BRITISH STANDARD

BS EN
1279-6:2002

Glass in building — Insulating glass units —

Part 6: Factory production control and periodic tests

The European Standard EN 1279-6:2002 has the status of a British Standard

ICS 81.040.20

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 1279-6:2002.

The UK participation in its preparation was entrusted by Technical Committee B/520, Glass and glazing in building, to Subcommittee B/520/2, Insulating 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

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Building and Civil Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 12 July 2002

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 69 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 40109 X

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1279-6

July 2002

ICS 81.040.20

English version

Glass in building - Insulating glass units - Part 6: Factory production control and periodic tests

Verre dans la construction - Vitrage isolant préfabriqué scellé - Partie 6: Contrôle de production en usine et essais périodiques

Glas im Bauwesen - Mehrscheiben-Isolierglas - Teil 6: Werkseigene Produktionskontrolle und Auditprüfungen

This European Standard was approved by CEN on 5 March 2002.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document EN 1279-6:2002 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 January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

The described testing and inspections are part of routine production of insulating glass units.

This Part of the standard does not stand alone, it is part of one standard:

- prEN 1279-1, Glass in building - Insulating glass units - Part 1: Generalities, dimensional tolerances and rules for the system description.
- prEN 1279-2, Glass in building - Insulating glass units - Part 2: Long term test method and requirements on moisture vapour penetration.
- prEN 1279-3, Glass in building - Insulating glass units - Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances.
- EN 1279-4, Glass in building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals.
- prEN 1279-5, Glass in building - Insulating glass units - Part 5: Evaluation of conformity.
- EN 1279-6, Glass in building - Insulating glass units - Part 6 Factory production control and periodic tests.

The annexes A, B and C are normative. The annexes D, E, F, G, H, J and K are informative.

This standard includes a Bibliography.

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

1 Scope

This European Standard is the product standard for insulating glass units, which defines insulating glass units, and ensures by means of an adequate evaluation of conformity to this standard that over time:

- energy savings are made because the U-value and solar factor do not change significantly;
- health is preserved because sound reduction and vision do not change significantly;
- safety is provided because mechanical resistance does not change significantly.

It covers additional characteristics that are of importance for trade. Marking conditions are included.

For glass products with electrical wiring or connections for e.g. alarm or heating purposes, this standard covers only wiring subject for electrical potential difference to earth less than 50 V a.c. or less than 75 V d.c.

The main intended uses of the insulating glass units are installations in buildings and constructions such as in windows, doors, curtain walling, roofs and partitions where there exists protection against direct ultraviolet radiation at the edges.

NOTE 1 In cases where there is no protection against direct ultraviolet radiation at the edges, such as structural sealant glazing systems, additional European technical specifications should be followed.

NOTE 2 Units where the nature is only artistic are not part of this standard.

This Part of the standard, which is inextricably bound up with the other Parts of the standard, covers the routine factory production control (annex A), the periodic testing and inspection (annex B) and fogging test (annex C) to verify that production conforms with the system description.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

prEN 1279-1, *Glass in building - Insulating glass units - Part 1: Generalities, dimensional tolerances and rules for the system description.*
prEN 1279-2, *Glass in building - Insulating glass units - Part 2: Long term test method and requirements on moisture vapour penetration.*
prEN 1279-3, *Glass in building - Insulating glass units - Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances.*
EN 1279-4, *Glass in building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals.*
EN 10204, *Metallic products - Types of inspection documents.*
prEN 13022, *Glass in building - Structural sealant glazing.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions in prEN 1279-1 apply, as well as the following terms and definitions.

3.1
factory production control
permanent control of production exercised by the manufacturer. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control documentation system ensures a common understanding of quality assurance and enable the

achievement of the required product characteristics and the effective operation of the production control to be checked

3.2
information from the supplier
information which is based on periodic measurements and on the fact that the supplier operates a quality assurance system which ensures that no significant deviations occur between measurements. See 5.2.6

3.3
lot
amount of products of a continuous production run, which can be a fixed number (e.g. 5, 100, 3 000) or manufactured in a fixed interval (e.g. 1 hour, half a day, a shift, one day)

3.4
periodic tests
series of tests for checking the continuing conformity of the product with the technical specifications

4 Quality assurance and factory production control

A manufacturer operating under a third party surveillance Quality Assurance System according to EN ISO 9001 (Bibliography [4]), in which the quality procedures cover to the relevant annex(es) of this Part of the standard has the benefit of being presumed to comply with this EN 1279-6.

5 Factory production control requirements

5.1 Organisation

5.1.1 Responsibility and authority

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

a) initiate action to prevent the occurrence of product non-conformity;
b) identify and record any product quality problems.

5.1.2 Management representative for factory production control

At every factory unit, where the insulating glazing units are manufactured, the manufacturer shall appoint a person who shall have defined authority, appropriate knowledge and experience of the production of the insulating glass, to be responsible for the conduct and supervision of factory production control procedures, including assessment of the qualifications of any subcontracted testing and inspection body.

NOTE Accreditation to EN 45000 series would be a sufficient but not a necessary qualification for such a body (see Bibliography [1], [2] and [3]).

It will also be the responsibility of the appointed person to ensure that the requirements given in this standard are implemented and maintained.

5.1.3 Management review

The production control system shall be reviewed at appropriate intervals by the manufacturer's management staff to ensure its continuing suitability and effectiveness in respect to this Part of the standard. Records of such reviews shall be maintained.

5.2 Quality system

5.2.1 General

The manufacturer shall establish and maintain a documented system as a means of ensuring that the product conforms to this standard. The following requirements hereafter shall be fulfilled.

5.2.2 Personnel

The manufacturer shall appoint personnel for the inspections and production control tests that will be carried out before, during and after production (e.g. incoming materials), or the manufacturer can subcontract to a testing or inspection body.

5.2.3 Documentation

The manufacturer's documentation and procedures shall be relevant to the production and process control of the insulating glass unit, and in this quality manual and associated documentation shall describe adequately the following:

a) the quality aims and the organizational structure, responsibilities and powers of the management, especially the management representative for the factory production control, with regard to product conformity;
b) the procedures for specifying and verifying the raw and constituent materials or components;
c) the product, the production control and other techniques, processes and systematic actions that will be used;
d) the inspections and tests that will be carried out before, during and after production, and the frequency with which they will be carried out;
e) provisions for defining, keeping and using the records of the results of inspections and tests;
f) the test reports in accordance with all other relevant Parts of this standard;
g) the provisions taken for control of products that fail the specified criteria;
h) documents of conformity made available by suppliers.

The documents shall be maintained during a period which shall be laid down in the quality manual. Records may be in the form of any type of media, such as hard copy or electronic, e.g. by means of a declaration in accordance with EN 10204.

5.2.4 Test equipment

Test equipment necessary for factory production control shall be calibrated as described in the quality manual.

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

5.2.5 Inspection and testing

Inspection and testing depends on the design of the insulating glass units. The different inspection and testing schemes are described in the annex A and annex B.

Annex A details the inspection and tests: the requirements and the records are normative, the frequency and test methods are recommended and therefore only given as information. Those recommended frequencies are sufficient for production. If no testing scheme, method or frequency is described in the annex A, and/or another testing scheme is used, it shall be described in detail in the quality manual.

Annex B describes the periodic, low frequency test.

Annex C describes the fogging test.

Annex D onwards describes the tests referred to in annex A as recommendations.

5.2.6 Quality contracts

Inspection and tests on incoming materials (the Material control part of the tables in the Annex A) can be reduced on the basis of quality contracts between the supplier and the insulating glass unit manufacturer, on condition that the contract refers to the appropriate tables in annex A.

Quality contracts shall include the possibility of an audit of the supplier.

The quality contracts can also include the documents demonstrating conformity to this European Standard. If so, and supplying manufacturers who comply with EN ISO 9001, the inspection and tests on incoming material may be further reduced, so that the inspection and tests are not unnecessarily duplicated.

Where contractually requested, quality records shall be made available by suppliers for evaluation by the customer's representative for an agreed period.

6 Handling, storage, packaging and delivery

The manufacturer shall establish, document and maintain procedures for handling, storage, packaging and delivery of the insulating glass units. The procedure shall be adequate to guarantee the quality of the product.

Delivered individual products or product batches shall be identifiable and traceable with regard to their production data. For this purpose, the manufacturer shall establish and maintain the records required in the relevant technical specification, and shall mark the insulating glass units or their delivery documents correspondingly.

7 Training of personnel

The manufacturer shall establish and maintain procedures for the training of all personnel activities affecting quality. Personnel performing specific assigned tasks shall be qualified on the basis of appropriate education training and/or experience, as required. Appropriate records of training shall be maintained.

Annex A
(normative)

Inspection and testing tables of insulating glass units

A.1 General

The tables in A.2 onwards in this annex deal with particular design of insulating glass units. When a modified or new design cannot find tables fitting with its production method, appropriate tables shall be defined. These new tables can be incorporated in the standard when revision of the standard takes place.

NOTE 1 In the meantime, a CEN report containing the draft new tables can be elaborated, so that placing the product on the market may proceed without interruption.

Each of A.2 till A.7 in this annex onwards, dealing with a particular design, consists of two parts: additional definitions related to the specific design, and a table containing three sections:

– first section: Material control;
– second section: Production Control;
– third section: Product control.

Due to the nature of products used, it is reasonable to carry out some tests simultaneously on line. This is acceptable providing sufficient controls are incorporated into the system to allow change/replacement if a test failure occurs.

Some inspections in the product control section can be, and therefore may be performed during production (e.g the determination of the intended thickness of sealant on the back of the spacer can be performed during placing the spacer onto the glass). In those cases, and to prevent duplication of inspections, the production control documentation shall contain the relevant instructions.

The product control section of the tables refer to a random sample inspection plan. That inspection plan is a recommended plan. See Table A.1 in NOTE 2. Use of this plan, or plans with the same statistical accuracy (e.g. based on ISO 2859, Bibliography [6]) can be helpful for passing successfully periodic inspections by independent bodies.

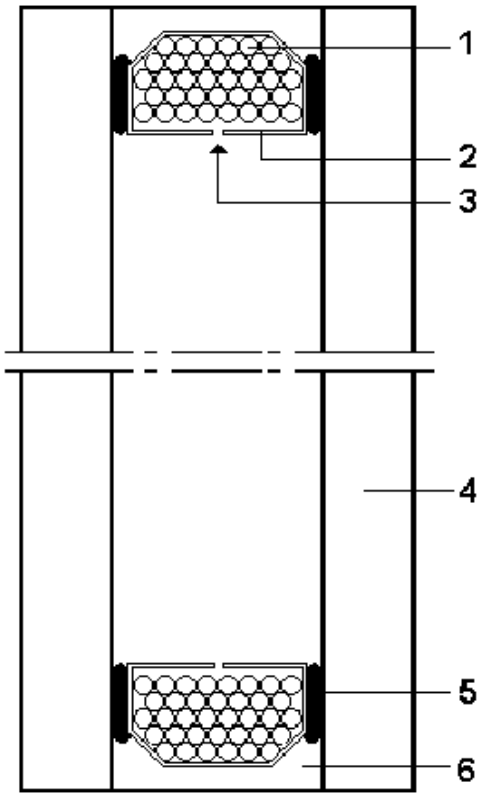
NOTE 2 **Table A.1 - Recommended random sample inspection plan for finished insulating glass units** (decision is to be made by the manufacturer)

Lot or day's production	Number of test pieces for inspections	Maximum number of units falling outside the system description
2 – 15	2	0
16 – 25	3	0
26 – 90	5	0
91 – 150	8	1
151 – 500	13	1
501 – 1 200	20	2
1 201 – 9 999	32	3

To be effective, Table A.1 should be used in the following way. When the inspection of a lot or a day's production reveals more than the acceptable number of occurrences which exceed the absolute limits described in the system description (for the rules of the system description, see prEN 1279-1), all the units of the lot or day's production should be re-inspected. Any units which exceed the absolute limit(s) should be repaired or re-manufactured. Decision is to be made by the manufacturer.

A.2 Air filled organic sealed insulating glass units with hollow spacer

The listed inspections and tests relate to organic sealed (without hot melt butyl as outer seal) air-filled insulating glass units with hollow spacer. Figure 1 gives the principle of this system of insulating glass units.



Key 1 Desiccant 2 Spacer bar 3 Diffusion openings
4 Glass 5 Inner seal 6 Outer seal

Figure A.1 - A principle of an organic sealed insulating glass units with hollow spacer

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

The inspections and/or tests on the raw materials should be carried out in time to react in the case of non-conformance of the material.

Volatile content tests are only to be carried out if the cavity of the unit is in contact with a material with a volatile content so high that condensation can occur, and if there is no information from the supplier that the volatile content is below a certain limit. This limit is defined as 1,5 times the value for the volatile content of the material for use in construction of the samples which were prepared for the fogging test, and when the same adequate heating procedure is used for both. For the volatile test parameters, see annex G. In connection with the volatile contents in Table A.2, one has to read "recommended limits" instead of "requirements".

No volatile content test is required when fogging tests are carried out.

The required records in the following tables can be any documents such as order documents, production documents, logbook, etc. as described in the quality procedures and associated documentation. When no record is required, this is valid only if there are no complaints. In case of complaint, records shall always be kept.

Adjustments of machinery and equipment used for manufacturing insulating glass units are periodically checked according to defined parameters for optimum results, and/or according to the recommendations of the manufacturer or the supplier of the machinery or equipment and in any case when non conformity of the products occurs.

Table A.2 - Inspection and test table for air-filled organic sealed insulating glass units with hollow spacer *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Glass**				
1.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
1.2	identification (glass/coated glass, according to relevant standards)	Visual	See purchase specification	Each batch	Yes
1.3	dimensions (length/width/shape when applicable)	Measurement	See purchase specification	Each batch, package and thickness: 1	No
2	**Spacer bar:**				
2.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
2.2	straightness	Visual	See purchase specification	Each batch: 2	No
2.3	dimensions (height, width)	Measurement	See purchase specification	Each batch: 1 samples/type	Yes
2.4	shape	Visual	see purchase specification	each batch: 1 sample/type	No
2.5	surface condition	Adhesion test (e.g. annex F.)	See product description	Each batch: 2 samples/type	Yes
2.6	diffusion openings	Visual	See product description	Per shift and per type: 1 (See note 1)	No
2.7	undesired openings (if relevant e.g. welded on back)	Visual (see annex H)	No openings	2 samples of the amount used per shift	Yes
2.8	volatile content (if no information from supplier is available)	Weight loss	See purchase specification	Each batch: 2 samples/type	Yes
3	**Spacer tape:**				
3.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
3.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
3.3	adhesion	Adhesion test (annex F.3)	See product description	Each batch: 2 samples/type	Yes
3.4	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
4	**Desiccant:**				
4.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
4.2	activity : test method shall be in agreement with desiccant supplier, eg. ΔT measurement	See annex K	initial H_2O content ≤ 3 %	Each batch: 1	Yes
NOTE 1 Per shift means minimal 1 per day and maximal 3 per day and per type					

Table A.2 - Inspection and test table for air-filled organic sealed insulating glass units with hollow spacer *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
5	**Inserts:**				
5.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
5.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
5.3	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
6	**Leaded light strip:**				
6.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
6.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples	Yes
6.3	adhesion	Adhesion test (annex J)	See product description	Each batch: 2 samples	Yes
6.4	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples	Yes
7	**Outer seal:**				
7.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
7.2	shelf life	Visual	Suppliers' specification	Each batch: 1	No
7.3.a	adhesion on glass and on spacer (not needed for structural seals)	Adhesion test (F.3)	Refer to F.3.3	Each batch: 2 samples	Yes
7.3.b	adhesion on glass (edge seals for structural purposes)	Tensile test EN 1279-4	prEN 13022	Each batch: 2 samples	Yes
7.4	hardness: may be combined with, and see further, Section 2: Production control, line 7.5 of this table			Each batch: 2 samples/type	Yes
7.5	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
8	**Inner seal:**				
8.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
8.2	penetration (if there is no information from supplier)	ISO 2137	See purchase specification	Each batch: 2 samples/type	No
8.3	volatile content (if no information from supplier is available)	Weight loss	See purchase specification	Each batch: 2 samples/type	Yes
9	**Marking materials:**				
9.1	packaging and label	Visual	See purchase specification	Each batch: 1	No

Table A.2 - Inspection and test table for Air-filled organic sealed insulating glass units with hollow spacer *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
10	**Cutting oil:**				
10.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
11	**Washing machine liquid:**				
11.1	packaging and label	Visual	See purchase specification	Each batch: 1	No

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Cutting of glass (if relevant):**				
1.1	type of glass	Visual	See relevant specifications	Continually	No
1.2	cutting quality	Visual	See relevant specifications	Continually	No
1.3	dimensions	Measurement	See relevant specifications	1 plate/shift and line	Yes
1.4	thickness	Visual	See relevant specifications	Continually	No
1.5	stripping of coating	visual	See relevant specifications	Continually	No
2	**Washing efficiency:**				
2.1	residue cutting lubricant	Visual	No visible contamination	Continually	No
2.2	dry and clean glass surface	Visual	No visible contamination	Continually	No

Table A.2 - Inspection and test table for Air-filled organic sealed insulating glass units with hollow spacer *(continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
3	**Spacer bar:**				
3.1	dimensions in relation to glass dimensions	Measurement	See product description	Per shift and width of spacer: 1 frame	Yes
3.2	desiccant filling (quantity)	Measurement	See product description	Per shift and per type: 1	Yes
3.3	contamination	Visual	See product description	Per shift and per type: 1	No
3.4	bending quality	Visual		Continually	No
3.5	junction(s)	Visual	See product description	Continually	No
3.6	placing frame on glass	Visual		Continually	No
4	**Spacer tape:**				
4.1	application	Visual	See product description	Continually	No
5	**Desiccant** (taken from a frame just before sealing into a unit)**:**				
5.1	activity : test method shall be in agreement with desiccant supplier, eg. ΔT measurement	See annex K	initial H_2O content ≤ 3 %	Per shift: 1	Yes
6	**Inner seal** (if relevant)				
6.1	continuity	Visual	See product description	Continually	No
6.2	thread at corners	Visual	See product description	Continually	No
6.3	extruded behaviour	Visual	See product description	Continually	No
6.4	contamination's in the bonding area	Visual	See product description	Continually	No
6.5	amount of inner seal material per extruder head	measurement	See product description	each day	Yes

Table A.2 - Inspection and test table for Air-filled organic sealed insulating glass units with hollow spacer *(continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
7	**Outer seal:**				
7.1	adhesion (not needed for structural seals)	Annex F (If possible, butterfly test)	F.3 or F.4.1 or F.4.2	Per day and at least per batch: 1	Yes
7.2	adhesion (edge seals for structural purposes)	Tensile test EN 1279-4	prEN 13022	Each batch: 2 samples	Yes
7.3	mixing ratio	See equipment- and sealant specifications	See sealant specification	See quality manual	Yes
7.4	thoroughness of mixing	Mixing check (annex D)	No marbling	Per shift: 1	Yes
7.5	air inclusions (during 7.3, thoroughness of mixing)		No air inclusions		No
7.6	hardness	Hardness test (annex E)	See product description	Per shift: 2 samples	Yes
7.7	contamination	Visual	See purchase specification	Each drum	No

Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Inner seal:** (if relevant)				
1.1	dimensions	Measurement	See product description	Random inspection plan (Table A.1)	Yes
1.2	occurrences exceeding absolute limits	Visual	See product description	Random inspection plan (Table A.1)	Yes
2	**Outer seal:**				
2.1	dimensions	Measurement	See product description	Random inspection plan (Table A.1)	Yes
2.2	occurrences exceeding absolute limits	Visual	See product description	Random inspection plan (Table A.1)	Yes

Table A.2 - Inspection and test table for air-filled organic sealed insulating glass units with hollow spacer *(concluded)*

Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
3	**Glass components or type of used glasses**	Visual	See label	Random inspection plan (Table A.1)	Yes
4	**Dimensions of unit** (length and width)	Measurement	See relevant specifications	Random inspection plan (Table A.1)	Yes
5	**Glass blemishes**	Visual	See internal quality standard	Random inspection plan (Table A.1)	Yes
6	**Storage**	Visual	See product description	Once per shift	No
7	**Marking**	Visual	See product description	Random inspection plan (Table A.1)	Yes
8	**Flatness** (immediately after sealing the unit)	Visual	No remarkable deviation	Random inspection plan (Table A.1)	Yes
9	**Fogging** (This test is relevant when no information exist on the volatile contents of the relevant components)	Annex C	No visible fogging	- Once per year, or more if relevant - When relevant component change	Yes Yes

A.3 Gas-filled insulating glass units

The inspections and tests listed in the following table relate the gas-filling of insulating glass units, and are additional those required for air-filled units.

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

The inspections and/or tests on the raw materials should be carried out in time to react in case of non-conformance of the material.

The required records in the following tables can be any documents such as order documents, production documents, logbook, etc. as described in the quality procedures and associated documentation. When no record is required, this is valid only if there are no complaints. In case of complaint, records shall always be kept.

Adjustments of machinery and equipment used for manufacturing insulating glass units, especially gas fill stations and gas concentration measurement equipment, shall be periodically checked according to defined parameters for optimum results, and/or according to the recommendations of the manufacturer or the supplier of the machinery or equipment and in any case when non conformity of the products occurs.

Prior to first use in production, the gas concentration measurement method, which comprises equipment and procedures to be described in the quality manual, shall be calibrated with appropriate laboratory equipment.

When gas mixing is applied in the factory, then prior to first use in production, the mixing and filling machinery and procedure shall be checked with appropriate laboratory equipment.

Table A.3 - Inspection and test table for gas-filled insulating glass units *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Materials for closing the gas fill holes**				
1.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
2	**Gas or gas mixture**				
2.1	packaging, label and date of expiration	Visual	See purchase specification	Each batch: 1	No

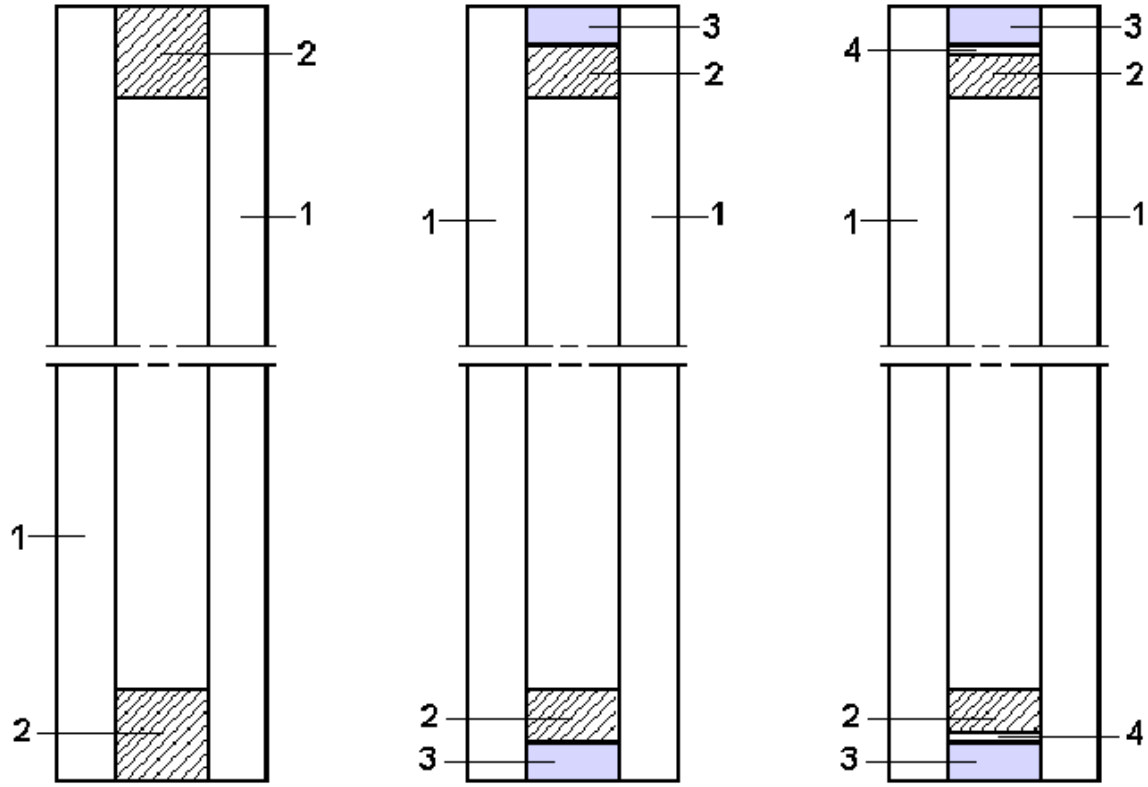
Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Gas filling**				
1.1	type of gas or gas mixture when supplied as such and date of expiration	Visual	See product description	Per shift, per type and mixture: 1	Yes
1.2	operation of filling system	Machinery adjustment	See production manual	Per shift: 1	No
1.3	setting of gas mixture: control of equipment parameters	Visual	See production manual	Per shift: 1 time During gas concentration periodic test. See annex B	No Yes
1.4	closing of gas fill hole (if applicable)	Visual	See product description	Continually	No

Table A.3 - Inspection and test table for gas-filled insulating glass units (*concluded*)

Section 3: Product control					
Ref.	**Inspection or test** May substitute the gas concentration periodic test (EN 1279-6:2002, annex B) if the measurement accuracy is similar to the method used for the initial type test in accordance with prEN 1279-3.	**Recommended method** (decision to be made by manufacturer)	**Requirement** (for symbols, see prEN 1279-3; tolerances are expressed in % absolute)	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Single gas concentration :** c_i **Gas mixture total concentration** c_t.	Measurement	$c_i = c_{i,o}$ (+10 %, -5 %) and maximal 10% of units sampled over five working days: $c_i = c_{i,o}$ (+20 %, -10 %) $c_t = (\Sigma c_{i,o})$(+10 %, -5 %) and maximal 10 % of units sampled over five working days: $c_t = (\Sigma c_{i,o})$(+20 %, -10 %)	1 per 1 000 units with a minimum of 3 units/day, or 1 unit/day when production is less than 100 units/day	Yes
2	**Concentration of each of the constituting gases in a mixture :** c_c	Measurement	B.4.1	Conform B.2	Yes

A.4 Air filled organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant

The listed inspections and tests relate to organic sealed (without hot melt butyl as outer seal) air-filled insulating glass units where the seal incorporates desiccant or includes an organic spacer incorporating desiccant.



Key
1 Glass
2 Organic sealant incorporating desiccant
3 Outer sealant with or without desiccant
4 Impermeable barrier

Figure A.2 - Three principles of organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant

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

The inspections and/or tests on the raw materials should be carried out in time to react in case of non-conformance of the material.

Volatile content tests are only to be carried out if the cavity of the unit is in contact with a material with a volatile content so high that condensation can occur, and if there is no information from the supplier that the volatile content is below a certain limit. This limit is defined as 1,5 times the value for the volatile content of the material for use in construction of the samples which were prepared for the fogging test, and when the same adequate heating procedure is used for both. For the volatile test parameters, see annex G. In connection with the volatile contents in Table A.4, one has to read "recommended limits" instead of "requirements".
No volatile content test is required when fogging tests are carried out.

The required records in the following tables can be any documents such as order documents, production documents, logbook, etc. as described in the quality procedures and associated documentation. When no record is required, this is valid only if there are no complaints. In case of complaint, records shall always be kept.

Adjustments of machinery and equipment used for manufacturing insulating glass units are periodically checked according to defined parameters for optimum results, and/or according to the recommendations of the manufacturer or the supplier of the machinery or equipment and in any case when non conformity of the products occurs.

Table A.4 - Inspection and test table for air-filled organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Glass**				
1.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
1.2	identification (glass/coated glass according to relevant standards)	Visual	See purchase specification	Each batch	Yes
1.3	dimensions (length/width/shape when applicable)	Measurement	See purchase specification	Each batch, package and thickness: 1	No
2	**Organic spacer incorporating desiccant:**				
2.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
2.2	consistency	Visual	See purchase specification	Each batch: 2	No
2.3	dimensions (if applicable)	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
2.4	desiccant activity: test method shall be in agreement with organic spacer material supplier.	See annex K	See product description	Each batch: 2 samples/type	Yes
2.5	shelf-life	Visual	See product description	Each batch: 1	Yes
2.6	adhesion (if no outer seal) to combine with line 3.11 of Section 2: Production control of this table			Each batch: 2 samples/type	Yes
2.7	volatile content (if no information from supplier is available)	Weight loss	See purchase specification	Each batch: 2 samples/type	Yes
3	**Inserts:**				
3.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
3.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
3.3	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
4	**Leaded light strip:**				
4.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
4.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples	Yes
4.3	adhesion	Adhesion test (annex J)	See product description	Each batch: 2 samples	Yes
4.4	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples	Yes

Table A.4 - Inspection and test table for air-filled organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
5	**Outer seal (if applicable):**				
5.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
5.2	shelf life	Visual	Suppliers' specification	Each batch: 1	No
5.3	adhesion to glass (not needed for structural seal)	Adhesion test: F.3	See annex F.3.3	Each batch: 1 sample	Yes
5.4	adhesion on glass (edge seals for structural purposes)	Tensile test EN 1279-4	prEN 13022	Each batch: 2 samples	Yes
5.5	hardness: may be combined with line 5.5 of Section 2: Production control, of this table			Each batch: 2 samples	Yes
5.6	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples	Yes
6	**Marking materials:**				
6.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
7	**Cutting oil:**				
7.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
8	**Washing machine liquid:**				
8.1	packaging and label	Visual	See purchase specification	Each batch: 1	No

Table A.4 - Inspection and test table for air-filled organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant *(continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Cutting of glass (if relevant):**				
1.1	type of glass	Visual	See relevant specifications	Continually	No
1.2	cutting quality	Visual	See relevant specifications	Continually	No
1.3	dimensions	Measurement	See relevant specifications	1 plate/shift and line	Yes
1.4	thickness	Visual	See relevant specifications	Continually	No
1.5	stripping of coating	Visual	See relevant specifications	Continually	No
2	**Washing efficiency:**				
2.1	residue cutting lubricant	Visual	No visible contamination	Continually	No
2.2	dry and clean glass surface	Visual	No visible contamination	Continually	No
3	**Organic spacer incorporating desiccant:**				
3.1	continuity	Visual	See product description	Continually	No
3.2	steadiness	Visual	See product description	Continually	No
3.3	position relative to edge of glass	Visual	See product description	Continually	No
3.4	contamination in the bonding area (if applicable)	Visual	See product description	Continually	No
3.5	thread at junctions	Visual	See product description	Continually	No
3.6	closing at final junction	Visual	See product description	Continually	No
3.7	size control (if applicable)	Measurement	See product description	Per shift and per type: 1	Yes
3.8	weight of extruded spacer (if applicable)	Measurement	See product description	Per shift and per type: 1	Yes
3.9	desiccant activity: test method shall be in agreement with organic spacer material supplier	See annex K	See product description	Per shift: 1	Yes
3.10	extrusion temperature (if applicable)	Measurement	See product description	Per shift: 1	Yes
3.11	adhesion to glass (not needed for structural seal)	Butterfly test:Annex F.4	See product description	Per shift: 1	Yes
3.12	adhesion on glass (edge seals for structural purposes)	Tensile test EN 1279-4	prEN 13022	Each batch: 2 samples	Yes

Table A.4 - Inspection and test table for air-filled organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant *(continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
4	**Pressing:**				
4.1	temperature in the press (if applicable)	Measurement	See product description	Continually	No
4.2	thickness of unit	Measurement	See purchase specification	Per shift: 2	No
5	**Outer seal:**				
5.1	adhesion	Annex F (If possible, butterfly test)	See product description	Per day and at least per batch: 1	Yes
5.2	mixing ratio	See equipment- and sealant specification	See sealant specification	See quality manual	Yes
5.3	thoroughly of mixing	Mixing check (annex D)	No marbelling	Per shift: 1	Yes
5.4	air inclusions (during 5.3 thoroughly of mixing)		No air inclusions		No
5.5	hardness	Hardness test (annex E)	See product description	Per shift: 2 samples	Yes
5.6	contaminations	Visual	See purchase specification	Each drum	No

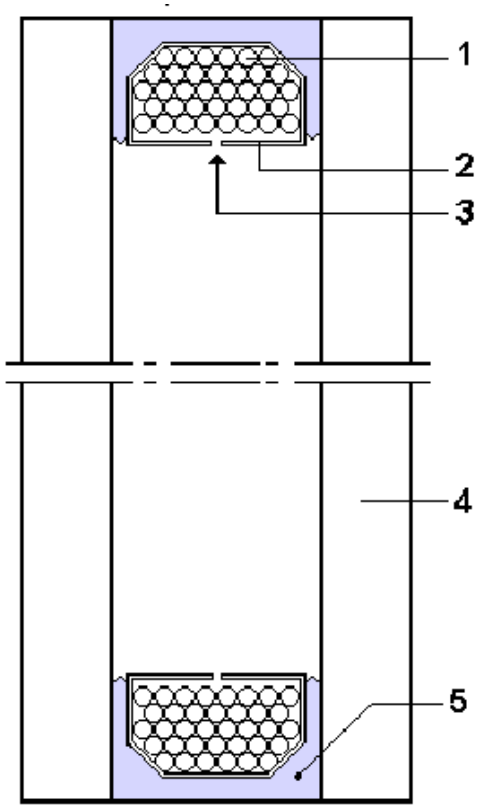
Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Organic spacer incorporating desiccant:**				
1.1	dimensions and position	Measurement	See product description	Random inspection plan (Table A.1)	Yes
1.2	occurrences exceeding absolute limits	Visual	See product description	Random inspection plan (Table A.1)	Yes

Table A.4 - Inspection and test table for air-filled organic sealed insulating glass units sealed by, or including, an organic spacer incorporating desiccant *(concluded)*

Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
2	**Outer seal (if applicable):**				
2.1	dimensions	Measurement	See product description	Random inspection plan (Table A.1)	Yes
2.2	occurrences exceeding absolute limits	Visual	See product description	Random inspection plan (Table A.1)	Yes
3	**Glass components or type of used glasses**	Visual	See label	Random inspection plan (Table A.1)	Yes
4	**Dimensions of unit**	Measurement	See relevant specifications	Random inspection plan (Table A.1)	Yes
5	**Glass blemishes**	Visual	See internal quality standard	Random inspection plan (Table A.1)	Yes
6	**Storage**	Visual	See product description	Once per shift	No
7	**Marking**	Visual	See product description	Random inspection plan (Table A.1)	Yes
8	**Flatness** (immediately after sealing the unit)	Visual	No remarkable deviation	Random inspection plan (Table A.1)	Yes
9	**Fogging** (This test is relevant when no information exist on the volatile contents of the relevant components)	Annex C	No visible fogging	- Once per year, or more if relevant - When relevant component change	Yes Yes

A.5 Insulating glass units with hollow spacer sealed by hot applied hot-melt sealant

The listed inspections and tests relate to air-filled insulating glass units sealed with hot applied hot melt sealant, with hollow spacer.



Key 1 Desiccant 2 Spacer bar 3 Diffusion opening
4 Glass 5 Hot applied hot melt butyl

Figure A.3 - A principle of an insulating glass unit with hollow spacer sealed by hot applied Hot-melt sealant

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

The inspections and/or tests on the raw materials should be carried out in time to react in case of non-conformance of the material.

Volatile content tests are only to be carried out if the cavity of the unit is in contact with a material with a volatile content so high that condensation can occur, and if there is no information from the supplier that the volatile content is below a certain limit. This limit is defined as 1,5 times the value for the volatile content of the material for use in construction of the samples which were prepared for the fogging test, and when the same adequate heating procedure is used for both. For the volatile test parameters, see annex G. In connection with the volatile contents in Table A.5, one has to read "recommended limits" instead of "requirements".

No volatile content test is required when fogging tests are carried out.

The required records in the following tables can be any documents such as order documents, production documents, logbook, etc. as described in the quality procedures and associated documentation. When no record is required, this is valid only if there are no complaints. In case of complaint, records shall always be kept.

Adjustments of machinery and equipment used for manufacturing insulating glass units are periodically checked according to defined parameters for optimum results, and/or according to the recommendations of the manufacturer or the supplier of the machinery or equipment and in any case when non conformity of the products occurs.

Table A.5 - Inspection and test table for air-filled hot applied hot melt sealed insulating glass units with hollow spacer (continued)

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Glass**				
1.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
1.2	identification (glass/coated glass according to relevant standards)	Visual	See purchase specification	Each batch	Yes
1.3	dimensions (length/width/shape, when applicable)	Measurement	See purchase specification	Each batch, package and thickness: 1	No
2	**Spacer bar:**				
2.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
2.2	straightness	Visual	See purchase specification	Each batch: 2	No
2.3	dimensions (length/width)	Measurement	See purchase specification	Each batch: 1 samples/type	Yes
2.4	shape	Visual	See purchase specification	Each batch: 1 samples/type	No
2.5	surface condition	Adhesion test (annex F.3)	See product description	Each batch: 2 samples/type	Yes
2.6	diffusion openings	Visual	See product description	Per shift and per type: 1	No
2.7	undesired openings (if relevant, e.g. welded on back)	Visual (annex H)	No openings	2 samples of the amount used per shift	Yes
2.8	volatile content (if no information from supplier is available)	Weight loss	See purchase specification	Each batch: 2 samples/type	Yes
3	**Spacer tape:**				
3.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
3.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
3.3	adhesion	Adhesion test (annex F)	See product description	Each batch: 2 samples/type	Yes
3.4	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
4	**Desiccant:**				
4.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
4.2	activity: test method shall be in agreement with desiccant supplier, e.g. ΔT measurement	See annex K	See purchase specification	Each drum	Yes

Table A.5 - Inspection and test table for air-filled hot applied hot melt sealed insulating glass units with hollow spacer *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
5	**Inserts:**				
5.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
5.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
5.3	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
6	**Leaded light strip:**				
6.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
6.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples	Yes
6.3	adhesion	Adhesion test (Annex J)	See product description	Each batch: 2 samples	Yes
6.4	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples	Yes
7	**Hot melt outer seal:**				
7.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
7.2	shelf life	Visual	Supplier's specification	Each batch: 1	No
7.3	appearance	Visual	See purchase specification	Each batch: 1	Yes
7.4	temperature of application	Certificate from supplier	See purchase specification	Each batch: 1	Yes
7.5	adhesion: may be combined with line 7.2 of Section 2: Production Control, of this table			Each batch: 2 samples	Yes
7.6	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
8	**Alternative assembly aids** (where used) e.g hot melt inner seal/spacer adhesive:				
8.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
8.2	shelf life	Visual	Supplier's specification	Each batch: 1	No
8.3	temperature of application (spacer adhesive only)	Certificate from supplier	See purchase specification	Each batch: 2 samples/type	No
9	**Marking materials:**				
9.1	packaging and label	Visual	See purchase specification	Each batch: 1	No

Table A.5 - Inspection and test table for air-filled hot applied hot melt sealed insulating glass units with hollow spacer *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
10	**Cutting oil:**				
10.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
11	**Washing machine liquid:**				
11.1	packaging and label	Visual	See purchase specification	Each batch: 1	No

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Cutting of glass (if relevant):**				
1.1	type of glass	Visual	See relevant specifications	Continually	No
1.2	cutting quality	Visual	See relevant specifications	Continually	No
1.3	dimensions	Measurement	See relevant specifications	1 plate/shift and line	Yes
1.4	thickness	Visual	See relevant specifications	Continually	No
1.5	stripping of coating	Visual	See relevant specifications	Continually	No
2	**Washing efficiency:**				
2.1	residue cutting lubricant	Visual	No visible contamination	Continually	No
2.2	dry and clean glass surface	Visual	No visible contamination	Continually	No

Table A.5 - Inspection and test table for air-filled hot applied hot melt sealed insulating glass units with hollow spacer *(continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
3	**Spacer bar:**				
3.1	dimensions in relation to glass dimensions	Measurement	See product description	Per shift and width of spacer: 1 frame	Yes
3.2	desiccant filling (quantity)	Measurement	See product description	Per shift and per type: 1	Yes
3.3	contamination	Visual	See product description	Per shift and per type: 1	No
3.4	bending quality	Visual		Continually	No
3.5	junction(s)	Visual	See product description	Continually	No
3.6	placing frame on glass	Visual		Continually	No
4	**Spacer tape:**				
4.1	application	Visual	See product description	Continually	No
5	**Desiccant** (taken from a frame just before sealing into a unit)**:**				
5.1	activity : test method shall be in agreement with desiccant supplier, e.g. ΔT measurement	See annex K	initial H_2O content ≤ 3 %	Per shift: 1	Yes
6	**Assembly aids:** (if relevant)				
6.1	continuity	Visual	Supplier's recommendation	Continually	No
6.2	application at corners	Visual	Supplier's recommendation	Continually	No
6.3	dosage (if hot melt spacer adhesive)	Supplier's recommendation		Per shift: 1 time 2 samples	No
6.4	contaminations in the bonding area	Visual	No contamination	Continually	No

Table A.5 - Inspection and test table for air-filled hot applied hot melt sealed insulating glass units with hollow spacer *(Continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
7	**Hot melt outer seal:**				
7.1	temperature of application at nozzle	Measurement	Supplier's recommendation	Beginning, middle and end of shift	Yes
7.2	adhesion	Measurement: annex F	See annex F.4.1	Beginning, middle and end of shift	Yes
7.3	air inclusions (use samples of line 7.2 adhesion)	Visual	No significant inclusions	Beginning, middle and end of shift	No
7.4	contaminations	Visual	See purchase specification	Each batch: 1	No
7.5	air bubbles	Visual	See purchase specification	Each batch: 1	No
7.6	completion of junctions	Visual	See product description	Continually	No
7.7	equalisation (parallellity of panes)	Visual	See product description	Per shift: 1 time 2 samples	No

Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Inner seal:** (if relevant)				
1.1	dimensions and position	Measurement	See product description	Random inspection plan (Table A.1)	Yes
1.2	occurrences exceeding absolute limits	Visual	See product description	Random inspection plan (Table A.1)	Yes
2	**Outer seal:**				
2.1	dimensions	Measurement	See product description	Random inspection plan (Table A.1)	Yes
2.2	occurrences exceeding absolute limits	Visual	See product description	Random inspection plan (Table A.1)	Yes

Table A.5 - Inspection and test table for air-filled hot applied hot melt sealed insulating glass units with hollow spacer *(concluded)*

Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
3	**Glass components or type of used glasses**	Visual	See label	Random inspection plan (Table A.1)	Yes
4	**Dimensions of unit**	Measurement	See relevant specifications	Random inspection plan (Table A.1)	Yes
5	**Glass blemishes**	Visual	See internal quality standard	Random inspection plan (Table A.1)	Yes
6	**Storage**	Visual	See product description	Once per shift	No
7	**Marking**	Visual	See product description	Random inspection plan (Table A.1)	Yes
8	**Flatness** (immediately after sealing the unit)	Visual	No remarkable deviation	Random inspection plan (Table A.1)	Yes
9	**Fogging** (This test is relevant when no information exist on the volatile contents of the relevant components)	Annex C	No visible fogging	- Once per year, or more if relevant - When relevant component change	Yes Yes

A.6 Air filled organic insulating glass units sealed by a metal strip between the glass panes

A.6.1 Additional definitions

A.6.1.1 copper wire
A source of copper, necessary for the hermetic edge seal which is deposited onto the glass in order to obtain a layer along the glass edge.

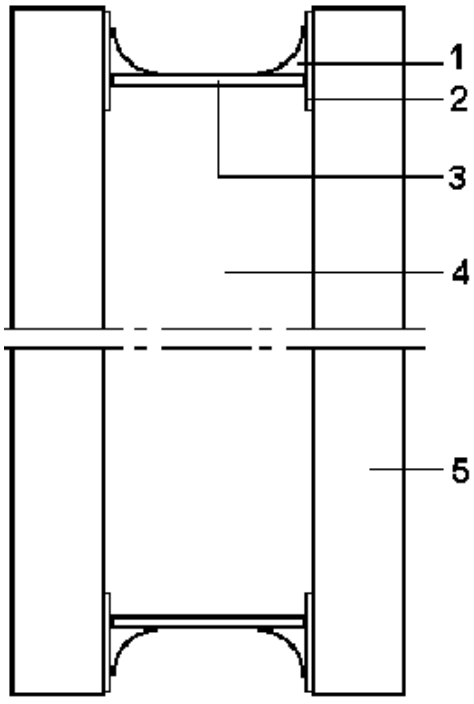
A.6.1.2 solder:
- An alloy deposited onto the copper layer during the tinning process, necessary for the hermetic edge seal.
- An alloy used for hermetically sealing the insulating glass units.

The composition of the two alloys can be different, but will include lead as well as tin.

A.6.1.3 metal spacer
A metal strip acting as a spacer, and necessary for the hermetic edge seal.

A.6.2 Information to the tables

The listed inspections and tests relate to metal sealed air-filled insulating glass units with metal strip as spacer, without channel.



Key 1 Solder 2 Copper and tin layer 3 Metal strip
4 Dehydrated air 5 Glass

Figure A.4 - A principle of an insulating glass unit sealed by a metal strip between the glass panes

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

The inspections and/or tests on the raw materials should be carried out in time to react in case of non-conformance of the material.

Volatile content tests are only to be carried out if the cavity of the unit is in contact with a material with a volatile content so high that condensation can occur, and if there is no information from the supplier that the volatile content is below a certain limit. This limit is defined as 1,5 times the value for the volatile content of the material for use in construction of the samples which were prepared for the fogging test, and when the same adequate heating procedure is used for both. For the volatile test parameters, see annex G. In connection with the volatile contents in Table A.6, one has to read "recommended limits" instead of "requirements".

No volatile content test is required when fogging tests are carried out.

The required records in the following tables can be any documents such as order documents, production documents, logbook, etc. as described in the quality procedures and associated documentation. When no record is required, this is valid only if there are no complaints. In case of complaint, records shall always be kept.

Adjustments of machinery and equipment used for manufacturing insulating glass units are periodically checked according to defined parameters for optimum results, and/or according to the recommendations of the manufacturer or the supplier of the machinery or equipment and in any case when non conformity of the products occurs.

Table A.6 - Inspection and test table for air-filled insulating glass units sealed by a metal strip soldered between the glass panes (continued)

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Glass**				
1.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
1.2	identification (glass/coated glass according to relevant standards)	Visual	See purchase specification	Each batch	No
1.3	dimensions (length/width/shape when applicable)	Measurement	See purchase specification	Each batch, package and thickness: 1	No
2	**Copper wire:**				
2.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
2.2	winding and geometrical irregulations	Visual	See purchase specification	Each reel	No
2.3	oxidation	Visual	See purchase specification	Each reel	No
2.4	chemical composition (if no information available)	Measurement	See purchase specification	Each batch: 1 sample	Yes
2.5	tensile strength/elongation curve (if not available)	EN 10218-1	See purchase specification	Each batch: 1 sample	Yes
2.6	diametre of wire	Measurement	See purchase specification	Each reel: 1 sample	No
3	**Solder for tinning process:**				
3.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
3.2	chemical composition (if no information available)	Measurement	See purchase specification	Each batch: 1 sample	Yes
3.3	dimensions and contamination (if relevant)	Measurement	See purchase specification	Each batch: 1 sample	No
4	**Solder for sealing the unit** (if applicable)**:**				
4.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
4.2	contamination on solder bars	Visual	See purchase specification	Each bar	No
4.3	cross section of solder bars	Visual	See purchase specification	Each bar	No
4.4	chemical composition (if no information available)	Measurement	See purchase specification	Each batch: 2 sample	Yes

Table A.6 - Inspection and test table for air-filled insulating glass units sealed by a metal strip soldered between the glass panes *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
5	**Metal spacer:**				
5.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
5.2	winding	Visual	See purchase specification	Each reel	No
5.3	oxidation	Visual	See purchase specification	Each reel	No
5.4	tin spots (if applicable)	Visual	See purchase specification	Each reel	No
5.5	scratches	Visual	See purchase specification	Each reel	No
5.6	marking (if applicable)	Visual	See purchase specification	Each reel	No
5.7	chemical composition (if no information available)	Measurement	See purchase specification	Each batch: 1 sample	Yes
5.8	profile dimensions	Measurement	See purchase specification	Each batch: 1 sample	No
5.9	thickness of tin layer (if applicable)	Measurement	See purchase specification	Each batch: 1 sample	No
6	**Desiccant cartridge** (when applicable)**:**				
6.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
6.2	cleanliness	Visual	See purchase specification	Each batch: 1	No
6.3	Inner and outer cross section	Measurement	See purchase specification	Each batch: 1 cartridge	No
6.4	length	Measurement	See purchase specification	Each batch: 1 cartridge	No
6.5	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 1 cartridge	No
7	**Desiccant:**				
7.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
7.2	activity : test method shall be in agreement with desiccant supplier, e.g. ΔT measurement	See annex K	See purchase specification	Each drum	Yes

Table A.6 - Inspection and test table for air-filled insulating glass units sealed by a metal strip soldered between the glass panes *(continued)*

Section 1: Material Control (See also 5.2.6)					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
9	**Inserts:**				
9.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
9.2	dimensions	Measurement	See purchase specification	Each batch: 2 samples/type	Yes
9.3	volatile content (if no information from supplier is available)	Weight loss	See product description	Each batch: 2 samples/type	Yes
10	**Marking materials:**				
10.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
11	**Cutting oil:**				
11.1	packaging and label	Visual	See purchase specification	Each batch: 1	No
12	**Washing machine liquid:**				
12.1	packaging and label	Visual	See purchase specification	Each batch: 1	No

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Cutting of glass:**				
1.1	type of glass	Visual	See relevant specifications	Continually	No
1.2	cutting quality	Visual	See relevant specification	Continually	No
1.3	dimensions	Measurement	See relevant specification	1 plate/shift and line	Yes
1.4	thickness	Visual	See relevant specification	Continually	No
1.5	dimensions	Visual	See relevant specification	Continually	No

Table A.6 - Inspection and test table for air-filled insulating glass units sealed by a metal strip soldered between the glass panes *(continued)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
2	**Washing efficiency:**				
2.1	residue cutting lubricant	Visual	No visible contamination	Continually	No
2.2	dry and clean glass surface	Visual	No visible contamination	Continually	No
3	**Metal deposit on glass:**				
3.1	uniformity in thickness	Visual	See product description	Per shift: 2 glass panes	No
3.2	tinning junctions in corners	Visual	See product description	Per shift: 2 glass panes	No
3.3	width of metal deposit	Measurement	See product description	Per shift: 2 glass panes	No
3.4	thickness of tin layer	Measurement	See product description	Per shift: 2 glass panes	No
3.5	stripping of coating	Adhesion tests (annex F)	See annex F.4.1	Per shift, per machine: 2 samples	Yes
4	**Metal spacer:**				
4.1	Positioning of spacer (if applicable)	Visual	See product description	Continually	No
4.2	bonding quality	Visual	See product description	Continually	No
4.3	junctions	Visual	See product description	Continually	No
5	**Soldering:**				
5.1	size and continuity of meniscus	Visual	See product description	Continually	No
6	**Desiccant cartridge** (if applicable)**:**				
6.1	clean surface	Visual	See product description	Continually	No
6.2	marking (if applicable)	Visual	See product description	Continually	No
6.3	desiccant filling	Visual	See product description	Continually	No
6.4	activity : test method shall be in agreement with desiccant supplier, e.g. ΔT measurement	See annex K	Initial H_2O content ≤ 3 %	Per shift: 1	Yes

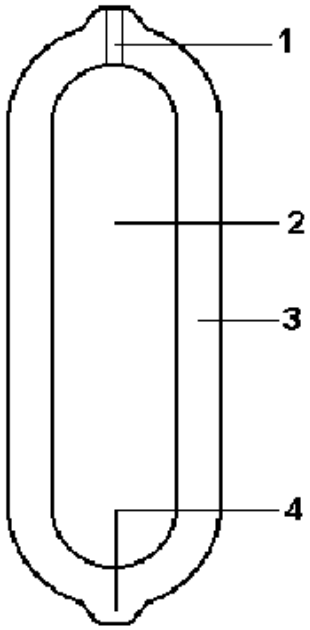
Table A.6 - Inspection and test table for air-filled insulating glass units sealed by a metal strip soldered between the glass panes *(concluded)*

Section 2: Production control					
Ref.	**Material, inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
7	**Dry air** (if applicable)**:**				
7.1	flow rate of dry air	Measurement	See product description	Per shift: 5 outlets	Yes
7.2	time of dry air	Measurement	See product description	Per shift: 1 sample	Yes
7.3	dew point	Measurement	See product description	Equipment supplier's recommendation	Yes
8	**Seal quality:**				
8.1	unit tightness	See production manual	See production manual	Each unit	No

Section 3: Product control					
Ref.	**Inspection or test**	**Recommended method** (decision to be made by manufacturer)	**Requirement**	**Recommended frequency** (decision to be made by manufacturer)	**Record**
1	**Glass components or type of used glasses**	Visual	See label	Random inspection plan (Table A.1)	Yes
2	**Dimensions of unit**	Measurement	See relevant specifications	Random inspection plan (Table A.1)	Yes
3	**Glass blemishes**	Visual	See internal quality standard	Random inspection plan (Table A.1)	Yes
4	**Metal deposit, occurrences exceeding absolute limits**	Visual	See product description	Random inspection plan (Table A.1)	Yes
5	**Soldering, occurrences exceeding absolute limits**	Visual	See product description	Random inspection plan (Table A.1)	Yes
6	**Storage**	Visual	See product description	Random inspection plan (Table A.1)	Yes
7	**Marking**	Visual	See product description	Random inspection plan (Table A.1)	Yes
8	**Flatness**	Visual	No remarkable deviation	Random inspection plan (Table A.1)	Yes
9	**Dew point for units without desiccant**	Check	No condensation	Random inspection plan (Table A.1)	Yes
10	**Fogging** (This test is relevant when no information exist on the volatile contents of the relevant components)	Annex C	No visible fogging	- Once per year, or more if relevant - When relevant component change	Yes Yes

A.7 Air filled glass-glass welded insulating glass units

For this system of insulating glass unit the inspections and tests shall be detailed in the quality manual in accordance with 5.2.5.



Key

1 Opening closed after dehydration of cavity
2 Dehydrated cavity
3 Glass
4 Glass-glass welded edge

Figure A.5 - A principle of a glass-glass welded insulating glass units

Annex B
(normative)

Periodic testing and inspection

B.1 General

The purpose of the periodic, low frequency test and inspection is to check that factory production control is assisting effectively production so that characteristics of the product continue to conform to the technical specification, and so ensuring a reasonably economical working life of the performances of the insulating glass units, by means of:

- ensuring constancy of the tightness of the seal throughout the production: visual inspection of the seal geometry of a number of insulating glass unit samples;
- ensuring that the moisture penetration index is not exceeded: a short climate test with the same samples as for the visual inspection;
- when relevant, ensuring that the gas leakage rate is not exceeded: a gas permeability test on sealant membrane, and in the case of a gas permeable spacer on a membrane made of the same material of the spacer.
  This is not required when documented information from the supplier is available, preferably by means of a declaration in accordance with EN 10204.
- ensuring concentration of single gases and of gas mixtures. Refer to prEN 1279-3.

Periodic, low frequency testing and inspection is part of the routine production control, however it can be performed under the surveillance of, or by a third party as part of third party surveyed productions.

B.2 Frequencies of periodic testing and inspection

When starting production, or in the case of non third party surveyed productions, periodic testing and inspection shall be carried out with a minimum of twice a year when no change of relevant material. When the outcome fulfills the requirement during four successive low frequency tests and inspection, the frequency is reduced to once a year.

When a manufacturer is already operating an existing third party surveyed factory production control, the starting frequency shall be once a year when no change of relevant material.

When a relevant material changes (see also prEN 1279-1), the low frequency test in accordance with B.4 shall be repeated. If this test coincidentally falls together with a forthcoming low frequency test, no duplication of test is necessary.

If the requirements are not fulfilled, the periodic test will be repeated within two months, and the frequency returns to, or remains twice a year.

B.3 Conformity of seal geometry to the system description

B.3.1 Requirements

The seal geometry of the five insulating glass units selected at random is deemed to conform with the manufacturer's system description when not more than one unit is outside the system description.

B.3.2 Visual inspection: sampling and testing

Select at random five insulating glass units which are ready for shipment out of the storage room. The units shall be as near as possible to 500 mm by 350 mm, but not smaller, with a cavity as near as possible to 12 mm. Units made with cast glass or wired glass should be not selected, to reduce the risk of glass breakage.

Inspect and record the seal geometry of all units before the short climate test, and of two test pieces after climate exposure including the spacer width.

B.4 Moisture penetration index

B.4.1 Requirement

The units selected randomly as described in B.3.2 and subjected to the short climate test as described in B.4.2, shall have a moisture vapour penetration index, I, equal to or less than I_{req}. The MVP index I_{req} is equal to the measured value from the initial short climate test, increased with 2,5 % or 0,025 whichever is applicable, which has been performed in the same time as the initial long term moisture vapour penetration test in accordance with prEN 1279-2.

Breakage of glass does not constitute failure.

When no initial short term test is performed in the same time as the initial long term moisture penetration test, the units selected randomly described in B.3.2 and subjected to the climate tests as described in B.4.2, shall have a moisture penetration index, I, equal to or less than 8,5 % or 0,085, depending on whether I is expressed as a percentage or a fraction.

In the case of gas filled units, the total gas concentration (c_t), and of the component gases in the case of gas mixtures (c_c), shall be measured on three units not submitted to any climate test, and shall be for each of the units $c_t = c_{i,0-5}^{+10}$ % or $c_c = c_{i,0-5}^{+10}$ %.

B.4.2 Short climate test: sampling and test procedure

B.4.2.1 The test is similar to the long term test for moisture penetration as described in prEN 1279-2, but with the following modifications.

B.4.2.2 Numbering of test pieces: number from 1 to 5 the units selected for the visual inspection of B.4.1. Designate the units in accordance with Table B.1.

Table B.1 - Designation of insulating glass units for audit test

Unit number	Designate units for
2 and 4	measurement of initial moisture content (T_i) and of the gas concentration (c_i) when applicable
1 and 5	climate exposure and measurement of the final moisture content of desiccant (T_f)
3	spare unit to apply for: – when needed, measurement of standard moisture adsorption capacity of desiccant (T_c) – when applicable of gas concentration (c_i)

B.4.2.3 Test procedure: the test remains the same, apart from the reduced number of test pieces.

B.4.2.4 Climate conditions in cabinet: expose the test pieces for three weeks to the constant climate conditions as defined in prEN 1279-2.

B.4.2.5 Accuracy: the accuracy of the test itself under this Part of the standard is estimated at ± 0,045 when I is expressed as a fraction.

B.5 Gas loss rate

If information of the sealant supplier on gas permeability is available, preferably by means of a declaration in accordance with EN 10204, this periodic test is not relevant for production of gas-filled insulating glass units.

The gas concentration shall be periodically measured.

The gas permeability of sealant membrane or on gas permeable spacer shall be periodically checked according to EN 1279-4.

B.6 Test and inspection report

The test report shall evaluate the test in detail and shall include the following summary:

Name of test house, its address and logo.

Summary of report n°..... Date .....
Insulating glass units - Periodic test according to EN 1279-6
For details, see the test report

Company: Name: .....
Address: .....
.....
.....
.....
.....

Plant: Name: .....
Address: .....
.....
.....
.....
.....

System description, file number: .....

Product name: .....

Samples conform to the periodic testing and inspection requirements: | YES | NO | (Delete which is not applicable)

NOTE: Comparisons of moisture penetration indices of different insulating glass unit systems are meaningless

.....
Name and signature

Annex C
(normative)

Fogging test

C.1 Purpose

The test checks whether unacceptable condensation appears on the glass surfaces faced the unit cavity, due to release of volatile substances.

The release of gaseous substances is achieved by applying heat at a point on the relevant organic component. Condensation is achieved by cooling a spot of the glass surface.

The test shall be carried out before starting up a new production line, or when a relevant component in the design changes.

NOTE It is recommended that this test is carried out once a year.

C.2 Principle of the test

Test pieces are subjected to visual inspection of the interior glass surfaces (e.g. in a viewing box). The test pieces are conditioned for one week under factory conditions, and then placed in the fogging test apparatus. After exposure, the test pieces are visually inspected again for evidence of fogging on the interior glass surfaces.

Breakage of glass does not constitute failure; such a unit may be replaced by a spare test piece and the test repeated.

C.3 Test parameters

- Number of insulating glass units subject to testing shall be 2.
- Heated surface temperature nearest to 20 % to 30 % of the relevant component: between 50 °C to 60 °C.
- Cold spot shall be located in the centre of the test unit. Length and width shall be 1/3 of the length and width of the unit, or 10 % of the unit surface.
- Cold spot surface temperature shall be 27 K to 33 K lower than the temperature of the surface nearest to 20 % to 30 % of the relevant component. This temperature difference is between the average temperature of the heated surface, which is between 50 °C and 60 °C, and the average temperature of the cold spot.
- Temperature of the unit elsewhere shall be high enough to ensure that all condensation occurs on the cold spot.
- Duration of the test shall be (168±4) h.

NOTE For heating the relevant component, a lamp, or an arrangement of lamps, can be used, with an ultraviolet radiation of equal to or more than 40 W/m² measured in the plane where the units are located. The ultraviolet radiation intensity can be obtained with, for example, a high pressure mercury lamp with a tungsten filament, simulating sun radiation lamps (e.g. Ultravitalux lamps), of 300 watt at 300 mm from the spot on the surface of the relevant component.

C.4 Visual inspection

Observe the test units, by transmission and reflection, for interference and for scattered light caused by fogging, e.g. clean the test pieces and mount each in turn in a viewing box at eye level (see Figure C.1 for an example). Stand directly in front of, and at a distance of approximately 1 m from, the test piece, and look for evidence of dirt or other contamination on the interior of the glass surfaces.

If condensation is seen in the viewing box, store the unit between 15 °C and 25 °C for seven days, and re-examine in the viewing box from a distance of 1 m.

No permanent visual condensation is permitted.

C.5 Examples of exposure equipment

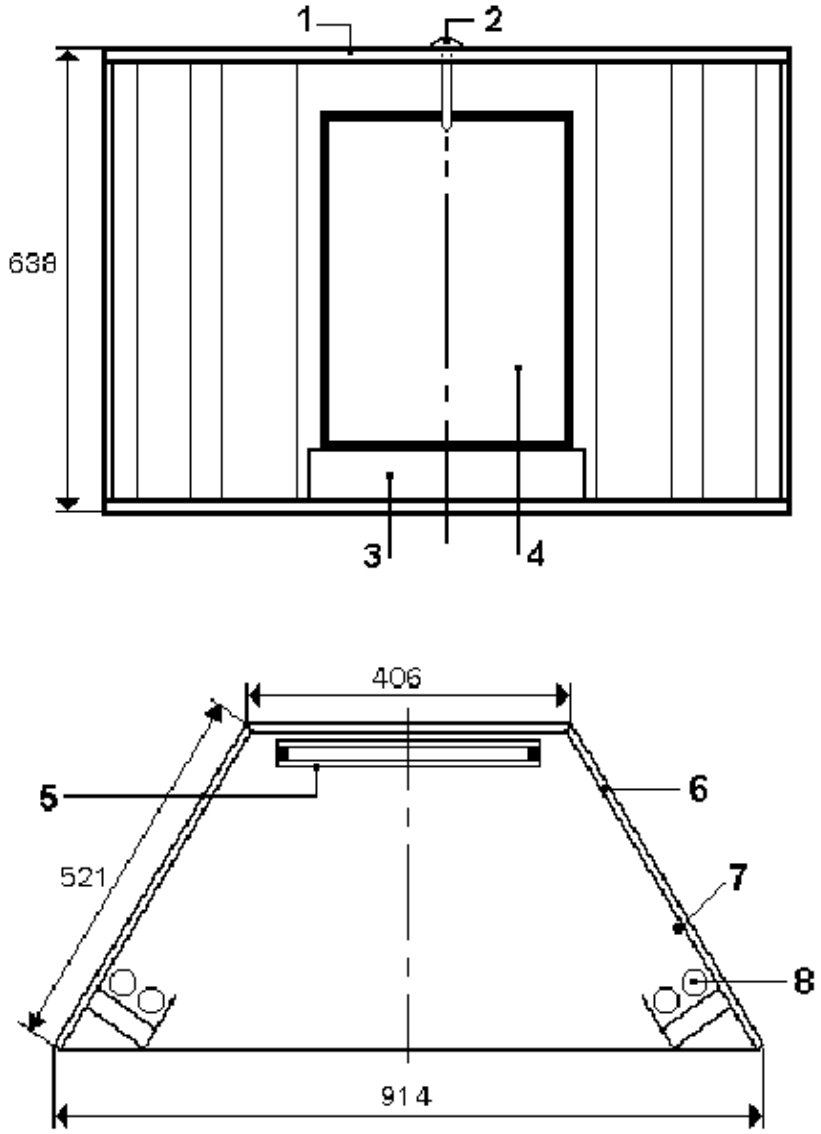
The examples in Figures C.2 and C.3 illustrate respectively the British and the continental European type of equipment. Figure C.4 illustrates a test unit suitable for the application of a radiation wall as heating source without the necessity of cooling the glass with water.

C.6 Report

The report on fogging test shall include the following data:

– date of test;
– hot spot temperature;
– cold spot temperature;
– time;
– result;
– any deviation from the test described above.

Dimensions in millimetres

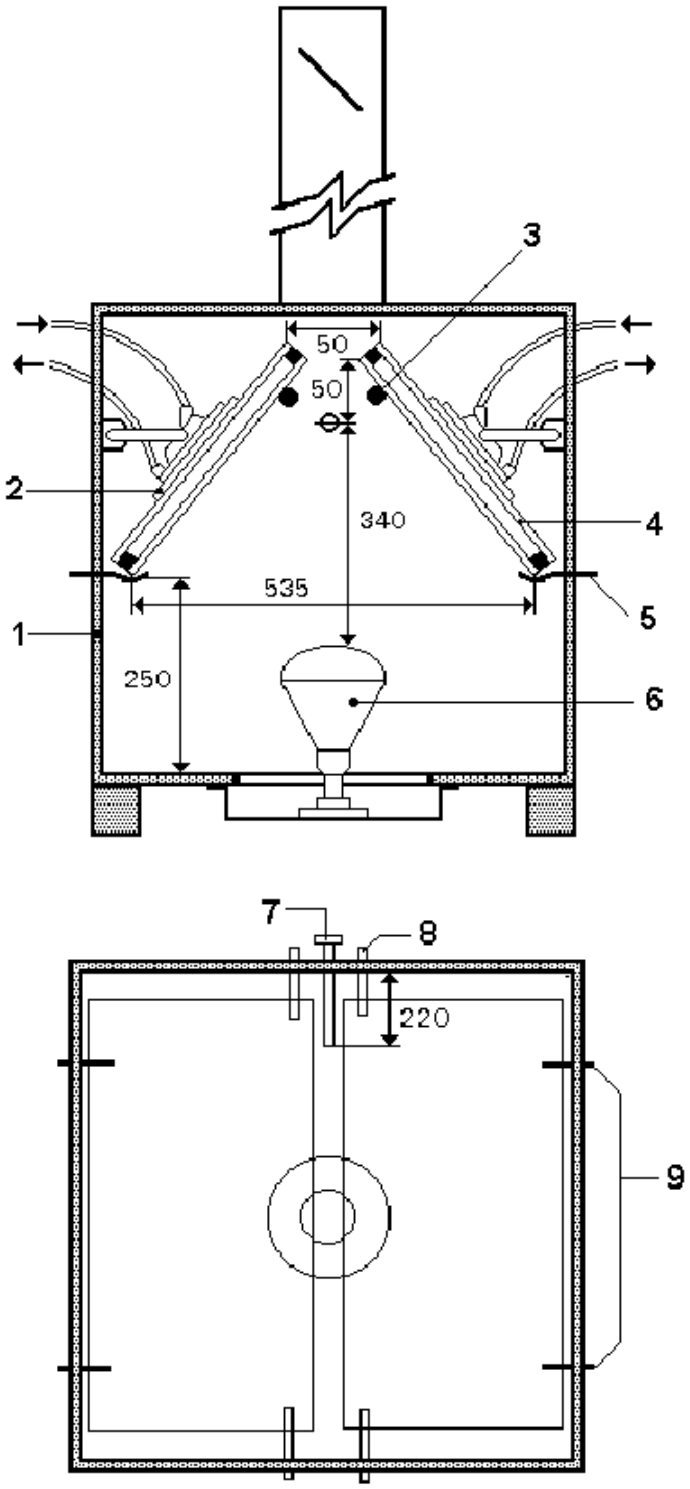


Key

1 12 mm plywood cover and base
2 Retaining pin to prevent unit from falling forward
3 Wood block fixed to base as a support for the unit
4 Insulating glass unit to be inspected
5 Surface onto which the cooling plate was placed
6 6 mm plywood sides and back
7 Interior of box painted matt black
8 Two lamps 610 mm 20 Watt fluorescent assembly wired in parallel

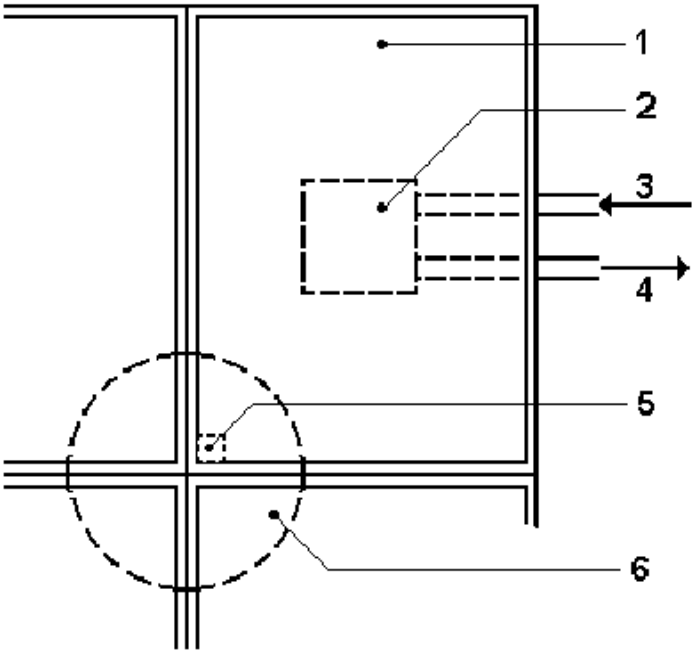
Figure C.1 - Example of a viewing box for fogging test

Dimensions in millimetres



Key
1 Cabinet 560 mm x 560 mm, 560 mm high from 12 mm plywood lined with aluminium foil
2 150 mm diameter cooling plate
3 Retaining pin
4 Factory sealed
5 Cranked pin
6 UV lamp
7 Dial thermometer
8 Top support
9 Bottom support

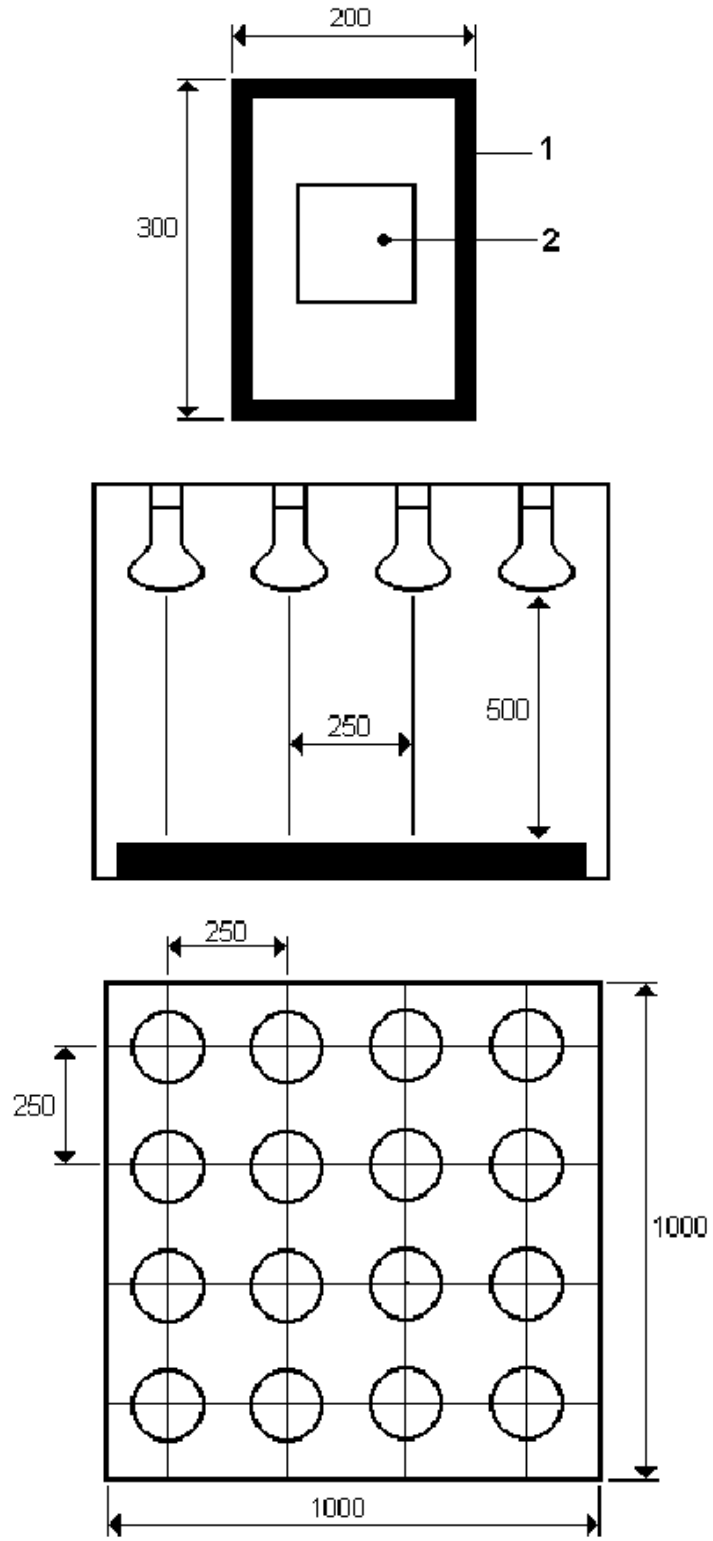
Figure C.2 - Example of a fogging test equipment (British)



Key
1 Test specimen
2 Copper cooling plate 127 mm x 127 mm
3 Water inlet
4 Water outlet
5 Temperature gauge, e.g. a thermocouple, well secured on the glass surface with 12,7 mm x 12,7 mm lead or aluminium strip
6 Area on which there is concentration of ultraviolet light

Figure C.3 - Example of fogging test equipment (continental European)

Dimensions in millimetres



Key 1 Insulating glass edge encapsulated with black rape (if necessary) to get higher glass temperature
2 Centred silver foil square of approximately 80 mm x 80 mm

Figure C.4 - Example of a test unit suitable for the application of a radiation wall

Annex D
(informative)

Two component sealants: check on the thoroughness of mixing

D.1 General

This annex gives a method to evaluate the quality of the mixing. The description of the methods of measurement and of testing given below are intended to help production control. Every effort has been made to keep these methods as simple as possible without detracting from the achievement of consistency of quality in the manufactured products.

D.2 Purpose

The purpose of the test is to ensure that the two parts of the sealant, usually referred to as base and curing compound, are mixed thoroughly.

D.3 Test specimen

Two pieces of clean 4 mm float glass of approximate 250 mm × 150 mm shall be prepared. Approximately 10 g of mixed sealant, freshly taken from the production line are required. The test should be carried out within five minutes of obtaining the sample, including visual inspection.

D.4 Test procedure

Hold the two pieces of glass by the edges, and examine them visually to ensure they are clean and free from smears, grease marks, finger prints or other contamination.

Place approximately 10 g of freshly mixed sealant in the centre of one piece of glass, which should be laid flat on a clean surface. Ideally the sealant should form a cone, with minimum entrapment of air. Where meter/mix machines are used, either robotic or manual, the sealant should be applied directly from the nozzle.

Place the second piece of glass onto the sealant to form a glass/sealant/glass combination and, using slight finger pressure, press the two pieces of glass together until the sealant is approximately 1 mm thick.

View both sides of the combination immediately, and examine for signs of striations (marbling or streaks) which would indicate poor mixing. The sealant should be evenly coloured over both surfaces.

NOTE The shade of colour in this test can be ignored as sealant manufacturers do not guarantee colour, any overall difference in shade of colour from the specification cannot be construed as evidence of an incorrect ratio.

D.5 Report

The report should indicate the quality of mix as noted by the test indicated above and should include the following:

– identification of mixer;
– designation and lot number of the sealant;
– date of test;
– any deviation from the test described above.

Annex E
(informative)

Sealants, hardness measurements

E.1 General

This annex gives a method to evaluate a quality aspect of the sealant after curing. The description of the methods of measurement and of testing given below are intended to help production control. Every effort has been made to keep these methods as simple as possible without detracting from the achievement of consistency of quality in the manufactured products.

E.2 Purpose

The purpose of this method of measurement is to be able to state the hardness of curable sealants in accordance with defined curing conditions.

E.3 Definitions

E.3.1 Curing time

– For two-part sealants: The time from completion of mixing of material until the final hardness in accordance with sealant manufacturer's information, is achieved.

– For one-part sealants: The time from removal of the sealant from its supply container into the open atmophere until the final hardness in accordance with sealant manufacturer's information, is achieved.

E.3.2 Free surface

The top surface of the sealant test specimen. When a mould has been filled with sealant, the top surface is planed with a scraper and cured towards the air side. This surface is called the free surface.

E.4 Instruments

– A shore A measuring instrument is used for the measurement of hardness.. There are two alternatives for the contact forces, of which alternative (a) is the most precise in relation to insulating glass unit sealants:

  a) a contact force of 50 N (total weight of instrument, guide, and weight: 5,0 kg ± 0,1 kg) is obtained when the instrument is mounted in a stand;
  b) a contact force in the form of firm finger pressure on the measuring instrument.

– Mould of polyethylene with an internal diameter of minimal 50 mm and a depth of minimal 6 mm, for preparation of sealant specimens.

– Rotating spiral mixer.

E.5 Calibration

The Shore A instrument is calibrated and adjusted regularly as described in ISO 7619 (Bibliography [7]). Using scales, the Shore A is calculated from:

$$F = 550 + 75HA \qquad \text{(E.1)}$$

where F is the force in millinewton (mN) measured by the scales, and
HA is hardness measured by the Shore A instrument.

The difference allowed between the calculated and measured force is ± 80 mN.

E.6 Test specimens

Sealant for the test specimens can be taken in two ways:

– two-part sealant is mixed for 5 min with a rotating spiral mixer at a maximum of 600 rpm. Usually the material is mixed according to nominal mixing ratio;
– from machines with sealant ready for use. Sufficient sealant for filling the mould is taken out.

The polyethylene mould is filled, avoiding air inclusions in sealant. The free surface is planed with a scraper.

Alternatively sealant could be placed on paper and top surface planed at a thickness more than 6 mm and area greater than 50 mm of diameter.

For curing conditions, one of the three following alternatives are recommended:

– A : (60 ± 5) min, 60 °C heating condition (e.g. infrared lamp, oven, etc.);
– B : (24 ± 0,5) h, factory conditions;
– C : (168 ± 4) h, factory conditions.

Condition A, B or C is chosen in agreement with the sealant supplier.

At the end of the curing time, the specimen is taken out of the mould (if used) and its temperature cooled down to factory conditions over the following periods depending on the curing conditions:

– A : (60 ± 5) min;
– B and C : (10 ± 2) min.

E.7 Test Procedure

The specimen is tested on a plane and firm base.

The hardness is measured on the free surface, or alternatively on the cut surface or on the surface which had been adjacent to the polyethylene mould. The final result is taken as the average of measuring at five different points (greater than 12 mm from edge and greater than 15 mm between the measuring spots).

The time from contact of the instrument with the free surface to reading of the instrument has to be no more than one second. If the instrument has a maximum indicator, this shall be used.

The instrument shall be read to the nearest whole Shore A.

E.8 Report

Statement of hardness according to this method should include the following:

- type of sealant and delivery number, mixing machine, date, etc.;
- hardness in whole numbers in unit of Shore A;
- contact force, in whole numbers in N;
- curing conditions: time, temperature;
- temperature during hardness measurement;
- surface e.g. free surface;
- any deviation from conditions in this test method.

Annex F
(informative)

Seals, adherance measurements

F.1 General

This annex gives methods to evaluate the adhesion of sealant to the various substrates. The description of the methods of measurement and of testing given below are intended to help production control. Every effort has been made to keep these methods as simple as possible without detracting from the achievement of consistency of quality in the manufactured products.

F.2 Purpose

The purpose of this method is to control the adhesion of organic based sealants to glass and if relevant, to the spacer. It can be applied either to incoming material or during production of the insulating glass units. This method ensures that the adhesion of the edge seal conforms with EN 1279-4.

For metal edge insulating glass units, refer to F.4.1.

F.3 General method

F.3.1 Instruments

For the achievement of a defined tensile tension, special test equipment is needed (see Figure F.1), which allows the application of different forces by a suitable set of weights. A tensile test machine may be used.

F.3.2 Test specimens

F.3.2.1 Glass-glass specimen

Two pieces of clean glass (20 mm × 30 mm, see Figure F.2) are applied to two shaping pieces and fixed with a tape. The gap will be filled with sealant. The conditioning time, temperature and relative humidity for the organic sealant should be stipulated in agreement with the sealant supplier and specified in the system description.

F.3.2.2 Spacer-spacer specimen

In case of spacer-spacer samples, two length of spacer bar (20 mm length, see Figure F.2) representative for production, are placed in parallel 11,5 mm apart. The gap can be filled with sealant by using a non-adhering plate on the opposite side. The conditioning time, temperature and relative humidity for the organic sealant should be stipulated in agreement with the sealant supplier and specified in the system description.

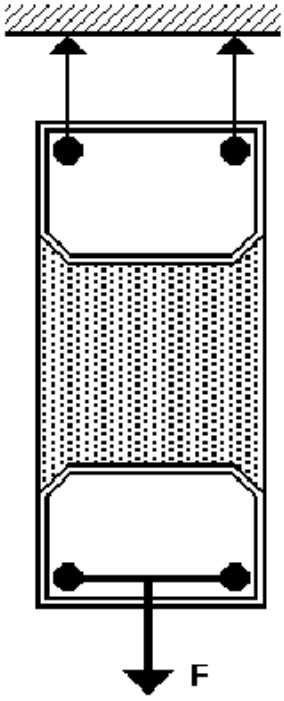
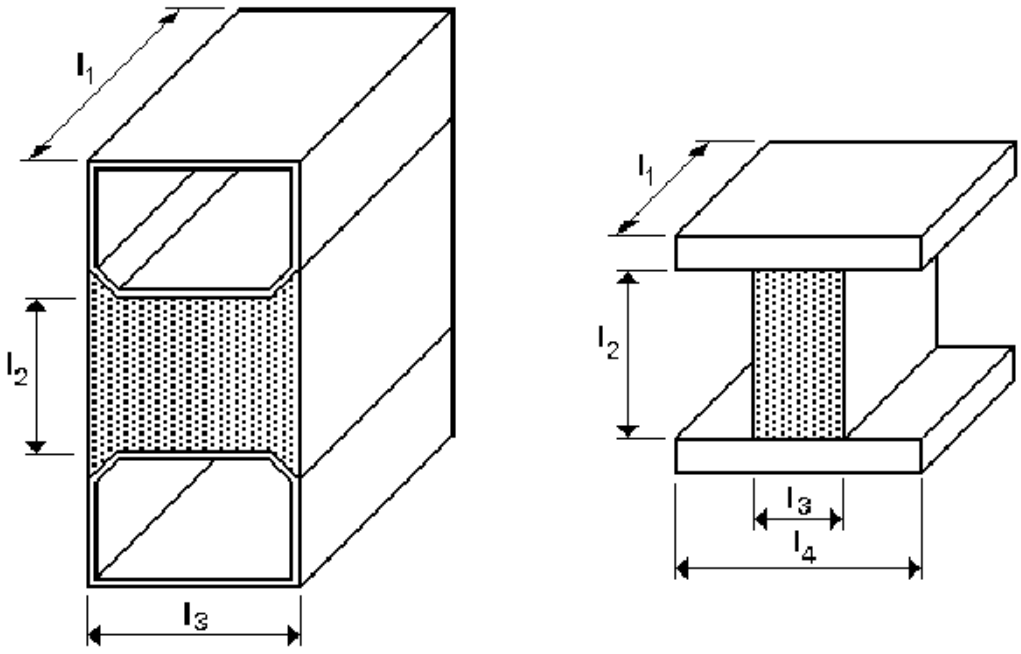


**Figure F.1 - Example of the principle of the adhesion test.
Tensile tension 0,30 MPa, test time 10 min**



Spacer-spacer sample: l_1 = 20 mm, $l_2 \geq$ 11,5 mm and l_3 = spacer width
Glass-glass sample: l_1 = 20 mm, l_2 = 25 mm, l_3 = 11,5 mm and l_4 = 30 mm.
Tensile tension: 0,30 MPa, test time 10 min.

Figure F.2 - Test specimen

F.3.3 Test procedure

A defined load is applied to the test specimen by hanging weights on it, on the specimen's holding device, the weight supports, etc. respectively.

The determination of the load is based on the width of the choosen spacer bar and the dimension of the test specimen. The self weight of the test device has to be considered. The tensile tension of the test specimen shall be 0,30 MPa. During the loading time of 10 min, no break is allowed.

F.3.4 Test report

The report on adhesion should include:

– type of sealant and delivery number, mixing machine, date etc.;
– type of glass and eventually type of watering;
– any deviation from conditions in this test method.

F.4 Other methods

F.4.1 Tensile test

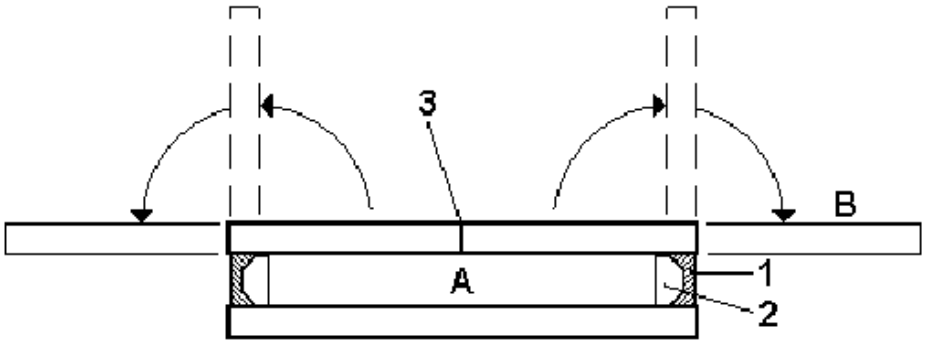
Initial tensile test (no ageing of test pieces) according to EN 1279-4 with test pieces described in annex A of EN 1279-4:2002.

F.4.2 Butterfly test

The butterfly test gives information on adherence to glass, to coatings and to glass where coatings are required to be removed, if it is known that the cohesive strength is satisfactorily, under production conditions. This test gives no information on the cohesive strength.

Assemble a unit according to Figure F.3 using clean glass taken from the production line, and press it on the production line. The minimum size should be acceptable for the washing machine and press.
Store the unit at a temperature of 23 °C or higher for a time in accordance with the sealant supplier.
Cut the glass in the middle (see figure F.3) and force both panes to position B using gloved hands or a suitable jig over a period of 10 s.
No adhesion failure of the sealant from the glass or the coating is allowed.

NOTE This method tests only the adhesion to glass and to coatings. Due to high stresses applied, failure of the sealant to the spacer does not constitute failure of the system.



Key
1 Sealant
2 Spacer
3 Cutting line
A Position A
B Position B

Length and width of test specimen convenient for washing machine and press

Figure F.3 - Example of a butterfly test piece

Annex G
(informative)

Volatile test

G.1 Testing elements

For the volatile test, including the measurement of the loss of mass after exposure to heating, the following parameters apply:

– temperature 70 °C, or higher upon agreement between insulating glass manufacturer and supplier of the material;
– exposure duration 7 d. If the time is disputed, then it should be recorded in agreement with the supplier of the relevant material.

For one test, at least two test pieces of adequate size should be used so that the equipment listed below can be applied.

The equipment can be:

– a simple oven receiving the test pieces;
– a balance capable to measure the volatile content of the material which may be releasing volatile, with an accuracy within 10 % absolute.

EXEMPLE: Volatile has been measured for painted spacers. Test specimen:
– initial weight: 4,390 6 g
– final weight after 7 d at 70 °C: 4,386 6 g
– difference: 0,004 0 g
Conclusion, rrequired accuracy of balance: 10 % of 0,0040 g is approximately 0,000 4 g

G.2 Test report

Statement of the volatile content should include:

– material or component;
– volatile content;
– temperature;
– time.

Annex H
(informative)

Tightness check of hollow spacer closed by welding on the back

H.1 Purpose

This test applies to hollow spacers with profile showing a closing slit on the back. In order to have a stiff and tight spacer, the closing slit is welded. This test checks the tightness of the welded slit.

H.2 Equipment

Penetrating liquid according to MIL-I-25135 (see Bibliography [8]).

H.3 Test specimen

Approximately one metre of spacer bar

H.4 Procedure

Place the test piece in a horizontal, slightly sloping position, with the welded slit downwards. Spray the penetrating liquid inside the spacer until the liquid comes out at the opposite end. Wait 5 min. Check with the black light for liquid leakage along the welded slit.

H.5 Test report

The statement of tightness to this method should include:

- designation of spacer bars and delivery number;
- the observed leakage if any;
- any deviations from the condition of this test method.

Annex J
(informative)

Adhesion test for leaded light strip

J.1 Purpose

The purpose of this annex is to describe the tests carried out on leaded light strip.

J.2 Equipment

The following equipment will be required to carry out the leaded light strip adhesion test:

– two 1 kg weights;
– two 500 g weights;
– two stands;
– two clamps;
– one piece of glass 80 mm wide and 950 mm long;
– one boning peg.

J.3 Test specimen

The leaded light sample should be four strips approximately 1,1 m long taken off the roll used to produce the leaded units. See Figure J.1.

J.4 Procedure

Stick two test specimens onto the piece of glass by removing the backing paper to expose the adhesive and using a boning peg to rub the lead. Secure the glass by the clamps and stand approximately 1,1 m from the bench top.

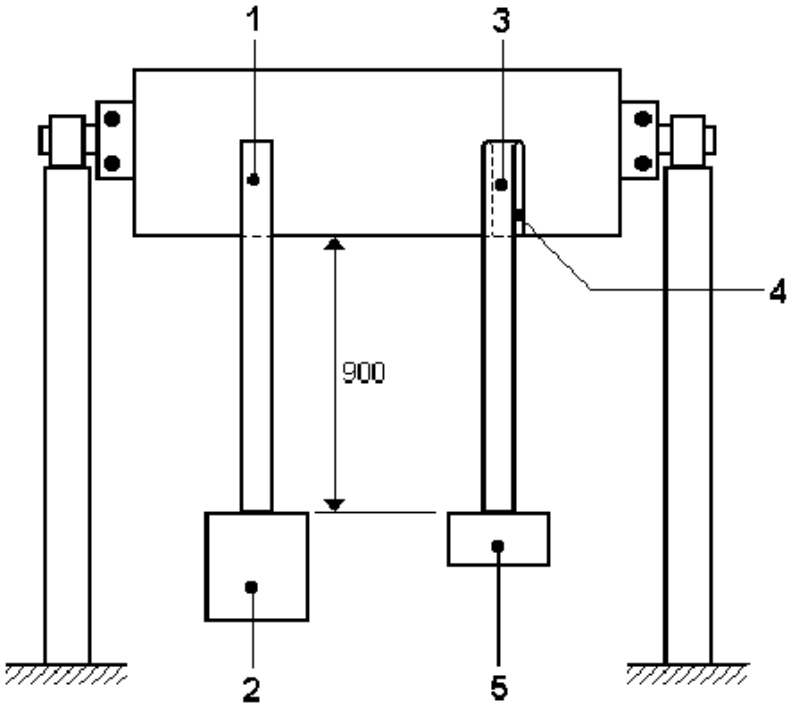
– Peel test: Leave the strip for one day to cure. Trim the strip so that there is 75 mm stuck to the glass. Fold back the strip on itself. Hang the 500 g weights from both pieces of lead so that adhesive is put under a force by approximately 0,9 m of lead pulling by the 500 g weight. Leave the weight on for a minimum of 30 min.

– Shear test: Leave the strip for one day to cure. Trim the strip so that it just touches the bench. Hang a 1 kg weight from both pieces of lead so that force is applied to the adhesive as a shear. Leave the weight on for a minimum of 2 h.

J.5 Test report

The test report on adhesion should include:

– designation of leaded light strip and delivery number;
– the observed peel or shear resistance time;
– any deviation from the condition of this test method.



Key
1 Shear resistance measurement
2 Weight with a mass of 1 000 g
3 Peel resistance measurement
4 Folded lead tape
5 Weight with a mass of 500 g

Figure J.1 - Illustration of the adhesion test for leaded light strip

Annex K
(informative)

Desiccant, adsorption capacity check

Desiccant suppliers may offer methods of checking the adsorption capacity for use in insulating glass unit factory production control. One possible method is the temperature increase (ΔT) measurement when desiccant and water are mixed.

Any method of checking should be accompanied by a table, graph or other mean of relationship between the measured variable (e.g. ΔT) and the real water content in the desiccant.

Bibliography

[1] EN 10218-1, *Steel wire and wire products - General - Part 1: Test methods.*
[2] EN 45011, *General requirements for bodies operating product certification systems (ISO/IEC Guide 65:1996).*
[3] EN 45012, *General requirements for bodies operating assessment and certification/registration of quality systmes (ISO/IEC Guide 62:1996).*
[4] EN ISO 9001, *Quality management systems - Requirements (ISO 9001:2000).*
[5] ISO 2137, *Continuous mechanical handling equipment for loose bulk materials - Oscillating conveyors and shaking or reciprocating feeders with tubular trough.*
[6] ISO 2859, *Sampling procedures for inspection by attributes.*
[7] ISO 7619, *Rubber - Determination of indentation hardness by means of pocket hardness meters.*
[8] MIL-I-25135

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