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EGOLF POSITION PAPER 006-2019

Subject of Position Paper	State-of-the-art review of EN 1634-3 (outcome of EGOLF WORKSHOP 01/2018 at DBI)
Related test standard	EN 1634-3
Date of issue	2019-01-31
Reference original query	EGOLF TC2 N830, Helpdesk 2017-03
Previous publication number (if applicable)	EGR 051-2018 (TC2 N876)
Keywords (max. 20)	Revision EN 1634-3
EGP to be forwarded for attention of	CEN/TC 127 WG3

Problem

When testing to EN 1634-3 DBI has experienced many problems with shortcomings in the description of the standard. DBI believes that the standard in its current state is close to useless for tests at medium temperature. The results of medium temperature tests depend on interpretation of the test way. DBI explained some of the issues in Helpdesk document TC2 N830.

The outcome of the TC2 helpdesk was to hold a workshop to discuss the main unclear points of the current version of EN 1634-3. This was held at the end of January 2018 at DBI. The following labs participated:

Della Pergola, CSI spa / Jordi Reyes Tineo, Applus-LGAI / LUTZ Sander, Efectis FR / Andreas Tranlöv, RISE / Ralf Andexlinger, IBS Austria / Nerijus Augaitis, FRC Lithuania / Istvan Moder, IBS Austria / Peter Wittke, MPA Braunschweig / Jeroen Zwart, Peutz NL / Niklas Lauersen, DBI / Christian Bjerglund, DBI / Uwe Herbers, DMT GmbH & Co.KG

The outcome of the workshop was a proposal for a revision of EN 1634-3, pending publication of revised standard. Until the final revision is ready, participants of the workshop agree that the workshop proposal should be made into an EGOLF Recommendation (EGR).

Furthermore, the following existing EGOLF Recommendation and Agreements, which are publically available in the Documents folder on the EGOLF website, .are also considered in the proposal which has been forwarded for attention of CEN TC 127 WG3:

EGR 034 - Opening/closing of doors before test
EGA 033- Calculation of adjusted leakage rate
EGA 035 - Gap length of smoke control doors
EGA 037 - Number of specimens to be tested

The main items of the workshop were as follows:

- adapting and supplementing the measuring uncertainty of the relevant sensors to the state of art

- define the max. leaking rate of the test chamber and supporting construction up to 5 m³/h for S_a and up to 3 m³/h for S_{200} tests
- define the inlet of pressure sensor pipe into the test chamber to be able to count the pressure gradient of approximately 4,5 Pa per meter height at 200 °C
- more detailed description of the heating phase and test procedure at the S_{200} measuring
- more detailed description of measuring points for gap measurement according to EN 1634-1 / prEN 15269-20
- detailed description of number and position of deflection sensors at the test elements
- add some necessary items in clause 12 “Test Report”, for example:
    - the height of the pressure sensing probe with respect to the notional floor level
    - The pressure generated by the moisture content after the outlet valve is closed
    - Gap measurement, both primary and secondary gaps

The main problems were listed in the helpdesk document TC2 N830 and discussed in detail at the EGOLF workshop held at DBI in 01/2018. The relevant technical sections in the following recommendation for EN 1634-3 are marked in blue and the numbering refers to the numbering of the current EN 1634-3 standard.

EGOLF POSITION PAPER 006-2019

Proposal of

1 Scope

This Part of EN 1634 specifies a method for determining the leakage of cold and warm smoke from one side of a door assembly to the other under the specified test conditions. The test can be applied to door and shutter assemblies of different types intended for purposes of controlling the passage of smoke in case of fire. This test can also be applied to lift landing doors and conveyor system doors and shutters. The principle of the test is explained briefly in Annex A.

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

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

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

EN 16034, Pedestrian doorsets, industrial, commercial, garage doors and openable windows. Product standard, performance characteristics. Fire resisting and/or smoke control characteristics

EN ISO 13943, *Fire safety — Vocabulary (ISO 13943)*

3 Definitions, symbols and designations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1, EN 1634-1 and EN ISO 13943, together with the following, apply:

3.1.1
smoke control door
door assembly which has the function of restricting the passage of smoke, when in a closed position, to prescribed limits

3.1.2
ambient temperature
for the purpose of this standard ambient temperature is an air temperature of (20 ± 10) °C

3.1.3
medium temperature
for the purpose of this standard medium temperature is an air temperature of (200 ± 10) °C

3.1.4
smoke leakage Sa
ambient temperature smoke leakage classification as defined in 7.5.6.3.1 of EN 13501-2:2003

3.1.5
smoke leakage S_{200}
ambient plus medium temperature (200 °C) smoke leakage classification as defined in 7.5.6.3.1 of EN 13501-2

3.1.6
test specimen
door or shutter assembly on which leakage measurements are to be made. It includes all the components necessary for the use of the door when installed in a building e.g. side panels and over panels

3.1.7
associated construction
specific form of construction in which the test specimen is mounted which is identical to that into which the door or shutter assembly is designed to be installed in practice. The method of sealing the joint between the test specimen and the associated construction is specific to that construction and forms part of the construction being evaluated by the test

3.1.8
supporting construction
form of construction with adequate strength and stiffness which is used to support the test specimen and to fill up the difference between the size of the test specimen and the opening in the test frame in an impermeable manner. The seal between the test specimen and the supporting construction should withstand the test temperature and is part of the test. The test frame may be considered to be part of the supporting construction

Flexible supporting construction: Steel or wooden studs wit air tight lining at one or both sides.

Rigid supporting construction: Aerated concrete or another brick like material with a higher density.

3.1.9
test specimen leakage rate Q_{spec}
leakage through the test specimen (3.1.6) and seal between that and the test frame or any supporting/associated construction used

3.1.10
test specimen linear leakage rate Q_l
leakage rate through the test specimen (3.1.6) and seal between that and the test frame or any supporting/associated construction used, excluding any leakage at the threshold, expressed in terms of loss per linear metre of the perimeter bounded by the door frame when excluding the length of the threshold

3.1.11
aspect ratio
fixed relationship of width divided by height of a four sided constructional component

3.1.12
S_a background test

Test to determine the leakage rate through the test chamber and any supporting or associated construction at ambient temperature i.e. $Q_{app}^{(20)} + Q_{sup/assoc}^{(20)}$;

3.1.13
S_{200} background test

Test to determine the leakage rate through the test chamber and any supporting or associated construction at medium temperature i.e. $Q_{app}^{(200)} + Q_{sup/assoc}^{(200)}$;

3.1.14
Length of gap
The length of the gap between the fixed and moving components of the doorset (e.g. between the door leaf and frame as well as, where appropriate, between the moveable elements) but excluding the length of the threshold gap shall be measured and recorded.

Note:Joints between elements in e.g. rolling shutte doors shall not be as gap between movable componets

3.1.15
Outlet valve
The valve that is opened during the heating up period to let out pressure from the test chamber.
3.1.16 Pressure increasePressure created inside the test chamber by the fan system, in addition to the pressure spontaneously generated inside the test chamber when the outlet valve is closed.

3.2 Symbols and designation

The symbols and designation listed below define those used in this standard.

Symbol	Unit	Designation
Q	m^3/h	leakage rate
Q_{app}	m^3/h	apparatus leakage rate
$Q_{sup/assoc}$	m^3/h	supporting/associated construction leakage rate
Q_{spec}	m^3/h	test specimen leakage rate
Q_t	m^3/h	total leakage rate
Q_l	$m^3/h/m$	linear leakage rate

4 Test equipment

4.1 Test apparatus

The test apparatus consists of a test chamber with an open front where the test construction is mounted to provide a sealed enclosure. The opening of the test frame shall be sufficient to accommodate the test specimen with its associated or supporting construction. A fan system is used to create the pressure increase and, for testing to evaluate S_{200}, a heating system is used to generate the temperatures specified in clause 5. The fan and the heating system shall be able to replace air at ambient and medium temperature, as required, in order to compensate for leakage rates through the test assembly.

Annex B provides an outline specification for a suitable apparatus but other designs are possible to achieve the same objectives.

4.2 Instrumentation

4.2.1 Air temperature

All thermocouples for the measurement of air temperature shall be of bare metal type with a wire diameter of 0,5 mm or steel sheathed type with the overall diameter not exceeding 1,0 mm.

For ambient temperature only leakage evaluation test to satisfy S_a, the temperature measuring equipment shall be capable of measuring temperatures up to 50 °C with an accuracy of ± 4 °C.

For ambient together with medium temperature leakage evaluation test to satisfy S_{200}, the temperature measuring equipment shall be capable of measuring temperatures up to 250 °C with an accuracy of ± 5 °C.

4.2.2 Pressure

A suitable instrument shall be provided to measure the static pressure difference between the inside and outside of the test chamber and also the pressure increases inside the chamber. The pressure measuring equipment shall be capable of measuring pressures with an accuracy of 10 % of the measured value.

4.2.3 Air flow

Instrumentation shall be provided to measure the volume, Qt, and the temperature of air supplied to or extracted from the apparatus to compensate for the total leakage. The apparatus shall be able to measure leakage up to at least 1 m³/h to min 55 m3/h to an accuracy of ± 1 m3/h. (calibrated at +20°C and 101,3 kPa)

4.2.4 Deformation sensor

Device, such as digital gauges or displacement transducers, for measuring displacements of measured points with an range of min. +/- 50 mm / 0-100 mm with an accuracy as specified in EN 1363-1.

5 Test conditions

A fan system shall be provided to create a pressure increaseof at least 55 Pa.

When testing for ambient together with medium temperature leakage, S_{200}, provision shall be made to heat the circulating air to the test temperature of (200 ± 10) °C within the test duration and to control the temperature within the prescribed limits given in 10.2.2.2.

The test chamber shall be well sealed and the apparatus leakage rate together with the leakage rate through an associated/supporting construction (Q_{app} + $Q_{sup/assoc}$) shall not exceed 10 m³/h at 50 ΔPa and ambient temperature. Extra rules for maximum leakage at ambient and medium temperature; maximum deduction of 5 m³/h for ambient temperatures and maximum deduction 3 m³/h for medium temperatures. See 10.2.1.1.

6 Test specimen

6.1 Size

The test specimen and all its components shall be full size unless limited by the size of the front opening of the test apparatus. Door assemblies which cannot be tested at full size shall be tested to the maximum size possible consistent with the use of supporting or associated constructions. If an associated construction is used, a minimum zone shall be exposed within the chamber, 200 mm wide each side and over the top of the aperture, into which the door assembly is to be fixed.

6.2 Number

Leakage tests shall be carried out from both sides for full evaluation except for doors for special applications. The number of tests shall be as given in Table 1.

Table 1 — Number of tests

Application	Temperature	Number of tests
General	Ambient	One test for each side: the same door may be used by either reversing the sample or by creating under-pressure in the test chamber
General	Medium	One test for each side: The same door may be used, If the same conditions as for the first test is obtained (no significant deflection of door leaf and no reacted intumescent seals)
Special	Ambient/medium	One test from the specified side

6.3 Design and construction

Test specimen construction and finish shall be fully representative of that intended to be used in practice. Any seal used in the door or between the door assembly and the associated construction shall be identical to that intended for application in practice.

Whenever the test specimen contains materials that emit vapour at medium temperature during the measurement (for example doors with a wooden facing) then the vapour emission should be kept as low as possible, for instance by treating the exposed surface with an impermeable material e.g. paint. Any eventual surface treatment shall be applied without increasing the stiffness of the door or reducing the leakage through the test specimen.

6.4 Verification

Where practicable, the size, thickness and material specification of the door assembly shall be determined before the test to check the construction of the door against the manufacturer's specification and to allow adequate description of the tested assembly.

Verification of the test specimen shall be in accordance with EN 1634-1, clause 6.6 and building hardware in accordance with EN 1634-1, clause 6.7

All gaps through which smoke can leak shall be measured and recorded. Generally these are gaps between the edge of the door leaf/leaves and the door frame, between door leaves and at sill level. Gap measurement shall be in accordance with EN 1634-1, clause 10.1.2. Both primary gaps and secondary gaps shall be recorded. (Gaps where smoke seals are installed are extra important for smoke control testing)

When testing for ambient temperature only leakage to satisfy S_a classification, the gap between the bottom of the door and the sill level may be tightly sealed with an impermeable material.

A full description shall be given of the conditions prevailing at each edge of the door leaf/leaves and the presence and the nature of any seals.

7 Installation of test specimen

7.1 Mounting in the supporting construction

The test specimen shall be mounted as in practice, in an associated or supporting construction, in accordance with the manufacturer's instructions, with appropriate gaps and clearances between the fixed and moveable parts.

All gaps between the supporting or associated construction and test specimen frame shall be measured and stated in the report.

All gaps not related to the test specimen or between the test specimen and the supporting construction shall be tightly sealed with an impermeable material..

The minimum supporting construction exposed to the pressure should be 200 mm at each side and at the top of the test specimen

7.2 Water content of the supporting construction

Whenever the supporting construction is made of building materials that emit vapour at medium temperature during the measurement, (for example gypsum boards or clay bricks) then the vapour emission should be kept as low as possible, for instance by limiting the dimensions of the supporting constructions and/or by treating the heated surface with an impermeable material eg paint.

8 Conditioning

8.1 Moisture content

The test construction shall be conditioned in accordance with EN 1363-1. Door assemblies made entirely of non-hygroscopic materials, e.g. metal or glass, shall be left in the laboratory for at least three days before testing. Any additional conditioning requirements in the relevant product standard shall also be observed.

8.2 Mechanical conditioning

Durability and mechanical testing/conditioning requirements are given in the relevant product standard.

9 Application of instrumentation

9.1 Thermocouples

For the ambient temperature tests (S_a) a minimum of two thermocouples shall be used to monitor the temperature in the chamber. These shall be equally spaced across the chamber at mid-height of the chamber.

For the ambient and medium temperature test to evaluate S_{200}, a minimum of nine thermocouples shall be used to monitor and control the temperature inside the test chamber. The thermocouples shall be arranged in three horizontal rows. These thermocouples shall be spread equally across the chamber with three 150 mm from the bottom edge of the opening in the test frame, three in the centre and three at ¾ height position. The hot junctions shall be positioned (100 ± 50) mm from the exposed face of the test construction.

9.2 Pressure

The pressure distribution over the height of a furnace is mainly influenced by the natural buoyancy effect of the gases. For the purpose of controlling the pressure, it can be assumed that the pressure gradient will be approximately 4,5 Pa per meter height of furnace at 200°C.

The pressure measuring device head (see 4.2.2) shall be mounted in the test chamber at the mid width of the test specimen, 100 ± 50 mm from the inside face of the test specimen.

Note: It is recommended that the height of the outlet valve is located at the same height as the pressure measurement point, preferable in the first meter in the bottom of the test chamber.

9.3 Air flow

The equipment described in 4.2.3 shall be installed.

Adjust the result of the air flow measurement (V_x) at each step, to calculate the air flow (V_0) at normal conditions (T_0 = 293 K, P_0 = 101,3 kPa), considering the actual temperature T_x expressing in °C and atmospheric pressure P_x expressed in kPa, during the test.

$$V_o = V_x \cdot \frac{293}{273 + T_x} \cdot \frac{P_x}{101{,}3}$$

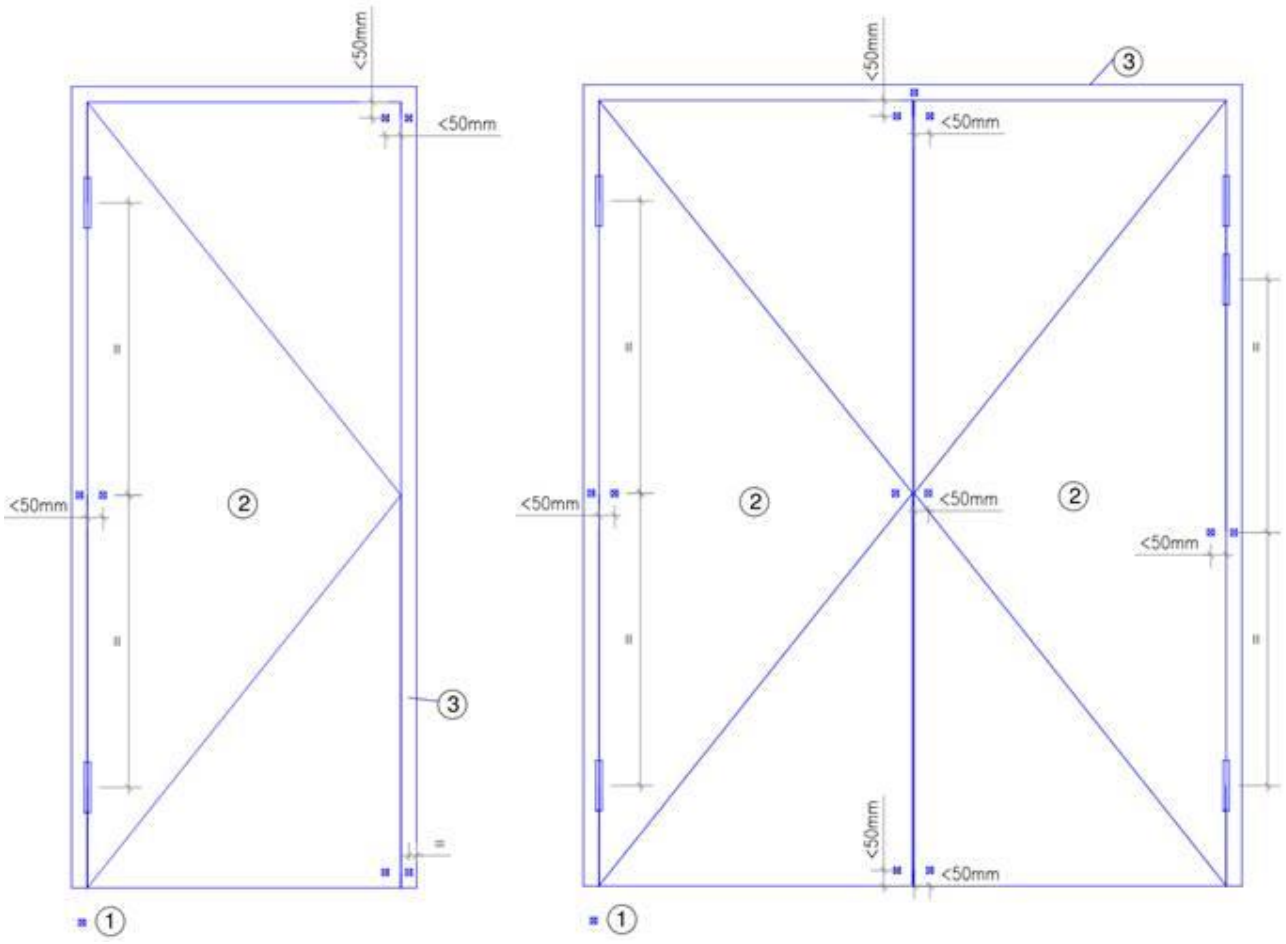
9.4 Deflection Sensor Position

The equipment described in 4.2.4 shall be installed

The following positions are suggested as areas where significant movement is likely to occur:

- door leaf corner or specimen relative to frame at the look side (position < 50 mm from door leaf of specimen corner);
- door leaf or specimen relative to frame at the hinge side center between the hinges. If there more than two hinges mounted at the leaves or specimen the measurement has to be made between the two hinges with the biggest distance between(position < 50 mm from door leaf of specimen edge);
- double leaf doorsets or specimen between active and inactive leaves at the corners and the center as also to the top frame (position < 50 mm from door leaf of specimen corner res. edge);

The principle of the measurement is to measure against a fixed point . Each pressure step one measurement shall be made and recorded. Figure 1 show an example for the required positions.



Key

1 Deflection sensor
2 Door leaves
3 Frame

Figure 1 — Example for the required positions of deflection sensors

10 Test procedure

10.1 Pre-test procedures

10.1.1 General

After installation of the assembly in the associated or the supporting construction, but before it is mounted in front of the test chamber, each door leaf, or moving element of a hinged door assembly, shall be opened to an angle of 30° and closed 10 times, using the automatic closing devices, if provided, to ensure the assembly operates normally. With other types of doors, such as folding, sliding or rolling shutters, the opening and closing operation shall be carried out as far as practicable to check the operation of the assembly. This procedure is not a durability test, for which special procedures are available.

10.1.2 Retention force measurements

The retention forces for all door assemblies which incorporate closing devices and which are meant to be opened without mechanical power shall be measured. These measurements are needed to establish the magnitude of the forces used to retain the door leaves closed to ensure that they are representative of those used in normal practice.

For each door leaf, the retention force shall be determined as given below. For double action doors the retention force shall be determined for each direction of opening, and for folding doors the retention force shall be determined in the direction of opening.

The retention forces for all door assemblies which incorporate closing devices operated by egressing personnel without mechanical assistance shall be measured as follows:

Open the test door slowly, using a force gauge attached to the handle and operating against the direction of closing, to a distance of the leading edge of the door leaf of 100 mm away from its closed position. Record the highest gauge reading between the closed and 100 mm positions.

10.1.3 Mounting

For ambient temperature only testing to evaluate S_a, the threshold gap may be tightly sealed using an impermeable material or may be sealed by an active drop seal or similar operational seal. Details shall be recorded in accordance with 6.4 above.

The door shall be in its final closed position, unlocked and the key, if any, removed.

10.2 Air leakage test

10.2.1 Sequence of testing

Tests shall be carried out in the following sequence:

a) determine the S_a background values ($Q_{app}^{(20)} + Q_{sup/assoc}^{(20)}$);

b) determine the total leakage rate at ambient temperature i.e. $Q_t^{(20)}$;

c) determine the total leakage rate at medium temperature i.e. $Q_t^{(200)}$;

d) determine the S_{200} background values ($Q_{app}^{(200)} + Q_{sup/assoc}^{(200)}$).

When testing for ambient only leakage to satisfy S_a classification, only (a) and (b) are necessary.

NOTE The order of a) and b) is not important and may be reversed. Point d) could be done prior to a), b) or c), If d) is done before c) the test specimen can not be include in the background test.

10.2.1.1 Determination of S_a and S_{200} background values

The choice of one of the options below shall be made in agreement with the laboratory and the client.

Option 1:

$Q_{sup/assoc}$ and Q_{app} are considered zero. No background test is needed.

$$Q_{spec}^{(20)} = Q_t^{(20)}$$

$$Q_{spec}^{(200)} = Q_t^{(200)}$$

Option 2:

$Q_{sup/assoc}$ is considered zero.

Q_{app} is determined by testing a leakage free wall(test frame) covering the entire opening face of the apparatus. This shall be done at least once a year.

Efforts to obtain the leakage free wall shall be made.

$$Q_{spec}^{(20)} = Q_t^{(20)} - (Q_{app}^{(20)} + Q_{sup/assoc}^{(20)}) = Q_t^{(20)} - Q_{app}^{(20)}$$

$$Q_{spec}^{(200)} = Q_t^{(200)} - (Q_{app}^{(200)} + Q_{sup/assoc}^{(200)}) = Q_t^{(200)} - Q_{app}^{(200)}$$

Note: Maximum deduction from $Q_{app}^{(20)}$ may never exceed $5m^3/h$ and maximum deduction from $Q_{app}^{(200)}$ may never exceed $3m^3/h$

Option 3:

$Q_{sup/assoc}$ and Q_{app} are measured by sealing the opening for the test specimen. If this is done prior to the leakage test of the test specimen, the background test can not include the test specimen. If this is done after the leakage test of the test specimen, it is allowed include the test specimen if it is sealed of.

The sealing can be done in various ways (tape, silicone, etc.). The purposed of the sealing is to avoid leakage from the sealed areas. Efforts to obtain this shall be made.

$$Q_{spec}^{(20)} = Q_t^{(20)} - (Q_{app}^{(20)} + Q_{sup/assoc}^{(20)})$$

$$Q_{spec}^{(200)} = Q_t^{(200)} - (Q_{app}^{(200)} + Q_{sup/assoc}^{(200)})$$

Note: Maximum deduction from $Q_{app}^{(20)} + Q_{sup/assoc}^{(20)}$ may never exceed 5m^3/h and maximum deduction from $Q_{app}^{(200)} + Q_{sup/assoc}^{(200)}$ may never exceed 3m^3/h

10.2.2 Procedure

10.2.2.1 Procedure for ambient temperature only testing to satisfy S_a classification

The leakage rate through the test specimen shall be measured at pressure increases of 10 ΔPa and 25ΔPa, or for special purposes at the pressure increase specified by the sponsor. During measurement of the leakage rate the pressure increase shall be maintained and the value of Q_t shall be established as an average value of 30 to 120 sec with a minimum of one measurement per second, using:

$Q_{spec} = Q_t^{(20)}$ – "value from option 1,2 or 3 from 10.2.1.1"

The length of the gap between the fixed and moving components of the doorset (e.g. between the door leaf and frame as well as, where appropriate, between the moveable elements) but excluding the length of the threshold gap shall be measured and recorded.

10.2.2.2 Procedure for ambient together with medium temperature testing to satisfy S_{200} classification

For ambient temperature tests follow the procedure from 10.2.2.1, but also include measurements of the leakage rate through the test specimen measured at pressure increase of 50 Pa.

For medium temperature tests the average air temperature close to the face of the door shall be raised from ambient temperature to the required temperature of (200 ± 10) °C in (30 ± 5) min in such a manner that the average air temperature is maintained within the limits shown in Figure 2. The temperature distribution over the face of the door shall be controlled to (200 ± 40) °C as measured by each thermocouple. During the heating up period, the pressure in the bottom of the test chamber shall be maintained below 20 Pa for the first 5 minutes and 10 Pa for the rest of the duration. A stabilizing phase of minimum 2 minutes is required after the heating up period to secure stabile conditions. Then the outlet valve is closed.

When the outlet valve is closed and the stabile conditions are achieved again, the initial pressure inside the test chamber shall be noted and recorded (measured over a period of minimum 30 sec.). Then the pressure inside the test chamber shall be increased with respect to this initial value. If the initial value is less than zero a initial value of zero shall be used.

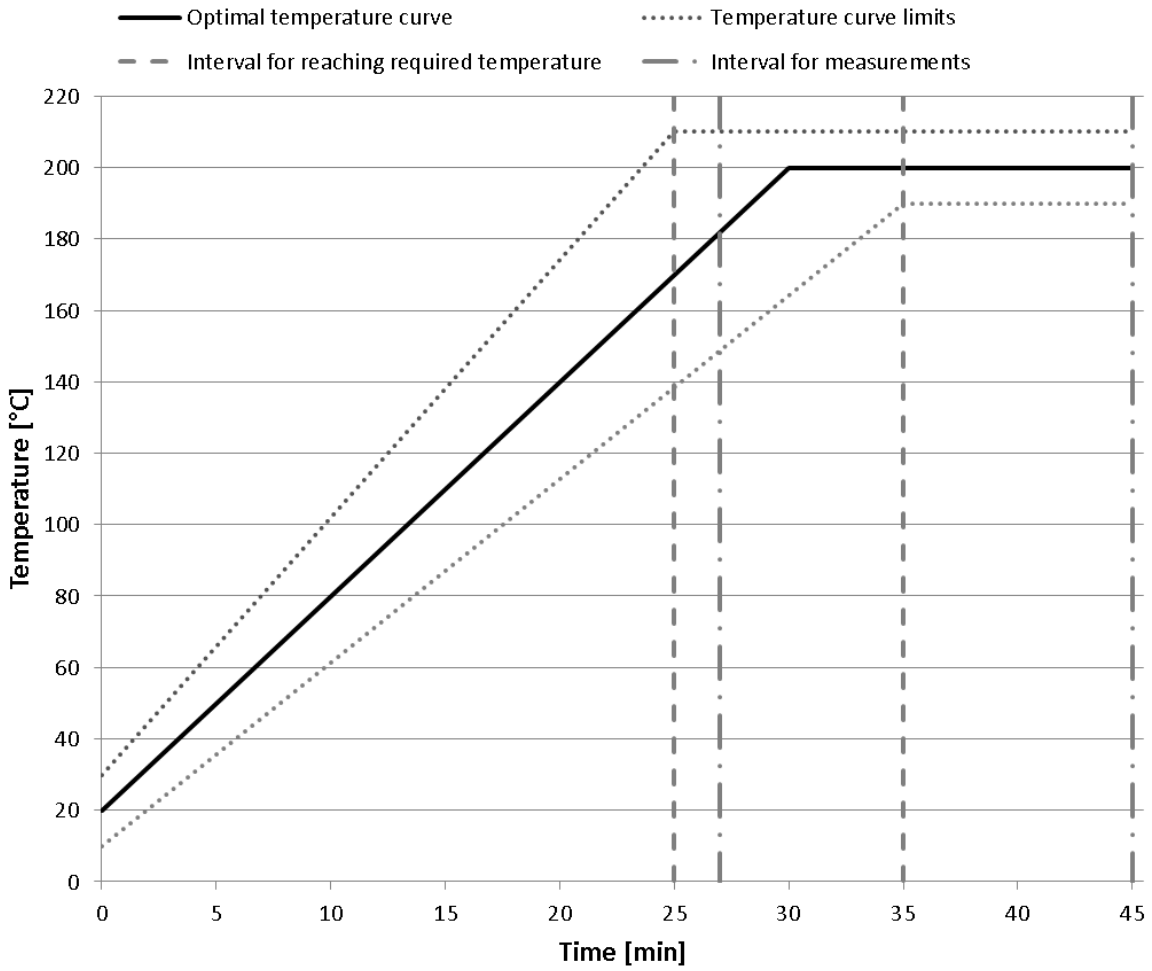


Figure 2 — Air leakage test: rate of temperature rise and permitted limits

10.2.2.2.1 The leakage rate through the test specimen shall be measured at pressure increases of 10 ΔPa, 25ΔPa and 50ΔPa or for special purposes at the pressure increases specified by the sponsor. These measurements shall be taken within 45 min from the start of the heating phase. The measurement of each leakage step should be taken as an average values (Q_t) of 30 to 120 sec with a minimum of one measurement per second. Before the start of each measurement period, stabile conditions should be established. The temperature may not variate more than +1 to – 3°C during each measurement period. During each of the measurements periods no changes to the heating power are allowed. Sequence of measuring at medium temperatures (see figure 2 and figure 3)

- Heating phase 30 min+-5 min with outlet valve open
- Stabilisation phase (minimum 2 min) after reaching 200 ± 10. Outlet valve shall be open.
- Outlet valve is closed, no changes of the heating power; stabile conditions are maintained; the pressure (initial value) is measured and zeroed or noted.

- 10 ΔPa measuring phase; Increase the pressure with 10 ΔPa.; No changes of the heating power; Stabile conditions at 10 ΔPa (+1 to – 3°C temperature tolerance); Leakage rate measured over 30 to 120 sec;
- The 10 ΔPa measuring phase is repeated for 25 ΔPa and 50 ΔPa pressure;
- All measurements must be preformed between the 27th to the 45th minute.

Q_t is established at the end of these periods using:

$Q_{spec} = Q_t^{(200)}$ – "value from option 1,2 or 3 from 10.2.1.1"

Phase	Conditions inside the test chamber		Duration	Outlet valve position	Possibility to operate on	
	Temperature	Pressure			Heating system	Fan system
Heating phase	Increase from ambient temperature to 200 ± 10 °C	Neutral (within admitted tolerances)	30 ± 5 minutes	Open	Yes	No (fan off)
Stabilisation phase	Constant 200 ± 10 °C	Neutral (within admitted tolerances)	Minimum 2 minutes	Open	Yes (reduction of the power to stabilise the temperature)	No (fan off)
Measurement of initial pressure value	Constant 200 ± 10 °C	Pressure spontaneously generated	From 30 to 120 seconds	Closed	No (constant power)	No (fan off)
Setting 10 ΔPa overpressure	Constant 200 ± 10 °C	Overpressure created by the fan system	Minimum 2 minutes (including measuring phase)	Closed	Yes (until stable conditions are achieved)	Yes (until stable conditions are achieved)
10 ΔPa measuring phase	Constant +1°C / -3°C	Constant	From 30 to 120 seconds	Closed	No (constant power)	No (constant frequency)
Setting 25 ΔPa overpressure	Same as above					
25 ΔPa measuring phase						
Setting 50 ΔPa overpressure	Same as above					
50 ΔPa measuring phase						

Figure 3 - Sequence of measuring at medium temperatures

10.3 Observations

During the ambient and medium temperature tests any observed deformation of the door and the magnitude and position of such deformation perpendicular to the plane of the door shall be measured and recorded. The pressure and temperature at which any significant breakdown of the seals occurs shall be noted and other observations of the behaviour of the specimen shall be recorded.

After the test it shall be noted whether the specimen has been damaged as a result of the test and it shall be determined whether the door is still able to be opened manually.

11 Expression of results

11.1 Ambient temperature only test to satisfy S_a classification

The specimen leakage rate shall be calculated for each specimen and under each condition examined as described in 10.2.1.1

The linear leakage rate shall be calculated for each specimen and under each condition examined as follows:

$$Q_l = Q_{spec}^{(20)} / \text{“length of gap”}$$

NOTE Details relating to the length of gap can be found in 10.2.2.1.

Results of the above shall be presented in a tabular form as shown in Table 2, filling in the data for the number of tests undertaken and identifying the following product details:

— door type,

— number of door leaves, for multi-leaf door constructions,

— identification of door sides A and B,

— size of door opening.

Table 2 — Test results

No of test	Face exposed to pressure	Temperature	Total leakage rate $Q_{spec}^{(20)}$ (m^3/h) at		Linear leakage rate Q_l ($m^3/h/m$) at	
			10 ΔPa	25 ΔPa	10 ΔPa	25 ΔPa
1	Side A	Ambient				
2	Side B	Ambient				

11.2 Ambient together with medium temperature tests to satisfy S_{200}

The specimen leakage rate shall be calculated for each specimen and under each condition examined as described in 10.2.1.1.

The test results shall be presented in a tabular form as shown in Table 3, filling in the data for the number of tests undertaken and identifying the following product details:

— door type,

— number of door leaves, for multi-leaf door constructions,

— identification of door sides A and B,

— size of the door opening.

If the sponsor of the test wishes to have the ambient temperature results evaluated for possible compliance with the requirements of S_a classification, this may be achieved by calculating the linear leakage rate for each specimen and under each condition examined as follows:

$Q_l = Q_{spec}^{(20)}$/"length of gap"

The length of gap is still as detailed in 10.2.2.1 even though the threshold gap is sealed in this case by an active drop seal or similar operational seal.

The result of the Q_l calculations may be added to the ambient temperature part of Table 3.

Table 3 — Test results

No of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure increases of			Linear leakage rate Q_l ($m^3/h/m$) at pressure increases of	
			10 ΔPa	25 ΔPa	50 ΔPa	10ΔPa	25ΔPa
1	Side A	Ambient					
2	Side B	Ambient					
3	Side A	Medium					
4	Side B	Medium					

Note: Test 1 and 2 shall always be performed when testing for S_{200}. Test 1 and 2 can not be interchanged with Sa testing. The test specimen has to pass 50 ΔPa for S_{200} testing at ambient temperatures.

12 Test report

In addition to the items required by EN 1363-1, the following shall also be included in the test report:

a) reference that the test was carried out in accordance with EN 1634-3;

b) measured retention forces of closing devices, if any;

c) description of the associated/supporting construction used, the method of fixing and the joint between the test specimen and the associated/supporting construction;

d) leakage rate for each test specimen and for each condition examined, and for each face, as described in clause 11;

e) length of gap as described in 10.2.2.1;

f) failure of any component observed in the test and any other observations made;

g) ability to open the specimen after the medium temperature test (when included);

h) details of any deformation observed, as described in 10.3.

i) The height of the pressure sensing probe with respect to the sill level

j) The pressure generated by the moisture content after the outlet valve is closed.

k) Gap measurement, both primary and secondary gaps.

If a summary report is prepared it shall refer to the full report and include at least the information given in d) together with those required by EN 1363-1.

Annex A
(informative)

Test principle

The test procedure represents in a simplified way the exposure of a door to the effects of a fire when the smoke travels along various routes and comes across a door in its movement. As part of the fire safety system the door may be required to restrict the passage of smoke in order to ensure that conditions on the other side of the door do not become unacceptable. If the door is at some distance from the seat of the fire initially the smoke reaching the door would have lost much of its heat in its travel. Consequently it will be less buoyant and at low temperatures but nevertheless capable of adversely affecting the safety level due to its effect on visibility and causing smoke damage. Even where doors are not too distant from a fire the exposure conditions alter progressively.

There are two exposure situations, in relation to either the distance from the fire or the stage of development of a fire, a condition where there is no noticeable rise in temperature and a condition when the temperature has risen to a level at which ignition of combustible materials does not occur but heat damage may be caused by deformation or by failure of seals. These conditions have been termed as:

a) ambient temperature exposure conditions with air temperatures around 20 °C;

b) medium temperature exposure conditions with air temperatures around 200 °C.

In both cases it is assumed that there is no stratification of smoke.

Pressure is, however, developed on the exposed side and the pressure between the two faces forces the smoke through all available gaps and openings. Pressure increasess of up to 50 ΔPa may be developed during this early stage which are sufficient to cause an unlatched door to be forced open.

The test procedure measures the leakage of air from one side of the door to the other. The smoke leakage rates are likely to be almost the same because smoke is particulate material transported by air.

Annex B
(informative)

Test apparatus

B.1 General

The test apparatus consists essentially of a well sealed box, termed the test chamber, which has an open side, provision for the supply of air to the inside of the chamber and a provision for heating the air to temperatures of 200 °C where medium temperature leakage is to be evaluated. A schematic arrangement of the test apparatus is shown in Figure B.1.

B.2 Test chamber

The test chamber may consist of a sheet steel construction with a layer of insulation on the inside to prevent loss of heat from the circulating air. The permissible leakage rate for the chamber is not more than 10 m^3/h. The front opening of the chamber should be designed so as to accommodate the largest size assembly on which information is required. In general a 3 m x 3 m opening will allow tests to be undertaken on the majority of constructions as this is also the recommended size for fire resistance furnaces for vertical elements. If a laboratory is only likely to be interested in testing single leaf doors of sizes found in normal buildings, a smaller opening may be feasible. As the test door has to be mounted in an associated or supporting construction, the actual size of the door that can be tested is smaller than the size of the opening. The test frame containing the test door assembly and the associated/supporting construction is fixed and sealed against the test chamber opening. The chamber should have provision for the following:

a) A fan system capable of producing a pressure increase across the specimen of up to 55 Pa and of circulating air in the chamber such that the pressure increase over the height of the door is small.

b) A piping system for the supply of air.

c) Equipment for measuring the volume of air flow supplied to the chamber to compensate for the air leakage.

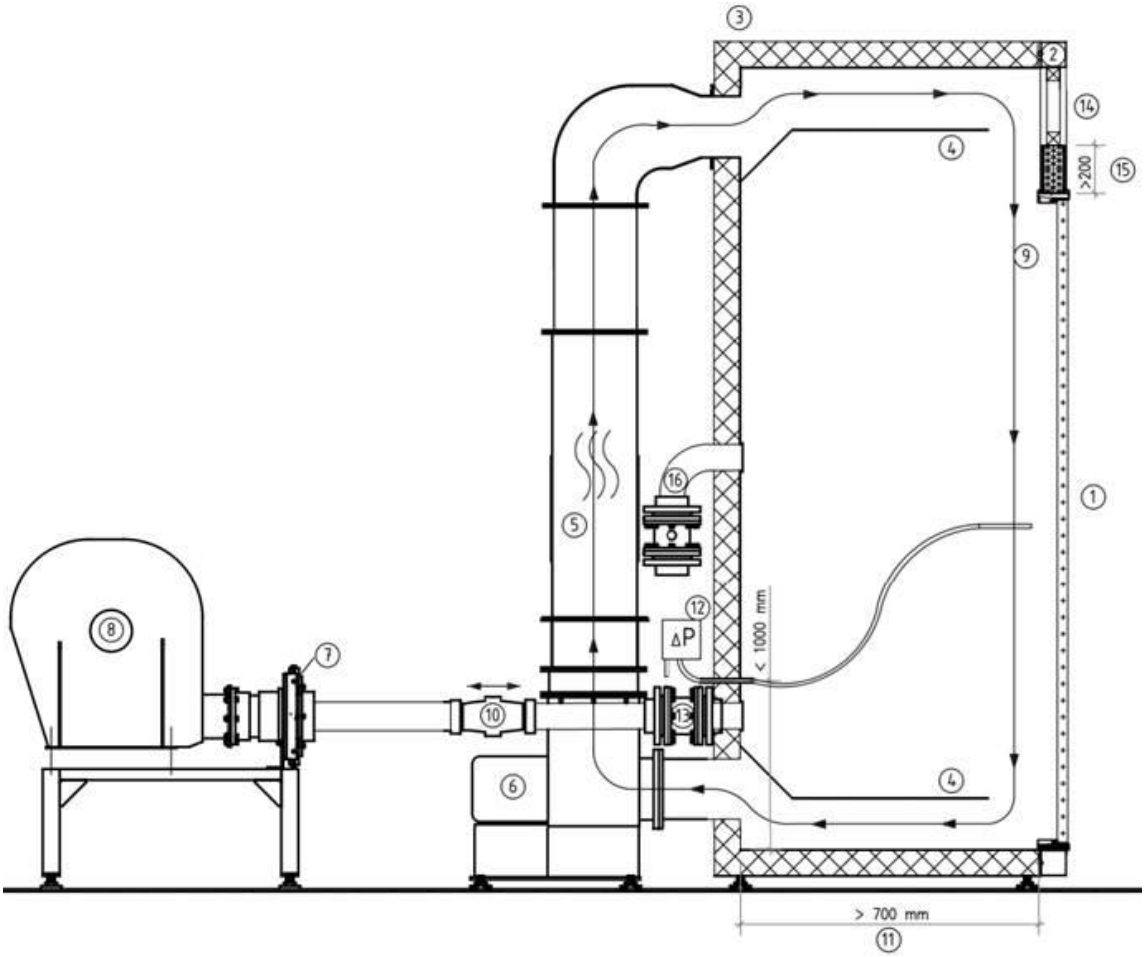
d) An air flow meter arranged in the piping system to control the amount of air flow.

e) Provision for fastening and sealing the test frame to the chamber.

f) A heat exchanger capable of heating the air supplied to the chamber for medium temperature testing.

g) Adequate insulation for the walls and the piping to minimize heat loss from the apparatus for medium temperature testing.

h) Equipment for measuring air temperature and pressure inside the chamber and air temperature close to the flow meter.



Key

1 Test specimen
2 Test frame
3 Sheet metal test chamber with insulation inside
4 Sheet metal for air conducting
5 Heat exchanger (10 kW/m³ chamber volume)
6 Air fan for circulation
7 Change-valve for over- and under-pressure
8 Fan for over- and under-pressure
9 Airflow direction
10 Air flow meter (2 directions)
11 Depth at least 700 mm
12 Pressure sensor (inlet less than 1 m from bottom of chamber)
13 Valve of air flow meter (open during the measuring period)
14 Sup frame made of non-hygroscopic materials
15 Supporting construction min.>200 mm and < 500 mm laterally and top
16 Outlet valve (open during the heat up and stabilized period) min.Ø150 mm for 3m x 3m chamber

Figure B.1 — Schematic sketch of the test apparatus

EGOLF POSITION PAPER 006-2019