BRITISH STANDARD

BS EN
12150-2:2004

Glass in building — Thermally toughened soda lime silicate safety glass —

Part 2: Evaluation of conformity/Product standard

The European Standard EN 12150-2:2004 has the status of a British Standard

ICS 81.040.20

National foreword

This British Standard is the official English language version of EN 12150-2:2004.

The UK participation in its preparation was entrusted by Technical Committee B/520, Glass and glazing in building, to Subcommittee B/520/1, Glass and glazing in building — Basic and transformed glass products, 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 subcommittee can be obtained on request to its secretary.

Cross-references

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Glass in building - Thermally toughened soda lime silicate safety glass - Part 2: Evaluation of conformity/Product standard

Verre dans la construction - Verre de silicate sodo-calcique de sécurité trempé thermiquement - Partie 2: Evaluation de la conformité

Glas im Bauwesen - Thermisch vorgespanntes Kalknatron-Einscheibensicherheitsglas - Teil 2: Konformitätsbewertung/Produktnorm

This European Standard was approved by CEN on 27 May 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 12150-2:2004) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by IBN.

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 April 2005, and conflicting national standards shall be withdrawn at the latest by July 2006.

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.

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

No existing document is superseded

This part of the document does not stand-alone, it is a part of one document:

— EN 12150-1: *Glass in building – Thermally toughened soda lime silicate safety glass – Part 1: Definition and description*

— EN 12150-2: *Glass in building - Thermally toughened soda lime silicate safety glass – Part 2: Evaluation of conformity*

This document contains other aspects of importance of trade.

1 Scope

This document covers the evaluation of conformity and the factory production control of flat thermally toughened soda lime silicate safety glass for use in buildings.

Note: For glass products with electrical wiring or connections for, e.g. alarm or heating purposes, other directives, e.g. Low Voltage Directive, may apply.

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 356, *Glass in building - Security glazing - Testing and classification of resistance against manual attack*

EN 410, *Glass in building - Determination of luminous and solar characteristics of glazing*

EN 572 – 1, *Glass in building - Basic soda lime silicate glass products – Part 1: Definition and general physical and mechanical properties*

EN 572 – 2, *Glass in building - Basic soda lime silicate glass products – Part 2: -Float 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 673, *Glass in building – Determination of thermal transmittance (U value) – Calculation method*

EN 1063, *Glass in building - Security glazing - Testing and classification of resistance against bullet attack*

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 12150-1:2000, *Glass in building – Thermally toughened soda lime silicate safety glass – Part 1: Definition and description*

EN 12600, *Glass in building - Pendulum test - Impact test method and classification for flat glass*

EN 12758, *Glass in building - Glazing and airborne sound insulation – Product descriptions and determination of properties*

EN 12898, *Glass in building - Determination of the emissivity*

prEN 13474, *Glass in building - Design of glass panes*

EN 13501-1, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests*

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

prEN 13501-5, *Fire classification of construction products and building elements - Part 5: Classification using data from fire exposure roof tests*

EN 13541, *Glass in building - Security glazing - Testing and classification of resistance against explosion pressure*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12150-1:2000 and the following apply.

3.1
initial type testing
determination of the performance of a product (characteristic, durability), on the basis of either actual tests or other procedures (such as conventional, standardised, tabulated or general accepted values, standardised or recognised calculation methods, test reports when made available, …), in accordance with this document that demonstrates compliance with this document

3.2
test report
document that covers the results of tests undertaken on a representative sample of the product from production or on a prototype design of the product

3.3
product description
document that details the relevant parameters, e.g. process conditions, structure, etc., for defining a product that complies with the standard. It includes specific reference(s) to characteristics that are modified by the production process

3.4
significant change
variation in performance beyond the permitted tolerance for the characteristic

4 Requirements

4.1 Product description

For conformity purposes the thermally toughened soda lime silicate glass manufacturer is responsible for the preparation and maintenance of the product description. This description shall describe the product and/or product families.

Disclosure of the product description shall be at the discretion of the thermally toughened glass manufacturer or his agent except in the case of regulatory requirements.

The description shall contain at least a normative part. The description may also contain an informative part, when the manufacturer foresees further development of the product.

The normative part of the description shall contain the following minimum information:

- a reference to EN 12150 parts 1 and 2 and all other standards with which the manufacturer claims compliance.

- the radiometric properties and durability of coated glass, i.e. coated glass that conforms with EN 1096-1, EN 1096-2, EN 1096-3, when those properties are changed, intentionally or unintentionally, by the thermal toughening process.

The definition of product families shall be consistent with the normative part of the product description.

The substitution of materials shall maintain the conformity with the product description. The substituting material can be added to the product family and also the product description when compliance has been demonstrated.

4.2 Conformity with the definition of thermally toughened soda lime silicate safety glass

Products shall conform to the definition and fulfil the requirements of thermally toughened soda lime silicate safety glass as defined in EN 12150-1.

4.3 Determination of the characteristic's performances

4.3.1 Characteristics of thermally toughened soda lime silicate safety glass

4.3.1.1 General

The characteristics of thermally toughened soda lime silicate safety glass are in general those of the glass substrate (see 4.3.1.2).

4.3.1.2 Characteristics of the soda lime silicate glass panes used for the production of thermally toughened soda lime silicate safety glass

Panes shall be made of soda lime silicate glass according to EN 572-1, EN 572-2, EN 572-4, EN 572-5. The panes may be coated according to EN 1096–1, EN 1096-2, EN 1096-3 and/or enamelled according to EN 12150-1.

For the characteristics listed in table 1, for the soda lime silicate glass panes, generally accepted values or calculated values may be used.

Since the majority of the characteristics of table 1 are not changed significantly by the thermal toughening process they shall be used for thermally toughened soda lime silicate safety glass. The exceptions shall be the characteristic bending strength ($f_{g,k)}$ and the resistance against sudden temperature changes and temperature differentials.

Table 1: Information on the characteristics of soda lime silicate glass panes, according to EN 572-1, used for the production of thermally toughened soda lime silicate safety glass

Characteristic	Symbol	Unit
- density	ρ	kg/m³
- hardness	$HK_{0,1/20}$	GPa
- Young's modulus	E	Pa
- Poisson's ratio	μ	Dimensionless
- Characteristic bending strength	$f_{g,k}$	Pa
- Resistance against sudden temperature changes and temperature differentials		K
- Specific heat capacity	c	J/(kg.K)
- Coefficient of linear expansion	α	K^{-1}
- Thermal conductivity (for *U*-value)	λ	W/(m.K)
- Mean refractive index to visible radiation	n	Dimensionless
- Emissivity	ε	Dimensionless
- Light transmittance	τ_v	Dimensionless
- Solar direct transmittance	τ_e	Dimensionless
- Total energy transmittance	g	Dimensionless

If some coatings, i.e. coated glass conforming with the EN 1096 series, when thermally toughened change their radiometric properties the manufacturer shall refer to the following for the determination of the appropriate characteristics, etc.:

— 4.3.2.11 for the emissivity;

— 4.3.2.12 for the light transmittance and reflectance;

— 4.3.2.13 for the solar energy transmittance;

— EN 1096-2 for the durability of A, B and S coatings;

— EN 1096-3 for the durability of C and D coatings.

4.3.2 Determination of characteristics of thermally toughened soda lime silicate safety glass products

If the thermally toughened glass manufacturer wishes to claim that any performance characteristic is independent of the production equipment used then the factory production control system shall be in accordance with this document including his specific process control conditions

4.3.2.1 Safety in the case of fire - Resistance to fire

Fire resistance shall be determined and classified in accordance with EN 13501-2.

Note: EN 357 may be used as a classification reference specific to fire resistant glazed elements.

4.3.2.2 Safety in the case of fire - Reaction to fire

Reaction to fire shall be determined and classified in accordance with EN 13501-1.

Thermally toughened soda lime silicate safety glass products are products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of Classes A1* according to Commission Decision 96/603/EC, as amended 2000/605/EC)

4.3.2.3 Safety in the case of fire - External fire behaviour

Where the manufacturer wishes to declare external fire performance (e.g. when subject to regulatory requirements), the product shall be tested and classified in accordance with prEN 13501-5.

Note: Compliance with this requirement is not possible until a version of prEN 13501-5 later than 2002 becomes available.

4.3.2.4 Safety in use - Bullet resistance: shatter properties and resistance to attack

Bullet resistance shall be determined and classified in accordance with EN 1063.

4.3.2.5 Safety in use - Explosion resistance: impact behaviour and resistance to impact

Explosion resistance shall be determined and classified in accordance with EN 13541.

4.3.2.6 Safety in use - Burglar resistance: shatter properties and resistance to attack

Burglar resistance shall be determined and classified in accordance with EN 356.

4.3.2.7 Safety in use - Pendulum body impact resistance: shatter properties (safe breakability) and resistance to impact

Pendulum body impact resistance shall be determined and classified in accordance with EN 12600.

4.3.2.8 Safety in use - Mechanical resistance: Resistance against sudden temperature changes and temperature differentials

The resistance against sudden temperature changes and temperature differentials is a generally accepted value that is given in EN 12150-1 and shall be ensured by compliance with this document.

4.3.2.9 Safety in use - Mechanical resistance: Resistance against wind, snow, permanent load and/or imposed loads of the glass unit

The mechanical resistance of thermally toughened soda lime silicate safety glass is a characteristic value that is given in EN 12150-1 and shall be ensured by compliance with this document.

As long as on the concerned construction or building site no part of prEN 13474 is applicable then the current method of determining mechanical resistance in the country of destination shall be applied.

The manufactured or supplied thickness of thermally toughened soda lime silicate safety glass shall conform to the ordered thickness.

4.3.2.10 Protection against noise - Direct airborne sound reduction

The sound reduction indexes shall be determined in accordance with EN 12758. However, the information supplied with the incoming glass may be used as the thermal toughening process does not alter the values.

4.3.2.11 Energy conservation and heat retention - Thermal properties

The thermal transmittance value (*U*-value) shall be determined by calculation in accordance with EN 673 with:

— emissivity ε: the declared value of the glass manufacturer. If the information is not available, the emissivity shall be determined in accordance with EN 12898.

— nominal thickness of the glass panes

Subject to 5.2.1 the information supplied about the thermal properties of the incoming glass may be used if the thermal toughening process does not alter the values.

4.3.2.12 Energy conservation and heat retention - Radiation properties: Light transmittance and reflectance

The light transmittance and reflectance shall be determined in accordance with EN 410.

Subject to 5.2.1 the information supplied about the radiation properties of the incoming glass may be used if the thermal toughening process does not alter the values.

4.3.2.13 Energy conservation and heat retention - Radiation properties: Solar energy characteristics

The solar energy transmittance and reflectance shall be determined in accordance with EN 410.

Subject to 5.2.1 the information supplied about the radiation properties of the incoming glass can be used if the thermal toughening process does not alter the values.

4.4 Durability

When products conform to the definition of thermally toughened soda lime silicate glass as 4.2 then the characteristics' performances in 4.3.2 are ensured during an economically reasonable working life.

The durability of glass products including their characteristics, shall be ensured by the following:

— Compliance with this document

— Compliance with instructions from the glass product manufacturer or supplier

The manufacturer shall supply specific installation instructions or make reference to appropriate technical specifications.

Note 1: The durability of glass products depends on:

— building and construction movements due to various actions;

— building and construction vibrations due to various actions;

— deflection and racking of the glass support due to various actions;

— glass support design (e.g. drainage of infiltrated water in the rebate, prevention of direct contact between glass support members and glass);

— accuracy of glass support and glass support member dimensions;

— quality of the assembling of glass support members up to a glass support;

— quality of installation of the glass support into or onto the buildings or constructions;

— glass support expansion due to adsorbed moisture from the air or other sources;

— the quality of installation of the glass product into or onto its support.

4.5 Dangerous substances

Materials used in products shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material or permitted in the national regulations of the Member State of destination.

5 Evaluation of conformity

5.1 General

Evaluation of conformity in accordance with this document shall be as a result of FPC and ITT in accordance with this document

1) Factory production control;

This shall include the following:

a) Inspection of samples taken at the factory in accordance with a prescribed test plan;

b) Initial inspection of the factory and of factory production control;

c) Continuous surveillance and assessment of the factory production control.

2) Initial type testing of the product;

Note: There may be a need to involve a third party, with 1b, 1c, and/or 2, for the purpose of regulatory marking (see Annex ZA).

5.2 Initial type testing of the product (see 5.1, 2)

5.2.1 General

The product's characteristics shall be initial type tested to verify they are in conformity with the requirements. Instead of performing any actual testing, initial type testing may make use of:

– generally accepted and/or conventional and/or standardised values, in the Clause 2 referenced standards, or in publications that are referred to in these standards;

– standardised calculation methods and recognised calculation methods in Clause 2 referenced standards, or in publications that are referred to in these standards;

– test report(s) on the basis of 5.2.1.2 when made available except for the characteristics listed in 5.2.2.

– where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of conformity with other product standards, these characteristics need not be reassessed providing they remain unchanged by the manufacturing process;

– release of dangerous substances may be assessed indirectly by controlling the content of the substance concerned;

– durability may be assessed indirectly by controlling the production processes according to this document;

Note 1: Products CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated with the CE marking.

Note 2: There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).

When actual testing is required then the Initial Type Testing (ITT) shall be undertaken on a sample representative of the product taken from direct production or a prototype, any plant and/ or line.

Whenever a change occurs in the raw material or the production process (subject to the definition of the family), which would change significantly one or more of the characteristics, the type tests shall be repeated for the appropriate characteristics.

5.2.1.1 Multiple lines/sites

If a manufacturer operates more than one line and/or site, the following can reduce the requirement for multiple Initial Type Testing (ITT):

i) The manufacturers' technical file for a product shall specifically covers all sites and/or lines of the same manufacturer[1],

ii) The manufacturer shall establish a direct relationship between production control, initial type testing and on-going internal audit testing,

iii) The manufacturer has a responsible individual designated to ensure product compliance based on:

— The operation of a consistent Factory Production Control system on all applicable sites and/or lines,

— The manufacturer having obtained evidence that shows the product to be consistent, with respect to both product characteristics and intended use characteristics,

— The manufacturer has in place an internal auditing scheme, including product consistency.

[1] The terms 'manufacturer' and 'producer' are understood as being synonyms (see CPD working document NB-CPD/02/019-issued 24 April 2002 – page1)

5.2.1.2 Historic Data

Tests previously performed in accordance with the provisions of this document (same product, same characteristic(s), same or more onerous test method, sampling method and attestation of conformity) may be taken into account.

5.2.2 Initial type testing of thermally toughened soda lime silicate safety glass

5.2.2.1 General

To establish if a product conforms to the definition of thermally toughened soda lime silicate safety glass, initial type testing shall consist of:

a) mechanical strength measurement in accordance with EN 12150-1;

b) fragmentation test in accordance with EN 12150-1

5.2.2.2 Test specimens

The test specimens needed for the initial type test shall be processed from float glass according to EN 572-1 and EN 572-2 in accordance with this document.

The ‘simplest’ type of edge work specified in the manufacturers production control documentation shall be used.. However, if an arrissed edge is used then all other types of edge working are deemed to satisfy.

The number of test specimens is as follows:

a) For mechanical strength measurement they are given in table 2a for float glass, table 2b for coated float glass and table 2c for enamelled float glass.

b) For fragmentation 5 test specimens per thickness are required.

Table 2a: Number of test specimens distributed over the product thickness range

Product thickness range	Number of test specimens for the mechanical strength measurement
– minimum	≥ 2
– first after minimum	≥ 2
– centre of range	≥ 2
– last before maximum	≥ 2
– maximum	≥ 2
TOTAL	≥ 10
NOTE : When the production range consists of: - two thicknesses, the distribution shall be as equal as practical - a single thickness, all specimens are of the same thickness	

Table 2 b: Number of test specimens of coated float glass, distributed over the product thickness range

Emissivity ε of incoming glass product	Product thickness range	Number of specimens for the mechanical strength measurement
$1 \geq \varepsilon > 0{,}25$	Minimum	≥ 2
	Middle	≥ 2
	Maximum	≥ 2
Total		(min.10)
$0{,}25 \geq \varepsilon > 0{,}1$	Minimum	≥ 2
	Middle	≥ 2
	Maximum	≥ 2
Total		(min.10)
$0{,}1 \geq \varepsilon$	Minimum	≥ 2
	Middle	≥ 2
	Maximum	≥ 2
Total		(min.10)
Note 1: Tests according to this table are valid for all coated glasses within the respective emissivity ranges Note 2: Half number of test specimen shall be tested with the coated side in tension and the other half with the uncoated side in tension		

Table 2 c: Number of test specimens of enamelled float glass, distributed over the product thickness range

Type of surface design	Product thickness range	Number of specimens for the mechanical strength measurement
Fully enamelled	Minimum	≥ 10
Note 1: This table covers all enamelled designs and all produced thicknesses Note 2: Mechanical test undertaken with enamelled surface in tension		

Note: Strength measurement outcomes are expressed in force per unit of area and are therefore independent of the thickness. Hence strength measurements may be performed on a collection of test specimens with different thicknesses.

5.2.2.3 Test results

a) When the mechanical strength is measured, no measured value shall be below that given in Clause 9.4 of EN 12150-1:2000. However, if one value falls below then the manufacturer shall ensure that the results relate to a 5 % probability of breakage at the lower limit of the 95 % confidence interval.

b) In the fragmentation test, no test specimen shall exhibit a fragmentation assessment that does not meet Clauses 8.5 and 8.7 of EN 12150-1:2000.

5.2.2.4 Measurement of surface pre-stress

The manufacturer may also use surface pre-stress measurement as a means of product control. If this is done then all test specimens shall be measured prior to testing. This will show the relationship between surface pre-stress and mechanical strength/fragmentation.

Manufacturers with more than one production line may perform the initial type test on specimens from one line. The outcome value of surface pre-stress measurement may then be used as reference for the other production lines and shall be confirmed by factory production control (FPC). This may also be applied to new production lines.

5.2.2.5 Thermally toughened patterned glass

Initial type testing of thermally toughened patterned glass may not be undertaken as a result of the wide variety of patterned surfaces of patterned glass in accordance with EN 572-5.

Compliance of thermally toughened patterned glass shall be ensured by the sampling during product control given Annex A – Table A.1 – 3.1.3 together with either 3.1.4.2 or 3.1.4.3.

5.2.3 Initial type testing of characteristic's performances

All characteristics in 4.3.2 shall be subject to initial type testing in accordance with Clause 5.2.1.

Optimising thermal toughening settings specifically for one characteristic may affect negatively the optimised settings for a different characteristic. When performance of both characteristics will be declared, the affected characteristic shall be subject to a further type test.

5.3 Factory production control and inspection of samples in accordance with a prescribed test plan (see 5.1, 1a and b)

Factory production control means the permanent internal control of production exercised by the manufacturer

All elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system documentation shall ensure a common understanding of quality assurance and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked.

Factory production shall be according to Annex A of this document.

Note 1: A factory production control system similar to EN ISO 9001 made product specific to this document is deemed to satisfy the requirements of this clause.

Note 2: There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).

Annex A of this document also summarises the tests that shall be carried out by the manufacturer as part of the production control in the factory, and as further testing of samples taken at the factory in accordance with a prescribed test plan.

If the factory production control includes the optical pre-stress measurement for control purposes, the method shall be correlated. Therefore, prior to any initial type test on mechanical strength/fragmentation according to 5.2.2.1, all test specimens shall be measured to determine their optical pre-stress. Outcomes shall be used as reference values during factory production control.

5.4 Initial inspection of factory and of factory production control (see 5.1, 1c)

The initial inspection of the factory and of the factory production control shall be limited to the parameters listed in table 3 in conjunction with Annex A.

Note: There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).

Table 3: Characteristics of interest for the Factory Production Control

Nr	Characteristic	Interested parameter related to the characteristic	For details, refer to
A	Resistance to fire Reaction to fire External fire behaviour	- checking incoming glass - checking process control - product control after toughening - labelling outgoing glass product	Annex A
B	Release of dangerous substances	- checking incoming materials	Annex A
C	Bullet resistance Explosion resistance Burglar resistance Pendulum body impact resistance Resistance against sudden temperature Changes and temperature differentials Wind, snow, permanent and imposed load resistance of the glass unit	- checking incoming glass - checking process control - product control after toughening - labelling outgoing glass product	Annex A
D	Direct airborne sound reduction Thermal properties Radiation properties: – light transmittance and reflection – solar energy characteristic	- checking incoming glass - checking process control - product control after toughening - labelling outgoing product	Annex A

5.5 Continuous surveillance and assessment of the factory production control (see 5.1, 1c)

The continuous surveillance and assessment of the factory production control shall cover the parameters listed in table 3 in conjunction with Annex A.

Note: There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).

The frequency of production surveillance shall be twice per year for new production facilities or for facilities that do not already have an established factory production control system in accordance with this document.

When assessment of FPC fails to identify major non-conformances during four successive assessments, the frequency can be reduced to once a year

When a major non-conformance is recorded, the inspection shall be repeated within two month. The frequency of production surveillance shall return to, or remain at twice a year. When the repeated inspection also results in a major non-conformance, then the production shall be subject within two months to a repeated initial inspection of the factory and of the factory production control together with a surveillance inspection. When this repeated initial inspection and surveillance inspection also results in a major non-conformance, then the products are considered as no longer conforming to this document.

6 Marking and/or labelling

6.1 General

All voluntary marking and/or labelling shall comply with Annex C.3.

Care shall be taken to ensure that any voluntary marking and/or labelling does not cause confusion with respect to the mandatory requirements.

Note: All marking and/or labelling of product to demonstrate compliance with the regulatory requirement is detailed in Annex ZA.

6.2 Product marking

The thermally toughened soda lime silicate safety glass product shall be marked in accordance with Clause 10 of EN 12150 – 1:2000.

6.3 Product characteristics

The manufacturer or his agent shall organise a system of references that allows for the following:

— the identification of exactly which characteristics have to be assessed (see clause 4.3.2);

— those characteristics that will be assessed;

— the values, classes, categories, etc. that have been determined for those characteristics.

This system shall be documented as part of the evaluation of conformity.

6.4 “Characteristics/performance identification paper”

The manufacturer shall prepare a “characteristics/performance identification paper” based on the information collected on the product characteristics (see 6.3). This document shall be part of the manufacturers technical file and is the basis for the accompanying information as required for regulatory purposes.

The "characteristics/performance identification paper" can be a catalogue in any media format (paper, disk, website, etc.), always identifiable by the reference that accompanies the marking with the product. The catalogue shall contain the values or classes of the characteristics for which a performance is declared. If no performance is declared, an indication of no performance determined (NPD) shall be made.

Note 1: See condition of use of NPD in Annex ZA.

Note 2: The catalogue should not contain any information other than that relevant to the “characteristics/performance identification paper”.

Annex A
(normative)

Factory production control

A.1 Factory Production Control Requirements

A.1.1 General

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control [raw and other] incoming materials or components, equipment, the production process and the product.

Note: An FPC system conforming with the requirements of EN ISO 9001 and made specific to the requirements of this document is deemed to satisfy the requirements of this document.

A.1.2 Organisation

A.1.2.1 Responsibility and authority

The responsibility, authority and the interrelation of all personnel who manage, perform and verify work affecting conformity shall be defined, particularly for personnel who have the organizational freedom and authority to:

a) initiate action to prevent the occurrence of product non-conformity;

b) identify and record any product non-conformances.

A.1.2.2 Management representative for factory production control

The manufacturer shall appoint a management representative who, irrespective of other responsibilities, shall have defined authority and responsibility for ensuring that the requirements of this document are implemented and maintained.

A.1.2.3 Management review

The production control system shall be reviewed by the manufacturer's management at appropriate intervals in accordance with the manufacturer's control to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained for a minimum of 5 years.

A.1.3 Control system

A.1.3.1 General

The manufacturer shall establish and maintain a documented system as a means of ensuring that the product conforms to EN 12150-1. The following requirements shall be fulfilled.

A.1.3.2 Personnel

The manufacturer shall use appropriately trained personnel for the operation and inspections of all production and inspection equipment.

A.1.3.3 Documentation

The manufacturer's documentation and procedures shall be relevant to the production and process control of the thermally toughened soda lime silicate safety glass, and shall be adequately described in a manual which shall include:

a) The organizational structure, responsibilities and authorities of the management with regard to product conformity.

b) The procedures for specifying and verifying the incoming materials.

c) The manufacturing, production control and other techniques, processes and systematic actions that will be used.

d) The inspections that will be carried out before production, the inspections and tests during and after production, and the frequency at which they will be carried out.

e) Required records of the inspections, test and assessments.

f) Non-conformity situations requiring corrective action and the action taken.

g) Unless otherwise indicated in national regulation records shall be kept for a minimum of one year after manufacturing the product

A.1.3.4 Test equipment

Calibration of test equipment necessary for factory production control shall be documented.

Note: The precision of calibration required is implied by the accuracy of the test method and tolerances specified.

A.1.3.5 Inspection and testing

Clause A.3 designates the inspections and tests by means of tables. The requirements and records shall be normative.

Frequencies shall be regarded as a minimum frequency.

A.2 Marking

The manufacturer shall establish, document and maintain procedures for marking of the products. The product shall be marked in accordance with the established documents.

For tracing purposes, the manufacturer shall establish and maintain the records required in clause A.3.

A.3 Inspection and testing tables of thermally toughened soda lime silicate safety glass production

A.3.1 Information on table A.1

Table A.1 consists of three parts:

— section 1: Material control

— section 2: Production Control

— section 3 : Product control

When a manufacturing process is such that one or more of the listed inspections or tests are not applicable or physically not possible, the concerned inspection or test may be ignored.

The inspections and/or tests on incoming materials shall be carried before use.

In the case of non-conforming materials, action shall be taken so that:

— non-conforming raw materials cannot be used

— non-conforming products cannot be delivered.

The required records in table A.1 may be any document, e.g. order documents, production documents, logbook, etc., as described in the FPC procedures and associated documentation.

For those criteria where no record is required this situation shall only apply until a complaint regarding that criteria is received. Records shall subsequently be kept to show that corrective action has been successful.

The machinery and equipment used for manufacturing the products shall be checked at periods consistent with the manufacturers' documented process control against defined parameters, maintained and adjusted for optimal results.

A.3.2 Use of proxy testing

A manufacturer may employ a test method/method of evaluation other than those referred to in the Table A.1. However, it shall be the manufacturer's responsibility to prepare suitable documentation describing such tests and their correlation with the recommended method to ensure that the appropriate characteristic is as declared.

Table A.1: Inspection and test table for thermally toughened soda lime silicate safety glass

Section 1: Incoming material					
Ref.	Material, inspection or test	Recommended method (Decision to be made by manufacturer)	Requirement	Recommended minimum frequency	Record
1.1	Incoming material glass				
1.1.1	Identification, including packaging and label	Visual	See purchase specification	Each delivery	Yes
1.1.2	Thickness	Visual	See purchase specification	Each delivery	Yes
1.2	Other materials, e.g. ceramic frit, paint				
1.2.1	Delivery documentation	Visual	See purchase specification	Each delivery	Yes
1.2.2	Chemical analysis	Visual	See purchase specification	Each delivery	Yes

Section 2: Production control, including material control prior to thermal toughening I					
Ref.	Material, inspection or test	Recommended method (Decision to be made by manufacturer)	Requirement	Recommended minimum frequency	Record
2.1	Prior to toughening				
2.1.1	Type	Visual	See customer order	1 Product type per order	Yes
2.1.2	Thickness	Measurement	See customer order	1 Product type per order	Yes
2.1.3	Dimensions, shapes, holes, notches, etc.	Measurement	See customer order	1 Product type per order	Yes
2.1.4	Edge work	Visual	See customer order	1 Product type per order	Yes

2.1.5	Edge work for special applications, e.g. fire resistance	Assessment of edge work: see manual of manufacturer	See manual of the manufacturer	1 test specimen per week	Yes
2.1.6	Marking	Visual	EN 12150-1	Each glass	No
2.2	Process control				
2.2.1	Relevant process conditions of oven and/or chiller and cooling as described in the manual	See manual instruction	See production instructions	Continuously (1)	Yes
2.2.2	In case of coated or enamelled glass: Identification of position of the coating/enamel	Visual	See production instructions	When required	No

Section 3: Product control after toughening					
Ref.	Inspection or test	Recommended method (decision to be made by manufacturer)	Requirement	Recommended minimum frequency	Record
3.1	Product				
3.1.1	Overall bow, local bow,	Measurement on test specimen or current production	See EN 12150-1 or customer order	1 test per day (2)	Yes
3.1.2	Dimensions, notches, holes	Measurement on current production	See customer order	1 test per day	Yes
3.1.3	Fragmentation	Measurement (Annex B) on test specimens	See EN 12150-1	minimum 1 test specimen (1100 mm x 360 mm) daily (2)	Yes
3.1.4.1 (3)	Surface pre-stress	Measurement (Annex B) on test specimen or current production Note: Measurement on current production recommended	See manual of the manufacturer	minimum 1 test per day (2)	Yes
3.1.4.2 (3)	Mechanical strength	Measurement (Annex B) on test specimen	See EN 12150-1	minimum 1 test specimen (1100 mm x 360 mm) daily (2)	Yes
3.1.4.3 (3)	Proxy test of mechanical strength	Measurement on current production or test specimen	See manual of the manufacturer	minimum 1 test per day (2)	Yes

Note:

(1) Continuously means a frequency based on an assessment of the requirements of the process used by the manufacturer that will give assurance that product characteristics will comply with the initial type test.

(2) The test shall be undertaken to ensure that all glass types and thicknesses manufactured in one week are tested during that week.

(3) The manufacturer must choose to undertake one of 3.1.4.1, 3.1.4.2 or 3.1.4.3.

Annex B
(informative)

Tests for factory production control

B.1 Strength measurement

B.1.1 Four point bending strength test

B.1.1.1 Requirements

For the requirements, refer to the value given in EN 12150-1 when measured in accordance with EN 1288-3

B.1.1.2 Measurement method

This test should be performed in accordance with EN 1288-3.

B.1.1.3 Test specimens

The dimensions of the test specimens should be in accordance with EN 1288-3.

The test specimens will be manufactured in accordance with this document.

B.1.2 Optical surface pre-stress measurement

If the optical surface pre-stress measurement is a part of the factory production control then the values obtained during factory production control may not be less than the reference values obtained during the initial type test (see 5.2.2). Additionally for these test specimens the fragmentation should be in accordance with the requirements of EN 12150-1.

B.1.2.1 Measurement method

Pre-stress measurements should conform to the recommendation of the test equipment supplier.

The pre-stress measurements should have place on five points as indicated in Figure B.1

Dimensions in mm

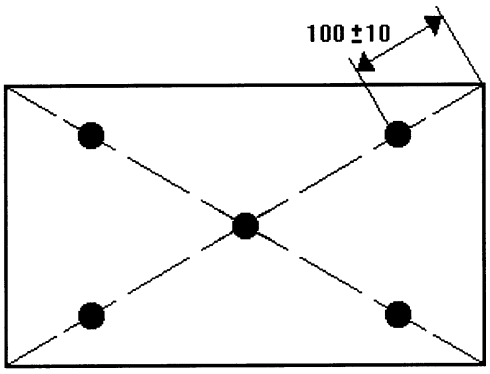

Figure B.1

B.2 Fragmentation test

B.2.1 Requirements

For the requirements, refer to EN 12150-1

B.2.2 Test method

Fragmentation tests should be performed in accordance with EN 12150-1.

Annex°C
(informative)

Provisions for voluntary involvement of third party(ies)

C.1 General

A manufacturer may employ third party(ies) for conformity assessment, which may involve a combination of initial type testing, inspection of factory production control, continuous surveillance and auditing of the product. The results of the conformity assessment by the bodies acting for regulators may be used by third party(ies) in carrying out their assigned tasks.

C.2 Voluntary tasks for third parties

A third party may be voluntarily contracted to perform the initial type testing, inspection of factory production control, continuous surveillance and auditing of the product.

Where a third party is voluntarily involved in the evaluation of conformity of the thermally toughened soda lime silicate safety glass products covered by this document then the assessment should be in accordance with clause 5, Evaluation of Conformity in this document.

A manufacturer may also voluntarily involve a third party in the control of characteristics, e.g. visual aspects, colour, etc., that are over and above the characteristics that are required for regulatory purposes.

C.3 Marking and labelling

The format of the label and position should be agreed between the body involved and the manufacturer.

All marks and/or labels of a voluntary nature should be so affixed as not to be confused with those marks and/or labels that are required for regulatory purposes.

In order to prevent confusion with any regulatory marking and/or labelling any marking and/or labelling associated with the involvement of third party(ies) on a voluntary basis should be accompanied with the following warning: "This marking/labelling has no relationship with any product characteristic covered by any legal marking and/or labelling".

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a mandate M/135 “Flat glass, profiled glass and glass block products” given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European standard shown in this Annex meet the requirements of mandate M/135 given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the thermally toughened soda lime silicate safety glass product characteristics covered by this annex for the intended uses herein; reference should be made to the information accompanying the CE marking.

WARNING: Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the thermally toughened soda lime silicate safety glass falling within the scope of this European Standard.

Note 1: In addition to any specific clauses relating to dangerous substances contained in this Standard, there may be other requirements applicable to products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

Note 2: An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (CREATE, accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This annex has the same scope as Clause 1 of this standard with regard to the products covered. It establishes the conditions for the CE marking of thermally toughened soda lime silicate safety glass intended for the use indicated below and shows the relevant clauses applicable (see Table ZA.1).

Construction Product: Thermally toughened soda lime silicate safety glass

Intended uses: In buildings and construction works

The requirement on a certain characteristic is not applicable in those Member States where there are no regulatory requirements on that characteristic for the intended end use of the product. In this case, manufacturers placing their products on the market of these Member States are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

Table ZA.1 – Relevant clauses for thermally toughened soda lime silicate safety glass and intended use in buildings and construction works

Product: Thermally toughened soda lime silicate safety glass as covered under the scope of this standard **Intended use**: **In buildings and construction works**			
Essential Characteristics	**Requirements in this and other European Standard(s)**	**Mandated Levels and/or classes**	**Notes**
Safety in the case of fire –			
Resistance to fire (for glass for use in a glazed assembly intended specifically for fire resistance)	4.2, 4.3.1 and 4.3.2.1	All	Minutes
Reaction to fire	4.2, 4.3.1 and 4.3.2.2	Any	Euroclasses
External fire performance (for roof coverings only)	4.2, 4.3.1 and 4.3.2.3	Any	Euroclasses
Safety in Use –			
Bullet resistance: Shatter properties and resistance to attack	4.2, 4.3.1 and 4.3.2.4	-	Classes of convenience
Explosion resistance: Impact behaviour and resistance to attack	4.2, 4.3.1 and 4.3.2.5	-	Classes of convenience
Burglar resistance: Shatter properties and resistance to attack	4.2, 4.3.1 and 4.3.2.6	-	Classes of convenience
Pendulum body impact resistance: Shatter properties(safe breakability) and resistance to impact	4.2, 4.3.1 and 4.3.2.7	-	Classes of convenience
Mechanical resistance: Resistance against sudden temperature changes and temperature differentials	4.2, 4.3.1 and 4.3.2.8	-	K and/or °C
Mechanical resistance: Resistance against wind, snow, permanent and imposed load and/or imposed loads of the glass unit	4.2, 4.3.1 and 4.3.2.9	-	mm
Protection against noise:-Direct airborne sound reduction	4.2, 4.3.1 and 4.3.2.10	-	dB

Energy conservation and heat retention: –			
Thermal properties	4.2, 4.3.1 and 4.3.2.11	-	W/(m².K)
Radiation properties:			
– light transmittance and reflectance	4.2, 4.3.1 and 4.3.2.12	-	Fractions or %
- solar energy characteristics	4.2, 4.3.1 and 4.3.2.13	-	Fractions or %

ZA.2 Procedure(s) for the attestation of conformity of thermally toughened soda lime silicate safety glass products

ZA.2.1 System(s) of attestation of conformity

The systems of conformity for thermally toughened soda lime silicate safety glass indicated in table ZA.1, are in accordance with the Decision of the Commission 2000/245/EC of 2000-02-02 as given in Annex III of the mandate for “Flat glass, profiled glass and glass block products”, is shown in table ZA.2 for the indicated intended use(s) and relevant level(s) or classes:

Table ZA.2 – System(s) of attestation of conformity

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Thermally toughened soda lime silicate safety glass	For used in a glazed assembly intended specifically to provide fire resistance	Any	1
	For uses subject to reaction to fire regulations	Euroclass A1*	4
	For uses subject to external fire performance regulations	Products requiring testing --- products "deemed to satisfy" without testing	3 --- 4
	For use as anti-bullet, or anti-explosion glazing --- For other uses liable to present "safety-in-use" risks and subject to such regulations	- --- -	1 --- 3
	For uses relating to energy conservation and/or noise reduction	-	3
	For uses other than those specified above	-	4

System 1: see Directive 89/106/EEC (CPD) Annex III.2.(i), without audit-testing of samples.

System 3: see Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility.

System 4: see Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility

* Products/materials that do not require to be tested for reaction to fire (eg Products/materials of Classes A1 according to Commission Decision 96/603/EC, as amended 2000/605/EC)

The attestation of conformity of the thermally toughened soda lime silicate safety glass in tables ZA.1. shall be based on the evaluation of conformity procedures indicated in tables ZA.3.1 to ZA.3.3 resulting from the application of the clauses of this or other European Standard indicated therein.

Where more than one table applies for the product, i.e. because its intended use makes different characteristics relevant, table ZA.3.1 has to be read in conjunction with subsequent tables in order to determine which characteristics assigned by the manufacturer in Table ZA.3.1 are type tested by a notified test lab (system 3) and which by the manufacturer (system 4).

Table ZA.3.1 – Assignment of evaluation of conformity tasks for thermally toughened soda lime silicate safety glass under system 1

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the Manufacturer	Factory production control (F.P.C.)	Parameters related to all relevant characteristics of table ZA.1	5.3
	Further testing of samples taken at factory	All relevant characteristics of table ZA.1	Annex A
	Initial type testing	All relevant characteristics of table ZA.1, except: resistance to fire, anti-bullet anti-explosion	5.2
Tasks for the notified body	Initial type testing	Resistance to fire, Anti-bullet Anti-explosion	5.2
	Initial inspection of factory and F.P.C.	Parameters related to all relevant characteristics of table ZA.1, in particular: Resistance to fire, Anti-bullet Anti-explosion	5.4
	Continuous surveillance, assessment and approval of F.P.C.	Parameters related to all relevant characteristics of table ZA.1, in particular: Resistance to fire, Anti-bullet Anti-explosion	5.5

Table ZA.3.2 – Assignment of evaluation of conformity tasks for thermally toughened soda lime silicate safety glass under system 3

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the Manufacturer	Factory production control (F.P.C.)	Parameters related to all relevant characteristics of table ZA.1	5.3
	Initial type testing	All other relevant characteristics of Table ZA.1 other than those shown below	5.2
Tasks for the notified body	Initial type testing	External fire performance Burglar resistance Pendulum body impact resistance Direct airborne sound insulation Thermal properties Radiation properties: – light transmittance and reflection – solar energy characteristics	5.2

Table ZA.3.3 – Assignment of evaluation of conformity tasks for thermally toughened soda lime silicate safety glass under system 4

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the Manufacturer	Factory production control (F.P.C.)	Parameters related to all relevant characteristics of table ZA.1	5.3
	Initial type testing	All relevant characteristics of table ZA.1, i.e. External fire performance	5.2

ZA.2.2 EC Certificate and Declaration of conformity

In case of products with system 1: When compliance with the conditions of this Annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix the CE marking. This certificate shall include:

— name, address and identification number of the certification body;

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use, …),

— provisions to which the product conforms (i.e. Annex ZA of this EN 12150-2)

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);

— the number of the certificate;

— conditions and period of validity of the certificate, where applicable;

— name of, and position held by, the person empowered to sign the certificate.

In addition, the manufacturer shall draw up a declaration of conformity (EC Declaration of conformity) including the following:

— name and address of the manufacturer, or his authorised representative established in the EEA;

— name and address of the certification body;

— description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;

— provisions to which the product conforms (i.e. Annex ZA of this EN 12150-2);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);

— number of the accompanying EC Certificate of conformity;

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

In case of products under system 3: When compliance with the conditions of this Annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

— provisions to which the product conforms (i.e. Annex ZA of this EN 12150-2);

— particular conditions applicable to the use of the product, (e.g. provisions for use under certain conditions, etc);

— name and address of the notified laboratory(ies);

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

In case of products under system 4: When compliance with this Annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

— provisions to which the product conforms (i.e. Annex ZA of this EN 12150-2);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

NOTE: Duplication of information between the declaration and certificate should be avoided. To avoid duplication of information, cross-reference between documents may be made when one contains more information than the other.

The above mentioned declaration and certificate shall be presented in the official language or languages of the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the thermally toughened soda lime silicate safety glass (or when not possible it may be on the accompanying label, the packaging or on the accompanying commercial documents e.g. a delivery note). The following information shall accompany the CE marking symbol:

— identification number of the certification body (only for products under systems 1);

— name or identifying mark and registered address of the producer;

— the last two digits of the year in which the marking is affixed;

— number of the EC Certificate of conformity or factory production control certificate (if relevant);

— reference to this European Standard;

— description of the product: generic name, material, dimensions, … and intended use;

— information on those relevant essential characteristics listed in table ZA.1 which are to be declared presented as :

  — declared values and, where relevant, level or class (including “pass” for pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in "Notes" in table ZA.1;

  — as an alternative, standard designation(s) alone or in combination with declared values as above, and;

  — “No performance determined” for characteristics where this is relevant.

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.

CE 01234	*CE conformity marking, consisting of the* *"CE"-symbol given in directive 93/68/EEC.* *Identification number of the certification body (where relevant) [16]*
AnyCo Ltd, PO Box 21, B-1050 **99** 01234-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *Certificate number (where relevant) [17]*
EN 12150–2 Thermally toughened soda lime silicate safety glass, intended to be used in buildings and construction works	*No. of European standard* *Description of product* *And*

Characteristics	
Resistance to fire	**NPD**
Reaction to fire	**A1***
External fire performance	**NPD**
Bullet resistance	**NPD**
Explosion resistance	**NPD**
Burglar resistance	**NPD**
Pendulum body impact resistance	**1(C)2**
Resistance against sudden temperature changes and temperature differentials	**200K**
Wind, snow, permanent and imposed load resistance	**6mm**
Direct airborne sound insulation	**31 -2 -3 dB**
Thermal properties	**5,6W/(m^2K)**
Radiation properties:	
light transmission and reflection	**0,70/0,13**
solar energy characteristics	**0,55/0,11**

information on regulated characteristics

Figure ZA.1 - Example CE marking information for system of attestation 1

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

Note: European legislation without national derogations need not be mentioned.

Bibliography

[1] EN 357 *Glass in Building - Fire resistant glazed elements with transparent or translucent glass products – Classification of fire resistance*

[2] EN 1288-3 *Determination of bending strength of glass - Part 3: Test with specimens supported at two points (four point bending)*

[3] EN ISO 9001 *Quality management systems - Requirements (ISO 9001:2000)*

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