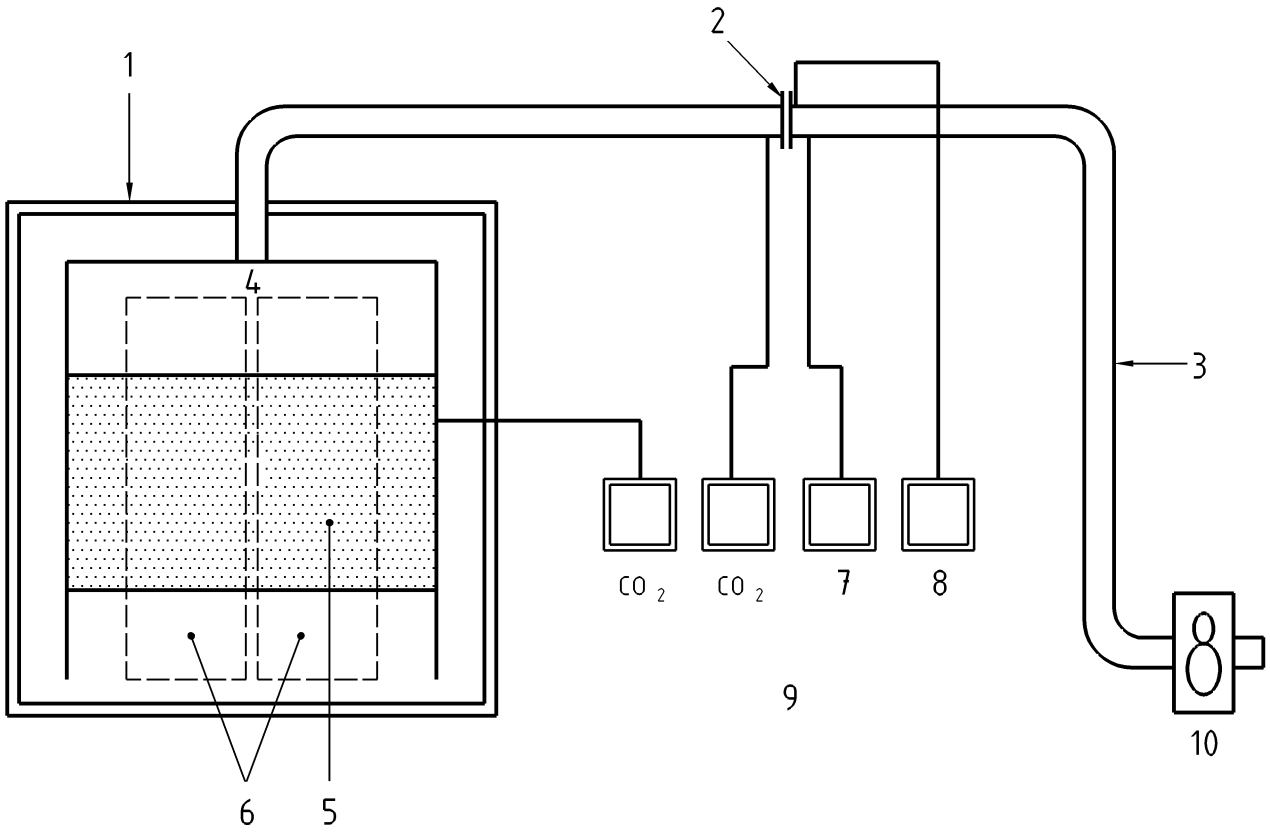
   1) CO_2 concentration, usually up to 1 % concentration;

   2) the gas temperature;

   3) the gas pressure;

   4) the pressure difference over the flow measuring device.

The total length of the duct should not be excessive and it should have a long straight portion each side of the gas flow measuring device as specified in the relevant above mentioned standard.

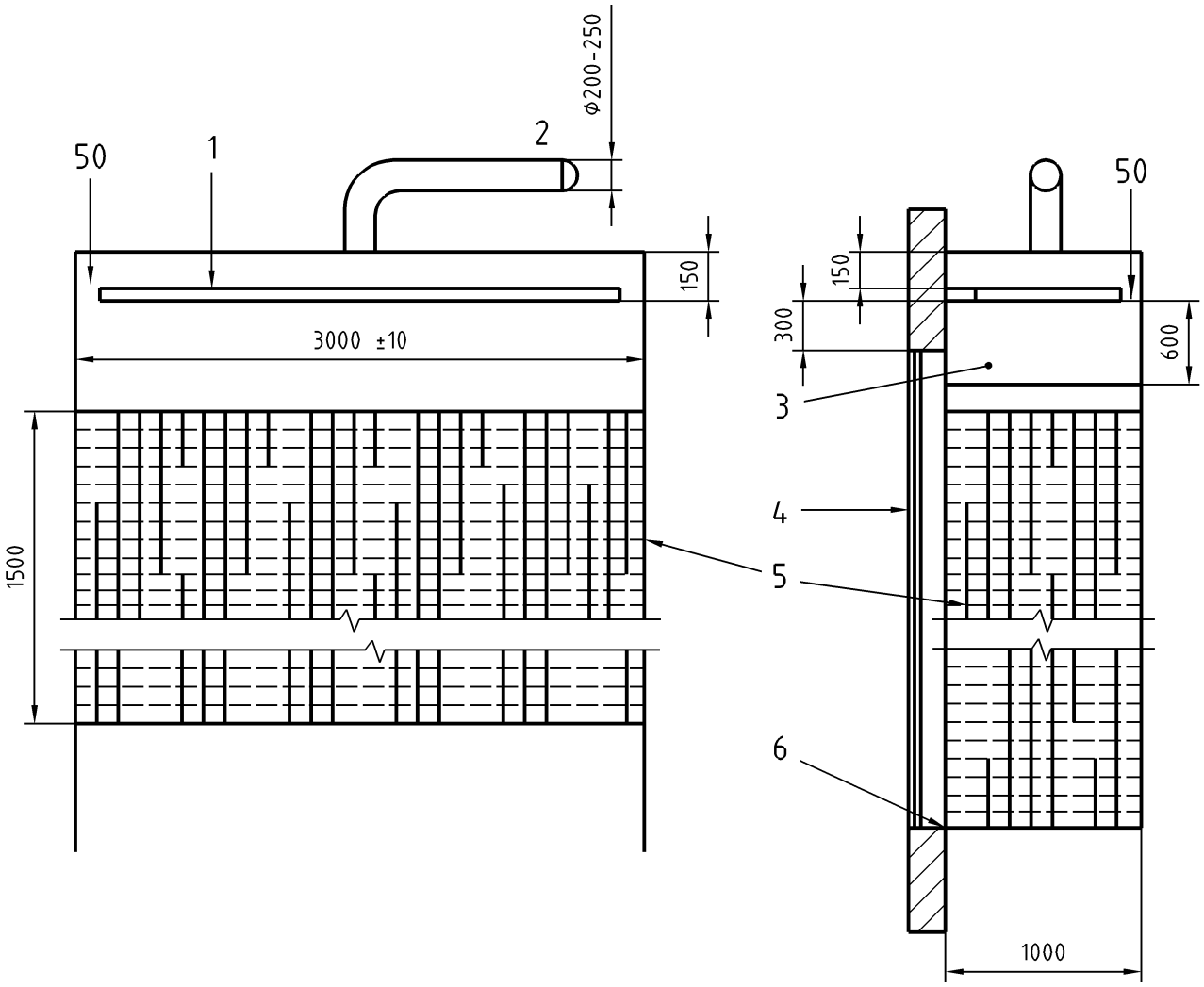


Key

1	Furnace	6	Test door
2	Orifice plate	7	Pressure
3	Exhaust pipe	8	Temperature
4	Canopy	9	Instrumentation
5	Curtain	10	Fan

Figure A.1 — General arrangement

Dimensions in millimetres



Key

1 Baffle
2 Exhaust pipe
3 Canopy
4 Door
5 Curtain
6 Sill level

Figure A.2 — Canopy details

Annex B
(normative)

Standard supporting construction

The supporting construction shall be blockwork, masonry or homogeneous concrete wall with an overall density of (1 200 ± 400) kg/m^3 and a thickness of (200 ± 50) mm.

Annex C
(normative)

Verification procedure for leakage rate measurement

Before the fire test on a lift landing door, the operation and the accuracy of the measuring system shall be verified by a 10 min preheat period followed by a 5 min measurement period.

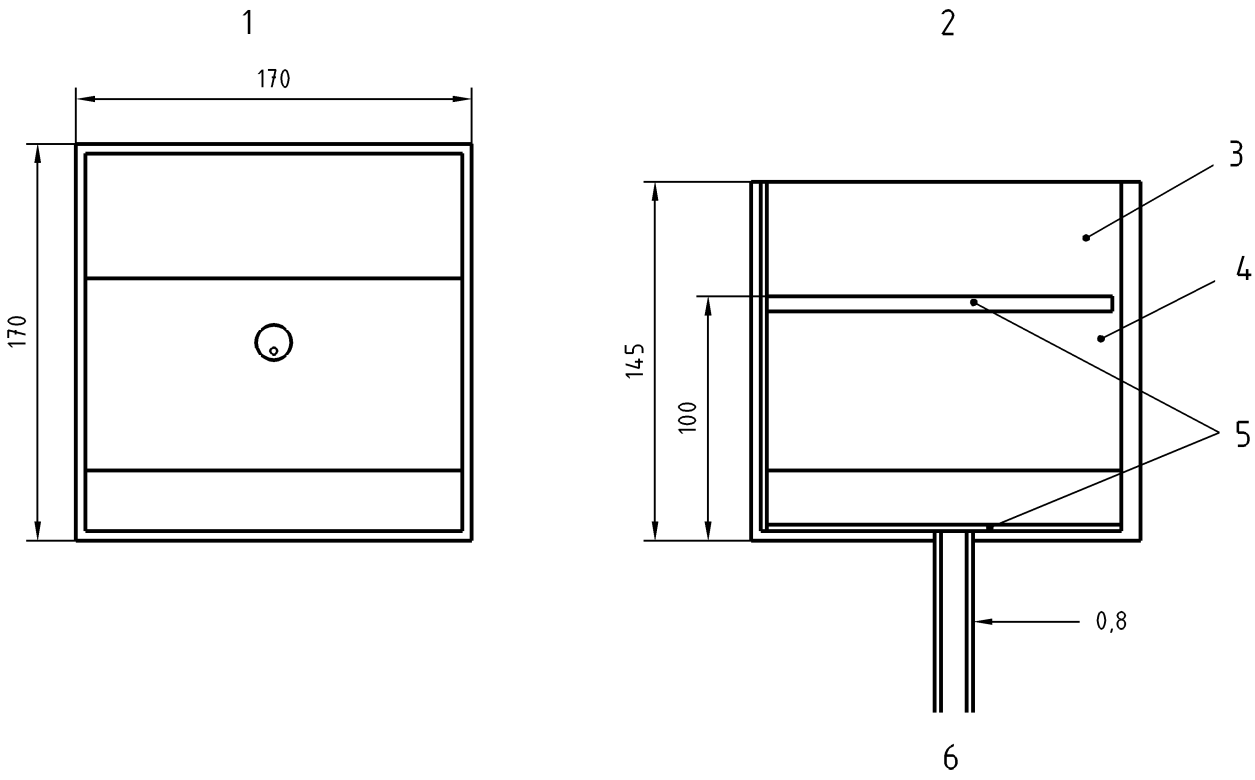
A burner an example of which is shown in Figure C.1, shall be placed below the canopy at about mid-height of the door. The burner shall conform to ISO 9705 with a heat output of up to 300 kW.

The burner shall be supplied with propane gas at the normalized rate of 1,36 l/s to produce CO_2 at the rate of 0,25 m^3/s. Using the relationship in equation (2) of annex D the flow rate and CO_2 concentration shall be established. The flow rate of CO_2 production can be controlled with a mass flow controller or by measuring weight loss.

Action shall be taken to reduce any difference between the theoretical and measured flow rate and CO_2 concentration of more than 10 %. If the difference is lower than 10 % the leakage rate of the test shall be corrected for this difference.

The test specimen shall be protected from the burner during this verification procedure.

Dimensions in millimetres



Key

1 Plan view
2 Sectional evaluation
3 Sand
4 Gravel
5 Brass wire gauze
6 Gas supply

Figure C.1 — Example of a standard calibration burner

Annex D
(normative)

Calculation of leakage rate

D.1 Calculation of leakage rate when measuring according to EN ISO 5167-1 with an orifice plate

During the course of a test the following measurements shall be made to establish the leakage rate through the specimen door:

1) CO_2 concentration in the furnace C_{furn} (%);
2) CO_2 concentration in the duct at the orifice plate C_{orif} (%);
3) Pressure at top of door in the furnace p_{furn} (Pa);
4) Pressure differential across the orifice plate Δp (Pa);
5) Under pressure at orifice plate p_{orif} (Pa);
6) Ambient pressure in the laboratory p_{amb} (Pa);
7) Temperature of gases at the orifice T_{orif} (°C);
8) Sectional area of the exhaust duct A (m^2).

The gas flow at the orifice shall be established from the orifice plate characteristics either on the basis of the information given in ISO 5221 or that supplied by the orifice plate manufacturers. This provides a constant k for the orifice plate assembly from which the flow rate q_{vo} is established as follows:

$$q_{vo} = k\,x\,A\sqrt{\frac{2\times\Delta p}{\rho_o}\ \frac{T_o + 273{,}15}{T_{orif} + 273{,}15}\times\frac{(p_{amb} - p_{orif})}{p_o}}\ \mathrm{m^3/s} \qquad (1)$$

where:

T_o, p_o and ρ_o are reference temperature, pressure conditions and density. If reference conditions of 20 °C, 1,2045 kg/m³ and 101 325 Pa are chosen equation (1)becomes:

$$q_{vo} = k.A\sqrt{\frac{2\Delta p}{1{,}2045}\ .\ \frac{293{,}15}{T_{orif} + 273{,}15}\ .\ \frac{(p_{amb} - p_{orif})}{101\,325}}\ m^3/s \qquad (2)$$

The leakage rate, q_{vleak}, for the door shall be calculated as below:

$$q_{vleak} = q_{vo}\ .\ \frac{C_{orif}}{C_{furn}}\quad m^3/s \qquad (3)$$

D.2 Pressure correction:

The estimated leakage rate shall be corrected for the pressure variation in the furnace from that specified as standard i.e 20 Pa. This gives the corrected leakage rate, q_{vcorr}, for the door.

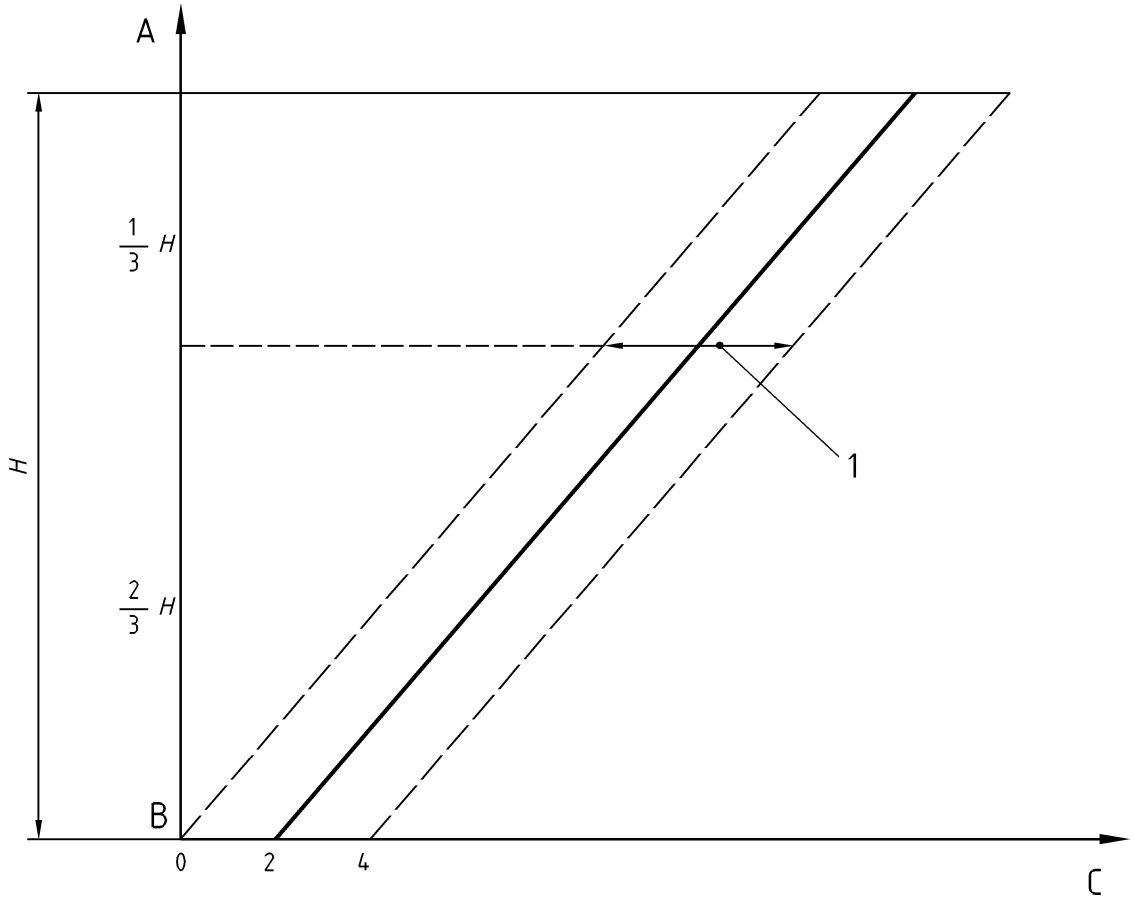
$$q_{vcorr} = q_{vleak} \cdot \frac{20}{P_{furn}} \quad m^3 / s \tag{4}$$

where:

P_{furn} is the pressure in the furnace at the height where it is expected to be 20 Pa.

The corrected leakage rate obtained by equation (4) shall be reported as the leakage rate for the door either as a continuous curve or at a specified classification time.

NOTE An explanatory diagram for pressure correction is given in Figure D.1.



Key

A Top of the lift door
B Sill
C (P_a)
H Clear height of the door
1 Range of fluctuations of the pressures in the furnace at this height

Figure D.1 — Explanatory diagram for pressure correction

The line in Figure D.1 represents the pressure in the furnace assuming a constant pressure/height gradient of 8 Pa/m and the prescribed pressure of 2 Pa at sill level. In practice this pressure (dark line) in the furnace will vary (between the dotted parallel lines). A higher pressure will create a higher leakage rate and vice versa. This explains the need for a correction for variations of the furnace pressure.

It is clear that the leakage rate should be corrected for pressure at the height at which the major openings are present, because they mainly cause this leakage of furnace gases, but in practice this is impossible. It has been shown by previous tests that the best correction of the leakage rate is obtained for the height corresponding with the gravity point of the triangle with the full line in the diagram and the Y axis (2/3 of the total height). Indeed, a correction for the leakage rate at sill level can lead to a correction of 100 % (if the pressure is twice the prescribed) while the pressure at the top would lead to a correction of only some percentages.

D.3 Interpreting the leakage rate curve

The different measurements for leakage rate in the measurement chain can have different time lags and different frequencies of recording. The measurements are: CO_2 content in the furnace and in the duct, pressures in the furnace, pressure differential over the flow measuring device, temperature in the duct.

The time lags are a function of the response time or the time between a real physical change and the time when this change is recorded. For the purpose of decreasing the noise or peaks not corresponding to real changes in the leakage rate curve, in the calculations above, the measurements need to be corrected for this time shift.

Differences in frequencies of sampling, measuring or recording, can also lead to an increase in noise or to interference which creates peaks, when calculating the leakage rate. This effect can be reduced, using an appropriate smoothing technique. Therefore it is the responsibility of the laboratory to characterize its measurement system (e.g. using a Fast Fourier Transform on the measurement and the results of calculation). To improve the accuracy of the leakage rate curve, actions can be taken by adjusting the measurement (e.g. electronic damping or changing frequencies) or by mathematical actions (e.g. damping, weighted averaging). Care has to be taken that important smoothing does not hide real changes in leakage. The report can include both curves of leakage rate: the curve with and without smoothing.

Annex ZA
(informative)

Relationship of this European Document with EC Directives

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EC Directive(s):

Lift Directive 95/16/EC.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

WARNING Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

This standard is likely to support essential safety requirement 4.2 of the lifts Directive.

Bibliography

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

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