INTERNATIONAL STANDARD

ISO 28278-1

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Glass in building — Glass products for structural sealant glazing —

Part 1: Supported and unsupported monolithic and multiple glazing

Verre dans la construction — Produits verriers pour vitrage extérieur collé —
Partie 1: Vitrages monolithiques ou multiples, supportés ou non supportés

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 28728-1 was prepared by Technical Committee ISO/TC 160, *Glass in building*, Subcommittee SC 2, *Use considerations*.

ISO 28728 consists of the following parts, under the general title *Glass in building — Glass products for structural sealant glazing*:

— *Part 1: Supported and unsupported monolithic and multiple glazing*

— *Part 2: Assembly rules*

Glass in building — Glass products for structural sealant glazing —

Part 1:
Supported and unsupported monolithic and multiple glazing

1 Scope

This part of ISO 28278 specifies requirements for the suitability of supported and unsupported glass products (see Figure 1) for use in the structural sealant glazing (SSG) technique. Regarding glass products, this part of ISO 28278 constitutes a supplement to the requirements specified in the corresponding ISO standards with regard to verifying suitability for use in SSG systems.

Only soda lime silicate glass is taken into consideration in this part of ISO 28278.

The glass products are installed and bonded into the support under controlled environmental conditions, as described in ISO 28278-2.

Plastic glazing is excluded from the scope of this part of ISO 28278.

The structural, weatherproofing and sealant and outer seal of insulating glass unit (IGU) products, which are commonly used in structural glazing applications, are those based on organo-siloxane, “silicone” polymers, and recommended for use by the sealant manufacturer. Where there is a risk of earthquake, the sealant design may not be sufficient to resist the loads, and complementary arrangements may be necessary.

This part of ISO 28278 does not preclude the use of other sealant types where these can demonstrate suitability for service according to this part of ISO 28278 and when used following the recommendations of the sealant manufacturer.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 527-3:1995, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 868:2003, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1183-1:2004, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method*

ISO 3231:1993, *Paints and varnishes — Determination of resistance to humid atmospheres containing sulfur dioxide*

ISO 7389, *Building construction — Jointing products — Determination of elastic recovery of sealants*

ISO 9227:2006, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 10563:2005, *Building construction — Sealants — Determination of change in mass and volume*

ISO 11358-2, *Plastics — Thermogravimetry (TG) of polymers — Part 2: Determination of activation energy*

ISO 11600, *Building construction — Jointing products — Classification and requirements for sealants*

ISO 12543 (all parts), *Glass in building — Laminated glass and laminated safety glass*

ISO 16269-6, *Statistical interpretation of data — Part 6: Determination of statistical tolerance intervals*

ISO 20492 (all parts), *Glass in buildings — Insulating glass*

ISO 28278-2:2010, *Glass in building — Glass products for structural sealant glazing — Part 2: Assembly rules*

ASTM C 1184:2000, *Standard Specification for Structural Silicone Sealants*

ASTM C 1265:2005, *Standard Test Method for Determining the Tensile Properties of an Insulating Glass Edge Seal for Structural Glazing Applications*

3 Terms and definitions

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

NOTE Figure 1 is included only as an aid to explaining the terminology used in this International Standard. The components indicated in broken and dotted lines are covered by other technical specifications such as ETAG 002 or standards concerned with curtain wall façades.

3.1
structural sealant glazing
SSG
assembly in which glass products are fixed to the structural seal frame by means of a sealant that has been shown to be capable of withstanding the load actions applied to the glass products of the structural seal frame

3.2
anchorage
anchorage of the structural seal support frame on the framework

NOTE See (1) in Figure 1.

3.3
backer rod
pre-formed continuous strip that limits the section and height of a fillet of weather sealant

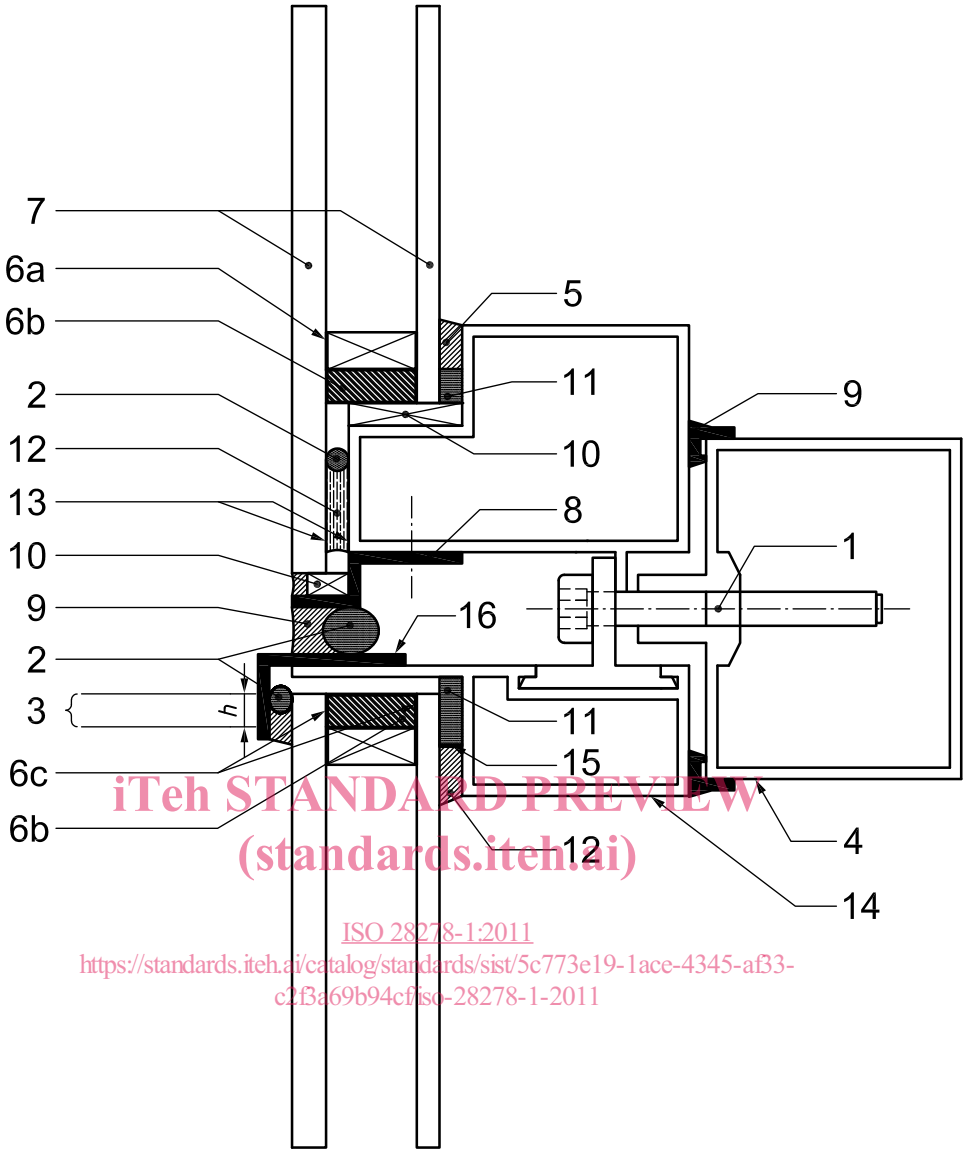
NOTE See (2) in Figure 1.

3.4
hermetic seal bite
dimension of the second barrier of the hermetic seal measured parallel to the glass unit at the panel level

NOTE See (3) in Figure 1.

3.5
façade framework
members to which the structural seal support frame is connected and which transmit the loads to the building

NOTE See (4) in Figure 1.



Key

1 anchorage
2 backer rod
3 height of the outer seal
4 façade framework
5 finishing material
6 hermetic seal
- 6a (inner seal)
- 6b (outer seal)
- 6c outer seal adhesion surface

7 glass unit
8 self-weight mechanical support
9 weather seal
10 setting blocks
11 adhesive spacer
12 structural seal
13 structural seal adhesion surface
14 structural seal support frame
15 anti-adhesive film
16 retaining device

Figure 1 — Terminology

3.6
finishing material
elastomeric sealant extruded into the joint, of sufficient cross-section as to constitute a barrier to air and water when cured, or a pre-extruded gasket with a fin of sufficient cross-section

NOTE See (5) in Figure 1 and (4) in Figure 3.

3.7
outer seal
sealant intended to ensure a hermetic seal, providing a barrier to water and vapour penetration, and light, around the edge of an insulating unit whilst remaining compliant with displacements caused by wind or other loads

NOTE 1 The hermetic seal is called “structural” (see 3.14) when it also has the supplementary function of adequately transmitting to the seal support frame the forces applied to the glass.

NOTE 2 See (6b) in Figure 1 and (3) in Figure 3.

3.8
glass unit
element consisting of a single glass pane (monolithic or laminated) or an insulating glass unit (IGU) specified for use in SSG

NOTE 1 The IGU may be one of two types: a unit with aligned edges for which the two panes have the same nominal dimensions, or a unit with stepped edges for which the two panes have different dimensions.

NOTE 2 See Figure 2 and (7) in Figure 1.

3.9
insulating glass unit
IGU
pre-assembled unit comprising panes of glass that are sealed at the edges and separated by dehydrated space(s), intended for use in buildings

3.10
self-weight mechanical support
element situated beneath the bottom edge of the glass unit that transmits the weight of the latter to the structural seal support frame

NOTE See (8) in Figure 1.

3.11
weather seal
fillet of sealant or weather fin of adequate cross-section constituting a barrier to air and water

NOTE See (9) in Figure 1.

3.12
setting blocks
bearing elements situated between the self-weight mechanical support and the bottom edge of a glass unit used to position the glass unit in the structural seal support frame and to avoid a permanent shear load

NOTE See (10) in Figure 1.

3.13
adhesive spacer
continuous pre-formed strip defining the cross-section of the fillet of sealant and used to align the glass relative to the structural seal support frame

NOTE See (11) in Figure 1.

3.14
structural seal
joint of elastic structural sealant extruded between glass element or glass and framework which is, when cured, of adequate transverse cross-section as to transfer appropriate forces applied on the glass to the structural seal support frame

NOTE See (12) in Figure 1 and (5) in Figure 3.

3.15
structural seal adhesion surface
continuous surface of the glass or structural seal support frame to which the structural sealant bonds

NOTE See (13) in Figure 1 and (6) in Figure 3.

3.16
structural seal support frame
metallic element to which the glass product is bonded

NOTE See (14) in Figure 1.

3.17
anti-adhesive film
film at the interface between two materials, used to prevent them bonding together

NOTE See (15) in Figure 1.

3.18
retaining device
piece intended to hold the glass product in place and therefore reduce any danger that may result in the event of a structural seal failure

NOTE See (16) in Figure 1.

3.19
cohesive failure
cohesive rupture
rupture in a body of the sealant

3.20
adhesive failure
adhesive rupture
rupture at the interface between the sealant and the substrate

3.21
initial cure
stage in the curing where the sealant has appropriate cohesive strength to resist different levels of action

3.22
creep factor
shear design stress under permanent static load

3.23
initial type testing
determination of the performance of a product (characteristics, durability), on the basis of either actual tests or other procedures

NOTE Other procedures include conventional, standardized, tabulated or generally accepted values, standardized or recognized calculation methods, and test reports when made available, in accordance with this International Standard.

3.24
test report
document that covers the results of tests undertaken on a representative sample of the product from production or on a prototype design of the product

3.25
product description
document that details the relevant parameters for defining a product that complies with its relevant standard

NOTE It includes specific reference(s) to characteristics that are modified by the production process and by raw materials.

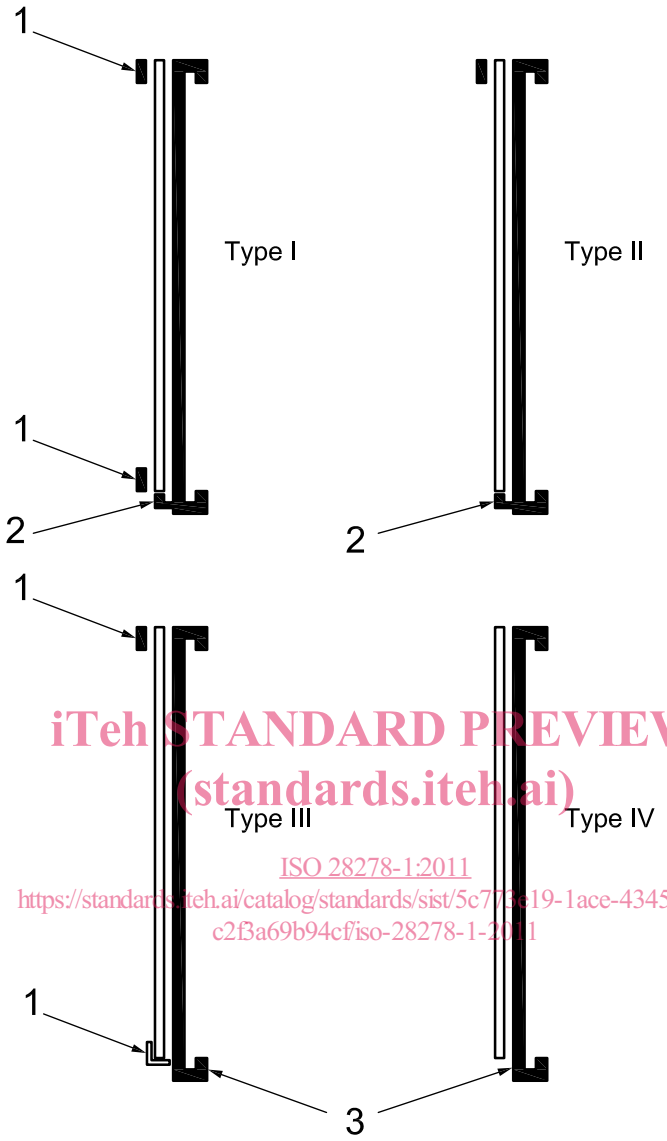
3.26
significant change
variation in performance beyond the permitted tolerance for the characteristic

4 Symbols

a	length of the smaller dimension of the glass	m
A_g	glass area	m^2
b	breadth of IGU air space	mm
b_w	width of the bead	mm
c	height of sealant necessary for structural purposes: $c = (0{,}5p \cdot a) / (\sigma \cdot \beta)$	mm
e_i	initial glass thickness per test piece for L_o	mm
E_o	modulus (tangent or secant)	kPa
F	relevant combined load for wind, snow and self-weight	Pa
F_s	shear force	Pa
$F_{t,i}$	tensile loading	Pa
F_{mean}	average breaking force	Pa
h	height of structural sealant	mm
h_o	height of sealant as specified in ISO 20492-2	mm
h_u	height of the outer seal of the unsupported IGU	mm
K_o	tangent stiffness at the origin	kPa
K_{sec}	rigidity modulus/secant stiffness	kPa
K_x	stiffness of the sample at x % elongation in the initial state	kPa
K_y	stiffness of the sample at y % elongation after conditioning	kPa
L	length of the loaded test piece	mm
L_o	initial length of the test piece	mm
l_s	vertical length of the outer seal	mm
l_b	length of the bead	mm
m	number of observations per test piece	—
n	number of test pieces per test for the temperature concerned	—
p	relevant combined load of the wind, snow, climatic effects and self-weight	kPa
P_u	weight of the unsupported IGU	kPa

R_{des}	design resistance	kPa
$R_{u,5}$	characteristic force giving 75 % confidence that 95 % of the test results will be higher than this	kPa
r	distance between structural seal and glass edge	mm
r_o	step between both glass components	mm
s	standard deviation of the series	—
s_{min}	minimum dimension of glass	m
s_{max}	maximum dimension of glass	m
t_1	minimum glass thickness of the outermost component of an IGU	mm
t_2	minimum glass thickness of the innermost component of an IGU	mm
t	time	—
u_c	displacement under compression	mm
u_{ij}	displacement under tension or compression	mm
w	width of structural sealant	mm
X	breaking stress	kPa
X_i	value of the breaking stress of test piece i, either under tension or shear	kPa
$\bar{x}$	average breaking stress, either under tension or shear	kPa
$\bar{x}_o$	average breaking stress, either under tension or shear, in the initial state	kPa
$\bar{x}_c$	average breaking stress, either under tension or shear, after conditioning or ageing	kPa
$\bar{x}_{tear}$	average tear breaking strength	kPa
ΔH	maximum difference in altitude between production transport and assembly at site	m
σ	allowable stress of the sealant	MPa
β	coefficient depending on relative thickness of insulating glass panes	—
τ	shear stress	kPa
$\tau_{\alpha\beta}$	eccentricity of 5 % with 75 % confidence	—
Γ_∞	shear design stress value declared by the sealant manufacturer	kPa
Γ_{des}	shear design stress under dynamic load	kPa
σ_{des}	design stress	kPa
σ_{ij}	tensile stress at the tensile displacement u_{ij}	kPa
γ_c	safety factor	—

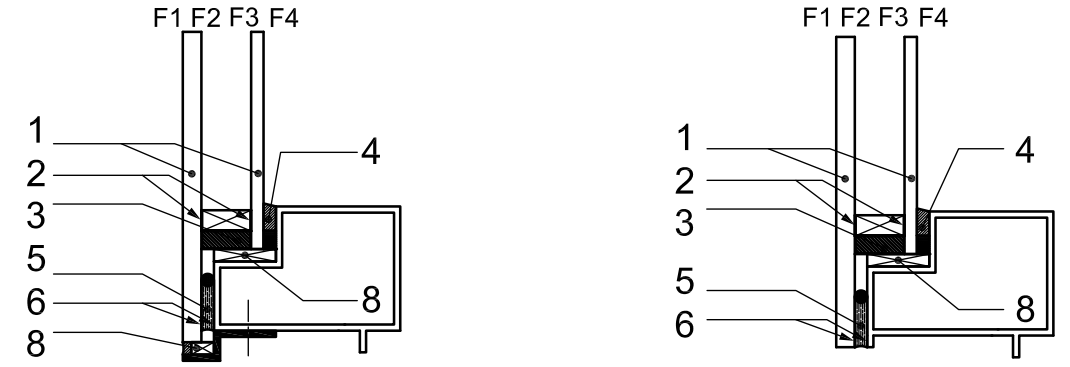
5 Principle



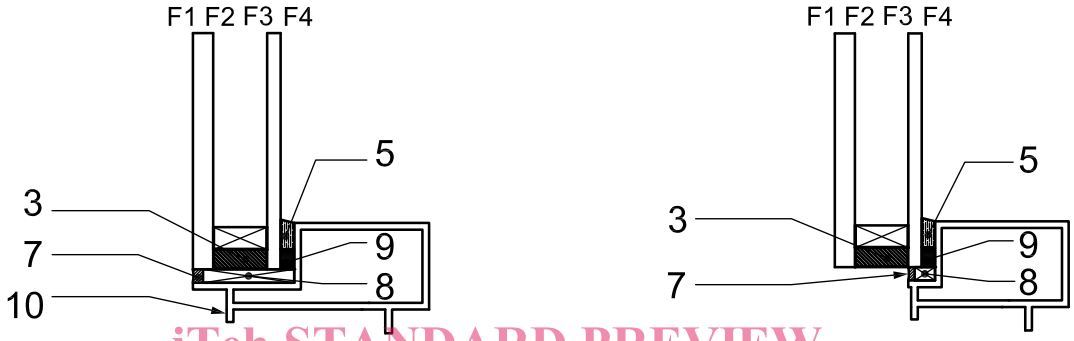
Key

1 retaining device
2 mechanical self-weight support
3 structural sealant support frame

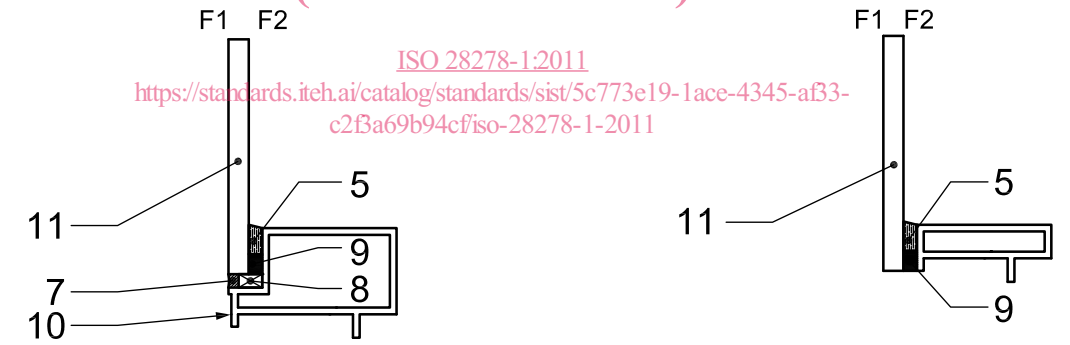
Figure 2 — Schematic examples of the different types of SSG system



a) Situation 1



b) Situation 2



c) Situation 3

Key

1	insulating glass unit	9	adhesive spacer
2	inner seal	10	structural seal support frame
3	outer seal	11	laminated or monolithic glass
4	finishing material	F1	face 1
5	structural seal	F2	face 2
6	structural seal adhesion surface	F3	face 3
7	weather seal	F4	face 4
8	setting block		

NOTE The section drawings above are examples of structural sealant glazing system types II and IV.

Figure 3 — Principle

SITUATION 1

The SSG seal is applied on face 2 of the insulating glass unit (IGU). The outer IGU sealant has no structural function and therefore only contributes to the resistance of the unit against the ingress of water (vapour and liquid), and air. Depending on the type and construction of the IGU sealant, any leakage of gas from the unit will be minimised. The SSG seal must have good adhesion to the glass and steel surfaces to withstand the mechanical stresses that result from the exposure of the IGU to the climatic elements and in particular the effects of solar radiation.

SITUATION 2

The SSG seal is applied on face 4 of the IGU. The outer IGU sealant has a structural function as well as having to maintain the integrity and performance of the IGU. Any stress or loads applied to the outer glass will be transferred to the IGU sealant.

SITUATION 3

The SSG seal is applied on face 2 of the laminated or monolithic glass unit. The sealant has a structural function and any loads applied to the glass will be transferred to it.

6 Required characteristics of glass products

6.1 Appropriate glass products

This part of ISO 28278 only allows the use of the following glass products.

6.1.1 Float glass

Until an ISO standard is published, the following standards may apply:

— EN 572-2;

— JIS R 3202;

— ASTM C 1036.

6.1.2 Polished wired glass

Until an ISO standard is published, the following standards may apply:

— EN 572-3;

— JIS R 3204.

6.1.3 Drawn sheet glass

Until an ISO standard is published, the following standard may apply:

— EN 572-4.

6.1.4 Patterned glass

Until an ISO standard is published, the following standards may apply:

— EN 572-5;

— JIS R 3203.

6.1.5 Coated glass

The following standards may apply:

— EN 1096;
— ASTM C 1376;
— JIS R 3221.

6.1.6 IGU

Until ISO 20492 (all parts) is published, the following standards may apply:

— EN 1279;
— ASTM E 2190;
— ASTM C 1249;
— JIS R 3209.

6.1.7 Heat strengthened soda lime silicate glass

The following standards may apply:

— EN 1863;
— ASTM C 1048;
— JIS R 3222.

6.1.8 Thermally toughened soda lime silicate safety glass

The following standards may apply:

— EN 12150;
— ASTM C 1048;
— JIS R 3206.

6.1.9 Heat soak tested thermally toughened soda lime silicate safety glass

The following standard may apply:

— EN 14179.

6.1.10 Laminated glass and laminated safety glass

The following standard may apply:

ISO 12543 (all parts).

6.2 Dimensional tolerances

The tolerances for the different glass products can be found in the appropriate glass standards listed in 6.1.