Information Sheet
“Glass in stand construction inside trade fair halls” 2024

PRELIMINARY REMARK

The contents of this information sheet have been jointly agreed upon by the following German exhibition companies:

Deutsche Messe AG Hannover

KölnMesse GmbH

Landesmesse Stuttgart GmbH

Leipziger Messe GmbH

Messe Berlin GmbH

Messe Düsseldorf GmbH

Messe Frankfurt Venue GmbH

Messe München GmbH

NürnbergMesse GmbH

It offers structural and design notes to Chapter 4.4.3 of the Technical Guidelines and defines the design specifications and requirements for the glass constructions in stand and decorative structures to be built within the trade fair halls of NürnbergMesse.
In the absence of additional specifications in this document, the Technical Guidelines (TR) of NürnbergMesse apply.

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1. Scope

Information sheet discusses the regulations concerning the use of glass in stand construction and design **inside the trade fair halls** NürnbergMesse. 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 imp

2. Definitions and explanations

2.1 **Types of supports**

- Glazing secured by linear supports: Secured by linear supports on at least two opposite edges over the full length of each edge of the glass plate.
- Glazing secured at individual points: Glazing anchored through drilled holes or by a clamping system.

2.2 **Types of glass and other transparent plastics**

Types of glass granted statutory construction approval:

- **Float glass** (polished plate glass, SPG) as specified in DIN EN 572-9: Also called 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 EN 12150-2: TSG is a fully thermically pre-stressed type of glass. It has internal residual stress characteristics: core tensile stress and surface compression 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 1863-2 or with other general approvals by building authorities (German: *allgemeine bauaufsichtliche Zulassung* – abZ): TVG 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.

Not permitted, on the other hand, are transparent panels made of mostly thermoplastic plastics for which no recognized engineering rules or certificates of usability in buildings or structural installations are available. Examples:

- **Acrylic glass** (PMMA), sold under the brand names *Plexiglas*® or *Perspex*®, for example;
- **Polycarbonate** (PC), sold under the brand name *Makrolon*®, for example;
- **Polyethylene terephthalate glycol** (PET-G).

These materials may only be used for non-supporting, non-bracing components that are not intended to prevent falling, thus for decorative or ornamental applications, for example.
In this case, however, due consideration must be given to the **critical smoking and burning behaviour** (e.g. normally flammable, strong smoke development) of these materials. In particular, the decorative use of such materials above persons is impermissible due to the frequently proven (burning) dripping behaviour in case of fire.

2.3 **Design calculation standards**

The static strength proof calculations for glass components must be carried out in accordance with the following design calculation concept and structural design standards (as amended): Glass in building design and construction rules.

DIN 18008 (T.1 - T.5) – Glass in building design and construction rules

- Part 1: T*erms and general bases*
- Part 2: *Linearly supported glazing*
- Part 3: *Point-fixed glazing*
- Part 4: *Additional requirements for barrier glazing*
- Part 5: *Additional requirements for walk-on glazing*

Table 1: Design concept

Design concept	**Load factor c**oncept
Proof concept	$\sigma_\kappa * \gamma_f < f_k * k_c * k_{mod} / \gamma_M$
Determination of action effects and stresses	At ULS (*GZT*)
Deformation checks	At SLS (*GZG*)
Designation of forces/stresses in the **serviceability limit state SLS** (forces due to characteristic loads, without γ_f)	SLS (*GZG*) after the number or index k after formula symbol e.g. supporting force = 12 kN (SLS) or F_k = 12 Kn
Designation of forces/stresses in **the ultimate limit state (ULS)** (forces due to characteristic loads, multiplied by γ_f)	ULS (*GZT*) after the number or index d after formula symbol e.g. supporting force = 16 kN (ULS) or F_d = 16 kN
Designation of the limit stress	f_k
Dimension calculation rules, dimension calculation standards	DIN 18008-1 [12] DIN 18008-2 [13] DIN 18008-3 [14] DIN 18008-4 [15] DIN 18008-5 [16]
Standards applying to loads and actions	This information sheet and DIN EN 1991-1-1 DIN EN 1991-1-1/NA: (2010-12)
Normal load factors γ_f for **permanent loads** (e.g. dead loads)	1.35
Normal load factors for **variable loads and actions** (e.g. dynamic pressure, imposed loads, cross-bar pressures)	1.5
Duration of loads typically encountered at trade fairs for k_{mod} from DIN 18008-1, Table 6	Own weight: permanent (k_{mod} = 0.25) Working loads: medium (k_{mod} = 0.4) Horizontal substitute load: short (k_{mod} = 0.7) Cross-bar pressure: short (k_{mod} = 0.7)

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Based on the above-mentioned standards and design calculation concept, verifiable static load calculations must be performed for **all** glass constructions and they must be built in conformance with the applicable standards, depending on the planned use as
- Vertical glazing, including (where applicable) **the function of preventing falls** in the case of balustrades
- Overhead glazing,
- Walk-on glazing.

For static load calculations, the load factor concept shall be used as a basis. Supporting forces transmitted by glass components must always be stated for the GZT *(ULS)* 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.

Note on the use of wire glass:
In consultation with the trade fair company, wire glass can still be used in existing components with certifications, based on the design calculation standards in effect at the time of initial construction of the trade fair stand.

2.4 **Material properties of glass products**

Glass products have a bulk density of 25 kN/m³, a thermal expansion coefficient of $8.4 \cdot 10^{-6}$/K and their Young´s modulus is 70.000 N/mm².
For structural design calculations, the design calculation values of the resistance R_d listed in *Table 1* must be observed.

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

Property	**Float glass** (not printed, not sand-blasted)	**HSG** (not printed, not sand-blasted)	**HSG** (printed/ enamel-coated)	**ESG** (not printed, not sand-blasted)	**ESG** (printed/ enamel-coated)
Normal **limit stress f_k** as DIN EN 572-1, DIN EN 1863-1 or abZ, DIN EN 12150-1	45 N/mm²	70 N/mm²	45 N/mm²	120 N/mm²	90 N/mm²
Design coefficient k_c, normal	1.8	1	1	1	1
k_{VSG} for laminated safety glass	1.1	1.1	1.1	1.1	1.1
k_{Kante} for calculating the effect of glass edges	0.8	1	1	1	1
Material factor γ_M	1.8	1.5	1.5	1.5	1.5
Modification factor for calculating the effect of load durations k_{mod}	permanent: 0.25 medium duration: 0.4 short: 0.7				
Rated value of the **resistance to stress failure R_d**	$R_d = k_{mod} * k_c * k_{VSG} * k_{Kante} * f_k / \gamma_M$	$R_d = k_c * k_{VSG} * k_{Kante} * f_k / \gamma_M$	$R_d = k_c * k_{VSG} * k_{Kante} * f_k / \gamma_M$	$R_d = k_c * k_{VSG} * k_{Kante} * f_k / \gamma_M$	$R_d = k_c * k_{VSG} * k_{Kante} * f_k / \gamma_M$

The intermediate films in LSG shall be made of PVB (polyvinyl butyral) or SGP (*Sentry glass plus/Ionoplast*):
- Films made of PVB must have a tear strength of at least 20 N/mm².
- Films or laminated safety glass made of SGP 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 Vertical glazing with a height h ≤ 4 metres above hall floor level

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.
- Either TSG or LSG must be used.
- The glass sheets may be secured by linear supports or at individual points.
- **Glass walls tilting at an angle of more than 10° 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.

3.1.2 Vertical glazing of height h > 4 metres above hall floor level

Vertical glazing **not** intended to prevent falling and whose uppermost edges are higher than 4 metres above hall floor level does **not** require ***Installation approval for a specific case*** (c.f. 4.2) provided that the type of glass used, structural design details and the type of supports securing the glass comply with the regulations specified in Chapter 2.3.

In addition, the following provisions shall be observed:
- Verified structural calculations or structural calculations suitable for verification and the corresponding construction plans must be submitted.
- In addition to the load of its own weight, the material must be capable of resisting horizontal forces, i.e. a pressure corresponding to at least h1 = 0.125 kN/m² for visible surfaces of up 4 m above hall floor level and at least h2 = 0.063 kN/m² for visible surfaces at more than 4 m above hall floor level.
- Wherever there is a high risk of impact, e.g. where there is a descending ramp leading towards the glazing, additional measures are required.
- Proof of structural characteristics is not required if the area of each individual sheet is less than 1.6 m² and TSG with a thickness of at least 4 mm is used, and the sheet(s) is(are) held on four sides by linear supports.
- Glazing secured at individual points may be used without further proof documentation if:
  - general construction approval (*abZ*) has already been granted for the combination of point-mounting method and glass type and thickness, or
  - the design specifications, and the dimensions and thickness of the glass as stated in DIN 18008-3, DIN 18008-4 or Table B are adhered to.

DIN 18008-3/-4 and Table B are referred to above because the fall-prevention glazing barriers described in these references are of course also suitable for glass panels not explicitly intended to prevent falls.
Installation approval for a specific case is required for all other designs.
If the use of TSG glazing is planned, a heat soak test certificate as TSG-H. Table A provides an overview of possible designs and the necessary proofs.

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 as an additional load case, a horizontal assumed surface load of h1 = 0.125 kN/m² for all visible surfaces at up to 4 m above the hall floor level and of h2 = 0.063 kN/m² 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 18008-4
- the relevant design specifications, glass dimensions and thicknesses as stated in Table B of this information sheet 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 depths) shall be modelled in accordance with the rules described in Chapter 2.3.
Experimental 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.

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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 0.2 then it will be necessary to refer to the Technical Regulations for accident-prevention (barrier) glazing 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.
- The pendulum impact test is not required for glass with linear support on all sides, provided that the appropriate dimensions and glass thickness conform to Table B, DIN 18008-3 and DIN 18008-4, or proof calculations are carried out in accordance with DIN 18008-4.
- The glazing supports must provide adequate protection to the edges of the glass sheets.

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 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 DIN 18008-4).
- The thickness of the intermediate PVB/SGP film must be at least 1.52 mm.
- The securing clamps/ clamping 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 can be classified as an extraordinary design calculation situation. The destroyed or damaged glass sheet shall be replaced immediately after the incident.

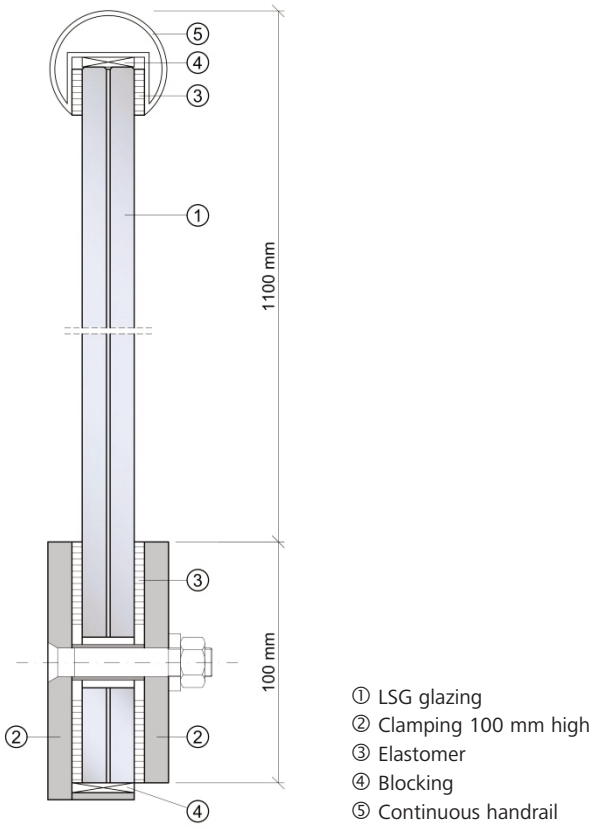


Figure 1: Clamped glazing with continuous handrail

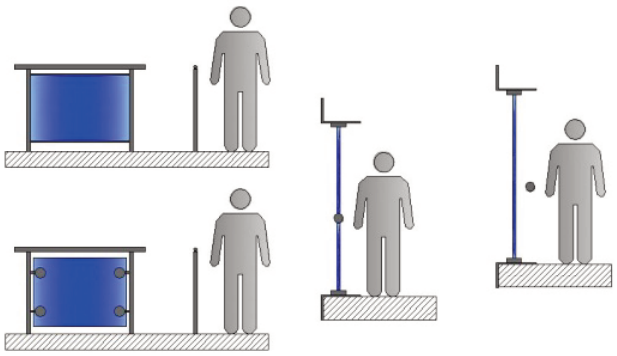
3.2.3 **Category C: Railing and balustrade infills or glass walls with load-distributing cross-bar fitted in front of it**

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 linear supports 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 handrail placed in front of it.



Category C1 Category C2 Category C3

- For Category C1 and C2 type glazing, the use of TSG is allowed if the sheets 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 in DIN 18008-4 are adhered to.

Alternative measures/protection against glass breakage:

If the proof calculations for Category C in accordance 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 tightly stretched steel rope of at least 5 mm diameter at a vertical spacing of not more than 35 cm and at an adequate distance in front of the glass sheets of the balustrade infill. Measures to protect against scattering glass splinters shall always be installed above and along the length of traffic areas (walkways), if this is not possible, LSG shall be used.

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)
- LSG made of HSG,
- Wire glass (only for existing components until effective span exceeding 0.7 m and the glass shall protrude into the supports by at least 15 mm).

In addition to submitting certification of load-bearing capacities, experimental of residual load-bearing capacities must be provided or, if this is not possible, a safety net must be hung under the glazing. If the structural design requirements of 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 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 secured 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 (*abZ*).

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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 [16]. In such cases, *a special individual construction approval* is always required.

Other design standards for overhead glazing:
- LSG sheets with an effective span exceeding more than 1.20 m shall be supported on all sides.
- The overall thickness of the intermediate PVB-/SGP-films must be at least 0.76 mm. If a sheet is supported on all sides, then a thickness of 0.38 mm is allowed under the condition that the effective span in the direction bearing the main load is not greater than 0.8 m.
- Cutting of recesses or notches in the glass sheets is not allowed.
- Only holes conforming to DIN 18008-3 are allowed.
- 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 must be demonstrated by component tests or a general construction approval (abZ). The requirements are specified in DIN 18008-5 [16]. 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 (as specified in DIN EN 1991-1-1/NA - **C**at. C3/T2), 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.

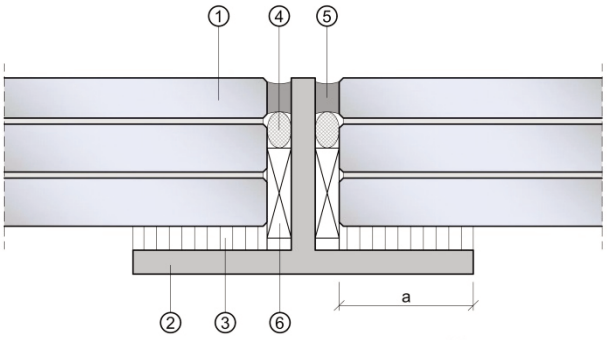
Table 3: Glazing mounted in linear supports at all four edges and intended to support human loads, with proven impact resistance and residual load-bearing capacity

max. length [mm]	**max. width** [mm]	**LSG structure** [mm] (top /*/ centre /*/ bottom)	**Min. supporting surface depth** [mm]
1500	400	8 HSG /*/ 10 Float /*/ 10 Float	30
1500	750	8 HSG /*/ 12 Float /*/ 12 Float	30
1250	1250	8 HSG /*/ 10 HSG /*/ 10 HSG	35
1500	1500	8 HSG /*/ 12 HSG /*/ 12 HSG	35
2000	1400	8 HSG /*/ 15 Float /*/ 15 Float	35

/*/ = 1.52 mm PVB – PVB or SGP *(SentryGlas® plus)*

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 surface 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 applicable standards.



① LSG glazing
② Elastomer (shore hardness ≥ 60)
③ Supporting selection
④ Gimp tape
⑤ Silicon gap
⑥ Blocking

Figure 2: Supporting surface depth a (glass insertion depth)

Table 4: Measurement parameters for walk-on glass

Design calculation concept	**DIN 18008-5**
Working surface load q_k, depending on usage category as specified in DIN EN 1991-1-1 or DIN EN 1991-1-1/NA	C1: 3.0 kN/m² C3, T2: 5.0 kN/m²
Point load Q_k as an additional changing load parameter to be inves-tigated	C1: 4.0 kN C3: 4.0 kN / T2: 2.0 kN
Application area of point load	50 x 50 mm
Inclusion of top sheet in structural static calculations allowed	For constant design situation and for temporary design situation
Proof calculation for situation with broken top sheet (i.e. only the two lower sheets still bear the load)	Proof for an extraordinary design load calculation situation
Standards relating to the action of loads	DIN EN 1991-1-1 DIN EN 1991-1-1 /NA
Max. sag/flexure f_{max} with 3 load-bearing sheets	l/200
Max. sag/flexure f_{max} with 2 load-bearing sheets	l/100

In the case of **stairways**, the construction/design must guarantee sufficient distribution of loads. Stairs on stand structures in the trade fair halls shall always be classified with **usage category T2**.

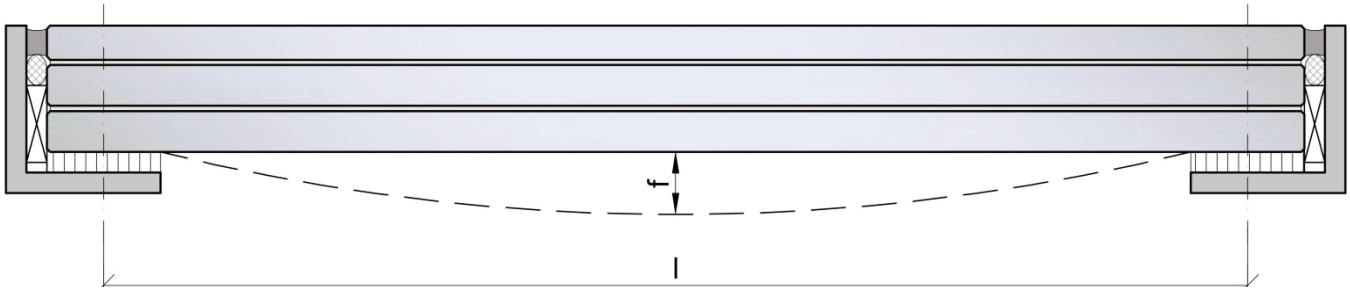


Figure 3: Span and sag

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 or verifiable structural calculations and plans. After that, the verification will be performed and if the documents are verified, 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 (abZ), a statutory construction test report (abP) 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* – ZiE) shall be required. An Installation Approval for a Specific Case may be granted by NürnbergMesse 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 an *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 German 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 the Spreadsheets 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 **42 days before the commencement of construction**.

Prior to conducting component tests, it is advisable to contact NürnbergMesse 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** from NürnbergMesse is as follows:

- 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).
- 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 NürnbergMesse (Exhibition Technology Department, see Technical Regulations Chapter 4.2) along with the other application documents requesting the construction permit.
- 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 test engineer carrying out the monitoring and inspection acts on behalf of NürnbergMesse and at the expense of the requesting exhibitor/customer**.

Recommended institutes for testing components used in glass construction/design are listed in **Table D**.

5. Notes on design and design calculations

Glass is a brittle material, any failure of which will occur spontaneously and without warning.
Glass is sensitive to blows with hard, pointed objects.

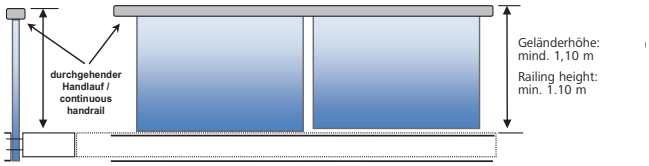
These properties lead to the following guideline notes:

- 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**)
- The support design must ensure that glass sheets are **not subjected to pressure or stresses by the supports**.
- 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.
- 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 Chapter 2.3 for the design calculation concept must be adhered to.
- 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.
- The edges of glass sheets must be finished or protected in such a way as to exclude any possibility of injury.
- In the case of TSG, HSG, or LSG glazing manufactured from sheets of TSG or HSG, subsequent reworking of the finished product such as cutting out sections or drilling holes is not possible.
- Sheets intended to bear human loads must have a durable non-slip surface finish.
- Load-bearing adhesive joints may only be used if a general construction approval (*abZ*) has been granted for the entire adhesive system (i.e. the glass, adhesive and metal combination), and under the condition that the joint is made exactly as described in the approval documents. The rules described in Chapter 2.3 do not yet make allowance for applying more favourable assumptions of the joint effect of the intermediate film layers in LSG and therefore an **Installation Approval for the Specific Case** has to be applied for if these assumptions are used in calculations. Trade publications [18] contain information on suitable calculation assumptions to account for the joint effects in LSG. This may possibly be useful for LSG in which SGP is used.

6. Examples of vertical glazing in structures 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



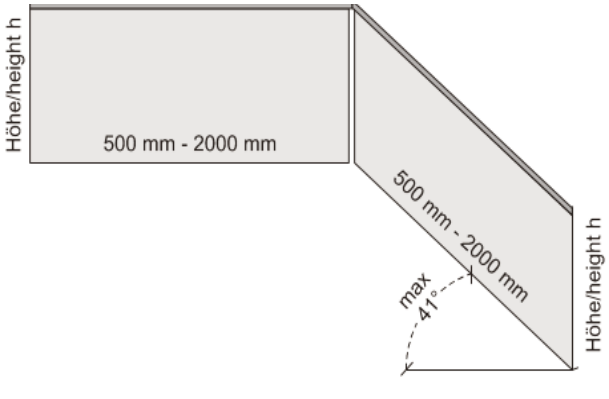
Note:

If **LSG** made of

- 10 mm TSG + 1.52 mm PVB/SGP + 10 mm TSG, or
- 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.

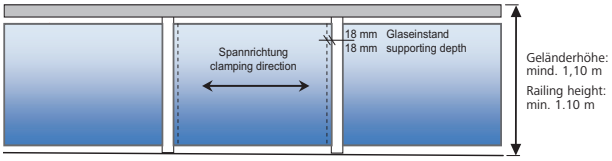
As specified in DIN 18008-4, this also applies to parallelogram-shaped balustrades.



Information Sheet
"Glass in stand construction inside trade fair halls" 2024 (continued)

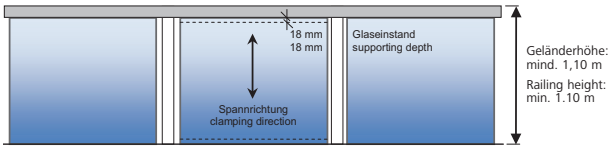
6.2 **Category C 1 (railing infills)**

6.2.1 **Railing infills secured <u>vertically</u> on 2 sides**



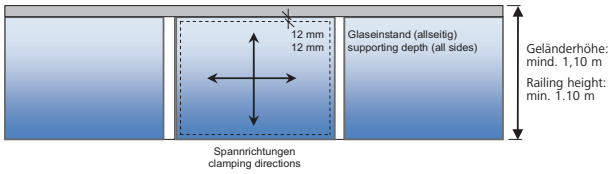
Note: If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.

6.2.2 **Railing infills secured <u>horizontally</u> on 2 edges**



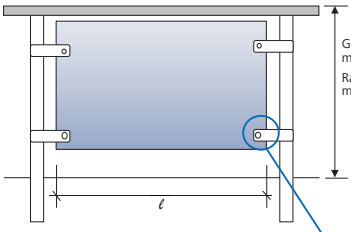
Note: If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.

6.2.3 **Railing infills secured on 4 sides**

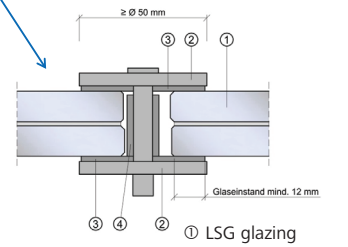


Note: If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required.

6.2.4 **Point-fixed with drilled anchors (design specifications according to DIN 18008-4)**



Note: If the types of glass and the dimensions listed in Table B are used, only static structural proof calculations are required for all point-fixed variants sided or 4-sided).

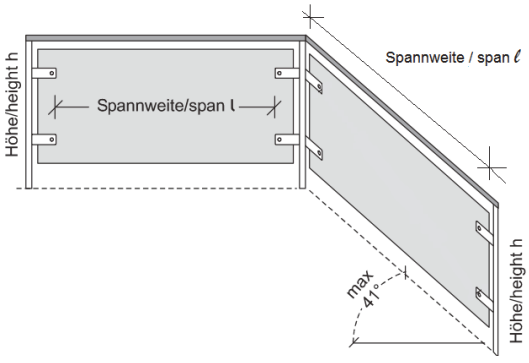


① LSG glazing
② Clamping retainer
③ Elastomer
④ Sleeve

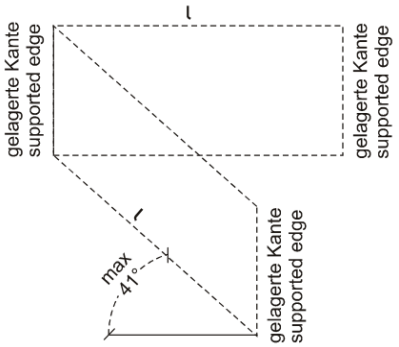
Figure 4: Cross-section of clamping plate holder

In accordance with DIN 18008-4, the rules for Categories C1 and C2 also apply to parallelogram-shaped balustrades:

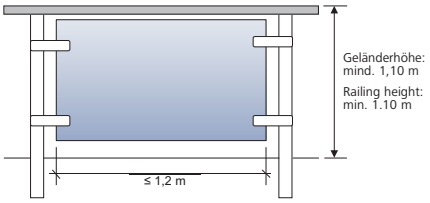
Category C1



Category C2



6.2.5 **Railing infills with point mounting, <u>lateral</u> clamps and anti-slip grips**

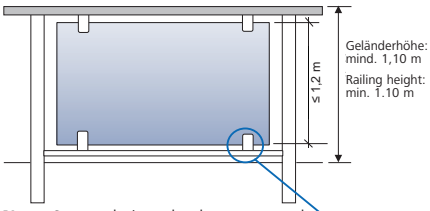


Note: Designs that have a general construction approval (abZ) shall be used in accordance with the specifications in the approval documents.

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

shall be used.

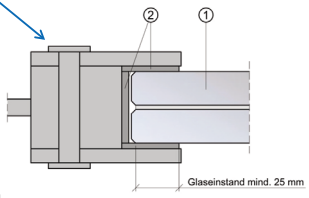
6.2.6 **Railing infills with point mounting and clamps <u>at top and bottom</u>**



Note: 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,
- 6 mm HSG + 1.52 mm PVB + 6 mm HSG

shall be used.

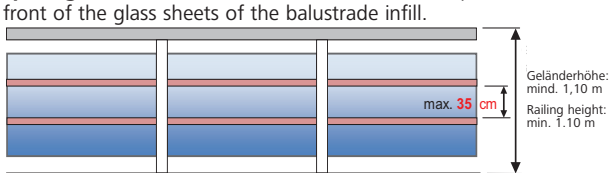


① LSG glazing
② Elastomer

Figure 5: Cross section of edge clamp holder

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

Alternative measures: If the proof calculations for Category C in accordance 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 tightly stretched steel rope (at least 5 mm diameter) at a **vertical spacing of not more than 35 cm** and at an adequate distance in front of the glass sheets of the balustrade infill.



Note: In this case (with horizontal bars), the type of glass used can meet the specifications of Part 9 - Table A, glazing not intended to protect against falls.
In the case of accident prevention balustrades in areas that are freely accessible to the **general trade fair public**, only vertical cross-bars should be used at the above-mentioned distance in front of the glass sheets, so as to prevent people (particularly children) from climbing over the balustrades.

7. Construction engineering regulations, generally accepted rules of engineer-ing and references

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[12] DIN 18008-1 (December 2010) Glass in building design and construction rules - Part 1: Terms and gen-eral bases

[13] DIN 18008-2 (Dezember 2010) Glass in building design and construction rules - Part 1: Terms and gen-eral bases – Part 2: Linearly supported glazings

[14] DIN 18008-3 (July 2013) Glass in building design and construc-tion rules - Part 3: Point fixed glazing

[15] DIN 18008-4 (July 2013) Glass in building design and construc-tion rules - Part 4: Additional requirements for barrier glazing

[16] DIN 18008-5 (July 2013) Glass in Building design and construc-tion rules - Part 5: Additional requirements for walk-on glazing

[17] Kasper, R., Pieplow, K., Feldmann, M.: Beispiele zur Bemessung von Glasbauteilen nach DIN 18008; Ernst & Sohn Verlag für Architektur und technische Wissenschaften GmbH, Berlin, 2016

[18] Wellershof, F.: Bemessungsschubmodule für Verbundglass-cheiben, Stahlbau 76 (März 2007), H.3, S. 177 188

[19] Building Rules List (see www.dibt.de)

[20] ETB Guideline: Building components designed to prevent falls (June 1985))

8. Abbreviations

abZ	German: Allgemeine bauaufsichtliche 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
DIBt	Deutsches Institut für Bautechnik (German civil engineering institute)
ESG	German: Einscheiben-Sicherheitsglas (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
TSG	Toughened safety glass
TVG	German: Teilvorgespanntes Glas (heat-strengthened glass)
ULS	Ultimate limit state
VSG	German: Verbund-Sicherheitsglas (laminated safety glass)
ZiE	German: Zustimmung im Einzelfall (individual construction approval)

Information Sheet "Glass in stand construction inside trade fair halls" 2024 (continued)

9. Spreadsheets A – D (for stand construction)

Table A: Vertical glazing, not intended to prevent falls

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Structure type					**Allowed, yes/no**	**Glass thikkness in mm**	**SGP/PVB film thikkness**	**Width in mm**		**Height in mm**		**Min. glass insertion depth in mm**	**Type of proof required**	**Civil engineering rules**
Type	**Character-istic**	**Structure**	**Sheet support**	**Glass type**				**min.**	**max.**	**min.**	**max.**			
Tab. A: Vertical glazing	**not intended to prevent falls**	**Glass wall ≤ 4.0 m** above floor level	Linear support on 2 sides	TSG	yes								1	
				LSG 2 layers	yes								1	
				Wire glass	yes								1	2)
				Acrylic glass	yes								1	
			Linear support on 4 sides	TSG	yes								1	
				LSG 2 layers	yes								1	
				Wire glass	yes								1	2)
				Acrylic glass	yes								1	
			Point supports	TSG	yes								1	
				LSG 2 layers	yes								1	
				Wire glass	no									
				Acrylic glass	yes								1	
		Glass wall > 4.0 m above floor level	Linear support on 2 sides	TSG	yes								2.5	DIN 18008-1/2
				LSG 2 layers	yes								2	DIN 18008-1/2
				Wire glass	yes								2	2)
				Acrylic glass	yes								1	
			Linear support on 4 sides	TSG	yes								2[1)]	DIN 18008-1/2
				LSG 2 layers	yes								2[1)]	DIN 18008-1/2
				Wire glass	yes								2[1)]	2)
				Acrylic glass	yes								1	
			Point supports	TSG	yes								2, 3, 5	DIN 18008-1…3
				LSG 2 layers	yes								2, 3	DIN 18008-1…3
				Acrylic glass	yes								1	
				Wire glass	no									
		Railing infill system with cross-bar and fall-prevention crossbars at knee-height (the actual glass sheet has no barrier function)	Linear support on 2 sides	TSG	yes								1.5	DIN 18008-1/2
				LSG 2 layers	yes								1	DIN 18008-1/2
				Wire glass	yes								1	2)
				Acrylic glass	yes								1	
			Linear support on 4 sides	TSG	yes								1	DIN 18008-1/2
				LSG 2 layers	yes								1	DIN 18008-1/2
				Wire glass	yes								1	2)
				Acrylic glass	yes								1	
			Point supports	TSG	yes								1.5	DIN 18008-1…3
				LSG 2 layers	yes								1	
				Wire glass	no									
				Acrylic glass	yes								1	

Proof type [column 14]:

1: No specific proof

2: Verified static calculations

3: Installation appr. for spec. case

4: Pendulum impact test

5: Heat soak test

6: Residual load-bearing cap. test

7: Shock impact resistance test

1) Proof type 2 (verified static design calculations) are not required for sheet areas A ≤ 1.6 m² and d ≥ 4 mm

2) Wire glass may continue to be used in existing components if documentation has been submitted of compliance with the technical standards in effect at the time of initial installation.

Information Sheet “Glass in stand construction inside trade fair halls” 2024 (continued)

Table B: Vertical glazing, intended to prevent falls (barrier glazing)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Structure type					Allowed, yes/no	Glass thik-kness in mm	SGP/PVB film thik-kness	Width in mm		Height in mm		Min. glass insertion depth in mm	Type of proof required	Civil engi-neering rules
Type	Character-istic	Structure	Sheet support	Glass type				min.	max.	min.	max.			
Vertical glazing	Fall-prevention, barrier (Δh > 1 m)	Glass wall (cat. A as defined in TRAV)	Linear support on 2 sides	TSG	no [2]									
				LSG 2 layers	yes		0.76					18	2,4	DIN 18008-1/2/4
			Linear support on 4 sides	TSG	no [2]									
				LSG 2 layers	yes	2 x 6 Float	0.76	500	1200	1000	2000			
						2 x 8 Float	0.76	500	1500	1000	2500	12	2	DIN 18008-1/2/4
						2 x 10 Float	0.76	1000	2100	1000	3000			
						2 x 6 Float	0.76	500	2000	1000	1200	12	2	DIN 18008-1/2/4
						2 x 8 Float	0.76	500	2500	1000	1500	12	2	DIN 18008-1/2/4
						2 x 10 Float	0.76	1000	3000	1000	2100	12	2	DIN 18008-1/2/4
						2 x 6 Float	0.76	300	500	500	3000	12	2	DIN 18008-1/2/4
			Point supports	TSG	no [2]									
				LSG 2 layers	yes	2 x 10 HSG	1.52		1200 [3]		1600 [3]	[4]	2	DIN 18008-1…4
				LSG 2 layers	yes	2 x 8 TSG	1.52		1200 [3]		1600 [3]	[4]	2	DIN 18008-1…4
				LSG 2 layers	yes	2 x 10 TSG	1.52		1600 [3]		1800 [3]	[4]	2	DIN 18008-1…4
				LSG 2 layers	yes	2 x 10 TSG	1.52		800 [3]		2000 [3]	[4]	2	DIN 18008-1…4
				LSG 2 layers	yes		0.76						2, 3, 4	DIN 18008-1…4
		Balustrade/parapet clamped at the bottom, with handrail (cat. B as defined in TRAV)	Linear clamping at one edge	TSG	no									
				LSG 2 layers	yes	2 x 10 TSG	1.52	500	2000	900	1100	100	2	DIN 18008-1/2/4
				LSG 2 layers	yes	2 x 10 HSG	1.52	500	2000	900	1100	100	2	DIN 18008-1/2/4
		Railing infill (cat. C1 and C2 as defined in TRAV)	Linear support on 2 sides oben u. unten	TSG	no [2]									
				LSG 2 layers	yes	2 x 6 Float	0.76	1000			800			
						2 x 5 TSG	0.76	800	as desired	500	1100	18	2	DIN 18008-1/2/4
						2 x 8 Float	1.52	800			1100			
			Linear support on 2 sides links u. rechts	TSG	no [2]									
				LSG 2 layers	yes	2 x 6 Float	0.76		800	1000				
						2 x 6 TSG	0.76	500	1100	800	1100	18	2	DIN 18008-1/2/4
						2 x 8 Float	1.52		1100	800				
			Linear support on 4 sides	TSG	yes							12	2, 4	DIN 18008-1/2/4
				LSG 2 layers	yes	2 x 5 Float	0.76	500	2000	500	1000	12	2	
		Railing infill (only cat. C1 as defined in TRAV)	Point supports	TSG	no [2]									
				LSG 2 layers	yes	2 x 6 TSG	1.52		1200 [3]		700 [3]	10	2	DIN 18008-1…4
						2 x 8 TSG	1.52		1600 [3]		800 [3]			
				LSG 2 layers	yes	2 x 8 HSG	1.52		1200 [3]		700 [3]	10	2	DIN 18008-1…4
				LSG 2 layers	yes	2 x 6 HSG	1.52		1600 [3]		800 [3]			DIN 18008-1…4
		Glass wall with load-bearing/ protective handrail in front of it (cat. C3 as defined in TRAV)	Linear support on 2 sides	TSG	no [2]									
				LSG 2 layers	yes							18	2, 4	DIN 18008-1/2/4
			Linear support on 4 sides	TSG	no [2]									
				LSG 2 layers	yes	2 x 5 Float	0.76	500	1500	1000	3000	12	2	DIN 18008-1/2/4
			Point supports	TSG	no [2]									
				LSG 2 layers	yes								2, 3, 4	DIN 18008-1…4

Proof type [column 14]:

1: No specific proof
2: Verified static calculations
3: Installation appr. for spec. case
4: Pendulum impact test
5: Heat soak test
6: Residual load-bearing cap. test
7: Shock impact resistance test

If a pendulum impact test, proof type “4”, is not specified in column 14, then this advantage is subject to adherence to the limit values stated in columns 7 to 13. Structural designs not listed here will require an Installation Approval for the Specific Case.

2) In systems having a valid general statutory construction approval, LSG may be used in accordance with the text of the approval documents.

3) The distance between neighbouring point supports in x-direction and in y-direction, respectively.

4) Clamped on both faces by circular plates with diameter d >= 50 mm, if spacing is greater than 1200 mm, plate diameter shall be d >= 70 mm, see DIN 18008-3/4

The use of acrylic glass and wire glass is **not allowed** for vertical glazing intended to prevent falls (barrier glazing). If the sheets are held in linear supports, LSG made of HSG and with the same specified thicknesses may be used instead of LSG made of float glass.

Information Sheet “Glass in stand construction inside trade fair halls” 2024 (continued)

Table C: Horizontal glazing

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Structure type					**Allowed, yes/no**	**Glass thickness in mm** top /*/ centre /*/ bottom) /*/ = 1.52 mm PVB / SGF	**SGP/PVB film thickness**	**Length in mm**		**Width in mm**		**Min. glass insertion depth in mm**	**Type of proof required**	**Civil engineering rules**
Type	**Characteristic**	**Structure**	**Sheet support**	**Glass type**				**min.**	**max.**	**min.**	**max.**			
Horizontal glazing	**Overhead glazing (angled at > 10° to the vertical)** [3]		Linear support on 2 sides	TSG	no									
				LSG 2 layers	yes		0.76		1200 [4]				2 [5]	DIN 18008-1/2
				Wire glass	yes				700 [4]			15	2	[7]
			Linear support on 4 sides	TSG	no									
				LSG 2 layers	yes		0.76						2 [5]	DIN 18008-1/2
				Wire glass	yes				700 [4]			15	2	[7]
			Point supports	TSG	no									
				LSG 2 layers	yes		1.52						2, 3, 6 [6]	DIN 18008-1…3
				Wire glass	no									
			Linear support on 2 sides	TSG	no									
				LSG 2 layers	no									
				VSG 3 layers	yes							30	2 [5]	DIN 18008-1…5
				Wire glass	no									
			Linear support on 4 sides	TSG	no									
				LSG 2 layers	no									
		Installed at height < 20 cm		VSG 3 layers	yes	8 HSG /*/ 10 Float /*/ 10 Float	1.52		1500		400	30	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 12 Float /*/ 12 Float	1.52		1500		750	30	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 10 HSG /*/ 10 HSG	1.52		1250		1250	35	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 12 HSG /*/ 12 HSG	1.52		1500		1500	35	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 15 Float /*/ 15 Float	1.52		2000		1400	35	2	DIN 18008-1…5
				VSG 3 layers	yes							30	2 [5]	DIN 18008-1…5
				Wire glass	no									
			Point supports	TSG	no									
				LSG 2 layers	no									
				VSG 3 layers	yes								2 [5]	DIN 18008-1…5
				Wire glass	no									
			Linear support on 2 sides	TSG	no									
				LSG 2 layers	no									
				VSG 3 layers	yes							30	2, 3, 6, 7	DIN 18008-1…5
				Wire glass	no									
			Linear support on 4 sides	TSG	no									
				LSG 2 layers	no									
		Installed at height < 20 cm		VSG 3 layers	yes	8 HSG /*/ 10 Float /*/ 10 Float	1.52		1500		400	30	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 12 Float /*/ 12 Float	1.52		1500		750	30	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 10 HSG /*/ 10 HSG	1.52		1250		1250	35	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 12 HSG /*/ 12 HSG	1.52		1500		1500	35	2	DIN 18008-1…5
				VSG 3 layers	yes	8 HSG /*/ 15 Float /*/ 15 Float	1.52		2000		1400	35	2	DIN 18008-1…5
				VSG 3 layers	yes							30	2, 3, 6, 7	DIN 18008-1…5
				Wire glass	no									
			Point supports	TSG	no									
				LSG 2 layers	no									
				VSG 3 layers	yes								2, 3, 6, 7	DIN 18008-1…5
				Wire glass	no									

Proof type [column 14]:

1: No specific proof
2: Verified static calculations
3: Installation appr. for spec. case
4: Pendulum impact test
5: Heat soak test
6: Residual load-bearing cap. test
7: Shock impact resistance test

3) Overhead glazing that has to be capable of supporting human loads to permit cleaning is subject to a special approval procedure.
4) The data apply to the smaller distance between supports (support direction).
5) If HSG which has not received general statutory construction approval (abZ) is used, an additional Installation Approval for the Specific Case is required.
6) If glass type/support type combination systems which have been granted a general statutory construction approval (abZ) are used, the Installation Approval for the Specific Case is not required
7) Wire glass may continue to be used in existing components if documentation has been submitted of compliance with the technical standards in effect at the time of initial installation.

The use of acrylic glass for horizontal glazing is not allowed. However, exceptions may be possible if the trade-fair company has no objections with regard to fire prevention/protection and structural stability.

Information Sheet
“Glass in stand construction inside trade fair halls” 2024 (continued)

Table D: Recommended institutions for conducting component tests of glass designs

Technische Universität Dresden,
Institut für Baukonstruktionen (Beyer-Bau)
Prof. Dr.-Ing. Weller
August-Bebel-Straße 30
01219 Dresden

MFPA Leipzig GmbH
Hans-Weigel-Straße 2B
04319 Leipzig

TU Hamburg - Harburg
Institut für Baustatik und Stahlbau
Prof. Dr.-Ing. Starossek
Denickestraße 7
21073 Hamburg

Leibnitz-Universität Hannover
Institut für Massivbau
Prof. Dr.-Ing. Marx
Appelstraße 9a
30167 Hannover

Materialprüfanstalt für das Bauwesen Braunschweig
Beethovenstraße 52
38106 Braunschweig

MPA Nordrhein-Westfalen
Marsbruchstraße 186
44287 Dortmund

RWT Aachen
Lehrstuhl für Stahlbau
Prof. Dr.-Ing. Feldmann
Mies-van-der-Rohe-Straße 1
52074 Aachen

MPA Darmstadt
Grafenstraße 2
64283 Darmstadt

TU Darmstadt
Institut für Werkstoffe und Mechanik im Bauwesen
Prof. Dr.-Ing. Wörner
Franziska-Braun-Straße 3
64287 Darmstadt

FMPA Baden-Württemberg
FB 2, Abt. 21, Referat 214
Pfaffenwaldring 4
70569 Stuttgart (Vaihingen)

Universität Karlsruhe
Versuchsanstalt für Stahl, Holz und Steine
Prof. Dr.-Ing. Ummenhofer
Otto-Amman-Platz 1
76131 Karlsruhe

Friedmann & Kirchner
Gesellschaft für Material- und Bauteilprüfung
Große Ahlmühle 7
76865 Rohrbach

FH München
Labor für Stahl- und Leichtmetallbau
Prof. Dr.-Ing. Bucak
Karlstraße 6
80333 München

TU München
Lehrstuhl für Metallbau
Prof. Dr.-Ing. Mensinger
Arcisstraße 21
80333 München

Institut für Fenstertechnik e.V.
Theodor-Grietl-Straße 7-9
83025 Rosenheim

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