

# Glass in building — Fire resistant glazed elements with transparent or translucent glass products — Classification of fire resistance

The European Standard EN 357:2004 has the status of a  
British Standard

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## National foreword

This British Standard is the official English language version of EN 357:2004. It supersedes BS EN 357:2000 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee B/520, Glass and glazing in building, to Subcommittee B/520/4, Glass and glazing in building — Properties and glazing methods, which has the responsibility to:

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## Glass in building - Fire resistant glazed elements with transparent or translucent glass products - Classification of fire resistance

Verre dans la construction - Eléments de construction vitrés résistant au feu, incluant des produits verriers transparent ou translucides - Classification de la résistance au feu

Glas im Bauwesen - Brandschutzverglasungen aus durchsichtigen oder durchscheinenden Glasprodukten - Klassifizierung des Feuerwiderstandes

This European Standard was approved by CEN on 10 September 2004.

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## Foreword

This document (EN 357:2004) has been prepared by Technical Committee CEN /TC 129, "Glass in building", the secretariat of which is held by IBN.

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## 1 Scope

This document specifies a classification of transparent or translucent glass products for use in appropriate glazed elements intended specially to provide fire resistance. These glass products are described in European Standards on basic and processed glass products.

## 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 572-2, *Glass in building — Basic soda lime silicate glass products — Part 2: Float glass.*

EN 572-3, *Glass in building — Basic soda lime silicate glass products — Part 3: Polished wired glass.*

EN 572-4, *Glass in building — Basic soda lime silicate glass products — Part 4: Drawn sheet glass.*

EN 572-5, *Glass in building — Basic soda lime silicate glass products — Part 5: Patterned glass.*

EN 572-6, *Glass in building — Basic soda lime silicate glass products — Part 6: Wired patterned glass.*

EN 572-7, *Glass in building — Basic soda lime silicate glass products — Part 7: Wired or unwired channel shaped glass.*

EN 1051-1, *Glass in building — Glass blocks and glass pavers — Part 1: Definitions and description.*

EN 1096-1, *Glass in building — Coated glass — Part 1: Definitions and classification.*

EN 1096-2, *Glass in building — Coated glass — Part 2: Requirements and test methods for class A, B and S coatings.*

EN 1096-3, *Glass in building — Coated glass — Part 3: Requirements and test methods for class C and D coatings.*

EN 1279-1, *Glass in building — Insulating glass units — Part 1: Generalities, dimensional tolerances and rules for the system description.*

EN 1279-2, *Glass in building — Insulating glass units — Part 2: Long term test method and requirements for moisture penetration.*

EN 1279-3, *Glass in building — Insulating glass units — Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances.*

EN 1279-4, *Glass in building — Insulating glass units — Part 4: Methods of test for the physical attributes of edge seals.*

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

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

EN 1364-1, *Fire resistance tests for non-loadbearing elements — Part 1: Walls.*

EN 1364-2, *Fire resistance tests for non-loadbearing elements — Part 2: Ceilings.*

prEN 1364-3, *Fire resistance tests for non-loadbearing elements — Part 3: Curtain walling.*

EN 1365-1, *Fire resistance tests for loadbearing elements — Part 1: Walls.*

- EN 1365-2, *Fire resistance tests for loadbearing elements — Part 2: Floors and roofs.*
- EN 1634-1, *Fire resistance tests for door and shutter assemblies — Part 1: Fire doors and shutters.*
- EN 1634-3, *Fire resistance tests for door and shutter assemblies — Part 3: Smoke control doors and shutters.*
- EN 1748-1-1, *Glass in building — Special basic products — Borosilicate glasses — Part 1-1: Definition and general physical and mechanical properties.*
- EN 1748-2-1, *Glass in building - Special basic products - Glass ceramics - Part 2-1 Definitions and general physical and mechanical properties.*
- EN 1863-1, *Glass in building — Heat strengthened soda lime silicate glass – Part 1: Definition and description.*
- EN 12150-1, *Glass in building — Thermally toughened soda lime silicate safety glass Part 1: Definition and description.*
- EN 12337-1, *Glass in building — Chemically strengthened soda lime silicate glass — Part 1: Definition and description.*
- EN 13024-1, *Glass in building — Thermally toughened borosilicate safety glass — Part 1: Part 1: Definition and description.*
- EN 13501-2, *Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services.*
- EN 14178-1, *Glass in building - Basic alkaline earth silicate glass - Part 1: Float glass.*
- prEN 14179-1, *Glass in building - Heat soaked thermally toughened soda lime silicate safety glass - Part 1: Definition and description.*
- prEN 14321-1, *Glass in building - Thermally toughened alkaline earth silicate safety glass - Part 1: Definition and description.*
- EN ISO 12543-1, *Glass in building — Laminated glass and laminated safety glass — Part 1: Definitions and description of component parts (ISO 12543-1:1998).*
- EN ISO 12543-2, *Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass.*
- EN ISO 12543-3, *Glass in building — Laminated glass and laminated safety glass — Part 3: Laminated glass (ISO 12543-3:1998).*
- EN ISO 12543-4, *Glass in building — Laminated glass and laminated safety glass — Part 4: Test methods for durability (ISO 12543-4:1998).*
- EN ISO 12543-5, *Glass in building — Laminated glass and laminated safety glass — Part 5: Dimensions and edge finishing (ISO 12543-5:1998).*
- EN ISO 12543-6, *Glass in building — Laminated glass and laminated safety glass — Part 6: Appearance (ISO 12543-6:1998).*
- ISO 834, *Fire resistance tests — Elements of building construction.*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1

##### **fire resistant glazed element<sup>1)</sup>**

element of construction containing one or more transparent or translucent glass products with mounting supports, sealing and fixing material including all particular constructional components proven and classified by testing<sup>2)</sup>

#### 3.2

##### **fire resistance**

property defined in the following terms:

##### 3.2.1

##### **loadbearing capacity, R**

ability of the element of construction to withstand fire exposure, on one or more faces, for a period of time without any loss of structural stability

##### 3.2.2

##### **integrity, E**

ability of the element of construction with a separating function to withstand fire exposure on one side only, without the transmission of fire to the non-fire side as a result of the passage of significant quantities of flames or hot gases from the fire to the non-fire side, thereby causing ignition of the non-fire exposed surface or any materials adjacent to that surface

##### 3.2.3

##### **reduction of radiation, W**

ability of the element of construction with a separating function to withstand fire exposure from one side only for a period of time, while the measured radiated heat in front of the glazing is below a specified level

##### 3.2.4

##### **insulation, I**

ability of the element of construction to withstand fire exposure on one side only, without the transmission of fire as a result of significant conduction of heat from the fire side to the non-fire side, thereby causing ignition of the non-fire exposed surface or any material in contact with that surface and the ability to provide a barrier to heat sufficient to protect people near the element of construction for the relevant classification period

##### 3.2.5

##### **smoke control, S**

ability of the element of construction to reduce the passage of hot or cold gases or smoke from one side to the other

##### 3.2.6

##### **self closing, C**

ability of the fire door or shutter to close an opening by means of a closing mechanism each time the door or shutter is opened or in the event of smoke

### 4 Glass products

Products according to this document include the following (they are specified in the documents referred to)

- float glass (see EN 572-2)
- polished wired glass (see EN 572-3)

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1) E.g. partitions, doors, framed glazing.

2) In accordance with the relevant clauses of the appropriate fire resistance test standards.



- drawn sheet glass (see EN 572-4)
- patterned glass (see EN 572-5)
- wired patterned glass (see EN 572-6)
- wired or unwired channel shaped glass (see EN 572-7)
- glass blocks and glass pavers (see EN 1051-1)
- glass block walls (see prEN 12725)
- borosilicate glasses (see EN 1748-1-1)
- glass ceramics (see EN 1748-2-1)
- heat strengthened soda lime silicate glass (see EN 1863-1)
- laminated glass and laminated safety glass (see EN ISO 12543-1, EN ISO 12543-2, EN ISO 12543-3, EN ISO 12543-4, EN ISO 12543-5 and EN ISO 12543-6)
- thermally toughened soda lime silicate safety glass (see EN 12150-1)
- chemically strengthened soda lime silicate glass (see EN 12337-1)
- heat soaked thermally toughened safety glass (see prEN 14179-1)
- thermally toughened borosilicate safety glass (see EN 13024-1)
- alkaline earth silicate glass (see EN 14178-1)
- thermally toughened alkaline earth silicate safety glass (see prEN 14321-1)

in single or multiple glazing (see EN 1279-1, EN 1279-2, EN 1279-3 and EN 1279-4), as coated (see EN 1096-1, EN 1096-2 and EN 1096-3) or uncoated glass.

NOTE 1 These products can only be classified as being appropriate for use in fire resistant glazed elements if they have been successfully tested in accordance with the test procedures referred to in 6.2.2.

NOTE 2 Annex A gives some variations of these products.

## 5 Classification

### 5.1 General

The fire resistance classification shall be related to the complete glazed element which incorporates the glass products and all given dimensions and tolerances. The classification values are those obtained by the tested fire resistant glazed elements containing the glass product in accordance with EN 13501-2. To achieve classification, an appropriate frame containing the glass product and designed by the sponsor, can be used for the fire test.

NOTE The classification obtained with this standard structure does not mean that the glass product, used in a different frame, offers the same fire resistance as it does in the tested frame.

On the basis of the performance obtained in the standard tests undertaken on samples of glazed elements, according to the fire resistance test standards, one or more of the classes in 5.2 and 5.3 shall be defined.

The classes are expressed by the letter(s) representing the considered functional requirement(s), followed by the performance time expressed in minutes:

R (minutes)/E (minutes)/EW (minutes)/EI (minutes)/S (minutes)/C

## EN 357:2004 (E)

Only the combinations of letters and performance times defined in 5.2 and 5.3 can be used for the relevant fire resistant glazed elements.

### 5.2 Loadbearing separating fire resistant glazed elements

#### 5.2.1 Walls (see EN 1365-1)

|                 |     |    |    |    |    |    |    |     |     |     |
|-----------------|-----|----|----|----|----|----|----|-----|-----|-----|
| Classification: | RE  |    | 20 | 30 |    | 60 | 90 | 120 | 180 | 240 |
|                 | REI | 15 | 20 | 30 | 45 | 60 | 90 | 120 | 180 | 240 |
|                 | REW |    | 20 | 30 |    | 60 | 90 | 120 | 180 | 240 |

#### 5.2.2 Floors and roofs (see EN 1365-2)

Floors and roofs are classified for the fire coming from the underside only.

|                 |     |    |    |    |    |    |    |     |     |     |
|-----------------|-----|----|----|----|----|----|----|-----|-----|-----|
| Classification: | RE  |    | 20 | 30 |    | 60 | 90 | 120 | 180 | 240 |
|                 | REI | 15 | 20 | 30 | 45 | 60 | 90 | 120 | 180 | 240 |

### 5.3 Non-loadbearing separating fire resistant glazed elements

#### 5.3.1 Non-loadbearing walls (see EN 1364-1)

|                 |    |    |    |    |    |    |    |     |     |     |
|-----------------|----|----|----|----|----|----|----|-----|-----|-----|
| Classification: | E  |    | 20 | 30 |    | 60 | 90 | 120 |     |     |
|                 | EW |    | 20 | 30 |    | 60 | 90 | 120 |     |     |
|                 | EI | 15 | 20 | 30 | 45 | 60 | 90 | 120 | 180 | 240 |

#### 5.3.2 Fire doors and shutters (see EN 1634-1)

|                 |                 |    |    |    |    |    |    |     |     |     |
|-----------------|-----------------|----|----|----|----|----|----|-----|-----|-----|
| Classification: | E               | 15 |    | 30 | 45 | 60 | 90 | 120 | 180 | 240 |
|                 | EW              |    | 20 | 30 |    | 60 |    |     |     |     |
|                 | EI <sub>1</sub> | 15 | 20 | 30 | 45 | 60 | 90 | 120 | 180 | 240 |
|                 | EI <sub>2</sub> | 15 | 20 | 30 | 45 | 60 | 90 | 120 | 180 | 240 |

For certain types of fire doors and shutters, the supplementary classifications C and S can be required.

#### 5.3.3 Curtain walls and non-loadbearing external walls (see prEN 1364-3)

Curtain walls and external walls can be tested in a different way from each side:

- fire from the inside: the standard temperature/time curve;
- fire from the outside: a temperature/time curve which follows the standard temperature/time curve up to 600 °C, staying at this level for the remainder of the test time.

Classification of curtain walls and external walls is normally based on both exposures. If an element is tested from one side only the classification designation will be followed by

"in → out" or "out → in".

|                 |    |    |    |    |    |
|-----------------|----|----|----|----|----|
| Classification: | E  | 15 | 30 | 60 | 90 |
|                 | EI | 15 | 30 | 60 | 90 |

### 5.3.4 Lift landing doors (see EN 1634-1)

Fire doors tested using the procedures specified in EN 1634-1 and classified as such are allowed to maintain their class when used as a lift landing door, without testing according to the lift door test standard. The opposite is not valid.

|                 |    |    |    |    |    |    |    |
|-----------------|----|----|----|----|----|----|----|
| Classification: | E  | 15 | 30 | 45 | 60 | 90 |    |
|                 | EW | 20 | 30 | 60 |    |    |    |
|                 | EI | 15 | 20 | 30 | 45 | 60 | 90 |

### 5.3.5 Ceilings (see EN 1364-2)

|                 |    |    |    |    |    |    |     |     |     |
|-----------------|----|----|----|----|----|----|-----|-----|-----|
| Classification: | EI | 15 | 30 | 45 | 60 | 90 | 120 | 180 | 240 |
|-----------------|----|----|----|----|----|----|-----|-----|-----|

### 5.3.6 Sloped and horizontal fire resistant glazed elements (in accordance with ISO 834)

Sloped and horizontal fire resistant glazed elements are classified for the fire coming from the underside only.

|                 |    |    |    |    |    |     |    |     |     |     |
|-----------------|----|----|----|----|----|-----|----|-----|-----|-----|
| Classification: | E  | 20 | 30 | 60 | 90 | 120 |    |     |     |     |
|                 | EW | 20 | 30 | 60 |    |     |    |     |     |     |
|                 | EI | 15 | 20 | 30 | 45 | 60  | 90 | 120 | 180 | 240 |

## 6 Requirements and test methods

### 6.1 General requirements and test methods

The glass products shall conform to the relevant European Standard for basic or processed glass products (see 4). The evaluation of conformity, including possible independent body involvement, shall be in accordance with the relevant product standard.

### 6.2 Fire resistance requirements and tests

#### 6.2.1 General

The test specimen and the number of successful tests shall be as described in the appropriate fire resistance test standard (see 6.2.2).

**6.2.2 Procedures**

The tests to determine the fire resistance are specified in the following test standards:

General: EN 1363-1  
EN 1363-2

Loadbearing and separating glazed elements:

Loadbearing walls: EN 1365-1  
Floors and roofs: EN 1365-2

Non-loadbearing and separating glazed elements:

Non-loadbearing walls: EN 1364-1  
Ceilings: EN 1364-2  
Curtain walls and external walls: prEN 1364-3  
Doors and shutters: EN 1634-1  
Smoke control doors: EN 1634-3  
Sloped elements: in accordance with ISO 834

The transfer of test results is only possible in accordance with the direct field of application.

## Annex A (informative)

### Typical structures commonly available in the relevant fire resistant glazed elements

Table A.1

|   | Glass product <sup>a</sup>                               | monolithic | laminated | insulating glass units |
|---|--|------------|-----------|------------------------|
|   | 1  | 2          | 3         | 4                      |
| 1   | polished wired glass                                     | x          | x         | x                      |
| 2   | wired patterned glass                                    | x          | x         | x                      |
| 3   | wired or unwired channel shaped glass <sup>b c</sup>     | x          |           |                        |
| 4   | glass blocks and paver units and glass block walls       | x          |           |                        |
| 5   | borosilicate glasses                                     | x          | x         | x                      |
| 6   | glass ceramics   | x          | x         | x                      |
| 7   | heat strengthened glass                                  |            | x         | x                      |
| 8   | laminated glass and laminated safety glass               |            | x         | x                      |
| 9   | thermally toughened safety glass                         | x          | x         | x                      |
| 10  | chemically toughened glass                               |            | x         |                        |
| 11  | heat soaked thermally toughened safety glass             | x          | x         | x                      |
| 12  | thermally toughened borosilicate safety glass            | x          | x         | x                      |
| 13  | alkaline earth silicate glass                            | x          | x         | x                      |
| 14  | thermally toughened alkaline earth silicate safety glass | x          | x         | x                      |
| x: typical structure  |  |            |           |                        |
| <p><sup>a</sup> coated or uncoated</p> <p><sup>b</sup> Definition of EN 572-7: 3.2 wired channel shaped glass: This is a channel shaped glass which has a wire inlay in the web, i. e. across the width, <i>B</i>, which runs in the direction of the length, <i>H</i>. Additional wires may also be in the flanges.</p> <p><sup>c</sup> in a special double layer assembly</p> |  |            |           |                        |

## Bibliography

prEN 12725, *Glass in building – Glass block walls – Design, dimensions and performances*

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