



EUROPEAN ASSESSMENT DOCUMENT

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INSULATED GLASS UNIT WITH STRUCTURAL SEALANT PUNCTUALLY ANCHORED

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1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD covers a structural sealant glazing kit consisting of infill elements made of glass which are fastened punctually to a supporting construction. For that purpose retaining devices, which are fixed to the supporting construction, grip into a U-profile which is glued into the insulating glass edge. The insulating glass units may consist of two or three glass panes. Instead of insulating glass units also mono panes in combination with thermal insulation can be used. The U-profile is inserted in the insulating glass edge next to the outer pane or alternatively next to the inner pane. It can be mounted as a continuous profile or in sections. The outer pane respectively the outer two panes are mounted via the structural sealant of the insulating glass edge, the inner pane respectively the inner two panes are held mechanically via retaining devices (toggles). The U-profile is applied both either with or without an upstand. The upstand serves as a wind protection device to secure the outer pane of the infill element in case of failure of the structural bond. Other wind protection devices are possible.

The self-weight of the glass panes always will be carried by mechanical supports as shown in Figure 2.

The dimensions of the infill elements depend on the specific composition of the system and shall be defined in the ETA.

If the construction shall be used as barrier against falling down specific mechanical protection devices are necessary.

The minimum content of the kit to be assessed shall include:

- Insulating glass unit with a thickness of 8 or 10 mm of the outer pane
- Mechanical self-weight support
- Retaining devices (toggles)
- Wind protection devices in case of bond failure

For illustration see Figure 1 (for example) and Figure 2.

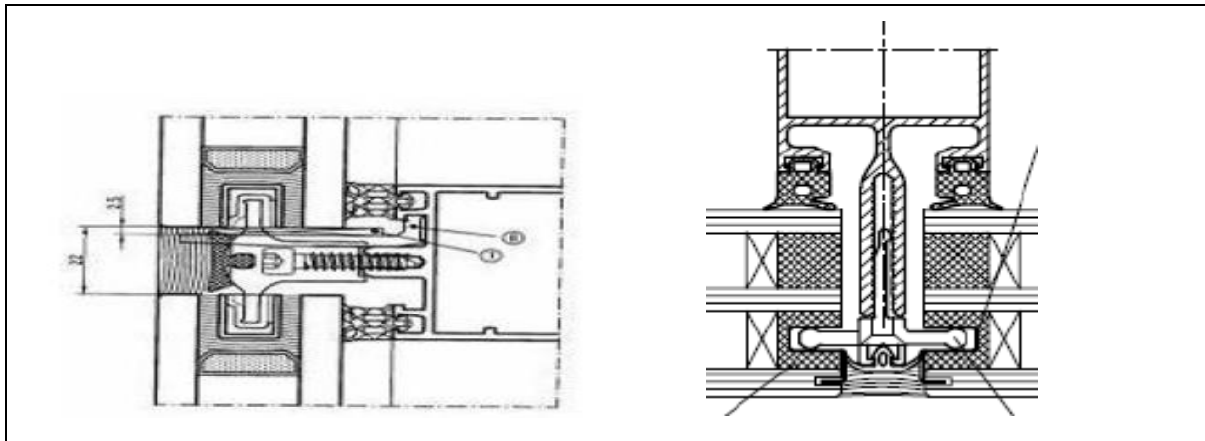


Figure 1 – The insulated glass unit with structural sealant punctually anchored with two and with three glasses and wind protection devices (other compositions are possible)

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended uses of the construction product

1.2.1 Intended uses

This EAD covers the following intended uses and assembled systems as in ETAG 002.

- Type I: Mechanical transfer of the self-weight of the infill to the sealant-support frame and thence to the structure. The structural seal transfers all other actions. Devices are used to reduce danger in the event of a bond failure.
- Type II: Mechanical transfer of the self-weight of the infill to the sealant-support frame and thence to the structure. The structural seal transfers all other actions and no devices are used to reduce danger in the event of a bond failure.

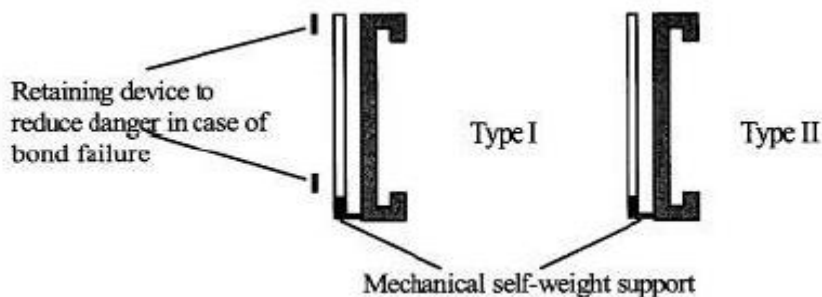


Figure 2 – Schematic example of the type I and II of Structural Sealant Glazing Kit (SSGK)

Restrictions for the bonding:

- The structural bond of the outer edge sealant is to be silicone, qualified by an ETA for loadbearing according to ETAG 002.
- The structural sealant is to be factory applied.

It is assumed that the system will follow normal good practice in relation to such matters as glass supply condition (cleanliness, freedom from defects, etc.) and application (use of heat-strengthened or laminated glass, etc., as required). These matters are not covered by this EAD as they are adequately covered by codes and standards.

Further assumptions:

- Machining of glass (for example where required for glazing safety devices) may only be carried out by and/or agreement with the manufacturer.
- Glass shall be selected to ensure it will safely transmit the wind load to the structural sealant support frame via the structural sealant in accordance with national design codes.

The "Insulated glass unit with structural sealant punctually anchored" is intended for use in facades and roofs, or parts of them, with glazing at any angle between vertical and 7° above horizontal (see Figure 3). An inclination with a slope to the outside with tensile stress of the structural sealant by means of the self-weight shall be avoided.

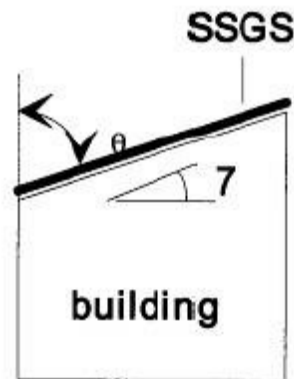


Figure 3 – Permissible inclination of the Structural Sealant Glazing System

To use the "Insulated glass unit with structural sealant punctually anchored" as barrier against falling down optional tests are defined in this EAD. In addition design calculation is requested.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the "Insulated glass unit with structural sealant punctually anchored" for the intended use of 25 years when installed in the works provided that the "Insulated glass unit with structural sealant punctually anchored" is subject to appropriate installation (see 1.1). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works¹.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

1.3.1 Specific terms for structural sealant glazing kits

The main part of the terminology is defined in ETAG 002 and is applicable for this EAD too.

1.3.2 Specific terms for "Insulated glass unit with structural sealant punctually anchored"

1.3.2.1 Retaining devices (toggles)

The retaining devices (toggles) retain the glass of the insulated glass unit mechanically and punctually to the substructure.

¹ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the working life referred to above.

1.3.2.2 U-profile

The U profile is the profile with a "U" shape bonded in the edge seal to hold the retaining devices (toggles). The U-profiles may be inserted in pieces or continuously.

1.3.2.3 Wind protection devices in case of bond failure

In case of bonding failure wind protection devices are intended to fix the panes. Different kinds of those devices are possible, for example:

- U-profile with upstand
- Special frame
- Discs

1.3.2.4 Mechanical devices for fall protection (optional)

If the construction shall be used as barrier against falling down further specific mechanical protection devices are necessary.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of "Insulated glass unit with structural sealant punctually anchored" is established in relation to the essential characteristics.

Table 1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Characteristic bending strength of the different glass products Heat-soaking process Compound effect of laminated glass	2.2.1.1	Description (Characteristics of the glass products)
2	Load bearing capacity	2.2.1.2	Description (Mechanical self-weight support) (Retaining devices (toggles)) (Wind protection devices)
3	Structural bonding	2.2.1.3	Description (ETAG 002-1 Table 8.3)
4	Impact resistance for barrier against falling down	2.2.1.4	Description (Dimensions of the kit tested)
5	Wind resistance	2.2.1.5	Description
6	Durability	2.2.1.6	Description
Basic Works Requirement 2: Safety in case of fire			
7	Reaction to fire	2.2.2.1	Description (Glass components)
8	Reaction to fire	2.2.2.2	Description (Mechanical devices)

No	Essential characteristic	Assessment method	Type of expression of product performance
9	Resistance to fire	2.2.3	Description (System)
Basic Works Requirement 4: Safety and accessibility in use			
10	Watertightness	2.2.4.1	Description
11	Air permeability	2.2.4.2	Description
Basic Works Requirement 5: Protection against noise			
12	Airborne sound isolation	2.2.5	Description
Basic Works Requirement 6: Energy economy and heat retention			
13	Thermal transmittance	2.2.6	Description

To facilitate the expression of different performances of the product with regard to combinations of essential characteristics referred to in Table 1 distinction is made between the following use scenarios:

- 1a / 1b: For the use of glass products different levels are defined according national provisions regarding the position of the glazing in the building and the probability of NiS-induced failure of tempered glass
- 2a / 2b: For the consideration of the compound effect of laminated safety glass
- 3a / 3b: For the use of laminated safety glass in the façade due to the fire reaction class

Use scenario 1a: When single panes of thermally toughened glass (mono panes) shall be used in the façade, the panes should be heat soaked. In deviation from the standard EN 14179-1 the duration of the holding phase is 4 hours. In addition the company involved in processing the heat soak test should be controlled by a notified body.

Use scenario 1b: There is no restriction for the use of single panes of thermally toughened glass (mono panes).

Use scenario 2a: For the bond behaviour of laminated safety glass a ball drop test according Annex A shall be performed. It is not allowed to consider a compound effect when designing the glass panes.

Use scenario 2b: The ball drop test according Annex A is not required. For the design of the glass panes (laminated safety glass) a compound effect may be considered, respecting $G = 0,4 \text{ N/mm}^2$.

Use scenario 3a: There is a restriction for the use of laminated safety glass in the façade dependent on the fire reaction class due to the place of installation.

Use scenario 3b: There is no restriction for the use of laminated safety glass in the façade.

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

Characterisation of products to be assessed shall be done in accordance with available specifications, notably standards, codes and other specifications. For the use and the obligatory dimensioning of the glass products only national standards are available. Regarding the design for the whole kit "Insulated glass unit with structural sealant punctually anchored" details shall be given in the ETA depending of the system and the special devices.

Different kits of the type covered by this EAD were already placed on the market according to 89/106/EEG. Therefore long term experience on site is provided.

2.2.1 Mechanical resistance and stability

2.2.1.1 Characteristics of the glass products

For the glass panes of the insulating glass units glass products according European harmonized standards shall be used. The characteristic bending strength of the glass panes according EN 1288-3 is required for designing to ensure that they will safely transmit the wind load to the structural sealant support frame via the structural sealant in.

For the use of heat strengthened glass products according to EN 1863-2, the fragmentation test should be passed according to EN 1863-2 with at least two panes of the maximum size and five panes 1000 mm x 1500 mm per thickness of the glass panes.

For laminated safety glass according EN 14449 an interlayer made of polyvinyl butyral (PVB) is required. Tear strength and elongation at rupture of the PVB-interlayer shall be determined according to EN ISO 527-3 with a test speed of 50 mm/min at 23 °C. The adhesive behaviour (see 2.1) for use scenario 2a / 2b shall be respected

2.2.1.2 Mechanical devices

2.2.1.2.1 Mechanical self-weight support

According to ETAG 002 5.1.4.3.1 and ETAG 002 Table 8.3. Depending on the system the deflection between the panes may be more than 0,5 mm (value of Table 8.3).

2.2.1.2.2 Retaining devices (toggles)

According to ETAG 002 5.1.4.3.1 and ETAG 002 Table 8.3. For the retaining devices (toggles), the tests should be performed with and without eccentric load.

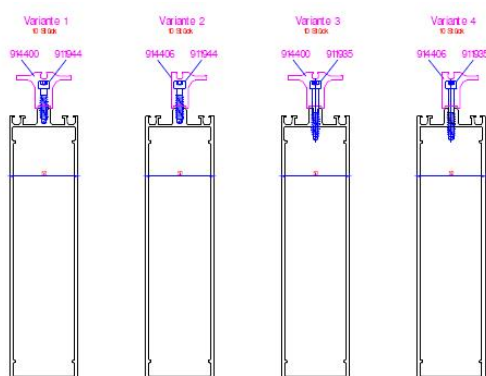


Figure 4 – Examples for tests with and without eccentric load

2.2.1.2.3 Allowable deformation of the U-profile

The deformation of the U-profile has to be limited so that the retaining devices cannot slip out of the U-profile and that the U-profile doesn't fail. For this a test shall be performed with maximal load depending on the dimensions of the glass panes which are assessed in the ETA.

2.2.1.2.4 Wind protection devices in case of bond failure

Conventional wind protection devices

Tests will be carried out according to ETAG 002 5.1.4.3.3 and ETAG 002 Table 8.3.

Special wind protection devices

Differently from ETAG 002 5.1.4.3.3 the glazing is machined and a recess is prepared to incorporate the special retaining devices. For this the following tests are provided.

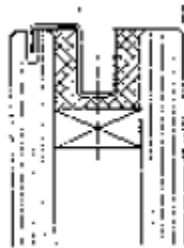


Figure 5 – Example for special wind protection devices

Pull-out tests

Two different failure modes should be tested. Test A and the test to determine the bending strength are required for the failure of the glass. Test B is required for the failure of the stainless steel sheets.

Test A

The aim is to get the ultimate load (tensile force) for the glass at the recess. Needed for the test: 15 test specimen, thermally toughened soda lime silicate safety glass, 300 mm x 300 mm; retaining devices made of stainless steel sheets. The test is carried out at a speed of 5 mm/min. It should be taken into account that during this test glass failure is expected. For this the retaining devices may be thicker than in practice. The retaining devices should be prevented from slipping out of the recess.

Test B

The aim is to get the ultimate load (tensile force) for the retaining devices made of stainless steel sheets. Furthermore the different kinds of failure of the retaining devices should be determined. Needed for the test: 15 test specimen, steel plate $t = 12$ mm, 300 mm x 300 mm, retaining devices made of stainless steel sheets. The test is carried out at a speed of 5 mm/min. It should be taken into account that during this test the failure of the retaining devices is expected. For this a steel plate instead of the glass plate is used. The retaining devices may slip out of the recess.

Determination of the bending strength of glass

According to EN 1288-3 reference glass panes should be tested to get characteristic values for the bending strength of the glass which is used for the pull-out tests. 15 specimen, 360 mm x 1100 mm.

2.2.1.3 Structural bonding

For the structural bonding a silicone shall be used, qualified by an ETA for loadbearing according to ETAG 002.

According to ETAG 002-1 5.1.4 tests shall be performed to qualify the U-profile for structural seal adhesion surface, particularly with specific sample according the real edge shape (Figure 6).

To avoid incompatibility between the structural sealant and other materials tests according ETAG 002-1, § 5.1.4.2.5 are requested. All materials in contact with the structural bonding shall be tested.

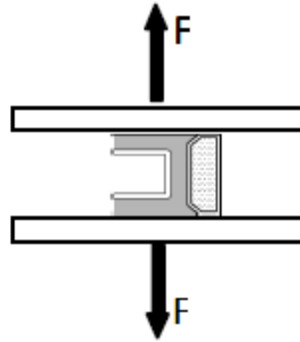


Figure 6 – Sample for specific tensile test

2.2.1.4 Verification procedure for the insulating glass unit used as barrier against falling down (optional)

For areas with different floor levels, where a risk of fall to a lower level is given, the "Insulated glass unit with structural sealant punctually anchored" shall be qualified for this property. Impact tests for "dynamic stress" and additional calculated verifications for "static stress" shall be performed. For this use one pane of the "Insulated glass unit with structural sealant punctually anchored" shall be made of laminated safety glass.

For impact tests see Annex B. The verification of the sufficient load-bearing capacity of the "Insulated glass unit with structural sealant punctually anchored" and of its direct fixings when subjected to impacts by persons is performed by experimental verification. The experimental verification may only be carried out by a testing laboratory approved for this purpose.

The load-bearing capacity under static loads for the "Insulated glass unit with structural sealant punctually anchored" shall be verified by calculation regarding the horizontal load at cross beam level. For insulating glass units it is further necessary to take account of pressure differences between the enclosed glass volume and the ambient air resulting from temperature variations and atmospheric pressure variations as well as of changes of levels between place of manufacture and place of installation. The design calculation shall be performed.

2.2.1.5 Wind resistance

Method of verification:

As a function of the SSGK which may have the function of a window or a curtain walling, this test shall be carried out in accordance with

- EN 12179:2000 - Curtain walling – Resistance to wind load - Test method
or

- EN 12211:2000 - Windows and doors – Resistance to wind load - Test method

For curtain walling, the test sample shall be defined in accordance to EN 12179:2000 Chapter 6 and the sequence of testing shall be made in accordance EN 13830 curtain walling – Product standard.

Assembly test:

The test assembly should fully represent the kit. For example, it should include an opening light where these are allowed for in the kit and be designed so that at least one of the elements has the largest surface area for which the drainage arrangements are designed. Tests on a number of separate assemblies or modifications to the original assembly can be necessary to include all the declared options, such as inside corners, outside corners and areas of non-vertical glazing. The supporting structure shall be designed by conventional calculation not to exceed the maximum deflection allowable for the kit at the maximum envisaged wind load. For curtain walling, the sample should be in accordance to EN 12179.

Method of assessing and judging:

Windows: Classification following EN 12210 - Windows and doors - Resistance to wind load - Classification. The maximum deflection of the prototype is to be mentioned in the ETA.

Curtain walling: Performance prescription according to EN 13116.

The design pressure to which the test has been done is to be mentioned in the ETA.

2.2.1.6 Durability

There are no specific durability aspects to be tested or assessed that have not been covered under other headings.

2.2.2 Reaction to fire

2.2.2.1 Assembled system

The reaction to fire behaviour of the kit depends on the reaction to fire behaviour of the glass panes. The mechanical devices are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that decision. Therefore only the components need to be tested and classified separately.

2.2.2.2 Components

Glass panes – Case 1:

The thermally toughened glass panes are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/582/EC (as amended) without the need for testing on the basis of its listing in that decision.

Glass panes – Case 2:

The laminated safety glass shall be tested, using the test methods relevant for the corresponding reaction to fire class, in order to be classified according to EN 13501-1 (see Annex C).

Mechanical devices:

The metal components like self-weight support, U-profile, retaining devices (toggles) and wind protection devices are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the EC Decision 96/582/EC without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

Therefore the performance of these products is A1.

The other materials of the "Insulated glass unit with structural sealant punctually anchored" (e.g. silicone) can be considered to satisfy any reaction to fire requirements. These components are embedded in the kit. They can be considered not to influence the reaction to fire class of the "Insulated glass unit with structural sealant punctually anchored" (Technical Report 021: Reaction to fire requirements for small components; June 2005).

2.2.3 Resistance to fire

The part of the works or assembled system in which the "Insulated glass unit with structural sealant punctually anchored" is intended to be incorporated, installed or applied shall be tested, using the test method relevant for the corresponding fire resistance class, in order to be classified according to the appropriate part of EN 13501.

2.2.4 Safety and accessibility in use

2.2.4.1 Water tightness

The testing of water tightness shall be conducted in accordance with EN 12155. The performance shall be given in compliance with EN 12154.

2.2.4.2 Air permeability

The testing of air permeability shall be conducted in accordance with EN 12153. The performance shall be given in compliance with EN 12152.

2.2.5 Protection against noise

The airborne of sound insulation of the façade is to be measured according to EN ISO 10140 Parts 1, 2, 4 and 5. The weighted airborne sound isolation R_w shall be determined according to EN ISO 717-1 and given in the ETA.

The test and assessment shall be performed with an assembly representing the worst case so that all façade build-ups covering by the ETA are considered.

Note: The option "no performance assessed" is possible.

2.2.6 Energy economy and heat retention

Regarding thermal insulation the thermal transmittance factor U of the façade shall be calculated according EN 12631.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 Systems of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 96/582/EC.

The systems are:

- System 1 for type II according 1.2.1
- System 2+ for type I according 1.2.1

In addition, with regard to e.g. reaction to fire for products covered by this EAD the applicable European legal act is: Decision 2003/656/EC.

The systems are: 1/3/4

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 2.

Dimensions and tolerances plus mechanical properties should be measured, visually checked and/or tested.

Table 2 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Glass panes acc. to § 2.2.1.1	2.2.1.1	CE-marking	Acc. to control plan	every delivery
2	Mechanical devices	2.2.1.2	Inspection certificate 3.1 acc. to EN 10204	Acc. to control plan	every delivery
3	Structural sealant	2.2.1.3	CE-marking	Acc. to control plan	every delivery
4	Additional devices for barrier against falling down	2.2.1.4	Inspection certificate 3.1 acc. to EN 10204	Acc. to control plan	every delivery
5	Bonding control with specific surfaces	ETAG 002	ETAG 002	Acc. to control plan	

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for "Insulated glass unit with structural sealant punctually anchored" are laid down in Table 3.

Table 3 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control <i>(for systems 1+, 1 and 2+ only)</i>					
1	The notified body has to verify that each manufacturing plant for bonding, in particular the staff and the equipment, and the factory production control, are suitable to ensure continuous and orderly manufacturing of the products in compliance with the provisions given in section 2.1 and in the Annexes of the European Technical Assessment.		Acc. to control plan		At the beginning of the production
Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1+, 1 and 2+ only)</i>					
2	The notified body shall perform the surveillance at each manufacturing plant for bonding. It shall be verified that the factory production control is maintained taking into account the specified control plan.		Acc. to control plan		Twice a year

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance.

- ETAG 002 – Edition November 1999 3rd Amendment: May 2012 – Guideline for European Technical Approval for STRUCTURAL SEALANT GLAZING KITS (SSGK) Part 1: Supported and unsupported Systems
- EN 12211:2000 - Windows and doors - Resistance to wind load – Test method
- EN 12179:2000 - Curtain walling - Resistance to wind load – Test method
- EN 572-1:2012 - Glass in building – Basic soda lime silicate glass products – Part 1: Definitions and general physical and mechanical properties
- EN 13059:2003 - Window – Soft and heavy body impact – Test method – Safety requirement and classification
- EN 14019:2014 - Curtain walling – Impact Resistance – Performance requirements
- EN 14449:2005 - Glass in building – Laminated glass and laminated safety glass – Evaluation of conformity/Product standard
- EN 1288-3:2000 - Glass in building - Determination of the bending strength of glass Part 3: Test with specimen supported at two points (four point bending)
- EN 12150-1 – Glass in building – Thermally toughened soda lime silicate glass – Part 1: Definition and description
- EN 13823:2015 – Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
- EN 1182:2010 – Reaction to fire tests for products – Non-combustibility test
- EN ISO 1716:2010 - Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value)
- EN ISO 11925-2:2011 – Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test
- EN 673:2011 – Glass in building – Determination of thermal transmittance (U value) – Calculation method
- EN 674:2011 – Glass in building – Determination of thermal transmittance (U value) – Guarded hot plate method
- EN 675:2011 – Glass in building – Determination of thermal transmittance (U value) – Heat flow meter method
- EN 1279-5:2009 – Glass in building – Insulating glass units – Part 5: Evaluation of conformity
- EN 10204:2005 – Metallic products – Types of inspection documents
- EN 12600:2003 – Glass in building – Pendulum test – Impact test method and classification for flat glass
- EN 12153:2000 – Curtain walling – Air permeability – Test method
- EN 13830:2015 – Curtain walling – Product standard
- EN 12155:2000 – Curtain walling – Watertightness – Laboratory test under static pressure
- EN 12154:2000 – Curtain walling – Watertightness – Performance requirements and classification
- EN 14179-1:2005 - Heat soaked thermally toughened soda lime silicate safety glass – Part 1: Definition and description
- EN 1863-2:2004 - Heat strengthened soda lime silicate glass - Part 2: Evaluation of conformity/Product standard; appropriate version
- EN 14449:2005 - Glass in building - Laminated glass and laminated safety glass - Evaluation of conformity/Product standard; appropriate version
- EN ISO 527-3:1995/AC:2002 - Plastics – Determination of tensile properties – Part 3: Test conditions for films and sheets
- EN 13501-1:2010 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
- EN ISO 12631:2012 – Thermal performance of curtain walling – Calculation of thermal transmittance
- EN ISO 10140: Part 1 – 5 – Acoustics – Laboratory measurement of sound insulation

ANNEX A

Ball drop test

Scope of application and objective

The ball drop test serves to test the behaviour of laminated glass in case of an impact-like hit of a hard impactor with small compact mass.

Equipment

Ball made of rolling bearing steel with a diameter of 63,50 mm (mass approx. 1030 g).

Fall mechanism

A mechanism for holding and releasing the dropping object (e.g. an electromagnet), which allows adjusting the drop height of 4 m and does not give any impulse to the dropping object so that it will be accelerated by the gravitational force only and falls perpendicularly.

Holding device for the sample

The holding device (see Figure 1) consists of two frames of hot-rolled flat steel. The edge surfaces of the frames processed to fit together have a width of 15 mm and are covered with a 3 mm thick and 15 mm wide frame of rubber strips of a hardness of (40 ± 10) IRHD. The upper frame weighs approx. 7 kg. The holding device is placed on a base plate of steel with a thickness of 12 mm. Between the base plate of steel and the base is a sandwich layer mad of 3 mm thick rubber with a hardness of (40 ± 10) IRHD.

Samples

At least five samples of the following setup shall be examined: 3 mm float glass (0,38 mm PVB film / 3 mm float glass; length of sample = width of sample = (500 ± 5) mm.

The samples shall be plane. Before the test they shall be stored for at least four hours at test temperature.

Execution

The test temperature is (23 ± 2) °C.

The sample is placed in the holding device, the drop height (lower edge of dropping object to surface of sample) adjusted to (4000 ± 40) mm and the dropping object released. The dropping object shall not hit the sample more than 50 mm off the sample centre; otherwise the test shall be repeated with a new sample.

Result

The test is passed when the ball does not penetrate the sample of the horizontal and vertical glazing.

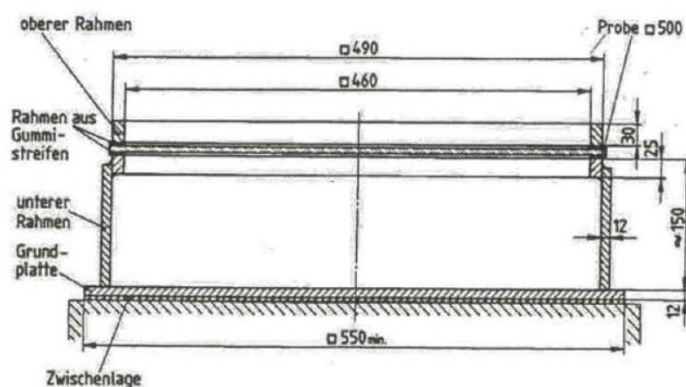


Figure 1: Holding device for the ball drop test)

ANNEX B

Impact tests

The load-bearing capacity of the "Insulated glass unit with structural sealant punctually anchored" and of its direct fixings when subjected to impacts shall be performed by experimental verification. For verifying the secure anchorage of the glazing construction at the building the relevant acknowledged technical rules for works shall be observed.

The tests described in the following may only be carried out by a testing laboratory approved for this purpose. The testing laboratory can decide, if the loadbearing capacity under impact actions of different construction types is to be assessed, which of the different types shall be tested. The test report shall include the detailed description of the test arrangement and the performed tests.

The experimental verification of the loadbearing capacity under impact actions of the "Insulated glass unit with structural sealant punctually anchored" is performed by means of a pendulum using a twin tire with reference to EN 12600:2003. A drop height of 900 mm of the pendulum shall be used.

The test arrangement shall represent on the safe side the load-bearing performance of the original construction (including base construction). Favourably acting sealings shall be, if relevant, opened before the impact test is carried out. In-situ tests at the original installation are admissible. The testing laboratory decides, which components may be further used after the impact tests have been carried out.

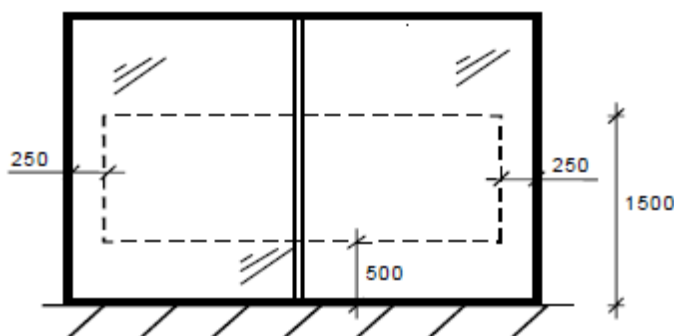


Figure 1 The so called Category A with impact area inside the interrupted lines
(all dimensions are in mm)

Two to four impact points shall be specified by the testing laboratory for the impact tests by taking account of the limitations according to Figure 1 with the aim of maximum glass and support stress. The tests shall be performed in room climate. For in-situ tests the testing laboratory decides, whether the climatic test conditions can be considered as regular.

The testing laboratory specifies, as a function of the construction type, the number of the panes to be tested. As a rule at least two panes shall be tested per type of construction.

At least one impact shall be performed on each impact point. After each impact using the pendulum the entire construction shall be examined with regard to permanent deformations and damages of the joints (e.g. toggles). Where permanent damages or a major elasticity of the construction is detected, the planned state of the test arrangement must be reset. The sufficient remaining load-bearing capacity of the glazing construction damaged by impact tests shall be checked by another pendulum impact with a drop height of 100 mm. This impact shall be performed on the same impact point, where the pendulum has caused the damage of the construction.

The pendulum impact test is considered to be passed, if neither the impact body punched through the glazing or the element torn out of the anchorage, nor broken pieces fall down, which could endanger the traffic areas. After the impact tests laminated safety glass with reference to EN 12600:2003 shall not show any cracks with a crack width of more than 76 mm. Monolithic outer panes of the "Insulated glass unit with structural sealant punctually anchored" shall not break in the impact tests.

In the case, where the inner pane of the "Insulated glass unit with structural sealant punctually anchored" consists of thermally toughened glass the outer pane of laminated safety glass shall alone resist the pendulum drop height of 450, even if the inner pane of thermally toughened glass did not break in the tests with the pendulum drop height of 900 mm.

ANNEX C

Test proposal on the verification of the reaction to fire of the "Insulated glass unit with structural sealant punctually anchored" according to EN 13501-1 (symmetrical composition)

1 Testing according to EN 1182

It is expected that this standard will not be applied; otherwise it shall be examined in accordance with the standard.

2 Testing according to EN 1716

2.1 Glass panes

The glass panes are classified in class A1 according to Commission Decision 96/603/EC (as amended). The heat value (PCS value) amounts to 0 MJ/kg.

2.2 Intermediate layers

For the intermediate layers, such as foils (PVB), etc. the heat value (PCS value) shall be determined according to the standard. (If the admissible PCS value for an A1 construction material is exceeded testing the laminated glass shall be performed according to EN 13823 in order to classify the construction product according to EN 13501-1).

2.3 Mechanical devices

The metal components of the "Insulated glass unit with structural sealant punctually anchored" are classified in class A1 according to Commission Decision 96/603/EC (as amended). The combustible components do not considerably contribute to the fire spread. Therefore the verification of reaction to fire can be done without testing (cf. "small components document" endorsed by the EOTA TB).

3 Testing according to EN 13823

Relevant parameters for this test method:

- composition of the laminated safety glass
- type and thickness of the glass used for the glass panes
- type (chemical composition) and thickness of the PVB-interlayer
- joint arrangement

General remarks on the set-up of the test specimen:

A horizontal joint as well as a vertical joint (as normally prescribed in EN 13823) on the long wing shall not be considered when preparing the SBI test specimens.

Both wings of the specimen shall be assembled according to EN 13823 Figure 2 in a free standing position. The instructions of EN 13823 Clause 5.2.2 a) have to be considered.

The glazing shall be fixed to according the "Insulated glass unit with structural sealant punctually anchored".

The distance between backside of the specimen and backing board shall be at least 80 mm. The pointwise support of the specimen also allows for free ventilation behind the specimen.

Note: If during testing the specimen collapses, the test cannot be evaluated.

Testing with the smallest thickness of the glass panes (per type of glass to be used) with the PVB-interlayer which shows the largest thickness and which verify the highest heat value (PCS value) according to EN ISO 1716.

The results with the smallest thickness of the glasses will also include the use of larger glass thickness.

The use of a PVB-interlayer with the largest thickness and the most critical heat value also includes the use of intermediate layers with the same or a smaller thickness and a lower PCS value.

4 Testing according to EN ISO 11925-2

Relevant parameters to be observed when performing this test:

- composition of the laminated safety glass
- type and thickness of the glass used for the glass panes
- type (chemical composition), number and thickness of the PVB-interlayer
- edge seal and sealing material (between the panes)

Test program suggested:

Three tests each with edge flame attack and on samples turned on 90 degrees on the laminated safety glass panes with the most critical result from the SBI test and heat value determination and taking into consideration edge seal and sealing material.

From the variant, which shows the most unfavourable test results regarding reaction to fire, three more test are carried out. These results are consulted as basis for the classification. The result applies to all aforementioned variants and applications.

Sealing materials between frame and panes:

Sealing materials not covered by EOTA-TR 21 shall be tested separately and taking in account the following parameters:

- each different composition
- minimum degree of compression (testing between steel angles)
- maximum joint width
- maximum joint depth

The test result covers higher degrees of compression, smaller joint widths and smaller joint depths.