Use of glass and acrylic glass in stand construction and design inside trade fair halls

Information sheet (Supplement to Technical Regulations, chapter 4.4.3)

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CONTENTS

1 SCOPE OF APPLICABILITY 2
2 DEFINITIONS AND EXPLANATIONS 2
  2.1 Types of supports 2
  2.2 Types of glass and acrylic glass 2
  2.3 Design calculation standards 2 / 3
  2.4 Material properties of glass products 3
3 STAND DESIGN, CONSTRUCTION AND LOADS 3
  3.1 Vertical glazing not intended to prevent falling 3
    3.1.1 Vertical glazing of a height h ≤ 4 metres above hall floor level 3
    3.1.2 Vertical glazing of height h > 4 metres above hall floor level 3 / 4
  3.2 Vertical glazing intended to prevent falls 4
    3.2.1 Category A – vertical glass wall 4
    3.2.2 Category B – clamped glass balustrade with continuous handrail 4
    3.2.3 Category C – Railing and balustrade infills and glass walls with load-distributing cross-bar fitted in front of it 4
  3.3 Horizontal glazing 5
    3.3.1 Overhead glazing 5
    3.3.2 Glazing designed to support human loads 5
4 APPROVAL PROCEDURES 6
  4.1 Basics 6
  4.2 Installation approval for a specific case 6
5 NOTES ON DESIGN AND DESIGN CALCULATIONS 7
6 EXAMPLES OF STRUCTURES (BARRIERS) DESIGNED TO PREVENT FALLS 7
  6.1 Category B 7
  6.2 Category C
    6.2.1 Railing infills secured vertically on 2 sides 8
    6.2.2 Railing infills secured horizontally on 2 edges 8
    6.2.3 Railing infills secured on 4 sides 8
    6.2.4 Glazing secured at individual points by means of drilled anchorage points (design specifications in accordance with TRAV and/or DIN 18008-4) 9
    6.2.5 Point mounting with lateral clamps and anti-slip grips 10
    6.2.6 Point mounting with clamps at top and bottom 10
  6.3 Balustrade with horizontal bars
    (protection against falling is provided solely by sufficiently strong handrails and knee-height bars) 10
7 CONSTRUCTION ENGINEERING REGULATIONS, GENERALLY ACCEPTED RULES OF ENGINEERING AND REFERENCES 11
8 ABBREVIATIONS 11
9 Keyword Index 12

Table A: Vertical glazing, not intended to prevent falling 13
Table B: Vertical glazing, intended to prevent falls (barrier glazing) 14
Table C: Horizontal glazing 15
Information sheet (Supplement to Technical Regulations, chapter 4.4.3)

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1 SCOPE OF APPLICABILITY

This information sheet discusses the regulations concerning the use of glass and acrylic glass in stand construction and design inside trade fair halls. It does not apply to stand construction and design outside trade fair halls. Designing, dimension calculations and assembly of glass components for use inside trade fair halls require that the design, planning and assembly personnel involved is adequately qualified for glass construction projects. Glass structures which have received general construction approval (including European Technical Approval ETA) may be used in all cases in trade fair halls in accordance with the wording of the approval. This information sheet does not impose restrictions on the use of such structures.

2 DEFINITIONS AND EXPLANATIONS

2.1 Types of supports

Glazing secured by linear supports:
- Glazing secured at individual points:

Laminated safety glass (LSG):
- Float glass
- Heat-strengthened glass (HSG)
- Tempered safety glass (TSG)

2.2 Types of glass and acrylic glass

Types of glass granted statutory construction approval in Building Regulation List A:

Float glass (polished plate glass – PPG) as specified in DIN EN 572-2:
- Also called flat or plate glass. It is characterised by relatively low ultimate flexural strength, and when destroyed, it fragments into large sharp-edged shards. Its use as single sheet glazing in trade fair construction is prohibited. If used in LSG, it is permitted in trade-fair construction.

Tempered safety glass (TSG) as specified in DIN 12150-1:
- TSG is a fully thermically pre-stressed type of glass. It has internal residual stress characteristics: core tensile stress and surface compressive stress. It has high ultimate flexural strength and when broken, it shatters into crumb-like fragments. Where TSG is referred to in this information sheet, TSG made of float glass is always meant.

Laminated safety glass (LSG): LSG consists of at least two sheets of PPG, TSG or HSG glass. The individual thicknesses of these are not permitted to differ from each other by a factor of more than 1.5. The sheets of glass are laminated together by intermediate film layers (PVB or SGP films). If a sheet is broken, then the film prevents the fragments from being scattered, thus providing residual load-bearing capacities and reducing the risk of injury from cuts.

Heat-strengthened glass (HSG) as specified in DIN EN 1663-1 or with other general approvals by building authorities (German: allgemeine bauaufsichtliche Zulassung – abZ).
- HSG is a type of glass that is only partially thermically pre-stressed. Its ultimate flexural strength is lower than that of TSG (tempered safety glass). When broken, HSG fragments into shards which are larger than those of broken TSG. Therefore LSG sheets made of HSG have higher residual load-bearing capacities than LSG sheets made of TSG. HSG laminated with PVB film is included in Building Regulation List A. A general construction approval by building authorities (German: allgemeine bauaufsichtliche Zulassung – abZ) for the SGP film is required for HSG laminated with SGP.

Types of glass for which no statutory construction approval has been granted:

Acrylic glass:
- Acrylic glass is a transparent thermoplastic product marketed under the brand names Plexiglas® and Perspex®, for example. At present no recognised technical regulations are available for the use of acrylic glass.

Polycarbonate products: e.g. Makrolon

Acrylic glass and polycarbonate may only be used for non-load-bearing, decorative infill components.

2.3 Design calculation standards

The static strength proof calculations for glass components can be carried out in accordance with the following design calculation concepts and structural design standards:

- Standards applying to loads and actions:
  - This information sheet
  - DIN EN 1991 1 1/NA (2010-12)
  - DIN EN 1991 1 1, NA (2010-12)

Normal load factors γV for permanent loads (e.g. dead loads):
- 1.35

Normal load factors γV for variable loads and actions (e.g. dynamic pressure, imposed loads, cross-bar pressure):
- 1.5

Duration of loads typically encountered at trade fairs:
- Own weight: permanent (γV = 0.25)
- Working loads: medium (γV = 0.4)
- Horizontal substitute load: short (γV = 0.7)
- Cross-bar pressure: short (γV = 0.7)
Information sheet (Supplement to Technical Regulations: chapter 4.4.3)

Use of glass and acrylic glass in stand construction and design inside trade fair halls

For static load calculations, either concept A, comprehensive safety, or concept B, load factors, shall be used as a basis. The two concepts must not be mixed (used together). After the design dimension calculation concept A or B has been chosen, all design requirement specifications (e. g. framing limits, glass clamping depth etc.) given in the set of standards chosen for the design concept are to be applied. The verbal description and the symbols and abbreviations used in equations must make it absolutely clear which concept is being applied. Supporting forces transmitted by glass components must always be stated for the SLS (GZG) and the ULS (GZT) so that the loads of the connected force-transmitting components of concrete, steel or wood can be calculated using the load-factor concept without transmission errors.

### 2.4 Material properties of glass products

Glass products have a bulk density of 25 kN/m³, a thermal expansion coefficient of $6.4 \times 10^{-6}$/K and their Young’s modulus is 70,000 N/mm².

For structural design calculations, the bending stresses listed in Table 1 are allowed (concept A) or the design calculation values of the resistance $R_d$ listed in Table 2 must be observed (concept B).

### Table 1: Allowable bending stresses for various glass sorts, in N/mm² (for static proof calculations according to the allowable stress concept)

<table>
<thead>
<tr>
<th>Glass Type</th>
<th>TSG</th>
<th>HSG</th>
<th>LSG made with float glass (PPG)</th>
<th>Float glass (polished plate glass PPG)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead glazing</td>
<td>50</td>
<td>30</td>
<td>18</td>
<td>79</td>
</tr>
<tr>
<td>Vertical glazing</td>
<td>50</td>
<td>30</td>
<td>18</td>
<td>79</td>
</tr>
</tbody>
</table>

### Table 2: Normal material properties for design calculation concept B, application of load factors

<table>
<thead>
<tr>
<th>Property</th>
<th>Normal limit stress $f_{lim}$, in N/mm²</th>
<th>Design coefficient $k_p$, normal</th>
<th>$k_{VSG}$ for laminated safety glass</th>
<th>$k_{Kante}$ for calculating the effect of glass edges</th>
<th>Material factor $Y_M$</th>
<th>Modification factor for calculating the effect of load durations</th>
<th>Rated value of the resistance to stress failure $R_d = k_{mod} * k_{VSG} * k_{Kante} * f_{lim} / Y_M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>45</td>
<td>1.8</td>
<td>1.1</td>
<td>0.8</td>
<td>1.8</td>
<td>permanent: 0.25</td>
<td>$R_d = k_{mod} * k_{VSG} * k_{Kante} * f_{lim} / Y_M$</td>
</tr>
<tr>
<td>Plated polished glass (not printed, not sand-blasted)</td>
<td>70 N/mm²</td>
<td>1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.5</td>
<td>medium duration: 0.4</td>
<td>$R_d = k_{mod} * k_{VSG} * k_{Kante} * f_{lim} / Y_M$</td>
</tr>
<tr>
<td>HSG (not printed, not sand-blasted)</td>
<td>120 N/mm²</td>
<td>1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.5</td>
<td>short: 0.7</td>
<td>$R_d = k_{mod} * k_{VSG} * k_{Kante} * f_{lim} / Y_M$</td>
</tr>
</tbody>
</table>

The intermediate films in LSG shall be made of PVB or SGP (SentryGlass®) plus. Films made of PVB must have a tear strength of at least 20 N/mm². SGP films shall have general approval by building authorities (including European Technical Approval ETA) and shall be processed in accordance with this approval.

### 3 STAND DESIGN, CONSTRUCTION AND LOADS

#### 3.1 Vertical glazing not intended to prevent falling

3.1.1 Neither static proof of structural characteristics in accordance with the regulations specified in chapter 2.3 is required, nor is it necessary to submit documentation of testing. In this case the exhibitor alone is responsible for ensuring that the construction/design is technically safe for general use and that it meets current and accepted technical standards. Table A provides an overview of the types of structural designs that are possible.

- **G** Either TSG or LSG must be used.
- **F** The glass sheets may be secured by linear supports or at individual points.
- **F** Glass walls tilting at an angle of more than $10^\circ$ from the vertical are considered to be overhead glazing for which the provisions of chapter 3.3 shall apply.

**Additional measures, e. g. provision of static proof calculations similar to those described in chapter 3.1.2, may be required to ensure protection of neighbouring walkways, or to be able to bear the loads of persons leaning against or bumping into the glass.**

**In addition, the following provisions shall be observed:**

- **F** Vertical glazing of height $h = 4$ metres above hall floor level.
- **G** Wherever there is a high risk of impact, e. g. where there is a descending ramp leading towards the glass, additional measures are required.

**Wherever there is a high risk of impact, e. g. where there is a descending ramp leading towards the glass, additional measures are required.**

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![Image](Image 145x840 to 206x1075)
Use of glass and acrylic glass in stand construction and design inside trade fair halls

3.2 Vertical glazing intended to prevent falls

In all three of the following categories, A, B and C, static load proof calculations for the glass and the supporting structures and proof of the load-bearing capacity under impact-like conditions are required. The static structural design calculations for the glass and the supporting structure shall be based on an assumed cross-bar pressure load and an additional load case, a horizontal assumed surface load of \( h_1 = 0.125 \, \text{kN/m}^2 \) for all visible surfaces at up to 4 m above the hall floor level and of \( h_2 = 0.063 \, \text{kN/m}^2 \) for surfaces located at more than 4 m above hall floor level.

The load-bearing capacity of the structure under impact action can be verified as follows:

- A pendulum impact test in accordance with DIN EN 12 600 if design calculation concept A is used, or in accordance with DIN 18008-4 if design calculation concept B is used, or
- the relevant design specifications, glass dimensions and thicknesses as stated in Table B are adhered to, or
- by providing proof calculations in accordance with the rules described in chapter 2.3.

Table B contains an overview of possible designs and the proofs required. All structural design details (including flexing/sag and glass insertion/clamping depth) shall be modelled in accordance with the rules described in chapter 2.3.

Pendulum impact tests must be carried out by one of the test centres/institutes named in chapter 4 well in advance of the fair and outside the trade fair halls.

3.2.1 Category A – vertical glass wall

Definition: Linearly-supported vertical glazing that does not contain any load-bearing bars at capping height and is not protected by a rail or cross-bar located in front of it, making it suitable for the direct action of rail or cross-bar loads, e. g. glazing of full room height.

If protection is required to prevent persons falling from a height of more than 1 metre, then it is necessary to refer to the Technical Regulations for the Use of Accident-Prevention (barrier) Glazing [Technische Regeln für die Verwendung von abschottenden Verglasungen (TRAV)] or DIN 18008-4.

- Only LSG shall be used.
- Verified proof of structural characteristics or static structural calculations suitable for verification, as well as a pendulum impact test (test in accordance with DIN EN 12 600 or DIN 18008-4) are required.

3.2.2 Category B – clamped glass balustrade with continuous handrail

Definition: Load-bearing glass balustrades held by linear supports secured by clamp-type base mountings, the individual glazing elements of which are connected by a continuous, load-bearing handrail (see example in chapter 6.1) attached to the top of the structure.

- Only LSG shall be used.
- Verified proof of structural characteristics or static structural calculations suitable for verification, as well as a pendulum impact test (test in accordance with DIN EN 12 600 or DIN 18008-4) are required.

If LSG made of 2 x 10 mm TSG (or 2 x 10 mm HSG) is used, no pendulum impact test is required, provided that the dimensions as stated in Table B are adhered to (design details in accordance with TRAV or DIN18008-4).

- The thickness of the intermediate PV/SGP film must be at least 1.52 mm.

- The securing clamps must be at least 100 mm above floor level.

Calculations shall be provided proving that the loads will be distributed via the capping to neighbouring glass sheets in the event of an individual sheet being destroyed. The stresses occurring in the neighbouring glass sheets under the resulting conditions may then increase to 50 % above permissible limits if structural design calculation concept A was applied. If structural design concept B has been applied, this case can be classified as an extraordinary design calculation situation. The destroyed or damaged glass sheet shall be replaced immediately after the incident.

3.2.3 Category C – Railing and balustrade infills and glass walls with load-distributing cross-bar placed in front of it

Definition: Accident-prevention (barrier) glazing which is not intended to distribute capping loads and which corresponds to one of the following groups:

- C1: Railing/balustrade infills secured by clamp-type base mountings and/or at individual points on at least two opposing sides.
- C2: Vertical glazing beneath a crosswise load-distributing spanning member located at capping level and secured by linear supports on at least two opposing sides.
- C3: Category A type glazing with a load-distributing cross-bar placed in front of it.

For category C1 and C2 type glazing, the use of TSG is allowed if the loads are secured by linear supports on all sides. For all other types of supports and for category C3, only LSG may be used unless other statutory construction approval exists.

Table B contains an overview of possible designs and the proofs required.

- The pendulum impact test is not required if the relevant design specifications and the dimensions and thickness of the glass as stated in Table B or TRAV or in DIN 18008-4 are adhered to.

Alternative measures / protection against glass breakage:

If the proof calculations for category C are in accordance with TRAV or DIN 18008-4 are not submitted for accident-prevention (barrier) glazing, then the accident-prevention (barrier) attribute can be achieved by installing adequately sturdy knee-height cross-bars or steel rope of at least 5 mm diameter at a vertical spacing of not more than 35 cm and at an adequate...
Use of glass and acrylic glass in stand construction and design inside trade fair halls

3.3 Horizontal glazing

3.3.1 Overhead glazing

Glass walls tilted at an angle of more than 10° from the vertical are considered to be overhead glazing. Table C contains an overview of possible designs and the proof documentation required. Only the following glass products may be used:

- LSG made with float glass (PPG)
- Wire glass (only for existing components)

In addition to submitting certification of load-bearing capacities, experimental proof of residual load-bearing capacity must be provided or, if this is not possible, a safety net must be hung under the glazing. If the structural design requirements of TRVL or as specified in DIN 18008-2 are met, proof of the residual load-bearing capacities in not required. The design loads to be assumed are the sheet's own weight and a horizontal pressure corresponding to at least h1 = 0.125 kN/m² for visible surfaces of up to 4 m above hall floor level or h2 = 0.063 kN/m² for vertical visible surfaces at more than 4 m above hall floor level. The sheets must secure in such a way as to properly safeguard against them slipping out of the mounts and forces which may lift them off the mounts. The design dimensions of glass sheets mounted at individual points and HSG sheets shall either be calculated according to the rules outlined in chapter 2.3 or they must have general construction approval (abb). If, for cleaning purposes, overhead glazing periodically has to support human loads, then such additional loads must be taken into consideration and experimental proof of residual load-bearing capacities must be provided [8].

In such cases a special individual construction approval is always required.

Cutting of recesses or notches in the glass sheets is not allowed.

LSG sheets with an effective span exceeding 1.20 m shall be supported. The maximum permissible sag shall not exceed 1/100 of the effective span between the closer supports of the sheet.

3.3.2 Glazing designed to support human loads

This kind of glazing is specifically intended to be subjected to persons walking over it, e.g. stairs, platforms, landings and cat-walks. The design and proof calculations shall take both dead loads (own weight) and the working loads into account. In addition, proof of impact resistance and residual load-bearing capacity shall be provided. Proof of impact resistance and residual load-bearing capacities as a result of component tests must be submitted. The requirements are specified in [8] and in DIN 18008-5.

For glazing mounted in linear supports at all four edges and an assumed working load of not more than 5.0 kN/m² for design calculations, proof of impact resistance and residual load-bearing capacity is deemed to have been provided if the sheets conform to the dimensions listed in Table 3.

Table 3: Glazing mounted in linear supports at all four edges and intended to support human loads, with proven impact resistance and residual load-bearing capacity

<table>
<thead>
<tr>
<th>max. length [mm]</th>
<th>max. width [mm]</th>
<th>LSG structure [mm] (top /<em>/centre/</em>/bottom)</th>
<th>Minimum supporting surface depth [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>400</td>
<td>8 HSG /<em>/10 Float /</em>/10 Float</td>
<td>30</td>
</tr>
<tr>
<td>1750</td>
<td>750</td>
<td>8 HSG /<em>/12 Float /</em>/12 Float</td>
<td>30</td>
</tr>
<tr>
<td>2000</td>
<td>1250</td>
<td>8 HSG /<em>/10 TVG /</em>/10 HSG</td>
<td>35</td>
</tr>
<tr>
<td>1500</td>
<td>1500</td>
<td>8 HSG /<em>/12 TVG /</em>/12 HSG</td>
<td>35</td>
</tr>
<tr>
<td>2000</td>
<td>1400</td>
<td>8 HSG /<em>/15 Float /</em>/15 Float</td>
<td>35</td>
</tr>
</tbody>
</table>

Glazing designed to support human loads may be secured by linear supports or at individual points. It must be made of LSG consisting of at least three layers of TSG and/or HSG/float glass. From the point of view of impact resistance, the use of TSG or HSG for the top layer is recommended. This design must possess non-slip characteristics in accordance with DIN 51097. In order to achieve the required residual load-bearing capacity, the two lower layers will normally be made of float glass or HSG. Glazing, mountings and supporting structure must be designed and their dimensions calculated to withstand the load of their own combined weight (dead load) as well as intended human (working) loads in accordance with the chosen design calculation concept and all relevant and applicable standards.
4 APPROVAL PROCEDURES

4.1 Basics

If a glass component and its glass products conform to the technical building regulations outlined in chapter 2.3 and to generally accepted technical principles, then it shall be sufficient to submit the verified structural calculations and the verified plans, following which construction approval will be granted. In addition, the construction work on site will be checked and the results subjected to an approval inspection.

If additional components are installed for which statutory construction approval, a statutory construction test report or type approval are required, then these documents are to be submitted together with the structural calculations.

If a glass component or parts of this component do not conform to the construction engineering regulations and generally accepted technical principles outlined in chapter 2.3, and if no statutory construction approval or statutory construction test certificate can be produced, then an individual construction approval (Zustimmung im Einzelfall – ZfE) shall be required. An Installation Approval for a Specific Case may be granted instead of the individual construction approval if glass is used only within the rules and limitations described in this information sheet.

4.2 Installation approval for a specific case

This approval procedure is similar to the procedure for obtaining individual construction approval. If an Installation Approval for a Specific Case has been granted once for a particular construction/design and type of usage, then the trade fair companies in question will accept this for an identical design serving an identical purpose. Nevertheless, a new application for construction work approval and approval inspection shall be submitted for each repeated case. The test report, all certificates and approvals, design details, as well as glass dimensions and thicknesses must be submitted with the application.

Glass components requiring approval and which require type 3 proof documentation are listed in column 14 of Tables A, B and C.

Installation approvals for specific cases cannot be granted at short notice, as they require a considerable period of time for processing. Applications for these should therefore be submitted at least 6 weeks before the commencement of construction.

Prior to conducting component tests, it is advisable to contact the relevant trade fair company in good time in order to coordinate procedures and intended testing methods. Normally, component testing requirements stipulate inclusion of parts of the glass component’s actual substructure in order to simulate realistic loads.

The procedure for obtaining an Installation Approval for a Specific Case is as follows:

1. The structural calculations and the required certificates confirming the identity of the product(s) (glass manufacturer/processing company’s factory certificates) must be verified and checked by a publicly certified structural building surveyor and tester (in the field of steel, concrete and brick construction/engineering).

2. The surveyor shall confirm that there are no objections with regard to the design’s suitability for use. It is his responsibility to decide on the necessity of additional testing of materials, impact resistance and whether further proof of residual load-bearing capacities must be obtained. The test report must be submitted to the trade fair company along with the other application documents requesting construction work permit (construction permit) and subsequent monitoring of the stand construction work and stand approval inspection.

3. Final approval will be granted on location following an inspection to confirm that the construction/design on site conforms to the previously inspected documents. The engineer carrying out the monitoring and inspection acts on behalf of the trade fair company.

Recommended Institutes for testing components used in glass construction/design:

<table>
<thead>
<tr>
<th>Institute/Office</th>
<th>Address</th>
<th>Contact Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technische Universität Dresden, Institut für Baukonstruktionen (Bayer-Bau)</td>
<td>Prof. Dr.-Ing. Woller George-Bähr-Str. 1 80333 München</td>
<td>Prof. Dr.-Ing. Woller</td>
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<td>Freiburg, Universität Freiburg, Institut für Massivbau</td>
<td>Prof. Dr.-Ing. Marx Leutert-Lücker, Universität Hannover Appelstr. 9a 76131 Karlsruhe</td>
<td>Prof. Dr.-Ing. Marx</td>
</tr>
<tr>
<td>RWTH Aachen, Lehrstuhl für Stahlbau</td>
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<tr>
<td>FMPA Baden-Württemberg FR 2, Abt. 21, Referat 214</td>
<td>Münzstraße 4 70569 Stuttgart</td>
<td>Münzstraße 4</td>
</tr>
<tr>
<td>IMT München</td>
<td>Prof. Dr.-Ing. Bozik Karlstr. 6 80333 München</td>
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<td>Prof. Dr.-Ing. Hentinger</td>
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</tr>
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<td>MPA Darmstadt</td>
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<tr>
<td>Universität Karlsruhe</td>
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<td>Universität Karlsruhe</td>
</tr>
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<td>Friedrich &amp; Kirchhammer</td>
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</tr>
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<td>Theodor-Grieß-Str. 7-9 83305 Rosenheim</td>
<td>Institut für Fenstertechnik e.V.</td>
</tr>
</tbody>
</table>
Use of glass and acrylic glass in stand construction and design inside trade fair halls

5 NOTES ON DESIGN AND DESIGN CALCULATIONS

5.1 Glass is a brittle material, any failure of which will occur spontaneously and without warning.
5.2 Glass is sensitive to blows with hard, pointed objects. These properties lead to the following guideline notes:
5.3 Proof calculations for the load-bearing capacity of structural glass not only take into consideration the unbroken glass but always include an investigation of the broken or partially broken glass (proof of residual load-bearing capacity).
5.4 The support design must ensure that glass sheets are not subjected to pressure or stresses by the supports.
5.5 Direct glass-to-glass contact and contact between glass and other hard materials (e.g. metal) shall be prevented at all times, whereby the effects of load and temperature fluctuations have to be taken into account.
5.6 The minimum supporting depths of glass sheets (“glass insertion depth”) on their respective support sections as well as the allowable sheet and supporting beam sections as specified in the standards listed in chapter 2.3 for the selected design calculation concept must be adhered to.
5.7 After glazing has been installed, the markings identifying the individual type of glass sheet used (e.g. TSG, HSG) must be durable and legible at all times. In the case of LSG glazing, a section of the edge must be left free for inspection purposes (to check the number of glass sheets, thickness, interlayer films) until the construction has been approved. If required, a manufacturer’s certificate shall be submitted as well.

6 EXAMPLES OF STRUCTURES (BARRIERS) DESIGNED TO PREVENT FALLS

All possible dimensions, types of glass, thicknesses and the necessary proof documents are summarised in Table B.

6.1 Category B

Note:

If LSG made of 10 mm TSG + 1.52 mm PVB/SGP + 10 mm TSG or of 10 mm HSG + 1.52 mm PVB/SGP + 10 mm HSG in the dimensions as stated in Table B is used, only static structural proof calculations are required.

As specified in TRAV or DIN 18008-4, this also applies to parallelogram-shaped balustrades.
Use of glass and acrylic glass in stand construction and design inside trade fair halls

6.2 Category C1

6.2.1 Railing infills secured vertically on 2 sides

Note:
If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.

6.2.2 Railing infills secured horizontally on 2 edges

Note:
If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.

6.2.3 Railing infills secured on 4 sides

Note:
If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.
Information sheet (Supplement to Technical Regulations; chapter 4.4.3)

Use of glass and acrylic glass in stand construction and design inside trade fair halls

6.2.4 Glazing secured at individual points by means of drilled anchorage points (design specifications in accordance with TRAV and/or DIN 18008-4)

Category C2

In accordance with Appendix D of TRAV 2003 and DIN 18008-4, the rules for Categories C1 and C2 also apply to parallelogram-shaped balustrades.

Category C1

Category C2

Note:
If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.
Use of glass and acrylic glass in stand construction and design inside trade fair halls

6.2.5 Point mounting with lateral clamps and anti-slip grips

Designs that have a general construction approval (abZ) shall be used in accordance with.

For all systems that have not been granted general construction approval, a pendulum impact test is required. Minimum requirement: LSG comprising 6 mm TSG + 1.52 mm PVB + 6 mm TSG or 6 mm HSG + 1.52 mm PVB + 6 mm HSG shall be used.

6.2.6 Point mounting with clamps at top and bottom

System designs that have a general construction approval (abZ) shall be used in accordance with the specifications in the approval documents.

For all systems that have not been granted general building approval, a pendulum impact test is required. Minimum requirement: LSG comprising 6 mm TSG + 1.52 mm PVB + 6 mm TSG or 6 mm HSG + 1.52 mm PVB + 6 mm HSG shall be used.

6.3 Balustrade with horizontal bars (protection against falling is provided solely by sufficiently strong handrails and knee-height bars)

The type of glass used shall be selected from Table A, glazing not intended to protect against falls. The spacing between horizontal bars should not exceed approx. 35 cm.
Use of glass and acrylic glass in stand construction and design inside trade fair halls

7 CONSTRUCTION ENGINEERING REGULATIONS, GENERALLY ACCEPTED RULES OF ENGINEERING AND REFERENCES

[8] Communications (Mitteilungen) of DIBt no. 2 / 2001: Anforderungen an barriere glazing (TRAV), (final version of January 2003)

8 ABBREVIATIONS

abZ German: Allgemeine baunutzrechtliche Zulassung (general construction approval)
C1, C3 Categories for vertically acting working loads on floors of public meeting spaces in buildings as specified in DIN EN 1991-1-1 / NA
DBt Deutsches Institut für Bautechnik (German civil engineering institute)
ESG German: Einscheiben-Sicherheitsgläser (fully-tempered glass / toughened safety glass)
HSG Heat-strengthened glass
LSG Laminated safety glass
PPG Polished plate glass
PVB polyvinyl butyral (intermediate film material for LSG)
SGP SentryGlas® plus (intermediate film material for LSG)
SLS Serviceability limit state
SPG German: Spiegelglas (float glass or PPG)
T2 Category for vertically acting working loads on stairs / staircase landings for large traffic loads and escape staircases as specified in DIN EN 1991-1-1 / NA
TRAV Technische Regeln für die Verwendung von absturzsichernden Verglasungen (Technical rules for the use of accident-prevention (barrier) glazing)
TRLV Technische Regeln für die Verwendung von lineenförmig gelagerten Verglasungen (Technical rules for the use of glazing with linear supports)
TRPV Technische Regeln für die Bemessung und die Ausführung punktförmig gelagerter Verglasung (Technical rules for the use of glazing with supports at individual points)
TSG Toughened safety glass
TVG German: Teilungsscheibensicherheit (heat-strengthened glass)
ULS Ultimate limit state
VSG German: Verbund-Sicherheitsgläser (laminated safety glass)
ZIE German: Zustimmung im Einzelfall (individual construction approval)
Use of glass and acrylic glass in stand construction and design inside trade fair halls
Use of glass and acrylic glass in stand construction and design inside trade fair halls

Table A, Vertical glazing, not intended to prevent falls

<table>
<thead>
<tr>
<th>Type</th>
<th>Characteristic</th>
<th>Structure type</th>
<th>Direct support</th>
<th>Glass type</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
<th>Type of proof</th>
<th>Civil engineering rules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Glass wall &gt; 4.0 m above floor level</td>
<td>Left support on 2 sides</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Left support on 4 sides</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No support</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Glass wall &gt; 4.0 m above floor level</td>
<td>Left support on 2 sides</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Left support on 4 sides</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No support</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel frame with cross bars and safety crossbars</td>
<td>Left support on 2 sides</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Left support on 4 sides</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No support</td>
<td>SGP</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>3.0</td>
<td>4.5</td>
<td>0.75</td>
<td>1.2</td>
<td>C: TRPV or DIN 18008-3</td>
<td></td>
</tr>
</tbody>
</table>

1) Proof type 2 (overall static design calculations) are not required for sheet areas A > 1.6 m² and D ≥ 6 mm.

Civil engineering rules:
- TRLV or DIN 18008-1/2
- TRAV or DIN 18008-1/2
- TRLV or DIN 18008-1/2
Use of glass and acrylic glass in stand construction and design inside trade fair halls

Use of glass and acrylic glass in stand construction and design inside trade fair halls

<table>
<thead>
<tr>
<th>Type of proof</th>
<th>Characteristic</th>
<th>Structure</th>
<th>Sheet support</th>
<th>Glass type</th>
<th>min</th>
<th>max</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support on 4 sides</td>
<td>Float 0.76</td>
<td>500</td>
<td>1200</td>
<td>1000</td>
<td>2000</td>
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<tr>
<td>2</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support on 2 sides</td>
<td>Float 0.76</td>
<td>500</td>
<td>1000</td>
<td>800</td>
<td>1100</td>
</tr>
<tr>
<td>3</td>
<td>Clamped on both faces by circular plates with diameter d &gt;= 50 mm</td>
<td>Glass wall</td>
<td>Linear support at left and right</td>
<td>Float 0.76</td>
<td>1100</td>
<td>800</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>4</td>
<td>Clamped on both faces by circular plates with diameter d &gt;= 70 mm, if spacing is greater than 1200 mm, plate diameter shall be d &gt;= 70 mm, see DIN 18008-3/4</td>
<td>Glass wall</td>
<td>Linear support at top and bottom</td>
<td>Float 0.76</td>
<td>800</td>
<td>1000</td>
<td>500</td>
<td>1100</td>
</tr>
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<td>800</td>
<td>1000</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>6</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support at left and right</td>
<td>Float 0.76</td>
<td>1100</td>
<td>800</td>
<td>500</td>
<td>1100</td>
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<tr>
<td>7</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support on 4 sides</td>
<td>Float 0.76</td>
<td>500</td>
<td>1200</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>8</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support on 2 sides</td>
<td>Float 0.76</td>
<td>500</td>
<td>1000</td>
<td>800</td>
<td>1100</td>
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<td>9</td>
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<td>1100</td>
<td>800</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>10</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support at top and bottom</td>
<td>Float 0.76</td>
<td>800</td>
<td>1000</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>11</td>
<td>Clamped on both faces by circular plates with diameter d &gt;= 50 mm</td>
<td>Glass wall</td>
<td>Linear support at left and right</td>
<td>Float 0.76</td>
<td>1100</td>
<td>800</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>12</td>
<td>Clamped on both faces by circular plates with diameter d &gt;= 70 mm, if spacing is greater than 1200 mm, plate diameter shall be d &gt;= 70 mm, see DIN 18008-3/4</td>
<td>Glass wall</td>
<td>Linear support at top and bottom</td>
<td>Float 0.76</td>
<td>800</td>
<td>1000</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>13</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support at top and bottom</td>
<td>Float 0.76</td>
<td>800</td>
<td>1000</td>
<td>500</td>
<td>1100</td>
</tr>
<tr>
<td>14</td>
<td>No</td>
<td>Glass wall</td>
<td>Linear support at left and right</td>
<td>Float 0.76</td>
<td>1100</td>
<td>800</td>
<td>500</td>
<td>1100</td>
</tr>
</tbody>
</table>

Note: where decimal fractions are listed in the table, a comma is used instead of a decimal point.
## Table C: Horizontal glazing

<table>
<thead>
<tr>
<th>Glass thickness in mm</th>
<th>Type</th>
<th>Characteristic</th>
<th>Structure</th>
<th>Sheet support</th>
<th>Glass type</th>
<th>Min. glass insertion depth in mm</th>
<th>Min. glass insertion width in mm</th>
<th>Min. glass insertion length in mm</th>
<th>Min. glass insertion height in mm</th>
<th>Max. glass insertion depth in mm</th>
<th>Max. glass insertion width in mm</th>
<th>Max. glass insertion length in mm</th>
<th>Max. glass insertion height in mm</th>
<th>Type of proof required</th>
<th>Civil engineering rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.52 PVB / SGP</td>
<td></td>
<td></td>
<td>Linear support on 2 sides</td>
<td></td>
<td>A</td>
<td>1000</td>
<td>500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>A</td>
<td>DIN 18008-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Linear support on 2 sides</td>
<td></td>
<td>A</td>
<td>1000</td>
<td>500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>A</td>
<td>DIN 18008-2</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>A</td>
<td>1000</td>
<td>500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>A</td>
<td>DIN 18008-5</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>A</td>
<td>1000</td>
<td>500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>A</td>
<td>DIN 18008-3</td>
</tr>
</tbody>
</table>

### Notes:

1. Glass that is capable of supporting human loads is subject to a special approval procedure.
2. The use of glass in a construction design with a height of more than 20 cm is subject to a special approval procedure.
3. The use of glass in a construction design with a height of less than 20 cm is subject to a special approval procedure.
4. If the glass thickness is less than 1.52 mm, the use of glass is subject to a special approval procedure.
5. If the glass thickness is greater than 1.52 mm, the use of glass is subject to a special approval procedure.
6. If the glass thickness is less than 1.52 mm, the use of glass is subject to a special approval procedure.
7. If the glass thickness is greater than 1.52 mm, the use of glass is subject to a special approval procedure.

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The use of glass in horizontal glazing is not allowed. However, exceptions may be possible if there is a special case for the prevention of fire and structural stability.