BS EN 15254-6:2014

BSI Standards Publication

Extended application of results from fire resistance tests — Non-loadbearing walls

Part 6: Curtain walling

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National foreword

This British Standard is the UK implementation of EN 15254-6:2014.

The UK participation in its preparation was entrusted to Technical Committee FSH/22/-/7, Non loadbearing separating elements.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Extended application of results from fire resistance tests - Non-loadbearing walls - Part 6: Curtain walling

Application étendue des résultats d'essais de résistance au feu - Murs non porteurs - Partie 6: Murs rideaux

Erweiterter Anwendungsbereich der Ergebnisse von Feuerwiderstandsprüfungen - Nichttragende Wände - Teil 6: Vorhangfassaden

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Foreword

This document (EN 15254-6:2014) has been prepared by Technical Committee CEN/TC 127 “Fire Safety in buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2014, and conflicting national standards shall be withdrawn at the latest by July 2014.

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1 Scope

This European Standard provides guidance and, where appropriate, defines procedures for variations of certain parameters and factors associated with the design of curtain walling according to EN 13830 which have been tested in accordance with EN 1364-3 and classified according to EN 13501-2 (curtain walling type B according to 3.2), components of curtain walling type A or type B according to 3.1 and 3.2, e.g. spandrel panels, which have been tested in accordance with EN 1364-4, and classified according to EN 13501-2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*

EN 1364-3:2014, *Fire resistance tests for non-loadbearing elements — Part 3: Curtain walling — Full configuration (complete assembly)*

EN 1364-4:2014, *Fire resistance tests for non-loadbearing elements — Part 4: Curtain walling — Part configuration*

EN 13119, *Curtain walling - Terminology*

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

EN 13830, *Curtain walling - Product standard*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1, EN 1363-2, EN 1364-3, EN 1364-4, EN 13119, EN 13830, EN ISO 13943 and the following apply.

3.1
curtain walling Type A
for definition see EN 1364-3

3.2
curtain walling Type B
for definition see EN 1364-3

3.3
vertically faceted curtain walling
curtain walling with a vertical and a sloped part without fixing/bracket at the joint (see Figure 1)

4 Principles

4.1 General principles

Extended application is a prediction of the expected fire resistance performance of a fire resistant curtain walling or its components. It may be based either on interpolation between or extrapolation from test data according to EN 1364-3 and/or EN 1364-4.

Curtain walling function as integral systems in which the individual components (e.g. frames and fixing of the framing system (anchoring), infill panels, perimeter seals and vertical linear gap seals) are combined in such a way that they are effective in meeting the defined fire resistance criteria. In this document in addition to rules for the complete construction rules are defined for the components of curtain walling which are separately characterised as the framing system, the fixing of the framing system (anchoring), the infill panels and its fixing methods, the perimeter seal and the vertical linear gap seals as well as the supporting construction (floor and walls).

4.2 Use of test evidence

The applicant for the extended application shall either be the “owner” (i.e. sponsor) of all test data being submitted for the extension, or have written permission from the owner to use the submitted test evidence.

4.3 Analysis of test results

In order to maximise the extended field of application, it is important that the test reports shall record details of any premature integrity and / or insulation failure.

Where a series of tests have been conducted, the field of extended application shall be based on the lowest performance achieved from the complete series of tests unless premature failure has been attributed to one or more specific construction parameter variations.

Where it has been possible, to identify specific parameter failures, the extended application for all other construction parameter variations can be based on the performance achieved after isolating the premature failure(s).

5 General rules

5.1 Fire resistance classification

In the extended application, an increase in the classification time (e.g. from 30 min to 45 min) and changes to the fire resistance classification (e.g. from E to EW to EI) are not permitted.

5.2 Combination of extended application

Each extended application shall be the subject of a separate evaluation. Within this application it is allowed to produce a combination of extensions provided these combinations can be substantiated by the supporting test evidence.

5.3 Overrun time

For some rules to be applicable an overrun time in the fire test result compared to the envisaged classification time is required. The required overrun time is shown in Table 1. The overrun time is required for the following criteria:

— E classification: integrity

— EW classification: integrity and radiation

— EI classification: integrity and insulation

Table 1 – Overrun time

Classification Time	Overrun time
≤ 20 min	minimum 3 min
30, 45 and 60 min	minimum 6 min
≥ 90 min	minimum 10 % of the classification time

6 Specific rules for curtain walling type B

6.1 General

Minimum one test according to EN 1364-3 is required. The assessment of the extended field of application may be based on additional test results from EN 1364-4 or EN 1364-3. The rules given in 6.2 to 6.4 apply to stick constructions only except where stated otherwise.

Rules which result in higher weight of the curtain walling are only applicable if the fixing of the framing system used in practice has been designed for the higher load. The measured temperature at the fixing of the framing system shall be taken into account.

6.2 Rules for the complete construction

6.2.1 Width for curtain walling with classification EW

Test results are also valid for curtain walling with classification EW extending over one or more fire separating walls with a higher distance between the fire separating walls than the width of the tested construction if in addition to the criteria given in EN 1364-3 the radiation criterion is fulfilled for the resulting larger area. The radiation criterion shall be assessed using the rules given in A.1. The result of a calculation for a width equalling three times the tested width or minimum 9 m, whatever is larger, is applicable to any larger width.

An increase in width is only permitted by replicating the tested construction (especially type and dimensions of infill panels) in the same arrangement as tested.

6.2.2 Span length for curtain walling with classification EW

Test results are also valid for curtain walling with classification EW for a higher span length than used in the test if in addition to the criteria given in EN 1364-3 the radiation criterion is fulfilled for the resulting larger area. The radiation criterion shall be assessed using the rules given in A.1. This rule applies also to unitised constructions.

6.2.3 Installation angle (vertical/sloped)

Test results cover all installation angles between the maximum and minimum angle used in tests. This rule applies also to unitised constructions.

6.2.4 Vertically faceted curtain walling

Test results cover all angles between vertically adjacent infill panels between the maximum and minimum angle used in tests. This rule applies also to unitised constructions.

6.2.5 Horizontally faceted curtain walling

For corners and facet angles not covered by the rules given in EN 1364-3 the following rules apply:

EI classification: Results from tests of faceted specimens according to EN 1364-3 using the test configurations A and B or alternatively E as illustrated in EN 1364-3:2014, Figure 8 and from minimum one test of a straight specimen cover all angles between horizontally adjacent infill panels at the common mullion from 45° to 315° (see Figure 2) with classification EI (o ↔ i).

E, EW classification: Results from tests of faceted specimens according to EN 1364-3 using the test configurations A, B, C and D or alternatively E and F as illustrated in EN 1364-3:2014, Figure 8 and from minimum one test of a straight specimen cover all angles between horizontally adjacent infill panels at the common mullion from 45° to 315° (see Figure 2) with classification E (o ↔ i) or EW (o ↔ i) respectively.

6.2.6 Inclusion of doors and/or windows

Doors and/or windows may be included into a curtain walling and the rules of the EN 15269 series may be used provided an additional test as required by the standards of the EN 15269 series was conducted using the intended curtain walling as the associated supporting construction with the dimensions d ≥ 200 mm (see Figure 3).

NOTE Dimensions d ≥ 500 mm are recommended.

The field of application of the classified curtain walling may be used when doors and/or windows are included in the curtain walling provided the test(s) including door(s) and/or window(s) has been conducted

— with internal fire exposure and surface S1 exposed to the fire as defined in EN 1364-3 and EN 1364-4, and

— the smallest mullion size has been used in case of timber framing, or

— the largest mullion size has been used in case of metal framing

These rules apply also to unitised constructions.

6.3 Framing system

6.3.1 Dimension of mullions and transoms

All dimensions of mullions and transoms are covered between maximum and minimum tested.

6.3.2 Connection between mullions and transoms

6.3.2.1 Connection geometry

For angles between mullions and transoms between a minimum of 80 degrees and a maximum of 100 degrees, see EN 1364-3.

For angles between mullions and transoms outside the range of 80 degrees to 100 degrees then for test result on angles less than 80 degrees will cover the range from 90 degrees to the angle tested and for results on angles tested greater than 100 degrees will cover the range 90 degrees to the angle tested, see Figure 4.

6.3.2.2 Other infill panel fixing systems than pressure plate

Results from tests with a smaller edge cover / overlap of the fixing system on the infill panel are also valid for a higher edge cover / overlap but not vice versa. This rule applies for both the outer and inner edge cover. This rule does not apply for classification E and EW in case of translucent or transparent infill panels.

6.4 Fire resistant translucent or transparent infill panels

6.4.1 Type of fire resistant translucent or transparent infill panel

6.4.1.1 Classification EI

Test results of fire resistant translucent or transparent infill panels of type A according to 13.4.3.1.1 and Figure 23 of EN 1364-3:2014 with exposure direction i → o, in combination with test results on fire resistant translucent or transparent infill panels of type C according to 13.4.3.1.1 and Figure 23 of EN 1364-3:2014 with exposure direction o → i cover both exposure directions (i → o and o → i) for fire resistant translucent or transparent infill panels of type A, B and C according to 13.4.3.1.1 and Figure 23 of EN 1364-3:2014.

6.4.1.2 Provisions

The rule given in 6.4. 1.1 is valid only provided

— the glass component that gives the fire resistance is of the same type (monolithic, laminated or gel type) as tested and is made by the same manufacturer, and

— the fire resistant translucent or transparent infill panel is CE marked based on a classification according to EN 13501-2 in minimum one glazed construction.

6.4.2 Dimensions of individual circular, triangular and non-rectangular four sided fire resistant translucent or transparent infill panels

The area may be extended either

i) based on a test according to EN 1364-3 on circular, triangular or non-rectangular four sided shaped fire resistant translucent or transparent infill panels or

ii) based on a test according to EN 1364-3 on a rectangular fire resistant translucent or transparent infill.

In case the basis is a test on circular, triangular or non-rectangular four-sided shaped fire resistant translucent or transparent infill panels the area may be extended in accordance with Formula (1), provided

— the extended fire resistant translucent or transparent infill panel is of the same orientation and type of shape (e.g. circular) as the tested fire resistant translucent or transparent infill panel, and

— all of the relevant frame junctions have been tested in accordance with EN 1364-3.

$$A_{ext} \leq A_{max} = A_o \times F \quad (1)$$

where

A_o is the area (m^2) of the tested fire resistant translucent or transparent infill;

A_{ext} is the extended area (m^2);

A_{max} is the maximum extended area (m^2);

F is a factor depending on the overrun achieved: F = 1,2 provided an overrun time according to Table 1 was achieved, F = 1,1 if the overrun achieved is less than the relevant requirement of Table 1 but minimum 50 % of the requirement, rounded up to a full minute.

In case the basis is a test on a rectangular fire resistant translucent or transparent infill panel the area of individual circular, triangular and non-rectangular four sided fire resistant translucent or transparent infill panels may be extended up to a size of its shape that fits into the size of the rectangular fire resistant translucent or transparent infill panel used in the test after applying the field of application rules given in EN 1364-3, provided all relevant frame junctions have been tested in accordance with EN 1364-3.

All other non-rectangular shapes may only be extended in size up to a size that fits into the size of the rectangular fire resistant translucent or transparent infill panel as used in the test, provided all relevant frame junctions have been tested in accordance with EN 1364-3.

For fire resistant translucent or transparent infill panels with an EW classification the rules given in 6.4.2 are only applicable provided

— the radiation value W_o was determined in a test according to EN 1364-3, measured in accordance with EN 1363-2 and the rules given in EN 1364-3, and

— the radiation value W_{ext} calculated for the extended area of the fire resistant translucent or transparent infill panel fulfils the criteria for the envisaged EW classification according to EN 13501-2, and

— the radiation value W_{ext} was calculated according to A.2 (rectangular infill panels), A.3 (circular infill panels) or A.4 (other shapes), and

— the calculated radiation value W_{ext} is equal or smaller than W_{max} according to EN 13501-2.

NOTE A radiometer as described in EN 1363–2 is not designed to measure the radiation from an individual glazing unit within a multi-unit curtain walling with fire resistant glazing.

6.4.3 Geometrical shape

Test results for a rectangular panel cover all other shapes provided that their size can be cut out of the tested rectangular size, subject to the rules given in 6.3.2.1.

7 Specific rules for curtain walling type A

7.1 General

The subsequent rules may be applied to test results from EN 1364-4 for the spandrel panel and EN 1364-3 or EN 1364-4 for the perimeter seal. The rules given in 7.2 to 7.4 apply to stick constructions only except where stated otherwise.

7.2 Rules for the complete construction

7.2.1 Width for curtain walling with classification EW

Test results are also valid for curtain walling with classification EW extending over one or more fire separating walls with a higher distance between the fire separating walls than the width of the tested construction if in addition to the criteria given in EN 1364-4 the radiation criterion is fulfilled for the resulting larger area. The radiation criterion shall be assessed using the rules given in A.1. The result of a calculation for a width equalling three times the tested width is applicable to any larger width.

An increase in width is only permitted by replicating the tested construction (especially type and dimensions of infill panels) in the same arrangement as tested.

7.2.2 Installation angle (vertical/sloped)

Test results cover all installation angles between the maximum and minimum angle used in tests. This rule applies also to unitised constructions.

7.2.3 Vertically faceted curtain walling

Test results cover all facet angles between the maximum and minimum angle used in tests. This rule applies also to unitised constructions.

7.2.4 Horizontally faceted curtain walling

For corners and facet angles not covered by the rules given in EN 1364-4 the following rules apply:

EI classification: Results from tests of faceted specimens according to EN 1364-4 using the test configurations A and B or alternatively E as illustrated in EN 1364-4:2014, Figure 3 and from minimum one test of a straight specimen cover all angles from 45° to 315° (see Figure 2) with classification EI (o ↔ i).

E, EW classification: Results from tests of faceted specimens according to EN 1364-4 using the test configurations A, B, C and D or alternatively E and F as illustrated in EN 1364-4:2014, Figure 3 and from minimum one test of a straight specimen cover all angles from 45° to 315° (see Figure 2) with classification E (o ↔ i) or EW (o ↔ i) respectively

7.3 Framing system

7.3.1 Dimension of mullions and transoms

See 6.3.1.

7.3.2 Connection between mullions and transoms

See 6.3.2.

7.4 Fire resistant translucent or transparent infill panels

See 6.4.

8 Report of the extended application analysis

8.1 Contents of the extended application report

The extended application report, prepared using this standard shall contain the following information:

a) The name and address of the issuing body;

b) The name and address of the sponsor;

c) The date of issue of the extended application report;

d) The unique reference number for the report;

e) Summary of the report(s) that the extended application is based upon;

f) The proposed extended field of application of the test results and the justification for that extension;

g) Reference to this document;

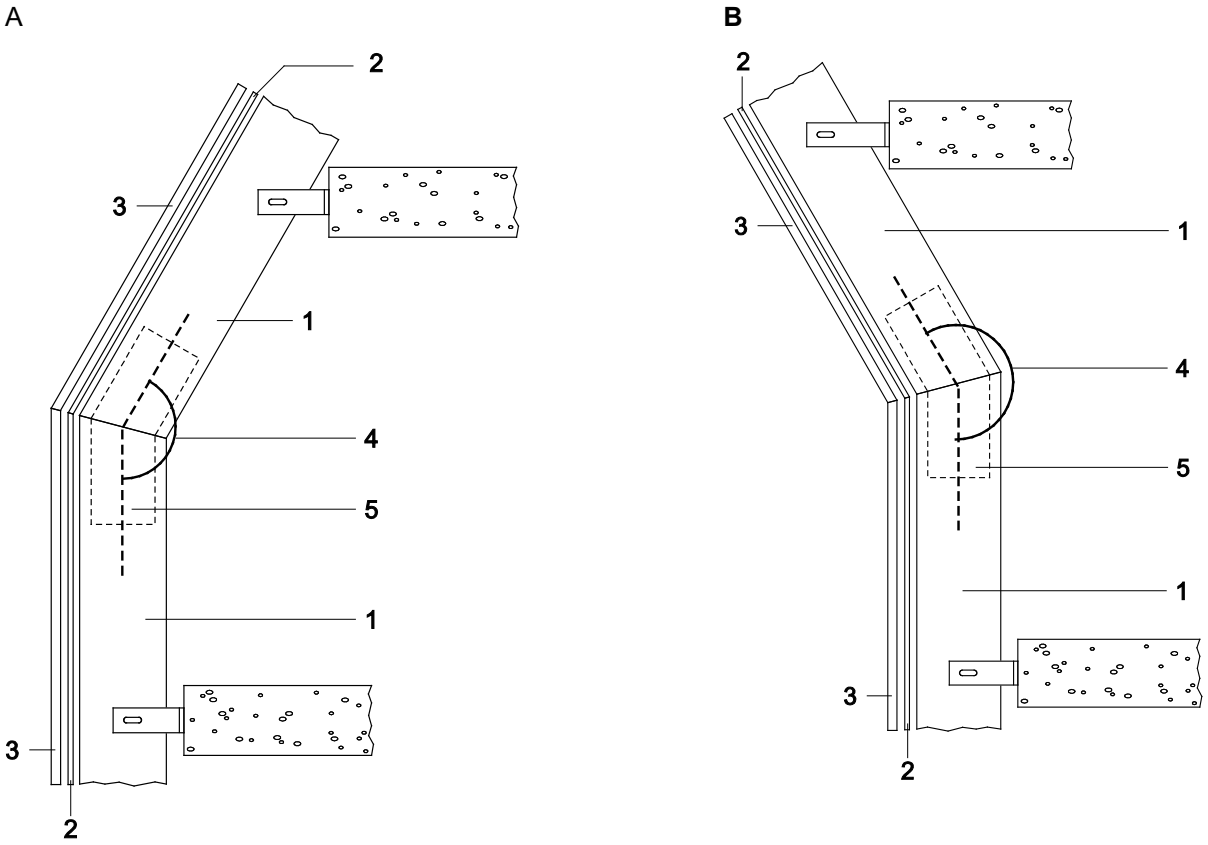
h) Classification of the modified construction in accordance with EN 13501-2;

i) The following statement:

“This extended application is issued on the basis of test data and information to hand at the time of issue. If contradictory evidence becomes available to the assessing authority the extended application will be unconditionally withdrawn and the applicant will be notified in writing. Similarly, the extended application is invalidated if the assessed construction is subsequently tested. The extended application is valid for a period defined in the classification report anticipated to be five years after which time it is recommended that it be submitted to the assessing authority for re-evaluation.”

8.2 Review of the extended application report

If requested by the applicant, the assessor may review the extended application report with a view to extending the period of validity of the classification report for a further period (five years). The purpose of the review is to ensure that incorporated assessments are based on current information, the original test information is still valid and any reference data, etc., are consistent with the current methodology. Any review of an extended application shall be conducted in accordance with EN 15254-6.



Key

A sloped inwards

B sloped outwards

1 mullion

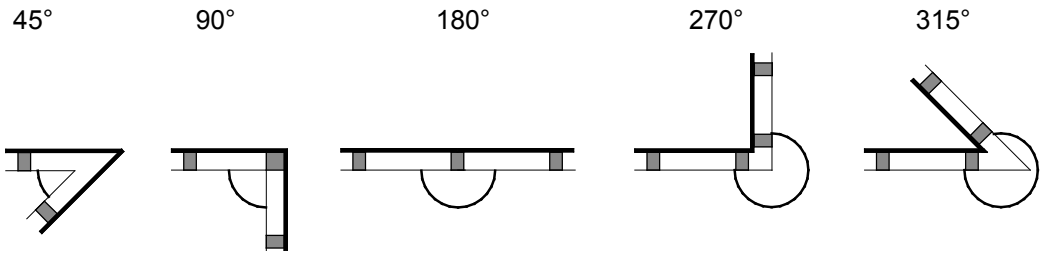
2 infill panel

3 pressure plate

4 facet angle

5 connector

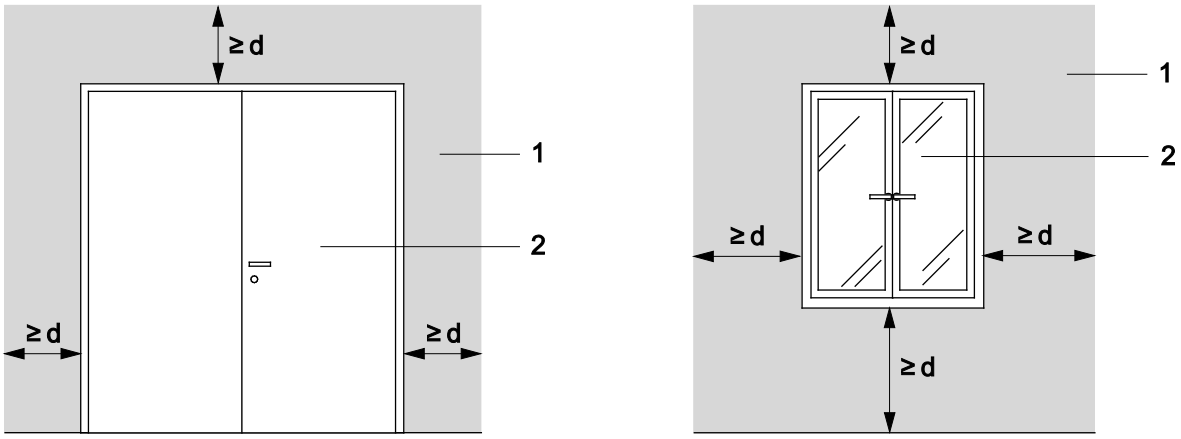
Figure 1 – Vertically faceted curtain walling



NOTE The angle indicates the interior side of the building.

Figure 2 – Range of facet angles covered by the rule according to 6.2.4

Dimensions in millimetres



Key

1 curtain walling as supporting construction

2 representative door set / openable window

d width of supporting construction (curtain walling)

Figure 3 – Test configuration for doors/windows to be included in a curtain walling

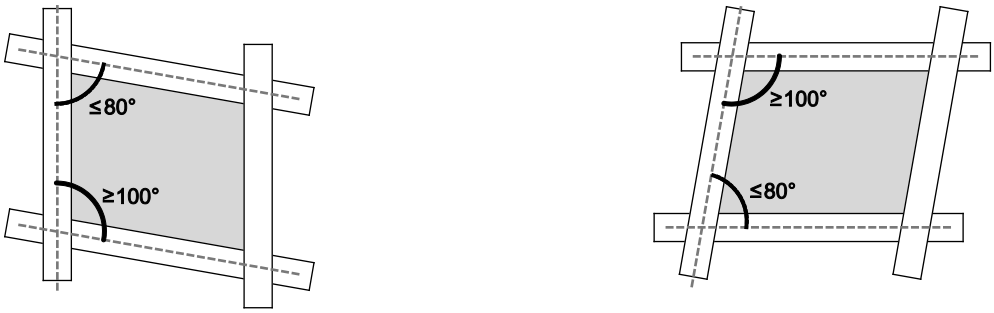


Figure 4 – Angles of connections between mullions and transoms according to 6.3.2.1

Annex A
(normative)

Radiation calculation

A.1 General

The following Formulae (A.1) to A.6 shall be applied in case of an extended field of application assessment of a curtain walling with intended classification EW.

They shall only be applied to a test specimen with the same fire resistant translucent or transparent panel in the entire relevant section of the test specimen (curtain walling type B) or spandrel area (curtain walling type A).

According to EN 13501-2, the radiation classification shall be given only by the time for which the measured radiation does not exceed the maximum value W_{max} = 15 kW/m^2. On this basis, the same value W_{max} shall be used as the maximum radiation intensity allowed for determination of the maximum infill panel area covered by the test results.

All the parameters and formulae given below (e.g. W_{max}, W_{ext}, W_0, φ_{ext}, φ_0, d, w_o, h_o, w_{ext}, h_{ext}, w_{max}, h_{max}) relate to the characteristics of the specimen as tested or the characteristics after extension.

NOTE An increase in area of a test specimen will result in an increase in radiation intensity. Hence, any possible extension of the area of the test specimen as detailed in Clause 6 and Clause 7 may be affected by the radiation limit $W_{ext} \leq W_{max}$.

A.2 Rectangular fire resistant translucent or transparent infill panels

An increase in radiation is not proportional to an increase in area of the test specimen. However, for a rectangular test specimen it may be calculated according to mathematical functions given in Formulae (A.1) to (A.3).

$$W_{ext} = W_0 \times \left[\frac{\varphi_{ext}}{\varphi_0} \right] \leq W_{\max} \tag{A.1}$$

with

$$\varphi_0 = \frac{2}{\pi}\left[\frac{w_0}{\sqrt{w_0^2 + 4d^2}} \times \arctan\left(\frac{h_0}{\sqrt{w_0^2 + 4d^2}} \right) + \frac{h_0}{\sqrt{h_0^2 + 4d^2}} \times \arctan\left(\frac{w_0}{\sqrt{h_0^2 + 4d^2}} \right) \right] \tag{A.2}$$

$$\varphi_{ext} = \frac{2}{\pi}\left[\frac{w_{ext}}{\sqrt{w_{ext}^2 + 4d^2}} \times \arctan\left(\frac{h_{ext}}{\sqrt{w_{ext}^2 + 4d^2}} \right) + \frac{h_{ext}}{\sqrt{h_{ext}^2 + 4d^2}} \times \arctan\left(\frac{w_{ext}}{\sqrt{h_{ext}^2 + 4d^2}} \right) \right] \tag{A.3}$$

where

W_{ext} is the radiation of the test specimen after extension;

W_0 is the measured radiation from the test specimen at the time of classification;

φ_0 is the configuration factor for tested test specimen;

φ_{ext} is the configuration factor of the test specimen after extension;

d is the distance between test specimen and sensor (1 m as required by EN 1363-2);

w_o, h_o is the width and height of the test specimen;

w_{ext}, h_{ext} is the extended width and height of the test specimen;

NOTE Source: VDI-Wärmeatlas.

In any case the final calculated radiation value W_{ext} for the extended area shall be equal or less than W_{max} (see A.1). This may limit the extension of the area of the test specimen or the W-classification will be lost.

The relevant calculation shall be provided in the extended application report.

A.3 Circular fire resistant translucent or transparent infill panels

For circularly shaped test specimen Formula (A.4) is applicable:

$$W_{ext} = W_0 \times \left[\frac{\varphi_{ext}}{\varphi_0} \right] \leq W_{\max} \quad \text{(A.4)}$$

with

$$\varphi_0 = r_0^2 / (r_0^2 + d^2) \quad \text{(A.5)}$$

$$\varphi_{ext} = r_{ext}^2 / (r_{ext}^2 + d^2) \quad \text{(A.6)}$$

where

r_0 = radius of tested test specimen (m);

r_{ext} = radius of test specimen after extension (m);

d = distance between the test specimen and sensor (1 m as required by EN 1363-2).

In any case the final calculated radiation value W_{ext} for the extended area shall be equal or less than W_{max} (see A.1). This may limit the extension of the area of the test specimen or the W-classification will be lost.

The relevant calculation shall be provided in the extended application report.

A.4 Other shapes of fire resistant translucent or transparent infill panels with EW-classification

For an infill panel of a shape other than rectangular or circular, an extension in area is permitted by calculating the area of a rectangle prescribed around the shape.

The area extension shall be calculated according to the following steps:

i) determine area of test sample: A_0;

ii) determine area of rectangle prescribed: $A_{0\text{-prescr}}$;

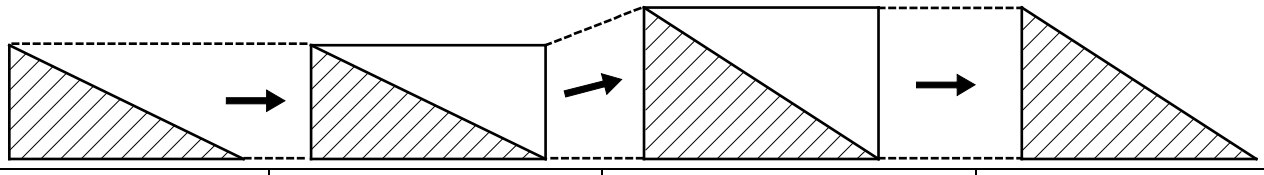
iii) determine multiplication factor $F = A_{0\text{-prescr}} / A_0$;

iv) multiply measured radiation W_0 by the multiplication factor F: $W'_0 = W_0 \times F$;

v) continue the radiation calculation and area extension calculation according to A.2 as for rectangular infill panels but using W'_0 instead of W_0 in order to determine the maximum permitted area extension (see Figure A.1 for an example).

In any case the final calculated radiation value W_{ext} for the extended area shall be equal or less than W_{max} (see A.1).This may limit the extension of the area of the test specimen or the W-classification will be lost.

The relevant calculation shall be provided in the extended application report.



i)	ii), iii), iv)	v)	v)
Tested infill panel with area A_0 Radiation: $W_0 = 5$ kW/m^2	Prescribed rectangle with area $A_{0\text{-precr}}$ Radiation: $W'_0 = W_0 \times A_{0\text{-precr}} / A_0 =$ 10 kW/m^2	Calculated extended area according to A.2 but using W'_0 instead of W_0	Permitted extended area related to tested infill panel size as shown in i)

Figure A.1 – Example for a radiation calculation for irregular shapes

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