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Glass in Building — Basic alumino silicate glass products

Part 2: Product standard

National foreword

This British Standard is the UK implementation of EN 15681-2:2017.

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European foreword

This document (EN 15681-2:2017) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by August 2017, and conflicting national standards shall be withdrawn at the latest by November 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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

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

EN 15681 *Glass in Building — Basic alumino silicate glass products* consists of the following parts:

— Part 1: Definitions and general physical and mechanical properties;

— Part 2: Product standard.

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

1 Scope

This European Standard covers the assessment and verification of constancy of performance and the factory production control of basic alumino silicate glass products 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 documents, in whole or in part, are normatively referenced in this document and 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 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 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 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using 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*

EN 13501-5, *Fire classification of construction products and building elements - Part 5: Classification using data from external fire exposure to roofs tests*

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

EN 15681-1:2016, *Glass in building - Basic alumino silicate glass products - Part 1: Definitions and general physical and mechanical properties*

EN 15998, *Glass in building - Safety in case of fire, fire resistance - Glass testing methodology for the purpose of classification*

prEN 16612, *Glass in building — Determination of the load resistance of glass panes by calculation and testing*

ISO 9385, *Glass and glass-ceramics — Knoop hardness test*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15681-1:2016 and the following apply.

3.1
factory production control
FPC
documented, permanent and internal control of production in a factory, in accordance with this standard

Note 1 to entry: See also Annex A.

3.2
product-type
set of representative performance levels or classes of a construction product, in relation to its essential characteristics, produced using a given combination of raw materials or other elements in a specific production process

3.3
essential characteristic
characteristic of the construction product which relate to the basic requirements for construction works

Note 1 to entry: Basic requirements for construction work are given in the regulation (EU) No 305/2011, Annex I.

3.4
performance of a construction product
performance related to the relevant essential characteristics, expressed by level or class, or in a description

3.5
level
result of the assessment of the performance of a construction product in relation to its essential characteristics, expressed as a numerical value

3.6
class
range of levels, delimited by a minimum and a maximum value, of performance of a construction product

3.7
type testing
TT
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 European Standard and that demonstrates compliance with this European Standard

3.8
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

3.9
product description
document that details the relevant parameters, e.g. process conditions, structure, etc., for defining a product that complies with the standard and that includes specific reference(s) to characteristics that are modified by the production process

3.10
product family
group of products determined by the manufacturer, which is made with similar components and processes and which is tested for FPC using the same test method

3.11
significant change
variation in performance beyond the permitted tolerance for the characteristic

4 Requirements

4.1 Product description

For conformity purposes the basic alumino silicate glass products 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 basic alumino silicate glass products manufacturer or his agent except in the case of regulatory requirements.

The product description shall contain at least the following:

— a reference to EN 15681-1 and EN 15681-2 and all other standards with which the manufacturer claims compliance;

— the type of manufacturing process used, i.e. float glass, drawn sheet glass, rolled glass;

— a description of the product family(ies);

— the spectrophotometric properties of the basic alumino silicate glass products;

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

4.2 Determination of the characteristic's performances

4.2.1 Characteristics of basic alumino silicate glass products

Basic alumino silicate glass products are made in accordance with EN 15681-1. For the characteristics listed in Table 1, the values given in EN 15681-1:2016, 5.1 and 5.2 shall be used.

Table 1 —Characteristics of basic alumino silicate glass products

Characteristic	**Symbol**	**Unit**
Density	ρ	kg/m^3
Hardness (Knoop hardness in accordance with ISO 9385)	$HK_{0,1/20}$	Dimensionless
Young's modulus	E	GPa
Poisson's ratio	μ	Dimensionless
Characteristic bending strength	fg,k	MPa
Resistance against sudden temperature changes and temperature differentials		K
Specific heat capacity	c	J/(kg.K)
Coefficient of linear expansion	α_l	K^{-1}
Thermal conductivity	λ	W/(m.K)
Mean refractive index to visible radiation	n	Dimensionless

4.2.2 Determination of the characteristics of basic alumino silicate glass products

4.2.2.1 General

If the basic alumino silicate glass products 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.

4.2.2.2 Safety in the case of fire - Resistance to fire

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

The testing methodology specified in EN 15998 shall be used for glass products that are claiming fire resistance.

4.2.2.3 Safety in the case of fire - Reaction to fire

Reaction to fire shall be determined and classified according to EN 13501-1.

Basic alumino silicate 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).

4.2.2.4 Safety in the case of fire - External fire performance (for roof coverings only)

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 EN 13501-5.

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

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

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

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

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

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

4.2.2.8 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.

4.2.2.9 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 15681-1 and shall be ensured by compliance with this standard.

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

The mechanical resistance of basic alumino silicate glass products is a characteristic value that shall be ensured by compliance with this document.

The value to be declared is the characteristic bending strength, as defined in EN 15681-1:2016, 5.2.

As long as prEN 16612 is not applicable for the glass design with respect to the concerned construction or building site, then the current method of determining mechanical resistance in the country of destination shall be applied.

4.2.2.11 Protection against noise - Direct airborne sound reduction

The sound reduction indexes shall be determined in accordance with EN 12758.

The values to be declared shall be rounded down to the nearest whole number.

4.2.2.12 Energy conservation and heat retention - Thermal properties

The thermal transmittance value (U-value) shall be determined in accordance with the following procedure:

a) The emissivity shall be taken equal to 0,837, as given in EN 15681-1

b) The U-value shall be determined by calculation in accordance with EN 673, with the normal emissivity as defined above and the nominal thickness of the glass panes.

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

The light transmittance and light reflectance shall be determined either:

a) in accordance with the following procedure:

   1) The light transmittance and light reflectance of one sample of basic alumino silicate glass product shall be determined in accordance with EN 410 and Annex B. The exact thicknesses of the glass shall be measured.

   2) The light transmittance and the light reflectance of any other thickness shall be calculated according to EN 410.

   3) The tool used to calculate the light transmittance and the light reflectance shall be validated.

b) or measured following EN 410 and Annex B.

The tolerances on the calculated light transmittance and light reflectance are given in Annex B.

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

The solar direct transmittance, the solar direct reflectance and the total solar energy transmittance (solar factor or g-value) shall be determined either:

a) in accordance with the following procedure:

   1) The solar direct transmittance and solar direct reflectance of one sample of basic alumino silicate glass product shall be determined in accordance with EN 410 and Annex B. The exact thicknesses of the glass shall be measured.

   2) The solar direct transmittance, the solar direct reflectance and the total solar energy transmittance (solar factor or g-value) of any other thickness shall be calculated according to EN 410.

   3) The tool used to calculate the solar direct transmittance, the solar direct reflectance and the total solar energy transmittance (solar factor or g-value) shall be validated.

b) or measured following EN 410 and Annex B.

The tolerances on the calculated solar energy characteristics are given in Annex B.

4.2.2.15 Durability / Conformity with the definition of basic alumino silicate glass products

Products shall conform to the definition, to the manufacturer product description and fulfil the requirements of basic alumino silicate glass products as defined in EN 15681-1.

The type testing concerns the product aspects as listed in Table 2.

Table 2 — Product aspects to be checked if product belongs to the group basic alumino silicate glass products

Product aspect	Requirement	Number of samples
Chemical composition	EN 15681–1:2016, Clause 4	1
Thickness	EN 15681–1:2016, 6.2	1
Light transmittance (distinction clear glass from tinted glass)	EN 15681–1:2016, 5.3	1

When products conform to the definition of basic alumino silicate glass as in 4.1, the other characteristic's performances in 4.2 are ensured during an economically reasonable working life.

The durability / conformity of basic alumino silicate 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 The durability of glass products depends also 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.

4.3 Characteristics other than listed in 4.2

Optical and visual characteristics and dimensional tolerances shall comply with EN 15681-1.

4.4 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets. In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction website on EUROPA accessed through: http://ec.europa.eu/growth/tools-databases/cp-ds/index_en.htm

5 Assessment and verification of constancy of performance – AVCP

5.1 General

The compliance of basic alumino silicate glass products with the requirements of this standard and with the performances declared by the manufacturer in the declaration of performances shall be demonstrated by:

1. Determination of the product type;

2. Factory production control by the manufacturer, including product assessment;

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.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

NOTE The assignment of tasks to the notified body(ies) and the manufacturer is shown in Tables ZA.2.1 to ZA.2.3.

5.2 Determination of the product type (see 5.1, 1)

5.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances. In addition, instead of performing any actual testing, type testing may make use of:

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

— standardized calculation methods and recognized calculation methods in the Clause 2 referenced standards, or in publications that are referred to in these standards;

— assessment previously performed in accordance with the provisions of this standard (i.e. historic data), may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system (see note 1) on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question;

— durability / conformity may be assessed indirectly by controlling the production processes according to this document.

NOTE 1 AVCP systems were called Attestation of Conformity (AoC) systems under the EU Construction Products Directive (89/106/EEC).

NOTE 2 Products CE marked in accordance with appropriate harmonized European specifications may be presumed to have the performances stated with the CE marking.

NOTE 3 The assignment of tasks to the notified body(ies) and the manufacturer is shown in Tables ZA.2.1 to ZA.2.3.

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

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for those same characteristics for all products within that same family

NOTE 4 Products may be grouped in different families for different characteristics.

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

5.2.2 Type testing of characteristic's performances

All characteristics in 4.2.2 that are declared shall be subject to type testing in accordance with 5.2.1.

5.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the basic alumino silicate glass products to which they relate.

5.2.4 Multiple lines/sites

If a manufacturer operates more than one line and/or site, the following can reduce the requirement for multiple type testing (TT):

a) The manufacturers' technical file for a product shall specifically cover all applicable sites and/or lines of the same manufacturer,

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

c) The manufacturer shall have a responsible individual designated to ensure product compliance based on:

   1) the operation of a consistent Factory Production Control system on all applicable sites and/or lines,

   2) the manufacturer has obtained evidence that shows the product to be consistent, with respect to both product characteristics and intended use characteristics,

   3) the manufacturer has in place an internal auditing scheme, including product consistency.

5.3 Factory Production control (FPC)

5.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

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.

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 factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked.

5.3.2 Inspection of samples in accordance with a prescribed test plan (see 5.1, 2a))

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

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

NOTE 2 The assignment of tasks to the notified body(ies) and the manufacturer is shown in Table ZA.2.1 to ZA.2.3.

Annex A of this document also summarizes the tests to 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.

5.4 Initial inspection of factory and of factory production control (see 5.1, 2b))

Initial inspection of factory and of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of Annex A are fulfilled.

During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European Standard are in place and correctly implemented, and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice, and

c) that the product complies with the product type samples, for which compliance of the product performance to the declaration of performances has been verified.

All locations where final assembly or at least final testing of the relevant product is performed shall be assessed to verify that the above conditions a) to c) are in place and implemented. If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

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 The assignment of tasks to the notified body(ies) and the manufacturer is shown in Tables ZA.2.1 to ZA.2.3.

Table 3 — Characteristics of interest for the Factory Production Control

Characteristic	**Interested parameter related to the characteristic**	**For details, refer to**
Resistance to fire Reaction to fire External fire performance	- checking incoming materials - chemical composition - product control after manufacture - labelling outgoing glass product	Annex A
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 materials - chemical composition - product control after manufacture - labelling outgoing glass product	Annex A
Direct airborne sound reduction Thermal properties Radiation properties: - light transmittance and reflection - solar energy characteristic	- checking incoming materials - chemical composition - product control after manufacture - labelling outgoing glass product	Annex A
Durability / conformity	- checking incoming materials - product control after manufacture	Annex A

5.5 Continuous surveillance and assessment of the factory production control (5.1, 2c))

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

NOTE The assignment of tasks to the notified body(ies) and the manufacturer is shown in Tables ZA.2.1 to ZA.2.3.

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 months. 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 standard.

The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to the determination of the product type and that the correct actions have been taken for non-compliant products.

5.6 Procedure for modifications

If modifications are made to the product, production process or FPC system that could induce a significant change (see 3.11) to any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type, as described in 5.2.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

5.7 Pre-production products (e.g. prototypes)

The basic alumino silicate glass product produced as pre-production products, assessed before full production is established shall be assessed as follows.

For type assessment, the provisions of 5.2.1 apply, together with the following additional provisions:

— the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

— on request of the manufacturer, the results of the assessment of samples of pre-production product may be included in a certificate or in test reports issued by the involved third party, as TT.

NOTE The manufacturer will preferably ensure the equivalence between pre-production samples and product made on the full production process.

6 Marking and labelling

6.1 General

All voluntary marking and/or labelling shall comply with 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.

6.2 Product marking

There is no requirement to permanently mark basic alumino silicate glass products.

Annex A
(normative)

Factory production control

A.1 Factory Production Control Requirements

A.1.1 General

The factory production control 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 A factory production control system conforming to EN ISO 9001 [1] and made specific to the requirements of this annex is deemed to satisfy the requirements of this annex.

A.1.2 Organization

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 organisational 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 documented control system to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained for a minimum period 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 15681-1. The following requirements shall be fulfilled.

A.1.3.2 Personnel

The manufacturer shall use appropriately trained personnel for the operation and inspection 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 basic alumino silicate glass products, and shall be adequately describe 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 inspections, tests and assessments;

f) records of non-conformity situations requiring corrective actions and the actions taken.

A.1.4 Equipment

A.1.4.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

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

A.1.4.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure that use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

A.1.5 Inspection and testing

Clause A.2 designates the inspections and tests by means of tables. The requirements and records shall be normative.

Frequencies shall be regarded as recommended minimum frequency.

A.1.6 Non-complying materials / products

The manufacturer shall have written procedures which specify how non-complying materials / products shall be dealt with.

Action shall be taken so that:

— non-conforming raw materials cannot be used;

— non-conforming products cannot be delivered.

A.2 Inspection and testing tables of basic alumino silicate glass production

A.2.1 Information to Table A.1 and Table A.2

The tables consist 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 practical, the concerned inspection or test may be ignored.

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

The required records in Tables A.1 and A.2 can 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 those 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.2.2 Use of proxy testing

A manufacturer may employ a test method/method of evaluation other than those referred to in Tables A.1 and A.2. 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 stock sizes of alumino silicate glass according to EN 15681–1

Section 1: Material Control						
Ref.	Material, inspection or test		Recommended method	Requirement	Recommended minimum frequency	Record
1.1	Incoming materials					
1.1.1	Raw material	option a)	Measurement	See purchase specification	See standard operating procedure	Yes
		option b)	- Audit of supplier - Supplier data check	- Quality system, e.g. EN ISO 9001 See purchase specification	- According to audit plan - As agreed with supplier	- Yes - Yes
1.1.2	Bought-in cullet		Visual / Measurement	See purchase specification	Each delivery	Yes
1.1.3	Raw material transport (check for contamination of vehicle)		Visual	Standard operating procedure	Each delivery	No
Section 2: Production control						
Ref.	Material, inspection or test		Recommended method	Requirement	Recommended minimum frequency	Record
2.1	Process control					
2.1.1	Process conditions of production equipment		Standard operating procedure	Standard operating procedure	Standard operating procedure	Yes
Section 3: Product control						
Ref.	Inspection or test		Recommended method	Requirement	Recommended minimum frequency	Record
3.1	Product control - Glass					
3.1.1	Chemical composition		Chemical analysis	EN 15681–1	Once per week	Yes
3.1.2	Light transmittance		Spectrophotometer	EN 15681–1	Once per week	Yes
3.1.3	Solar energy transmittance		EN 410	Claimed value	Once per week	Yes
3.2	Product control – Final Product					
3.2.1	Thickness		Measurement	EN 15681–1	Once per day	Yes
3.2.2	Plate dimensions		Measurement	EN 15681–1	Once per day	Yes
3.2.3	Optical quality		Measurement	EN 15681–1	Once per day	Yes
3.2.4	Visual quality		Visual test / Measurement	EN 15681–1	One stock size per day	Yes

Table A.2 — Inspection and test table for supplied and final cut sizes of alumino silicate glass according to EN 15681–1

Section 1: Material Control					
Ref.	Material, inspection or test	Recommended method	Requirement	Recommended minimum frequency	Record
1.1	Incoming materials				
1.1.1	Glass (clear and/or tint) [CE Mark plus accompanying documentation]	Visual	See purchase specification	Each delivery	Yes
Section 2: Production control					
Ref.	Material, inspection or test	Recommended method	Requirement	Recommended minimum frequency	Record
2.1	Process control				
2.1.1	Process conditions	Standard operating procedure	Standard operating procedure	Standard operating procedure	No
Section 3: Product control					
Ref.	Inspection or test	Recommended method	Requirement	Recommended minimum frequency	Record
3.1	Product control – Final Product				
3.1.1	Thickness	Visual	See customer order	1 test specimen per day	No
3.1.2	Dimensions	Measurement	See customer order	1 test specimen per day	No
3.1.3	Visual / optical quality	Visual	EN 15681–1	1 test specimen per day	No

Annex B
(normative)

Type testing of spectrophotometric and energy characteristics

B.1 Sampling

Samples for the type testing shall be representative of the product family as defined in the product description (see 4.1). One specimen is required for the measurement of the following characteristics:

— light transmittance and reflectance;

— energy transmittance and reflectance.

The same specimen shall be employed for the measurement of all characteristics.

B.2 Measurement of spectrophotometric characteristics

When measuring in accordance with EN 410, using an appropriate spectrophotometer, then three measurements per characteristic shall be made. The specimen shall be mounted in the spectrophotometer and a measurement made. Then the specimen shall be demounted, remounted and a further measurement made. This shall be repeated until the three measurements have been made. The average of the three measurements for each characteristic shall be used for the evaluation of the characteristic as required by Table B.1.

NOTE 1 These three measurements are made to remove any possible angular influence caused by the mounting of the measurement specimen.

In the event of a Fourier transform instrument, i.e. an integrating method, being used for the measurement of the characteristic then only one measurement per characteristic per sample is required. This measurement shall be used for the evaluation of the characteristics as required by Table B.1.

NOTE 2 An integrating method is regarded as a proxy method of measurement.

B.3 Tolerances on spectrophotometric characteristics

The spectrophotometric characteristics should be declared according to the requirements of Table B.1.

Table B.1 — Information on performances of photometric and energy characteristics

Characteristic	Method of Determining conformity	Determined Value	Declared value	Requirement
Light transmittance	EN 410	$\tau_{v,m}$	$\tau_{v,d}$	$\tau_{v,m} = \tau_{v,d} \pm 0{,}03$
Light reflectance	EN 410	$\rho_{v,m}$	$\rho_{v,d}$	$\rho_{v,m} = \rho_{v,d} \pm 0{,}03$
Energy transmittance	EN 410	τ_{e}	$\tau_{e,d}$	$\tau_{e} = \tau_{e,d} \pm 0{,}03$
Energy reflectance	EN 410	$\rho_{e,m}$	$\rho_{e,d}$	$\rho_{e,m} = \rho_{e,d} \pm 0{,}03$
Solar factor	EN 410		g_d	Derived from calculation
Emissivity	EN 15681–1:2016, Table 2	-	ε	Conventional value
Thermal transmittance	EN 673	-	*U-value*	Derived from calculation

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 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 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 basic alumino silicate glass products covered by this European Standard then the assessment should be in accordance with Clause 5 of this standard.

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 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.

Annex ZA
(informative)

Relationship of this European Standard with Regulation (EU) No.305/2011

(When applying this standard as a harmonized standard under Regulation (EU) No. 305/2011, manufacturers and Member States are obliged by this regulation to use this annex)

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a standardization request M/135 "Flat glass, profiled glass and glass block products" given to CEN and CENELEC by the European Commission (EC) and the European Free Trade Association (EFTA).

When this European Standard is cited in the Official Journal of the European Union (OJEU), under Regulation (EU) No. 305/2011, it shall be possible to use it as a basis for the establishment of the Declaration of Performance (DoP) and the CE marking, from the date of the beginning of the co-existence period as specified in the OJEU.

Regulation (EU) N° 305/2011, as amended, contains provisions for the DoP and the CE marking.

Table ZA.1 — Relevant clauses for basic alumino silicate glass products intended for use in buildings and construction works

Product: Basic alumino silicate glass products **Intended use: In buildings and construction works**			
Essential Characteristics	**Clauses of this standard related to essential characteristics**	**Classes and/or threshold levels**	**Notes**
Safety in the case of fire			
Resistance to fire (for glass for use in a glazed assembly intended specifically for fire resistance)	4.2.2, 4.2.2.2 and 4.2.2.15	Any	Classes
Reaction to fire	4.2.2, 4.2.2.3 and 4.2.2.15	A1	Classes
External fire performance (for roof coverings only)	4.2.2,4.2.2.4 and 4.2.2.15	All	Classes
Safety in Use			
Bullet resistance: Shatter properties and resistance to attack	4.2.2, 4.2.2.5 and 4.2.2.15	-	-
Explosion resistance: Impact behaviour and resistance to attack	4.2.2, 4.2.2.6 and 4.2.2.15	-	-
Burglar resistance: Shatter properties and resistance to attack	4.2.2, 4.2.2.7 and 4.2.2.15	-	-
Pendulum body impact resistance: Shatter properties(safe breakability) and resistance	4.2.2, 4.2.2.8 and 4.2.2.15	-	-

Product: Basic alumino silicate glass products **Intended use**: **In buildings and construction works**			
Essential Characteristics	**Clauses of this standard related to essential characteristics**	**Classes and/or threshold levels**	**Notes**
to impact			
Mechanical resistance: Resistance against sudden temperature changes and temperature differentials	4.2.2, 4.2.2.9 and 4.2.2.15	-	K
Mechanical resistance: Resistance against wind, snow, permanent and imposed load and/or imposed loads of the glass unit and edge seal when required	4.2.2,4.2.2.10 and 4.2.2.15	-	MPa
Protection against noise			
Direct airborne sound reduction	4.2.2, 4.2.2.11 and 4.2.2.15	-	dB
Energy conservation and heat retention:			
Thermal properties Declared normal emissivity ε_d U-value	4.2.2, 4.2.2.12 and 4.2.2.15	-	Decimals or % $W/(m^2.K)$
Radiation properties: light transmittance τv light reflectance ρv / $\rho' v$	4.2.2, 4.2.2.13 and 4.2.2.15	-	decimals or %
Solar energy characteristics Solar direct transmittance τe Solar direct reflectance ρ_e / ρ'_e Total solar energy transmittance g-value	4.2.2, 4.2.2.14 and 4.2.2.15	-	decimals or %
Durability / conformity	4.2.2.15, 5.2.1 and 5.2.2		-
Release of dangerous substances	4.4		

ZA.2 System of Assessment and Verification of Constancy of Performance (AVCP)

The AVCP system(s) for basic alumino silicate glass products indicated in Table ZA.1, can be found in the EC legal acts adopted by the EC: 2000/245/EC of 2000-02-02 (OJEU L 77) amended by 2001/596/EC (OJEU L 209).

Micro-enterprises are allowed to treat products under AVCP system 3 covered by this standard in accordance with AVCP system 4, applying this simplified procedure with its conditions, as foreseen in Article 37 of Regulation (EU) No 305/2011.

ZA.3 Assignment of AVCP tasks

The AVCP system(s) of the basic alumino silicate glass products as provided in Table ZA.1 is defined in Tables ZA.2.1 to ZA.2.3 resulting from application of the clauses of this or other European Standards indicated therein. The content of tasks assigned to the notified body shall be limited to those essential characteristics, if any, as provided for in Annex III of the relevant standardization request and to those that the manufacturer intends to declare.

Taking into account the AVCP systems defined for the products and the intended uses the following tasks are to be undertaken by the manufacturer and the notified body for the assessment and verification of the constancy of performance of the product.

Table ZA.2.1 — Assignment of AVCP tasks for basic alumino silicate glass products under system 1

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all essential characteristics of Table ZA.1 relevant for the intended uses which are declared	5.3 and Annex A
	Further testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan	All essential characteristics of Table ZA.1 relevant for the intended uses which are declared	
Tasks for the notified product certification body	An assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product	Essential characteristics relevant for the intended use which are declared, namely: - Resistance to fire, - Anti-bullet - Anti-explosion - Durability/ conformity of the product declaring at least one of the characteristics above	5.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to the following characteristics of Table ZA.1 relevant for the intended use which are declared, namely: - Resistance to fire, - Anti-bullet - Anti-explosion Documentation of FPC.	5.4
	Continuing surveillance, assessment and evaluation of FPC	Parameters related to the following characteristics of Table ZA.1 relevant for the intended use which are declared, namely: - Resistance to fire, - Anti-bullet - Anti-explosion Documentation of FPC.	5.5

Table ZA.2.2 — Assignment of AVCP tasks for basic alumino silicate glass products under system 3

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all essential characteristics of Table ZA.1 relevant for the intended uses which are declared	5.3 and Annex A
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.	Essential characteristics relevant for the intended use which are declared, namely: - External fire performance [a] - Burglar resistance - Pendulum body impact resistance - Direct airborne sound insulation - Thermal properties [b] - Radiation properties: - light transmittance and reflection [c] - solar energy characteristics [d] - Durability/ conformity of the product declaring at least one of the characteristics above and no characteristic under AVCP system 1	5.2

[a] for products requiring testing

[b] as emissivity is a conventional value, there is no need to involve a notified laboratory

[c] for the tasks described in 4.2.2.13, subclauses a1), a3) or b

[d] for the tasks described in 4.2.2.14, sub- clauses a1), a3) or b

Table ZA.2.3 — Assignment of AVCP tasks for basic alumino silicate glass products under system 4

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	An assessment of the performance of the construction product on the basis of testing, calculation, tabulated values or descriptive documentation of that product	All essential characteristics of Table ZA.1 except those listed in Tables ZA.2.1 and ZA.2.2. Durability/ conformity of the product declaring only characteristics of AVCP system 4	5.2
	Factory production control (FPC)	Parameters related to all essential characteristics of Table ZA.1 relevant for the intended uses which are declared	5.3 and Annex A

Bibliography

[1] EN ISO 9001, *Quality management systems — Requirements (ISO 9001)*

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