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Glazing Guidelines

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GLAZING GUIDELINES
Application-related information
about the UNIGLAS® product range

Publisher:

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1 General Information, Scope of Application and Warranty

The current UNIGLAS® Glazing Guidelines, January 2019 version, are the basis of the warranty.

The aim of the Glazing Guidelines is to clarify as many questions as possible regarding the execution of technically faultless glazing. The Glazing Guidelines have been compiled according to the current state of knowledge. Legal claims cannot be derived from these guidelines. The UNIGLAS® Glazing Guidelines are based on the technical rules applicable at the time the contractual services are performed and on the relevant national standards (DIN, ÖNORM, SN, NEN, NBN, etc.), and European and international standards (EN and ISO). Statutory regulations are to be observed for all applications. These Glazing Guidelines contain both dated and undated features as well as specifications from other publications. These references will be indicated at the appropriate points in the text. In the case of undated references, the version valid at the time of conclusion of the contract shall apply. The UNIGLAS® Glazing Guidelines and tolerances are integral to the General Terms and Conditions.

Technical specifications must be confirmed in the event of an order placement.

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Technical alterations reserved.

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UNIGLAS® STAR FLS Flexible Spacer

UNIGLAS® ACTIVE Easy Clean Glass

UNIGLAS® SHIELD Glass Fitting System

UNIGLAS® FACADE Timber-Glass-Composites

UNIGLAS® NANO Easy Clean Glass

UNIGLAS® OVERHEAD Canopy System

UNIGLAS® CLEAN The Shower Glass

UNIGLAS® STAR TPS Thermoplastic Spacer

UNIGLAS® SHADE Venetian Blind System

The area of glazing techniques has been strongly influenced by new technologies in the frame sector be it wood, plastic or aluminium, bonded glazing systems or new systems for the renovation of old buildings. The same applies to new developments in the sealant industry and new types of sealing profiles.

Architecture has changed and accordingly the wide range of UNIGLAS® functional glazing.

In this issue of the UNIGLAS® Glazing Guidelines, the latest findings and current information from different research groups, institutes and the industry are considered as well as German, Austrian and European standards.

2. Basic Requirements of Glazing

2.1. Scope of application and general information

These Glazing Guidelines are intended to provide both the specialist planner and architect, as well as the manufacturer of glass products and the designer of windows, doors and façade systems, with basic information and advice on planning and building with glass to suit the material. More detailed information over and above this can be found in the processing guidelines of the respective suppliers as well as in specific standards and guidelines.

These Glazing Guidelines describe requirements and provide guidance for the use of single-pane glass and insulating glass units, both for use in the building envelope and in interior works. Divergent glazing systems, such as point-fixed or glued systems, are not covered by these guidelines. They may be subject to more stringent requirements. In this case, close consultations are to take place in advance between the design engineer, the UNIGLAS® shareholder and the technician.

The window, door or façade system must be designed and constructed in such a way as to ensure the durability and functionality of the glazing over the entire period of use under the design loads.

The determination of the design loads and effects on a glazing system requiring consideration is a planning task. These framework conditions must therefore be specified by the architect or specialist planner. The preliminary services are to be checked to ensure that they are free of defects and, if necessary, reservations are to be reported.

Consequently, the profiles and glass supports, among other things, must be designed and dimensioned with sufficient load-bearing capacity. For certain types of glasses (e.g. sound-insulating or burglar-resistant glass), the corresponding requirements from the test reports for the declaration of performance are to be observed. The selection of glass products and their installation must meet the requirements of the overall system (window/door/façade). It is important to ensure that pressure equalisation and ventilation are always fully functional. Furthermore, contact between metal and glass must be permanently prevented.

Before starting the glazing work, the construction must be in a dry, dust and grease-free condition, independent of the frame material, and tested for sufficient strength and fastening. Existing and sufficiently dimensioned openings for pressure equalisation are to be checked. The same applies to whether the properties of the glass type are suitable for the application and whether the necessary fastenings are available for the glass panes. (cf. Ch. 8)

2.2. Determining the required glass thickness

The thickness of the glass is to be determined before construction. When dimensioning the glass thickness(s), all design and expected loads, such as wind load, loading capacity, snow load, overpressure or underpressure in the pane cavity, dead weight, etc., must be taken into account, depending on the installation situation. The dimensioning of the glass thicknesses (statics) is a planning service and must be agreed and separately remunerated.

The following points are to be observed:

- The standards and guidelines applicable at the place of application are to be observed, including the safety concept, the effects on the building and its components, the choice of glass type (cf. Chapter 8), the minimum glass thickness(s) required and the dimensioning of glass.
- The effects must be determined as realistically as possible in accordance with the national requirements, including wind loads corresponding to the position within the façade with superposition of the isochoric pressure (cf. 7.7.4.) as well as additional snow and dead loads with the effects of possible snow accumulations in horizontal glazing.
- For safety barrier glazing, proof of shock resistance is to be provided in addition to proof of structural safety.
- If the selected glass structures/types of glass and/or the design specifications do not comply with the technical rules or standards, further evidence may be required.
- Possible differences in altitude between the production site and the installation site, including the transport route, must be taken into account.

2.3. Basic principles of a glazing system

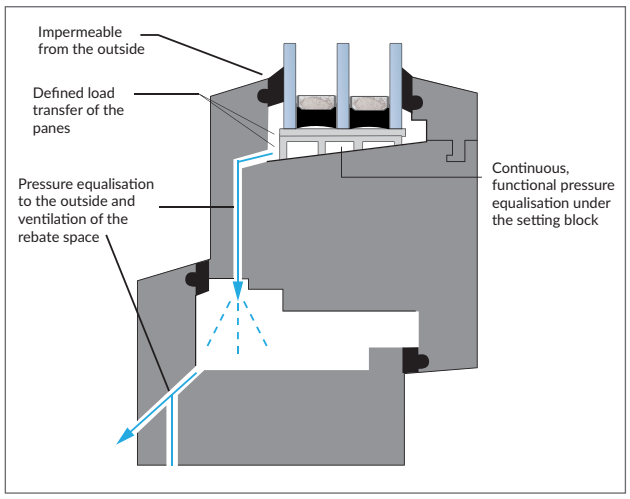
The basic requirements are shown in the schematic diagram in Fig. 1. These may vary depending on building use (e.g. for rooms with high humidity) and climate zone (e.g. in climate zones with high relative humidity) and must be adjusted accordingly.

For example, it may be necessary to install the glazing beads on the outside rather than on the room side, or to provide additional openings for pressure equalisation.

To ensure this, proper use, cleaning and maintenance are necessary. If available, the processing specifications of system manufacturers are to be observed.

The complete filling of the rebate area must be avoided, as bubble-free grouting of the rebate area is almost impossible. This would increase the risk of exposure to moisture, which could permanently damage the insulating glass unit or the frame. It is therefore recommended that only systems with sealant-free rebate space are used. Special cases, such as windows and façade systems to meet burglar-resistant requirements or bonded window systems, must be agreed with the window/façade manufacturer and the UNIGLAS® shareholder with regard to durability and material compatibility. In this case, it is advisable to use tested systems.

Fig. 1: General requirements of the construction



2.4. Materials compatibility

The sealants used for the edge seals of insulating glass units come into contact with a whole range of other materials that in turn may interact and lead to premature failure of the system. Therefore, only compatible materials that have been tested for compatibility may be used.

3. Glazing Rebate Requirements

3.1. Geometry and design requirements

- The materials used for the frame and the glass retention system must be suitable for the glazing process.
- The glazing rebate and the glazing beads must be sufficiently dimensioned so that the occurring loads can be safely transferred, the permissible tolerances compensated and the edges of the glass covered. In this context, it is important to note that specialised processed glass, such as toughened glass, laminated glass and laminated safety glass, reflective and absorbing glass or patterned glass, may have different tolerances or application-restricting dimensions due to production.
- The width of the glazing rebate must also be designed for the required thickness of the sealing material on both sides of the glass and for the proper attachment of the glazing beads.

3.1.1. Glazing rebate requirements

Requirements regarding the glazing rebate, glazing depth and the choice of sealant are governed, for example, by DIN 18545 and EN 15651-2.

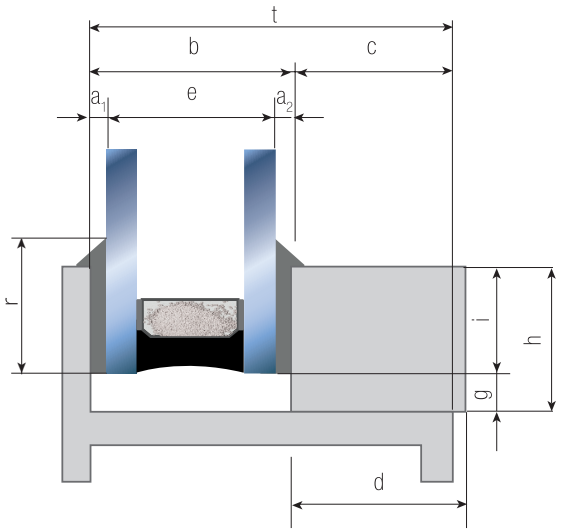
The schematic representation of a glazing system with the corresponding terms is shown in Fig. 2. This essentially corresponds to the description in DIN 18545. The requirements described in DIN 18545 generally apply to glazing systems with sprayable sealants (wet glazing), but can also be applied to other glazing systems with other types of sealing.

As a rule, the glazing depth should be at least 2/3 of the glazing rebate upstand and not exceed 20 mm in the design so that the thermal stressing on the pane is reduced to a minimum. If the glazing depth is increased by more than 20 mm, it must be ensured that the permissible temperature differences within the pane for the glass type used are not exceeded and that there is no danger of glass breakage due to mechanical loads (see Table 1).

In addition to the requirements of a minimum glazing depth according to DIN 18545, the requirements of DIN 18008-2 must also be observed. In this case, a minimum glazing depth of 10 mm and a minimum support width of 5 mm with maximum shortening by deformation are specified. If this cannot be met, the deformation of the glass must be limited to 1/100 (serviceability criterion).

In individual cases, the above requirements can be deviated from in consultation with the UNIGLAS® shareholder. In this regard, also refer to the BF bulletin 021/2017 "Fitness for purpose of linear-mounted glass" by the Bundesverband Flachglas (Federal Sheet Glass Association).

Fig. 2: Schematic diagram of glazing rebate



Dimensions

a_1 =	external sealant thickness or external weatherstripping	e =	thickness of glazing unit
a_2 =	internal sealant thickness internal weatherstripping	g =	glazing rebate base, min. 5 mm
b =	glazing rebate width	h =	glazing rebate upstand
c =	width of support for the glazing bead	i =	glazing depth (as a rule ≈ $^2/_3$ x h ≤ 20 mm)
d =	width of glazing bead	r =	coverage of the insulating glass edge seal
		t =	total rebate width

Table 1: Glazing rebate upstands from DIN 18545:2015-07

Longest side W/H of glazing unit [mm]	Glazing rebate upstand for Single-pane glass	Insulating glass units
W/H ≤ 1,000	10	18
1,000 < W/H ≤ 3,500	12	18
3,500 < W/H	15	20

In the case of insulating glass units with an edge length of up to 500 mm, the glazing rebate upstand may be reduced to 14 mm and the glazing depth to 11 mm in view of the narrow bar design. In the case of heavy panes, please consult the UNIGLAS® shareholder.

3.1.2. Special requirements for curved panes

The glazing guidelines formulated for flat glazing can also be applied in principle to curved glazing. Due to the special characteristics of curved glass, additional instructions from the manufacturer must be observed.

Due to its high degree of rigidity, the tolerances of the curved glass must be taken into account in the design in order to ensure that it is installed and mounted without being subjected to any constraints.

Constraint-free mounting is necessary in order to avoid glass breakage or, when using curved insulating glass units, overloading of the edge seal. In addition, optical impairments can result from mounting that is not free of constraints.

The support structure must comply with the special requirements for curved glazing. For this purpose, sufficiently dimensioned rebates are required for frame or façade constructions. The resulting required minimum rebate width corresponds to the sum of the total glass thickness plus the tolerance of the shape accuracy.

Glass thicknesses are to be considered as nominal dimensions. The requirements of DIN 18545 are also to be observed. In addition, support structure tolerances are to be taken into account. For curved glass, the use of window and façade systems with wet sealing is recommended.

The manufacturers of curved glass should be involved in the planning at an early stage in order to be able to take the special features of curved glass into account in the design. This is particularly necessary for use in structural glass construction.

4. Requirements of Glazing Systems

A distinction is to be made between dry glazing and glazing with wet sealing. Dry glazing is sealed with sealing lips, sealing bars or weatherstripping. Wet sealing is usually sealed using sprayable sealants. Mixing systems are also occasionally used. The room-side sealing is usually constructed with weatherstripping, and the weather-side sealing with sprayable sealant.

The glazing systems must be absolutely watertight from the outside to the room side. In the case of air tightness, this applies from the inside to the outside. On the other hand, vapour tightness must be ensured from the room side into the glazing rebate. The removal of moisture and pressure equalisation must take place to the outside.

4.1. Glazing with double-sided sealing

In the case of wet sealing, the necessary thickness of the sealant backing is usually ensured by the use of preformed strips.

Glazing with double-sided preformed strip

Wood elements and other frame materials are usually glazed using this system. The glass is flexibly supported by the preformed strip both on the inside and outside. This keeps constraints from installation and use to a minimum. The thickness of the preformed strip also determines the thickness of the sealant and should be selected according to the size of the glazing and the manufacturer's instructions. This preformed strip prevents the glass edge from being clamped too tightly.

The geometry of the sealing joint is created by means of the overhang and the glazing bead (see also IVD bulletin no. 10).

Glazing with single-sided preformed strip

The outer preformed strip must ensure that the insulating glass elements are not clamped in the rebate and that no local overloading occurs when installed.

Further information on this glazing system can be found in the ift Guideline VE-13/2 “Glazing of wooden windows without preformed strip”. This includes specification of a minimum distance between the glazing bead and the glass pane. Guideline VE-13/2 does not apply to windows made of other frame materials, shop windows and special glazing such as fire protection, roof and underwater glazing, glazing for indoor swimming pools and bonded glazing.

Glazing without preformed strip

A glazing system without a preformed strip must be carefully selected and designed.

If this type of glazing is chosen, the tolerances shown in the ift Guideline VE-13/2 “Glazing of wooden windows without preformed strip” must be observed. Otherwise, constraints and the associated potential risk of breakage of the insulating glass unit cannot be ruled out.

4.2. Dry glazing – sealing lips, sealing strips and weatherstripping

Weatherstripping must be suitable for the glazing system. Sealing must be carried out according to the principles described in chapter 4. Care must be taken to ensure that corners and joints in particular are properly sealed carefully and permanently.

These strips can be made of Chloroprene, EPDM (APTK) silicone, TPE or PVC. On the weather side, they need to be sealed on both sides; the same applies to indoor swimming pools and damp rooms and in rooms where high humidity is to be expected. Loads from dynamic stresses must also be absorbed safely and without loss of tightness, e.g. alternating pressure load or torsion. The requirements of EN 12365 are to be observed.

Weatherstripping must be matched to the fastening in the frame and to the thickness of the glass element, including tolerances. These strips must also demonstrate sufficient restoring force.

4.3. Contact pressure

In the case of screwed glazing beads, the torque resulting from the distance between the screws, the distance from the corner, and the screw type is to be determined by the system manufacturer. It is essential to ensure that the glazing bead creates uniform pressure on the glass edge. Excessive contact pressures can permanently damage the edge seal of insulating glass.

4.4. Planarity

Frame materials are to be selected which remain permanently flat even under scheduled loads on the glass contact surfaces.

4.5. Deflection limit

The frames must be sufficiently rigid so that the deflection under maximum load does not exceed 1/200 of the edge length (see also BF bulletin 021/2017 “Fitness for purpose of linear-mounted glass”).

4.6. Tightness and sealing

The sealants and seals must be resistant to weathering and environmental influences as well as cleaning agents. Sealing joints of wet glazing are maintenance joints. The joints are to be checked regularly, at least once a year, for adhesion to the frame and glass and for brittleness; they are to be replaced if necessary. In general, joints of all frame materials used in window construction can be sealed with sprayable sealants. It is imperative that the relevant specifications of the sealant manufacturer are observed. At the same time, the pre-treatment/ preparation of the material for sealing is extremely important. The installer must inspect each surface used in the sealing system. In general, if the adhesion partners are changed, the manufacturer's approval must be obtained again. From the point of view of the long-term suitability for use of window constructions, a holistic approach is essential.

4.7. Bonding insulating glass

A generally applicable approval for bonded glazing systems cannot be issued. Depending on the available test results, this requires coordination and release in individual cases for each defined system with and by the UNIGLAS® shareholder.

The basic principle when gluing the glazing into the frame is to utilise the rigidity of the glass; by bonding the casement frame and the glass together, the window can be reinforced as a composite element and designed to be settlement-free. The window constructions and the individual functional components must be considered as a whole. As one of the most important components, insulating glass in bonded glazing systems may be subjected to additional loads resulting from the corresponding window system.

5. Transportation, Storage, Installation and Maintenance

5.1. Transportation and storage

To maintain the quality and durability of single-pane and insulating glass, proper transportation and storage are essential. Glass surfaces, glass edges and edge seals of insulating glass must not be damaged during transportation, storage and installation. The following is to be observed in particular:

- Single-pane and insulating glass units may only be transported on racks with transport safeguards or in suitable transport crates.
- In general, transportation of the panes is to be carried out in a manner that ensures they are properly supported across the entire glass thickness. This especially applies to large and heavy glazing units.
- When installing the glazing, the glazing unit can only be manoeuvred into place by lifting it briefly by one of the panes of the insulating glass using lifting gear. The specifications of the insulating glass and sealant manufacturer are to be observed.
- The glass panes must be set down or stored almost upright on suitable racks or equipment. The requirements of the trade associations for storage and transportation of glass are to be observed.
- The anti-tilting support, the base and the upper safeguard must not cause any damage to the glass surface, edge or edge seal. The supports must be arranged perpendicularly to the pane surface and ensure full contact with the entire unit thickness.
- When transporting different, large glazing units, it must be ensured that the glass edges do not scratch the glass surfaces next to them. If several panes are stacked, intermediate layers are required (e.g. intermediate paper, intermediate buffer, stacking pads). These must not be able to absorb moisture.
- In general, insulating glass units are to be protected from harmful chemical or physical effects on building sites.
- Transporting on racks:
  The glass panes are to be secured on the racks for transportation. In the process, the safety devices must not subject the glass panes to impermissible pressure.
- **Transporting in boxes:** In the case of boxes used as lightweight packaging which are not designed for the effects of static or dynamic loads, it must be carefully checked in each individual case how the boxes can be handled or whether, for example, transport ropes can be used. Storage or setting down may only take place in an upright position on suitable racks or equipment. Boxes are a means of transport and are not intended for extended storage purposes.
- Insulating glass must be protected outdoors from prolonged exposure to moisture or solar radiation by means of a suitable, complete cover.

5.1.1. Additional requirements for curved glass

The curved glass glazing units must be stored upright under no tension in line with their geometry and accordingly transported. The specifications of the UNIGLAS® shareholder are to be observed.

The underlays and anti-tilt supports must not cause any damage to the insulating glass edge seal or to the glass itself.

Heavy glazing units are only to be transported in a manner that ensures every single pane is evenly held. Briefly lifting the glazing unit by only one pane during handling and insertion is permissible, but only with suitable equipment.

5.1.2. Transporting and installing insulating glass in high and low locations

The installation and/or transport of insulating glass to locations well below or above the place of manufacture of the insulating glass requires special measures for dimensioning and possibly pressure equalisation. Further parameters, such as format, dimension of the insulating glass units and temperature in the cavity must be considered in relation to the glass products used. When making an enquiry/order, the customer is obliged to indicate the installation location of the insulating glass units.

5.2. Installation

Each glass element supplied is to be checked for damage before installation. Among other things, DIN 18008-1 section 5.1.4 specifies maximum edge damage of thermally toughened glass of 15% of the pane thickness in the glass volume.

The dead weight and external influences (e.g. wind, traffic or snow loads) must be safely transferred to the primary structure.

5.2.1. Blocking

The blocking of the insulating glass has the following functions:

- to distribute or compensate the weight of the glass pane in the frame so that the frame supports the glass pane
- to keep the frame in its correct position unchanged
- to ensure functionality in opening elements
- to permanently separate the glass pane edges from the frame and maintain the minimum clearance of 5 mm to the rebate base
- to store the glass to static specifications.

The glazing block width must be 2 mm larger than the glass thickness. The minimum thickness of the setting block is 5 mm. Heavy-duty blocks are to be used for glass panes weighing more than 300 kg. The setting blocks are not to be arranged directly underneath the corner of the pane. The clearance between the setting block and corner of the glazing unit should be approximately one block length (100 mm). For special frame structures (width, fixed units, e.g. shop windows), the support blocks must sit above the fastening points of the frame. In this respect, the distance between the setting block and corner must not exceed 250 mm. (Klotzfibel ROTO 2017/setting block guide)

The frames are to be dimensioned to support the glass panes properly. With regard to the design of the setting blocks, EN 12488 or the Technische Richtlinie des Glaserhandwerks Nr. 3 “Klotzung von Verglasungseinheiten” (‘Technical Guideline of the Glazing Trade No. 3 “Blocking of glazing units”’) must also be observed.

Any excess sealant protruding beyond the glass edge of the insulating glass must be removed from the setting block sector before the glass is inserted. The edge of the glass must not be overstressed by the blocking.

The setting block must not cause any inadmissible deflection of the frame profiles. The maximum deflection limits for the frame profiles must be observed. Particularly with mullion-transom constructions, care must be taken that the deflections of the transom profiles do not multiply in the case of insulating glass units arranged one above the other so that the lower panes have to bear the loads from the panes above them.

If laminated glass/laminated safety glass and/or heavy glazing units are used (> 500 kg), marking of the standing edges is recommended and, if necessary, finishing them with smooth ground edges (KGN).

5.2.2. Protection from UV radiation

The edge seal of insulating glass units is usually not resistant to UV radiation. The edge seal must therefore be completely covered by the frame or protected by other measures such as cover profiles or suitable partial printing. This also applies to the storage of insulating glass units on transport racks as a matter of principle.

If complete framing is not required, a UV-resistant edge seal made of special silicone can be used as an alternative.

5.2.3. Processing tools and equipment

Only suitable processing tools may be used. It is imperative that the glass edge does not come into contact with hard objects such as chisels, screwdrivers, etc. Padding cranks are to be used with care to avoid spalling and shelling at the edges of the glass.

6. Additional Requirements for Special Applications

6.1. Extraordinary thermal stressing

In the case of partial or isolated temperature effects on glass panes, the different thermal expansion causes stresses which can lead directly to breakage. For this reason, uneven temperature loads over the surface of the glass are to be prevented. Glass damage caused by unscheduled loading is not covered by the manufacturer's liability for material defects.

Thermal loads can occur in the following situations, including:

- **Films, paints, posters, internal blinds, furnishings:** The subsequent application of absorbent films, (finger) paints, posters and the attachment of blinds or furnishings on the room side without sufficient distance from the glass, etc., leading to heat accumulation can result in thermally induced glass breakage when exposed to solar radiation. For further information on the thermal stress of glass, see VFF bulletin V.02 "Thermische Beanspruchung von Gläsern in Fenstern und Fassaden" ("Thermal stressing of glass in windows and façades") and BF information leaflet 006/2016 „BF-Information zu nachträglich angebrachten Folien" ('BF information on subsequently applied films'). Verifications or evaluations can also be carried out by means of a thermomechanical stress analysis.

- **Pouring mastic asphalt:** When mastic asphalt is placed in rooms and on balconies and terraces with glazed windows, the glass is heated intensely, unevenly and on one side only. The glazing must be protected against these factors by suitable means.

- **Radiators:** A minimum distance of 30 cm must be maintained between the radiator and normally cooled glass. For insulating glass in combination with toughened safety glass on the room side, the minimum distance can be reduced to 15 cm. At the same time, the width of the radiator should correspond approximately to the width of the insulating glass unit in order to ensure uniform heating of the panes. If thermal shields are used between the radiator and the glazing, this reduces heat loss and reduces the thermal stressing on the insulating glass pane. In this case, the distance between the thermal shield and the glazing must be at least 10 cm.

6.2. Sliding doors or windows

With glazing using insulating glass of any kind, especially with coloured glass in the mix, the use of toughened safety glass or heat strengthened glass is recommended, as the panes can become very hot when exposed to solar radiation. If sufficient ventilation of the space between the sliding elements is ensured, this may not be necessary. This also applies to partially opened sliding elements. Sufficient ventilation can be ensured, for example, by a catch/stopper. This also applies, for example, to installation situations in which the sliding door is not exposed to direct solar radiation. The thermal stressing is to be assessed in each case with the UNIGLAS® shareholder.

6.3. High room humidity and chemical stresses

Rooms with high air humidity include indoor swimming pools, bathrooms, air-conditioned rooms, factory rooms in breweries, butchers, bakeries, flower shops, dairies, dry cleaners, etc., but also rooms such as non-ventilated bedrooms and living rooms, where condensation can form on room-side surfaces. Increased demands are placed here both on the tightness of the construction on the room side and on the materials used.

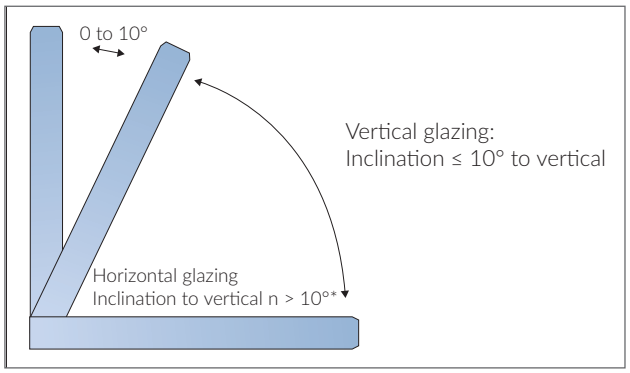
Good pressure equalisation from the glazing rebate to the outside must be ensured in all cases. Additional openings in the upper corner area of the glazing rebate have proven their worth in this case.

6.4. Horizontal and overhead glazing

In contrast to vertical glazing, horizontal and overhead glazing are subject to higher thermal and mechanical stresses (wind, snow and ice loads as well as dead weight). The glazing system must be able to withstand these stresses permanently. The cavity may have to be reduced in order to reduce the load on the insulating glass caused by higher climatic loads (isochoric pressure). If the outer pane of the insulating glass is used as the eaves edge, this is only possible in the version with stepped insulating glass. As a rule, the outer pane should be designed as toughened safety glass or heat strengthened glass for thermal reasons.

The insulating glass must not be installed as a complete glazing unit beyond the glazing system. The use of stepped insulating glass is recommended.

Fig. 3: Definition of horizontal glazing according to DIN 18008*)



*) *Note: In Austria, as well as most other European nations, the inclination n > 15° for horizontal glazing is different.*

6.5. Stepped insulating glass

With this type of insulating glass unit, at least one edge, including the edge seal, is exposed to UV radiation. Therefore the instructions in section 5.2.2 "Protection against UV radiation" must be observed when designing insulating glass units as stepped insulating glass.

6.6. Balustrades

Glass elements can be used as balustrades without additional railings. However, a glazing unit with laminated safety glass or toughened safety glass is generally required.

The additional requirements of the applicable national glass dimensioning and construction standard must be observed for the dimensioning of the corresponding glass thicknesses, the selection of the required glass types and the requirements for the glass retaining structure. For example, in Germany this is DIN 18008-4 and in Austria ÖNORM B 3716-3.

6.7. Spandrels

Spandrels are classified into:

- spandrel plates and
- spandrel panels.

The spandrel plates are single-pane or double-pane (insulating glass) glazing elements made of toughened safety glass. The spandrel plates are used for rear-ventilated external wall constructions (ventilated façade).

Spandrel panels consist of single or double-pane spandrel plates with thermal insulation on the back. These are used in non-ventilated façades.

In the case of spandrels where insulating glass units are used in front of pre-wall insulation or in so-called "shadow boxes", an increased temperature in the cavity between the panes is to be expected (see DIN 18008-1, Table 4).

General requirements for glazing of spandrels

The glazing of the double-glazed spandrel plates and the spandrel panels is to be carried out according to the principles described in these Glazing Guidelines.

6.8. Painted glass

Glass can be coloured using different methods or used as a mirror. For these types of glass and mirrors, the specifications of the manufacturer and the technical guidelines of the glazing trade must be observed with regard to installation/use and fastening. This also applies to the assessment of visual quality.

6.9. All-glass corners and all-glass joints

When planning and executing all-glass joints and all-glass corners made of insulating glass, additional instructions are to be observed.

This includes:

- Exposed glass edges, especially in the case of stepped insulating glass, should as a rule at least be arrissed or smoothly ground. If the edge is visible, a polished edge design is recommended.
- **Joint geometry:**
  Joint width w ≥ 8 mm. Joint depth d ≈ 0.5 x w, min. 6 mm.
- Joints between glass panes designed as "joint connections" must not, as a rule, be taken into account in the static calculation. If the joint connection needs to serve a structural function, corresponding dimensioning and, if necessary, a project-related design type approval may be required.
- The processing and application instructions of the sealant manufacturer, the relevant rules of engineering and the VFF bulletin V.07 "Glasstöße und Ganzglasecken in Fenster und Fassaden" ('All-glass joints and all-glass corners in windows and façades') are to be observed.

6.10. Fire protection glazing

In the case of glazing of fire protection elements, the regulations set out in the national technical approval (abZ) or the European Technical Assessment (ETA) take precedence.

6.11. Mirrors

For the glazing and installation of mirrors, the German Technische Richtlinie des Glaserhandwerks Nr. 11 "Montage von Spiegeln" ('Technical guideline of the glazing trade no. 11 "Installation of mirrors"') are to be observed.

7. Properties of Glass Products

7.1. Basic glass

The basic glass for all other glass products is usually a float glass according to EN 572-2. Float glass is defined as flat, transparent, clear or coloured soda lime silicate glass with parallel and polished surfaces, produced by continuous infusion and flow (float) over a metal bath. It is characterised by a very good optical quality.

This can be used to produce processed glass products such as coated glass, insulating glass units, single-pane and laminated safety glass as well as ornamental glass.

The general properties of basic products made of soda lime silicate glass are described in EN 572-1.

7.2. Toughened safety glass (with/without heat-soak test)

Toughened safety glass complies with product standard EN 12150-2. In order to reduce the risk of spontaneous failure, toughened safety glass is heat soaked in accordance with EN 14179. The national regulations regarding the use of toughened safety glass and heat soaked thermally toughened safety glass are to be observed.

7.3. Heat strengthened glass

Heat strengthened glass complies with product standard EN 1863-2 in conjunction with the usability certificates of the respective manufacturers and in accordance with the regulations of the Administrative Provisions – Technical Building Rules (VV TB) of the relevant Federal State in Germany.

7.4. Patterned glass

Patterned glass complies with EN 572-5. The use of patterned and wired patterned glass (patterned glass with wire insert) must be selected very carefully due to its special properties. Explicit reference is made to the building regulations and other technical instructions (e.g. DIN 18008).

Direction of structure

For cutting to size, the standard is that the structure runs parallel to the height dimension. Exceptions are possible only if the direction of structure is indicated on the drawing and the note "direction of structure according to drawing" is noted with the order. If the requirement is that the direction of structure of the glass is to be continued over several units, this must be expressly indicated in the order and reference points must be indicated.

This also applies accordingly to motif glass, e.g. sandblasted or printed glass.

Table 2: Properties of glass products

	Float glass	Heat strengthened glass	Toughened safety glass
Flexural strength σ_B	45 N/mm²	70 N/mm²	120 N/mm²
Resistance to temperature differences and sudden changes in temperature Δ T	40 K	100 K	200 K
Cutting	Yes	No	No
Breakage pattern	Radial cracks, large pieces	Radial cracks, large pieces	Web-like cracks, small pieces

7.5. Laminated and laminated safety glass

For areas of application with exposed glass edge, laminated glass and laminated safety glass are only to be used with:

- arrissed edge,
- ground edge,
- polished edge or
- mitre edge

The required edge quality is to be specified in the order. Optical effects at the storage edge, film residues in the arrissed area and film overhangs or film intakes in the case of fixed dimension laminated safety glass are technically unavoidable.

In the case of exterior glazing with permanent moisture loading of the film at the glass edge, optical changes can occur in a peripheral zone of approximately 15 mm. These changes are permitted. Divergent regulations can be agreed with the UNIGLAS® shareholder. To prevent this optical effect, the construction must be designed in such a way that permanent moisture loading of the film on the glass edge is avoided by the construction itself or by adequate ventilation.

In the area of canopies, this can be done, for example, by using laminated safety glass with a projection (step). In order to maintain the properties of the laminated glass over the entire period of use, professional cleaning of the glass edges at suitable intervals is a prerequisite. These must be determined depending on the installation situation, e.g. inner city locations and areas with expected high levels of contamination from other parts of the building. It should also be noted that interaction with other materials can lead to certain characteristics (e.g. bubbles). (cf. Ch. 2.4)

Further information on the use of laminated safety glass can be found in BF bulletin 013/2013 "Laminated safety glass (LSG) for use in building".

7.6. Coated glass and product properties

Glass products can have a wide variety of coatings applied to them. These coatings achieve optical changes, changes in technical and lighting values or special properties of the glass surface. The most common layers used are those that alter the energetic behaviour of the glazing. These especially include layers that improve thermal insulation properties and/or reduce the transmission of solar radiation. As a rule, coatings are associated with a corresponding colour impression. The aesthetic requirements (reflection of the coated glass, colouring by the coating or also the glass substrate) must therefore be agreed with the UNIGLAS® shareholder during the planning phase.

To determine optical properties and coordinate the expected optical quality with the UNIGLAS® shareholder, samples in component size should therefore be used from the outset, especially for larger objects. However, an initial product definition can also be made with specimen, usually 200 mm x 300 mm in size. The above requirements must be equally satisfied by both curved and flat glazing.

Further information can be found in the following leaflets, guidelines and standards:

- VFF bulletin V.03 "Farbgleichheit transparenter Gläser im Bauwesen", issue 09/2004 ('Colour uniformity of transparent glazing in building', published by the Association of Window and Façade Manufacturers, VFF).
- Guideline "GEPVP – Code of Practice for in-situ Measurement and Evaluation of the Colour of Coated Glass used in Façades", issue 2005
- ISO/DIS 11479 "Glass in building. Coated glass – Part 2: Colour of facade", 2011 version

Coating options for curved glass depending on geometry, glass structure and size are to be clarified with the UNIGLAS® shareholder in each case. Due to the large number of parameters mentioned above, it is not possible to determine the U_g values, g values, etc., that can be achieved.

U_g values as well as photometric and radiation-physical characteristic values are usually given for flat glazing with the same glass structure. This is determined in accordance with EN 673 and EN 410.

UNIGLAS® | ACTIVE Easy Clean Glass

UNIGLAS® | ACTIVE has an applied photocatalytic hydrophilic titanium oxide layer. When installing UNIGLAS® | ACTIVE, a few special features are to be observed. For example, other functional layers must be installed in certain glazing positions. For this reason, the separate glazing guidelines and instructions on the pane labels must be observed with particular care and the installation position must be followed precisely.

Direct contact between silicone/silicone oil and UNIGLAS® | ACTIVE must be prevented.

During glazing, specially approved, clean protective gloves must be worn which have not come into contact with silicones. Only suckers with clean pads are to be used. Also, no spray containing silicone oil may be used to treat the fittings.

The usual glass cleaning procedures and materials can be used to clean the glass. Abrasive cleaning agents are unsuitable.

Any contamination during the construction phase must be removed immediately with plenty of clean water.

Weatherstripping for dry glazing is often treated with silicone oils for better workability. This treatment is not permitted with hydrophilic and photocatalytic products such as UNIGLAS® | ACTIVE, as the silicone oils have high creep properties and deactivate the cleaning supporting function. Most sealant manufacturers offer dry seals or seals coated with talcum, glycerine, lubricating polymers or bonded coating, for example, which are compatible with UNIGLAS® | ACTIVE.

If seals without lubricant are to be used, they can be made lubricious with soapy water, glycerine, etc. Assembly spray (silicone oil) must not be used under any circumstances.

Instead of frequently used silicones for wet glazing, special, expressly approved sealants are to be used. Your UNIGLAS® shareholder will send you relevant processing information in case of application.

UNIGLAS® | VARIO Switchable Glass

Glazing of switchable glass with dynamic light transmittance and g values places special demands on the frame structure and cable bushings, which are provided by the UNIGLAS® shareholder on order or on request.

7.7. Insulating glass units

The technical data/values given in the UNIGLAS® publications refer to the specifications provided by different basic glass manufacturers and are to be confirmed by the UNIGLAS® shareholder in each case.

A further guarantee for technical values is not assumed. This applies, in particular, if tests with other installation situations are carried out or if subsequent measurements are carried out on the construction site. Only the manufacturer's specifications in the respective declaration of performance after delivery are decisive for the warranted properties.

7.7.1. Energy recovery and solar control glass

Coated insulating glass units obtain their technical properties through the coating of the glass surface in the cavity. The technical data depends in part on the installation position of this layer. For this reason, a sticker indicates the correct position for the installation.

If coated insulating glass units are required in combination with wired glass, the warranty of quality and durability is not applicable. The combination of coated insulating glass units with coloured glass requires a coloured pane of toughened safety glass or heat strengthened glass.

7.7.2. Sound reduction glass

Sound reduction glass is defined as single-pane glass or insulating glass units, which significantly improves sound insulation. In general, the glazing of sound reduction glass is subject to the same principles as insulating glass units. Sound reduction glass usually has a higher weight per unit area. For this reason, the design and stability of the frames, fittings and setting blocks must be taken into account. Good sound insulation of sound reduction glass can only be fully effective if the entire window element, including the fastening and design of the connecting joints, is highly airtight. When it comes to sound insulation, the main factor is the installed window and façade as a whole. The following includes some of the factors to be taken into account:

- A circumferentially even contact of the sash frame
- Sealing levels arranged in staggered order
- Maximum possible distance between the seals
- UNIGLAS® PHON Sound Reduction Glass (certified in accordance with EN ISO 10140-2)
- Fittings adapted to the weight of the pane
- A proper wall connection
- Type of construction and opening of the window (e.g. turn or tilt and turn design)
- Size of the window element (see correction values according to DIN 4109-35 and EN 14351-1, Annex B).

The structure of sound reduction glass is usually asymmetrical. The installation position of the thicker pane is irrelevant for the function of sound reduction in the case of sound that is usually diffuse. Therefore, with the exception of noise situations with directional sound, the thicker pane is to be mounted on the outside for visual reasons.

7.7.3. Insulating glass units with exposed edge seal

An exposed edge seal must be protected from UV radiation by suitable means (cover strips, partial printing, etc.); see section 5.2.2.

7.7.4. Compact insulating glass panes

All insulating glass elements with an edge length of < 500 mm for double insulating glass and < 700 mm for triple insulating glass can be regarded as “compact”. This type of glass results in higher stresses on the glass and edge seal compared to larger formats.

During the production of insulating glass, the cavity between the panes is hermetically sealed, i.e. the gas pressure in the cavity permanently corresponds to the air pressure prevailing at the respective production site at the time of manufacture. Temperature and atmospheric pressure fluctuations, e.g. due to changes in the weather or during transportation to a different geographical altitude, result in pressure differences between the outside air and the gas pressure prevailing in the cavity.

This leads to stresses in the glass and in the edge seal. These stresses are more pronounced with asymmetrical glass structures and enlarged cavities, such as in sound reduction insulating glass and triple insulating glass with cavity > 16 mm. In unfavourable conditions this may result in glass breakage. Furthermore, there is a risk that the function of the edge seal will be impaired in the long term by the great stresses.

With one cavity > 16 mm or two cavities > 12 mm each and an unfavourable aspect ratio, toughened safety glass is always recommended for the thinner pane.

If the aspect ratio is unfavourable (≥ 3: 1) and in the case of large cavities, it is recommended that the glass pane(s) at risk of breakage are always made of toughened safety glass for insulating glass.

7.7.5. Horizontal glazing

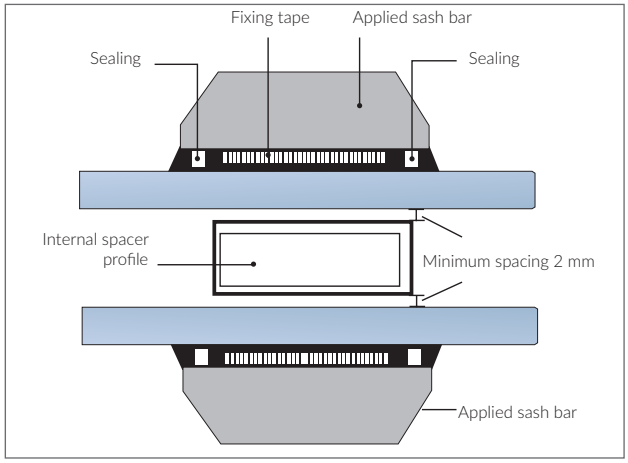
With an inclination from the vertical, the U_g value of the insulating glass units increases due to the onset of convection in the cavity. In order to declare the correct U_g value in the declaration of performance or in the data sheet, the angle of inclination to the vertical must therefore be specified in the order.

7.7.6. Insulating glass units with inner sash bars

Inner sash bars in the cavity alter the heat transmittance coefficients and the sound reduction index. All values stated are standard nominal values and are subject to the corresponding product tolerances according to relevant EN standards.

The BF bulletin 016 "BF Bulletin for Assessment of Sash Bars Inside the Cavity" is to be observed. Ensure that the sash bars are parallel to the frame profiles. When dimensioning the "climatic load case", the obstruction of the pane deflection by the inserted bar profiles must be taken into account. Climatic loads may cause the panes to deform and reduce the cavity. In addition to the static load assumptions according to the applicable standards (wind, traffic and climatic loads), the system-specific minimum distances of the cavity must be observed, depending on the element dimensions, to ensure its (movable) function. When adhering sash bars to the outer surfaces of the panes, the scheduled deflections of the outer panes must be observed.

Fig. 4: Example of Georgian bar



7.7.7. UNIGLAS® | SHADE Venetian Blind System

Glazing of UNIGLAS® | SHADE places special demands on the frame structure and cable bushings, which are provided by your UNIGLAS® shareholder on order or on request.

7.7.8. Insulating glass units with heating glass

Glazing of insulating glass units with heating glass places special demands on the frame structure and cable bushings, which are provided by your UNIGLAS® shareholder on order or on request.

7.7.9. Insulating glass units with alarm glass (toughened safety glass or laminated safety glass)

When ordering alarm glass, the position of the connection and the visible side must be specified. In this case, the handling and installation instructions of the manufacturer and the VdS specifications from the approval must be observed.

7.7.10. Technical glass

Glazing of technical glass, e.g. x-ray protection glass or glass panes attenuating electromagnetic waves (shielding), places special demands on the frame structure and, if applicable, potential equalisation; these types of glazing are provided by the your UNIGLAS® shareholder on order or on request.

7.7.11. Lead and brass glazing

At the customer's request, the lead glazing can be installed in the cavity in order to protect valuable, hand-crafted lead glazing from the effects of the weather while achieving increased thermal insulation. The use of clear lead glass is to be agreed with the UNIGLAS® shareholder beforehand.

In the case of lead glazing with mouth-blown glass, it is possible that small colour variations, hairline cracks, open bubbles, etc., may occur. This is due to production technology and a sign of "genuine handiwork". With all lead and brass glazing installed in the cavity, rattling noises or contact with the glass may occur when the sash moves. Technically, this cannot be entirely prevented.

7.7.12. Curved insulating glass/large bulls-eye panes

For production-related reasons, slight deviations of the curvature as well as small mineral melting spots on the pane surface may occur. These production-related characteristics are a sign of "genuine handiwork" and not a reason for complaint.

7.7.13. Insulating glass units with patterned and wired glass

The textured surface of patterned glass is generally installed on the outside. If a very textured side of the glass faces the cavity, there is a risk of leakage. Such designs are possible if expressly requested in the order, but are excluded from the warranty.

The machined patterned glass "Altdeutsch K" has open bubbles, highly irregular textures and different glass thicknesses. For these reasons, there is an increased risk of breakage, especially with small-format panes. We therefore do not advise using this ornamental element in the insulating glass unit.

In the case of frosted glass, there are isolated remains of bone glue on the surface which cannot be removed due to the manufacturing process. These specific characteristics do not constitute grounds for complaint.

The vertical installation of insulating glass units combined with wired glass or laminated wire glass is possible. Insulating glass units in combination with wired glass or wired patterned glass as well as insulating glass units made of two wired glass panes are subject to an increased risk of breakage. Glass breakage is not a reason for complaint.

In the case of wired glass, wired patterned glass or laminated wire glass, a uniform or congruent wire course is not possible for manufacturing reasons.

8. Choosing the Right Glass Products

As a rule, the selection and dimensioning of glass products is based on the applicable national regulations of the respective country. In Germany, for example, these are the building regulations in conjunction with the Administrative Provisions – Technical Building Rules (VV TB) and the introductory decrees of the respective federal states.

For the application of glass in Germany, the DIN 18008 series of standards must be observed and in Austria the ÖNORM B 3716 series of standards. These Technical Building Regulations apply to every building, whether for public, commercial or private use. In public, publicly accessible or commercial buildings, numerous additional safety regulations apply in addition to the Technical Building Regulations, depending on the type of use. These are rules that deal with build safety aspects relating to glass, such as accident prevention regulations (UVV), workplace legislation, meeting venues legislation, etc. They regulate the specific safety requirements for buildings such as childcare facilities, schools, sports facilities, offices or sales outlets. There are no clear legal requirements for the private sector. Only a generally formulated obligation to ensure build safety applies to these. This obligation to ensure build safety means that anyone who creates a hazardous situation is also obliged to avert potential injury to others. This general wording is interpreted in very different ways, as is shown by numerous, quite contradictory judgements in individual case-law rulings.

It can be assumed that every building structure and the glass component built into it create a hazardous situation for its use. Therefore, any buildings are to be assessed according to safety-relevant aspects which can expect large groups of people and crowds, in which vulnerable people, who are frail or have impaired mobility, but also children or athletes, may come into contact with glass components. In addition to sports facilities, hospitals, residential homes for the elderly, schools, child day-care centres and meeting places, this also applies to private buildings. It is essential to ensure that people are not exposed to danger in the event of glass breakage. For all freely accessible glazing adjoining circulation and recreation areas, this must be implemented with break-proof or break-inhibiting properties. These attributes are inherent in the use of laminated safety glass or toughened safety glass, the breakage of which does not eliminate sharp or sharp-edged glass parts that could cause serious injury.

However, it is not sufficient to use one of these glass products as an option. The entire glazed construction must always be assessed. Criteria for assessing the build safety are, for example:

- Stability (which effects are to be expected and how are these safely and reliably supported and derived?)
- Glass thickness, type and design of frame constructions, fittings and/or other installation or fastening options
- Requirements for the suitability of glazing for the intended purpose within the framework of a technical rule, a general technical approval, a general building inspection test certificate or a project-related approval
- The method of shielding glazing which is not sufficiently build safe or not fracture-proof.

Planners and contractors are confronted with various safety rules, accident prevention regulations, ordinances and standards governing the use of glass in the building industry. Essential regulations which restrict the use and/or suitability of different types of glass in construction can be found in the Appendix. In addition, further requirements may be imposed, e.g. a general construction technique permit (aBG), a project-related construction technique permit (vBG), a European Technical Assessment (ETA), a national technical approval (abZ) or a general test certificate by a building inspection authority (abP); as a result, the requirements must always be verified for each specific building. Depending on the use, Table 3 lists a selection of possible uses of glass in the building industry, with reference to the associated technical regulations. In addition to the basic requirements of DIN 18008, the structural general conditions of the respective technical regulations must also be observed. Parts 1 and 2 of this standard are still being revised at the time of going to print. At this point in time, the above-mentioned obligation to assess the hazard situation is discussed in Part 1 and is to be substantiated by the following sentence: *"If build safety so requires, protective measures must be taken in the case of freely accessible glazing. This can be done, for example, by restrictions on accessibility (barriers) or the use of glazing with safe and reliable breaking properties."*

Table 3: Usability of glass types in relation to type of use

Type of use		FG ESG[1]	VSG FG TVG ESG	Regulations
A Vertical glazing (without fall protection function)				
A.1 Vertical glazing (linear)				DIN 18008-2
A.2 Vertical glazing (fixed-point)	EG MIG	 [2] [2]	[2] [2] [2] [2]	DIN 18008-3 DIN 18008-3
A.3 Rear-ventilated façade			- -	DIN 18008-2
A.4 Structural glazing	interior exterior	 	 	ETAG 002
A.5 Glass fins				vBG
A.6 Shop windows				DIN 18008-2[3]
A.7 All-glass door systems and porch systems				DGUV reg. 108-005, ARBSTÄTTV, DGUV info. 208-014, ASR A1.7
A.8 Sound reduction wall				DIN 18008-2, ZTV-LSW 06
B Horizontal glazing (above circulation areas)				
B.1 Horizontal glazing[4] (linear)	above below	 	 	DIN 18008-2
B.2 Horizontal glazing[4,5] (fixed-point)				DIN 18008-3
B.3 Accessible glazing			[6] [6]	DIN 18008-5
B.4 Walk-on and anti-break/fall-resistant glazing	above below	 	 	DIN 18008-6
B.5 Glass beams				vBG
B.6 Projecting glass roof			[7]	DIN 18008-2
B.7 Glass slats			[7]	DIN 18008-2
C Safety barrier glazing				
C.1 Room-high glazing (Cat. A)	EG MIG	 [8, 9] [9]	 	DIN 18008-4
C.2 All-glass railing with attached handrail (Cat. B)			[10]	DIN 18008-4
C.3 Railing infill panels fixed-point[11] (Cat. C1)				DIN 18008-4
C.4 Railing infill panels linear (Cat. C1)		[12]		DIN 18008-4
C.5 Below transoms (Cat. C2)	EG MIG	 	 	DIN 18008-4
C.6 Room-high with front supporting rail (Cat. C3)	EG MIG	[8, 9] [9]	 	DIN 18008-4
C.7 Double façade	interior[13] exterior	 	 	DIN 18008-4
C.8 Lift shaft				DIN 18008-4, DIN EN 81-20

Type of use	FG ESG[1]	VSG FG TVG ESG	Regulations
D Glazing in buildings with special use			
D.1 Offices (walls, doors, etc.)	■ ■	■ ■ ■	ARBSTÄTTV, ASR A1.6, DGUV R.108-005
D.2 School	□[14] ■	■ ■ ■	DGUV REGULATION 81
D.3 Child day-care facilities	□[14] ■	■ ■ ■	DGUV Regulation 102-002
D.4 Hospital	■ ■	■ ■ ■	DGUV Information 207-016
D.5 Shopping areas	■ ■	■ ■ ■	DGUV Regulation 108-005
D.6 Swimming pools	■[14] ■	■ ■ ■	GUV-R 1/111, DGUV Regulation 107-001
D.7 Sports halls	■[14] ■	■ ■ ■	DIN 18032-1
D.8 Squash halls	■ ■	■ ■ ■	DIN 18038[15]
D.9 Multi-storey car park, bus depot, etc.	■ ■	■ ■ ■	ARBSTÄTTV App. 1.7(4), ASR A1.6, ASR A1.7
D.10 Entrance halls and foyers	■ ■	■ ■ ■	ARBSTÄTTV, DGUV R. 108-005, ASR A1.7
E Non-fall protection interior applications			
E.1 Shower wall partitioning	■[14] ■	■ ■ ■	DIN EN 14428
E.2 Door aperture	■ ■	■ ■ ■	ARBSTÄTTV, DGUV Inform. 208-014
E.3 Door aperture in upper third of door	■ ■	■ ■ ■	DGUV Information 208-014
E.4 All-glass door	■ ■	■ ■ ■	ARBSTÄTTV, DGUV Inform. 208-014, ASR A1.7, DGUV Regulation 108-005

■ Minimum glass type required ■ Recommended glass type ■ Alternative usable glass type □ Limited use glass type
■ Non-usable glass type

1 According to DIN 18008-2, monolithic single-pane glass or outer monolithic insulating glass units made of toughened safety glass and heat soaked thermally toughened safety glass may only be installed if their upper edge is less than 4 m above traffic surfaces due to the probability of failure caused by nickel sulphide inclusions (spontaneous failure). Deviating from this, heat soaked thermally toughened safety glass may be used as monolithic single glazing or outer monolithic panes from insulating glass units without limitation of the installation height, if the reliability class RC2 according to DIN 1990 is achieved by appropriate quality assurance measures through appropriate limitation of the probability of failure.
2 According to DIN 18008-3 only when using clamping mounts.
3 No additional rules exist to date.
4 If monolithic glass is used exclusively, the specifications for the lower pane in the case of insulating glass units apply to the glass type required.
5 According to DIN 18008-3 only when using plate holders. Only single glazing may be used.
6 According to DIN 18008-5 the top pane of glass can be made of toughened safety glass instead of heat strengthened glass. Float glass, on the other hand, is not to be used as the top pane of glass.
7 In case of fixed-point mounts, design is only possible with laminated safety glass made of heat strengthened glass.
8 According to DIN 18008-4, coarsely breaking types of glass may be used immediately behind toughened safety glass facing the impact, provided the latter does not fail the pendulum test.
9 In general, at least one pane of multi-pane insulating glazing must consist of laminated safety glass.
10 Laminated safety glass made of float glass as category B glazing is not covered by the certificates in Table B.1 of DIN 18008-4.
11 Support by means of clamp mounting requires a project-related approval (ZiE) or a national technical approval (abZ).
12 Only single glazings of category C1 and C2 according to DIN 18008-4 with linear bearings on all sides may also be designed as monolithic toughened safety glass.
13 No fall protection effect.
14 Translucent surfaces up to a height of 2 m are to be formed with unbreakable materials or adequately shielded.
15 According to DIN 18038 (now withdrawn), the rear panel must consist of at least 12 mm of toughened safety glass.

Source: Glasbau, Grundlagen · Berechnung · Konstruktion, 2. Auflage (Glass construction, basic information – calculation – construction, 2nd edition). Jens Schneider, Johannes Kuntsche, Sebastian Schula, Frank Schneider, Johann-Dietrich Wörner VDI book, Springer Vieweg, Springer-Verlag Berlin Heidelberg, 2001, 2016

FG: float glass, ESG: toughened safety glass, VSG: laminated safety glass, TVG: heat-strengthened glass, MIG: insulating glass units, EG: single-pane glass

9. Maintenance and Care of Glass

9.1. Glass surface damage

Glass surface damage can be caused by mechanical, thermal and chemical effects. Glazing can be ordered ex factory with UNIGLAS® | PROTEC Glass Protective Film temporarily applied to the glass surfaces outside of the rebate space.

9.2. Etching caused by the effects of alkaline substances

Mortar splashes, cement slurries and wash-outs from fibre-cement slabs or untreated concrete surfaces on glass elements can cause etching of the glass surface after only a short exposure time.

During the construction phase, already installed glazing units must be protected from these effects. While fresh mortar splashes and cement slurries that have not yet set can be removed with plenty of water, glass damage caused by etching can only be removed with special cleaning or polishing agents such as acetic acid, whiting or cerium oxide. After prolonged exposure, etching is usually no longer reversible. Functional layers on the outside (pos. 1) of the glass are particularly sensitive. Special cleaning regulations apply to these layers which are available from the UNIGLAS® shareholder, if applicable.

In the case of protection provided by films applied at a later stage, the BF information leaflet 006/2016 "BF-Information zu nachträglich angebrachten Folien" ('BF information on subsequently applied films') is to be observed. Compatibility is also to be taken into account with these films; for example, whether a change in the glass surface results from the application of this film (e.g. a change in the surface tension of the glass caused by adhesives, which may result in a change in wettability).

9.3. Welding beads or damage caused by grinding and cutting wheels

If welding or grinding work is carried out in the vicinity of unprotected glass surfaces, welding beads or glowing grinding particles may burn in which cannot be removed. The glazing must be protected accordingly, e.g. by mobile protective walls, wooden panels or similar.

9.4. Façade preparation agent

Façades – especially masonry – are often heavily contaminated during the construction process. Efflorescence can also occur. For cleaning the surfaces, façade stone cleaners containing hydrofluoric acid are often used; however, their components may irreversibly etch the glass surface. This must be prevented by covering the panes with a suitable foil.

9.5. Maintenance and repair work

For maintenance work, stains, wood preservatives, façade sealants, agents against mould and fungal attack, etc., may be used. The chemical components of these agents can attack the glass surfaces. The manufacturer's instructions must be observed before using these agents. Fluoride or strongly alkaline agents must be kept away from the glass surfaces.

9.6. Smear formation due to rubbing of joint sealants

With various glazing sealants, rubbing can occur during cleaning, which shows up as streaks on the glass surface. The glass element must be protected from the described factors.

General protective measures cannot be listed due to the diversity of the causes. In each individual case, they must be assessed, instigated and taken into account as early as the planning stage. Rub-resistant sealants are recommended.

9.7. Cleaning and maintenance of glass

Regular cleaning and maintenance is required to ensure the permanent function of the glass products. Depending on the glass product used, the installation situation and location, these intervals can vary and must be selected on an individual basis. The UNIGLAS® specialist information "Glass can withstand a lot – but not everything" must be observed.

As a rule, tests should be carried out and, if necessary, proof provided with regard to compatibility before starting to clean particularly firmly adhering dirt and when using cleaning agents.

10. Guideline for Assessing the Visual Quality of Glass for the Building Industry

Glass products in the building industry are produced and processed for a wide variety of applications. Basically, a distinction can be made between single panes (a monolithic pane or at least two panes joined together by a bond) and multi-pane insulating glazing as a combination of several single panes with cavities, for which different specific technical regulations apply.

Depending on the product properties, these glass products have to pass through various production steps. Each production step can influence the visual quality of the glass. For example, unavoidable optical phenomena occur even during the manufacture of single panes, which can only be reduced by visual inspections with the removal of defective parts. This also applies to all subsequent processing steps.

The Guideline is intended to describe visual qualities of glass that allow an acceptable cost/benefit ratio. In any case, it is recommended that contracting parties agree on the level of quality to be delivered (e.g. by clearly specifying it in a bill of quantities). The Guideline meets at least the requirements of Annex F of EN 1279-1: 2018 and defines a standard quality level.

Requirements that go beyond this standard quality must be agreed separately.

10.1 Scope of application

This Guideline applies to the assessment of the visual quality of glass for the building industry (use in the building envelope and in the development of buildings/ structures). The assessment is carried out in accordance with the test principles described below using the permissible discrepancies given in the tables in Section 10.3.

The clear glass surface retained in the installed state is evaluated. Glass products designed with coated glass, coloured glass, laminated glass or toughened glass (toughened safety glass, heat strengthened glass) can also be assessed using the table in Section 10.3.

Switchable/dimmable glass and panes with built-in movable devices have to be evaluated in transparent, clear condition.

The Guideline does not apply to special types of glass such as glass products using patterned glass, wired glass, special safety glass (laminated safety glass and laminated glass consisting of more than two panes), fire-resistant glass and non-transparent glass products. These glass products are to be assessed depending on the materials used, the production process and the corresponding manufacturer's instructions. Elements installed in the cavity or in the bond are not evaluated.

The assessment of the visual quality of the edges of glass products is not covered by this Guideline. For exposed glass edges, the rebate zone criterion is omitted; in its place, at least the evaluation of the edge zone or a separate agreement applies. The intended purpose must be specified when the order is placed. Special conditions must be agreed for viewing glass façades from the outside.

10.2. Inspection

In general, the inspection is based on looking through the glazing, i.e. considering the background and not the top view. However, the complaints must not be specially marked.

The glass is to be inspected in accordance with the tables in section 10.3 from a distance of at least 1 metre from the inside to the outside for up to 1 minute per metre, and from a viewing angle which corresponds to the general use of space (in the range from perpendicular to 30° to the glass surface). The inspection is preferably performed in diffuse daylight (such as overcast skies) without direct sunlight or artificial lighting. These conditions are to be simulated for the evaluation in the production process.

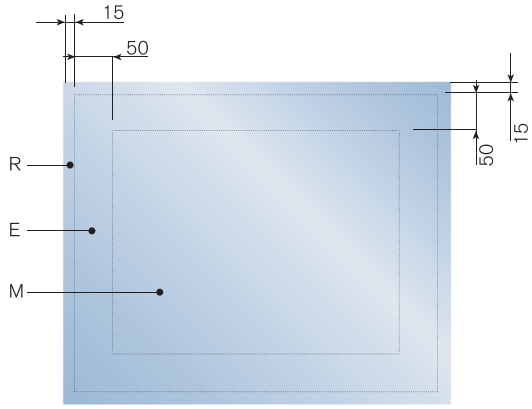
The panes within rooms (interior glazing) are to be inspected under normal (diffuse) illumination intended for the use of the rooms, preferably at an angle perpendicular to the surface. Changes in lighting in rooms, e.g. by installing new lighting fixtures, can change the visual impression of the glass.

An evaluation from the outside to the inside may be made in the installed condition at the usual viewing distances. Inspection conditions and viewing distances from specifications in product standards for the glass products under consideration may deviate from this. The inspection conditions described in these product standards can often not be fulfilled with the object concerned.

10.3. Permissible discrepancies for the visual quality

10.3.1 Zones for assessing the visual quality

Fig. 5: Zones for assessing the visual quality



R = rebate zone (or rabbet):
A 15 mm area normally covered by the frame (no restrictions except for mechanical edge damage – see also section 4.1.3).
For free glass edges, the criterion of a rebate zone (see above) is not applicable.

E = edge
Area at the edge of the visible surface, 50 mm wide.
For glass edges < 500 mm, 1/10 of the glass edge lengths are to be used as the edge.

M = main zone:
The remaining area

10.3.2 Permissible discrepancies in terms of faults, residues and scratches

Table 4: Permissible number of fixed-point characteristics

Zone	Extent of faults (without corona, Ø in mm)	Size of pane S (m^2)			
		S ≤ 1	1 < S ≤ 2	2 < S ≤ 3	S > 3
R	All sizes	Unrestricted			
E	Ø ≤ 1	Maximum of 2 permitted in an area with Ø ≤ 20 cm			
	1 < Ø ≤ 3	4	1 per metre of circumferential edge length		
	Ø ≤ 3	Not permitted			
M	Ø ≤ 2	2	3	5	5 + 2 per additional m^2 over 3 m^2
		Maximum of 1 permitted in an area with Ø ≤ 50cm			
	Ø > 2	Not permitted			

Table 5: Permissible number of residues (spots and stains)

Zone	Size and type (Ø in mm)	Size of pane S (m^2)	
		S ≤ 1	1 < S
R	All	Unrestricted	
E	Spots Ø ≤ 1	3 permitted in every area with Ø ≤ 20 cm	
	Spots 1 mm < Ø ≤ 3	4	1 per circumferential metre of edge length
	Stains Ø ≤ 17	1	
	Spots Ø > 3 and stains Ø > 17	Not permitted	
M	Spots Ø ≤ 1	3 permitted in every area with Ø ≤ 20 cm	
	Spots 1 < Ø ≤ 3	Not permitted	
	Spots Ø > 3 and stains Ø > 17	Not permitted	

Table 6: Permissible number of scratches

Zone	Individual length (mm)	Total of individual lengths (mm)
R	Unrestricted	
E	≤ 30	≤ 90
M	≤ 15	≤ 45

Table 4–6 Permissible discrepancies in assessing the visual quality

Fine scratches are not allowed in accumulation. In installed condition, the permissible lengths increase by 25% of the above values. The result is always rounded up to a full 5 mm.

Existing interference zones (corona) must not be larger than 3 mm.

Permissible in the rebate zone R: External flat edge damage or shells which do not impair the strength of the glass and do not exceed the width of the edge seal and internal shells without loose fragments filled with sealing compound.

10.3.3 Permissible discrepancies for triple insulating glass, laminated glass and laminated safety glass

The permissible discrepancies for zone E and M in Tables 4 to 6 increase in their frequency by 25% of the above values per additional glass unit and per laminated glass unit. The result is always rounded up.

10.3.4 Permissible discrepancies for monolithic single panes

The permissible discrepancies for zone E and M in Tables 4 to 6 decrease in their frequency by 25% of the above values. The result is always rounded up.

10.3.5 Additional requirements for thermally treated glass

The following applies for toughened safety glass and heat strengthened glass as well as for laminated glass and laminated safety glass made up of toughened safety glass and/or heat strengthened glass:

- The local ripple on the glass surface must not exceed 0.3 mm relative to a measuring distance of 300 mm, with the exception of toughened safety glass made of patterned glass and heat strengthened glass made of patterned glass.
- Distortion in relation to the total glass edge length must not exceed 3 mm per 1,000 mm glass edge length, with the exception of toughened safety glass made of patterned glass and heat strengthened glass made of patterned glass. Larger distortions may occur with square formats and approximately square formats (up to 1:1.5) as well as with individual panes with a nominal thickness < 6 mm.

For bonded glass constructions, higher requirements are generally required to comply with the approval specifications regarding the geometry of the bonded joint.

10.4 Other visual aspects for assessment

The Guideline represents an assessment standard for the visual quality of glass in the building industry. When assessing an installed glass product, it must be assumed that, in addition to the visual quality, the characteristics of the glass product must also be taken into account in order to fulfil its functions.

Property values of glass products, such as sound insulation, thermal insulation and light transmission values, etc., which are specified for the corresponding function, refer to test panes in accordance with the applicable test standard. The specified values and optical impressions may change with other pane formats and combinations as well as due to installation and external influences.

The large number of different glass products means that the tables in section 10.3 do not allow unrestricted application. A product-related assessment may be required. In such cases, e.g. in the case of special glazing, the special requirement characteristics must be evaluated depending on the use and the installation situation. When evaluating certain characteristics, the product-specific properties must be taken into account.

10.4.1. Visual properties of glass products

10.4.1.1. Natural colour

All materials used in glass products cause their own raw material-related colours, which can become more noticeable as the thickness of the glass increases. Coated glasses are used for functional reasons. The coatings also have a natural colour. This natural colour may be discernibly different when looked through and/or looked at straight on. Fluctuations in the colour impression are possible and unavoidable due to the iron oxide content of the glass, the coating process, the coating itself as well as changes in the glass thickness and the pane structure.

10.4.1.2. Colour differences in coatings

An objective evaluation of the colour difference in coatings requires its measurement or testing under precisely defined conditions (glass type, colour, illuminant). Such an assessment cannot be the subject of this Guideline. (Further information can be found in the VFF bulletin "Colour uniformity of transparent glass in building".)

10.4.1.3. Assessment of the visible area of the insulating glass unit edge seal and straightness of the spacers

In the visible area of the edge seal and thus outside the clear glass surface, production-related features may be visible on the glass and spacer frame of the insulating glass unit.

The permissible deviations of the parallelism of the spacer(s) to the straight glass edge or to other spacers (e.g. with triple insulating glass) are up to an edge length l of:

0.0 m < l ≤ 2.5 m	3 mm *)
2.5 m < l ≤ 3.5 m	4 mm *)
3.5 m < l	5 mm *)

*) Any deviations must not exceed 2 mm per 200 mm of edge length.

If the edge seal of the insulating glass is not covered due to the design, typical features of the edge seal may become visible which are not covered by the Guideline and are to be agreed in each case.

Special frame constructions and designs of the edge seal of insulating glass require coordination with the respective glazing system.

10.4.1.4. Insulating glass unit with inner sash bars

Climatic influences (e.g. insulating glass effect) as well as vibrations or manually excited oscillations can temporarily cause the sash bars to make rattling noises.

Visible saw cuts are due to production. Large-area colour delamination is not permitted in the cutting area. Any deviations from the perpendicularity and offset within the field divisions are to be assessed under consideration of the manufacturing and installation tolerances and the overall impression.

The effects of temperature-induced changes in the length of sash bars in the cavity between the panes can basically not be prevented. Production-related sash bar displacement cannot be entirely ruled out.

10.4.1.5. Damage to external surfaces

If mechanical or chemical damage occurring to the outer surface is identified after glazing, the cause is to be clarified. These complaints can also be assessed according to Section 10.3.

The following standards and guidelines apply in all other respects:

- Technische Richtlinien des Glaserhandwerks (Technical Guidelines of the Glazing Trade)
- VOB/C ATV DIN 18361 "Verglasungsarbeiten" (German construction contract procedures/general technical specifications in construction contracts 'Glazing works')
- Product standards for the glass products under consideration
- UNIGLAS® specialist information "Glass can withstand a lot – but not everything"
- Richtlinie zum Umgang mit Mehrscheiben-Isolierglas (Guideline on handling insulating glass units), published by Bundesverband Flachglas (Federal Flat Glass Association)

10.4.1.6. Physical properties

Assessment criteria cannot be defined in the framework of this Guideline for a number of unavoidable physical phenomena which may manifest in the clear glass surface.

This includes:

- Interference phenomena
- Insulating glass effect
- Anisotropy
- Condensation on the outer pane surfaces
- Wettability of glass surfaces

10.4.2. Glossary

10.4.2.1. Interference phenomena

With insulating glass made of float glass, interference may occur in the form of spectral colours. Optical interference is the superposition of two or more light waves when they hit a certain point.

They show up as more or less strong coloured zones, which change with pressure on the pane. This physical effect is enhanced by the plane-parallelism of the glass surfaces. This plane-parallelism ensures distortion-free viewing through the glass. Interference phenomena occur randomly and cannot be influenced.

10.4.2.2. Insulating glass effect

Insulating glass has an air/gas volume enclosed by the edge seal; its condition is essentially determined by the barometric air pressure, the altitude of the production site above German standard zero (roughly metres above mean seal level) and the air temperature at the time and place of manufacture. When insulating glass is installed at different altitudes or when there are temperature changes and fluctuations in barometric air pressure (high and low pressure), concave or convex curvatures of the individual panes are inevitable, resulting in optical distortions.

Multiple reflections may also occur to varying degrees on glass surfaces.

These mirror images may be more visible if, for example, the background of the glazing is dark.

This phenomenon is a physical regularity.

10.4.2.3. Anisotropy

Anisotropy is a physical effect in heat-treated glasses resulting from internal stress distribution. Depending on the viewing angle, dark-coloured rings or stripes may be perceived in polarised light and/or viewed through polarising glass.

Polarised light is present in normal daylight. The extent of the polarisation depends on the weather and the position of the sun. The birefringence is more noticeable when viewed from a flat angle or when the glass surfaces are positioned next to each other at the corners.

10.4.2.4. Condensation on the outer pane surfaces

Condensate (or condensation) can form on the outer glass surfaces when the glass surface is colder than the adjacent air (e.g. steamed-up car windows).

The formation of condensation on the outer surfaces of a glass pane is determined by the U_g value, the air humidity, the air flow and the inside and outside temperature.

The formation of condensation on the room-side pane surface is stimulated when air circulation is impeded, e.g. by deep reveals, curtains, flower pots, flower boxes and Venetian blinds as well as by the unfavourable arrangement of radiators and lack of ventilation, etc.

In insulating glass with high thermal insulation, condensation can temporarily form on the weather-side glass surface if the outside humidity (relative humidity outside) is high and the air temperature is higher than the temperature of the pane surface.

10.4.2.5. Wettability of glass surfaces

The wettability of the glass surfaces can vary, for example, due to impressions of rollers, fingers, labels, paper grain, vacuum cups, sealant residues, silicone components, smoothing agents, lubricants or environmental influences. The different wettability may become visible on damp glass surfaces due to condensation, rain or cleaning water.

11 Thickness Tolerances for the Edges of Insulating Glass Units

The actual thickness must be measured at each corner and near the centres of the edges between the outer glass surfaces. The measured values are to be determined to an accuracy of 0.1 mm. The measured thickness values must not differ from the nominal thickness specified by the manufacturer of the insulating glass units by more than the dimensions given in Table 7. Thickness tolerances smaller than those indicated in Table 7 require an individual contractual arrangement.

Table 7: Thickness tolerances of insulating glass units [source: EM 12791:2018-10]

	Glass product	Permissible element thickness dimensions*
Double insulating glass	All panes made of normally cooled float glass	± 1.0 mm
	One of the panes is not made of normally cooled float glass (e.g. Made of toughened safety glass, laminated glass, laminated safety glass, patterned glass, etc.)	± 1.5 mm
Triple insulating glass	All panes made of normally cooled float glass	± 1.4 mm
	One of the panes is not made of normally cooled float glass (e.g. Made of toughened safety glass, laminated glass, laminated safety glass, patterned glass, etc.)	+ 2.8 / - 1.4 mm

*) *If one of the single panes made of normally cooled float glass or toughened safety glass has a greater nominal thickness than 12 mm, or laminated glass or laminated safety glass has a greater nominal thickness (without interim layer) than 20 mm, the tolerances are to be agreed with the UNIGLAS® shareholder.*

Literature

[1] Bulletin 006/2018 “Guidelines to Assess the visible Quality of Glass in Buildings”) by the German Bundesverband Flachglas (Federal Flat Glass Association)

Anlagen

A 1. Zivilrechtliche Bestimmungen für das Bauwesen

VOB Teil A (DIN 1960)	Allgemeine Vertragsbedingungen für die Ausführung von Bauleistungen, insbesondere § 4, Ausführung Ziff. 2.1.
VOB Teil B (DIN 1961)	Vergabe- und Vertragsordnung für Bauleistungen: Allgemeine Bestimmungen für die Vergabe von Bauleistungen
VOB Teil C (DIN 18299)	Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV). Allgemeine Regelungen für Bauarbeiten jeder Art.
VOB Teil C (DIN 18351)	Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV): Hinterlüftete Fassaden
VOB Teil C (DIN 18355)	Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV): Tischlerarbeiten
VOB Teil C (DIN 18357)	Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV): Beschlagarbeiten
VOB Teil C (DIN 18358)	Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV): Rollladenarbeiten
VOB Teil C (DIN 18360)	Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV): Metallbauarbeiten
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ÖNORM A 2050	Vergabe von Aufträgen über Leistungen
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ÖNORM B 2110	Allgemeine Vertragsbestimmungen für Bauleistungen
ÖNORM B 2111	Umrechnung veränderlicher Preise von Bauleistungen
ÖNORM B 2118	Allgemeine Vertragsbestimmungen für Bauleistungen unter Anwendung des Partnerschaftsmodells, insbesondere bei Großprojekten
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ÖNORM B 2225	Metallbauarbeiten, Herstellung von Stahl- und Aluminiumtragwerken sowie Korrosionsschutzarbeiten
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4102-1:1998-05	Brandverhalten von Baustoffen und Bauteilen, Begriffe Anforderungen und Prüfungen
4102-1 Berichtigung 1:1998-08	Berichtigung zu DIN 4102-1:1998-05
4102-2:1977-09	Brandverhalten von Baustoffen und Bauteilen: Begriffe Anforderungen und Prüfungen
4102-3:1977-09	Brandverhalten von Baustoffen und Bauteilen: Brandwände und nichttragende Außenwände, Begriffe Anforderungen und Prüfungen
4102-4:2016-05	Brandverhalten von Baustoffen und Bauteilen: Zusammenstellung und Anwendung klassifizierter Baustoffe, Bauteile und Sonderbauteile
4102-7:1998-07	Brandverhalten von Baustoffen und Bauteilen; Bedachungen: Begriffe Anforderungen und Prüfungen
4102-22:2004-11	Anwendungsnorm zu DIN 4102-4
4103-1:2015-06	Nichttragende innere Trennwände: Anforderungen und Nachweise
4108-2:2013-02	Wärmeschutz und Energie-Einsparung in Gebäuden: Mindestanforderungen an den Wärmschutz
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4108-4:2017-3	Wärmeschutz und Energie-Einsparung in Gebäuden: Wärme- und feuchteschutztechnischen Bemessungswerte
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18008-1:2010-12	Glas im Bauwesen - Bemessungs- und Konstruktionsregeln: Begriffe und allgemeine Grundlagen
E 18008-1:2018-05*)	Entwurf: Glas im Bauwesen - Bemessungs- und Konstruktionsregeln: Begriffe und allgemeine Grundlagen
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E 18008-2:2018-05*)	Entwurf: Glas im Bauwesen - Bemessungs- und Konstruktionsregeln: Linienförmig gelagerte Verglasungen
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ISO 7619-2:2012-02*)	Elastomere oder thermoplastische Elastomere - Bestimmung der Eindringhärte: IRHD-Taschengeräteverfahren

**) Anwendung der Norm öffentlich-rechtlich in MVV TB nicht relevant*

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B 1600:2017-04	Barrierefreies Bauen - Planungsgrundlagen
B 2459:2018-03	Glas für die Umwehrung von Aufzugsschächten
B 3710:2016-03	Glas im Bauwesen - Benennungen und Definitionen für Glasarten und Glaserzeugnisse
B 3716-1:2016-06	Glas im Bauwesen - Konstruktiver Glasbau: Grundlagen
B 3716-2:2013-04	Glas im Bauwesen - Konstruktiver Glasbau: Linienförmig gelagerte Verglasungen
B 3716-3:2015-01	Glas im Bauwesen - Konstruktiver Glasbau: Vertikale Verglasung mit absturzsichernder Funktion
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B 3716-5:2013-04	Glas im Bauwesen - Konstruktiver Glasbau: Punktförmig gelagerte Verglasungen und Sonderkonstruktionen
B 3716-7:2014-09	Glas im Bauwesen - Konstruktiver Glasbau: Glasanwendungen
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B 3724:2011-11	Abdichten von Verglasungen mit Dichtstoffen - Verglasungssysteme

B 3725:2007-07	Glas im Bauwesen - Glaskanten - Begriffsbestimmungen für Formen und Ausführungsarten
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B 5301:2003-05	Lawinenschutzfenster und -türen - Allgemeine Festlegungen, Anforderungen und Klassifizierung
B 5305:2018-05	Fenster - Kontrolle und Instandhaltung
B 5312:2018-05	Holzfenster - Konstruktionsregeln
B 5328:2005-11	Fenster und Türen - Terminologie sowie Lage- und Richtungsbezeichnungen
B 5330-1:2012-10	Innentüren: Allgemeine Maße
B 5330-8:2014-07	Innentüren: Stahlzargen für Massivwände
B 5330-10:2014-07	Innentüren - Teil 10: Stahlzargen für Ständerwandsysteme mit Gipsplatten
B 5371:2011-08	Treppen, Geländer und Brüstungen in Gebäuden und von Außenanlagen - Abmessungen

A 4. EN-Normen (DIN EN, ÖNORM EN, SN EN, NF EN, BS EN etc.)

81-20:2014-11	Sicherheitsregeln für die Konstruktion und den Einbau von Aufzügen - Aufzüge für den Personen- und Gütertransport: Personen- und Lastenaufzüge
81-50:2015-02	Sicherheitsregeln für die Konstruktion und den Einbau von Aufzügen - Prüfungen: Konstruktionsregeln, Berechnungen und Prüfungen von Aufzugskomponenten
356:2000-02	Glas im Bauwesen - Sicherheitsonderverglasung - Prüfverfahren und Klasseneinteilung des Widerstandes gegen manuellen Angriff
357:2005-02	Glas im Bauwesen - Brandschutzverglasungen aus durchsichtigen oder durchscheinenden Glasprodukten - Klassifizierung des Feuerwiderstandes
410:2011-04	Glas im Bauwesen - Bestimmung der lichttechnischen und strahlungsphysikalischen Kenngrößen von Verglasungen
572-1:2016-06	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Definitionen und allgemeine physikalische und mechanische Eigenschaften
572-2:2016-06	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Floatglas
572-3:2012-11	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Poliertes Drahtglas
572-4:2012-11	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Gezogenes Flachglas
572-5:2012-11	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Ornamentglas
572-6:2012-11	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Draht-Ornamentglas
572-7:2012-11	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Profilbauglas mit oder ohne Drahteinlage
572-8:2016-06	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Liefermaße und Festmaße
572-9:2005-01	Glas im Bauwesen - Basiserzeugnisse aus Kalk-Natronsilicatglas: Konformitätsbewertung/Produktnorm
673:2011-04	Glas im Bauwesen - Bestimmung des Wärmedurchgangskoeffizienten (U-Wert) - Berechnungsverfahren
674:2011-09	Glas im Bauwesen - Bestimmung des Wärmedurchgangskoeffizienten (U-Wert) - Verfahren mit dem Plattengerät
675:2011-09	Glas im Bauwesen - Bestimmung des Wärmedurchgangskoeffizienten (U-Wert) - Wärmestrommesser-Verfahren
1036-1:2008-03	Glas im Bauwesen - Spiegel aus silberbeschichtetem Floatglas für den Innenbereich: Begriffe, Anforderungen und Prüfverfahren
1036-2:2008-05	Glas im Bauwesen - Spiegel aus silberbeschichtetem Floatglas für den Innenbereich - Teil 2: Konformitätsbewertung - Produktnorm
1051-1:2003-04	Glas im Bauwesen - Glassteine und Betongläser: Begriffe und Beschreibungen
1051-2:2003-04	Glas im Bauwesen - Glassteine und Betongläser: Konformitätsbewertung - Produktnorm
1063:2000-01	Glas im Bauwesen - Sicherheitsonderverglasung - Prüfverfahren und Klasseneinteilung für den Widerstand gegen Beschuss
1096-1:2012-04	Glas im Bauwesen - Beschichtetes Glas: Definitionen und Klasseneinteilung
1096-2:2012-04	Glas im Bauwesen - Beschichtetes Glas: Anforderungen an und Prüfverfahren für Beschichtungen der Klassen A, B und S
1096-3:2012-04	Glas im Bauwesen - Beschichtetes Glas: Anforderungen an und Prüfverfahren für Beschichtungen der Klassen C und D
1096-4:2005-01	Glas im Bauwesen - Beschichtetes Glas: Konformitätsbewertung - Produktnorm
1096-5:2016-06	Glas im Bauwesen - Beschichtetes Glas: Prüfverfahren und Klasseneinteilung für das Selbstreinigungsverhalten von beschichteten Glasoberflächen
1279-1:2004-08 1279-1:2018-10*)	Glas im Bauwesen - Mehrscheiben-Isolierglas: Allgemeines, Maßtoleranzen und Vorschriften für die Systembeschreibung
1279-2:2003-06 1279-2:2018-10*)	Glas im Bauwesen - Mehrscheiben-Isolierglas: Langzeitprüfverfahren und Anforderungen bezüglich Feuchtigkeitsaufnahme
1279-3:2003-05 1279-3:2018-10*)	Glas im Bauwesen - Mehrscheiben-Isolierglas: Langzeitprüfverfahren und Anforderungen bezüglich Gasverlustrate und Grenzabweichungen für die Gaskonzentration
1279-4:2002-10 1279-4:2018-10*)	Glas im Bauwesen - Mehrscheiben-Isolierglas: Verfahren zur Prüfung der physikalischen Eigenschaften des Randverbundes
1279-5:2010-11 1279-5:2018-10*)	Glas im Bauwesen - Mehrscheiben-Isolierglas: Konformitätsbewertung
1279-6:2002-10 1279-6:2018-10*)	Glas im Bauwesen - Mehrscheiben-Isolierglas: Werkseigene Produktionskontrolle und Auditprüfungen
1288-1:2000-09	Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas: Grundlagen
1288-2:2000-09	Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas: Doppelring-Biegeversuch an plattenförmigen Proben mit großen Prüfflächen

1288-3:2000-09	Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas: Prüfung von Proben bei zweiseitiger Auflagerung (Vierschneiden-Verfahren)
1288-4:2000-09	Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas: Prüfung von Profilbauglas
1288-5:2000-09	Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas: Doppelring-Biegeversuch an plattenförmigen Proben mit kleinen Prüfflächen
1363-1:2012-10	Feuerwiderstandsprüfungen: Allgemeine Anforderungen;
1363-2:1999-10	Feuerwiderstandsprüfungen: Alternative und ergänzende Verfahren
1364-3:2014-05	Feuerwiderstandsprüfungen für nichttragende Bauteile: Vorhangfassaden
1364-4:2014-05	Feuerwiderstandsprüfungen für nichttragende Bauteile: Vorhangfassaden - Teilausführung
1365-2:2015-02	Feuerwiderstandsprüfungen für tragende Bauteile: Decken und Dächer
1522:1999-02	Fenster, Türen, Abschlüsse - Durchschusshemmung - Anforderungen und Klassifizierung
1523:1999-02	Fenster, Türen, Abschlüsse - Durchschusshemmung - Prüfverfahren
1627:2011-09	Türen, Fenster, Vorhangfassaden, Gitterelemente und Abschlüsse - Einbruchhemmung - Anforderungen und Klassifizierung
1628:2016-03	Türen, Fenster, Vorhangfassaden, Gitterelemente und Abschlüsse - Einbruchhemmung - Prüfverfahren für die Ermittlung der Widerstandsfähigkeit unter statischer Belastung
1629:2016-03	Türen, Fenster, Vorhangfassaden, Gitterelemente und Abschlüsse - Einbruchhemmung - Prüfverfahren für die Ermittlung der Widerstandsfähigkeit unter dynamischer Belastung
1630:2016-03	Türen, Fenster, Vorhangfassaden, Gitterelemente und Abschlüsse - Einbruchhemmung - Prüfverfahren für die Ermittlung der Widerstandsfähigkeit gegen manuelle Einbruchversuche
1748-1-1:2004-12	Glas im Bauwesen - Spezielle Basiserzeugnisse - Borosilicatgläser: Definitionen und allgemeine physikalische und mechanische Eigenschaften
1748-1-2:2005-01	Glas im Bauwesen - Spezielle Basiserzeugnisse - Borosilicatgläser: Konformitätsbewertung - Produktnorm
1748-2-1:2004-12	Glas im Bauwesen - Spezielle Basiserzeugnisse - Glaskeramik: Definitionen und allgemeine physikalische und mechanische Eigenschaften
1748-2-2:2005-01	Glas im Bauwesen - Spezielle Basiserzeugnisse - Glaskeramik: Konformitätsbewertung - Produktnorm
1863-1:2012-01	Glas im Bauwesen - Teilvorgespanntes Kalknatronglas: Definition und Beschreibung
1863-2:2005-01	Glas im Bauwesen - Teilvorgespanntes Kalknatronglas: Konformitätsbewertung - Produktnorm
1990:2010-12	Eurocode: Grundlagen der Tragwerksplanung
1990/NA:2010-12	Nationaler Anhang - National festgelegte Parameter - Eurocode: Grundlagen der Tragwerksplanung
ÖNORM B 1990-1:2013-01	Eurocode: Nationale Festlegungen zu ÖNORM EN 1990 und nationale Ergänzungen
1991-1-1:2010-12	Eurocode 1: Einwirkungen auf Tragwerke: Allgemeine Einwirkungen auf Tragwerke - Wichten, Eigengewicht und Nutzlasten im Hochbau
1991-1-1/NA:2010-12	Nationaler Anhang - National festgelegte Parameter - Eurocode 1: Einwirkungen auf Tragwerke: Allgemeine Einwirkungen auf Tragwerke - Wichten, Eigengewicht und Nutzlasten im Hochbau
ÖNORM B 1991-1-1:2017-02	Eurocode 1 - Einwirkungen auf Tragwerke: Allgemeine Einwirkungen - Wichten, Eigengewicht, Nutzlasten im Hochbau - Nationale Festlegungen zu ÖNORM EN 1991-1-1 und nationale Ergänzungen
1991-1-3:2010-12	Eurocode 1: Einwirkungen auf Tragwerke Allgemeine Einwirkungen, Schneelasten
1991-1-3/NA:2010-12	Nationaler Anhang - National festgelegte Parameter - Eurocode 1: Einwirkungen auf Tragwerke: Allgemeine Einwirkungen - Schneelasten
ÖNORM B 1991-1-3:2013-09	Eurocode 1 - Einwirkungen auf Tragwerke: Allgemeine Einwirkungen, Schneelasten; Nationale Festlegungen zu ÖNORM EN 1991-1-3 und nationale Ergänzungen
1991-1-4:2010-12	Eurocode 1: Einwirkungen auf Tragwerke: Allgemeine Einwirkungen - Windlasten
1991-1-4/NA:2010-12	Nationaler Anhang - National festgelegte Parameter - Eurocode 1: Einwirkungen auf Tragwerke: Allgemeine Einwirkungen - Windlasten
ÖNORM B 1991-1-4:2013-05	Eurocode 1: Einwirkungen auf Tragwerke: Allgemeine Einwirkungen - Windlasten - Nationale Festlegungen zu ÖNORM EN 1991-1-4 und nationale Ergänzungen
10204:2005-01	Metallische Erzeugnisse - Arten von Prüfbescheinigungen
13012150-1:2000-11	Glas im Bauwesen - Thermisch vorgespanntes Kalknatron-Einscheiben-Sicherheitsglas: Definition und Beschreibung
12150-2:2005-01	Glas im Bauwesen - Thermisch vorgespanntes Kalknatron-Einscheibensicherheitsglas: Konformitätsbewertung - Produktnorm
12337-1:2000-11	Glas im Bauwesen - Chemisch vorgespanntes Kalknatronglas: Definition und Beschreibung
12337-2::2005-01	Glas im Bauwesen - Chemisch vorgespanntes Kalknatronglas: Konformitätsbewertung - Produktnorm
12488:2016-11	Glas im Bauwesen - Empfehlungen für die Verglasung - Verglasungsgrundlagen für vertikale und geneigte Verglasung
12600:2003-04	Glas im Bauwesen - Pendelschlagversuch - Verfahren für die Stoßprüfung und Klassifizierung von Flachglas
12603:2003-04	Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas - Schätzverfahren und Bestimmung der Vertrauensbereiche für Daten mit Weibull-Verteilung
12758:2011-04	Glas im Bauwesen - Glas und Luftschalldämmung - Produktbeschreibungen und Bestimmung der Eigenschaften
12898:2001-04	Glas im Bauwesen - Bestimmung des Emissionsgrades
13022-1:2014-08	Glas im Bauwesen - Geklebte Verglasungen: Glasprodukte für Structural-Sealant-Glazing (SSG-) Glaskonstruktionen für Einfachverglasungen und Mehrfachverglasungen mit oder ohne Abtragung des Eigengewichtes
13022-2:2014-08	Glas im Bauwesen - Geklebte Verglasungen: Verglasungsvorschriften für Structural-Sealant-Glazing (SSG-) Glaskonstruktionen

13024-1:2002-08	Thermisch vorgespanntes Borosilicat-Einscheibensicherheitsglas: Definition und Beschreibung
13024-2:2005-01	Thermisch vorgespanntes Borosilicat-Einscheibensicherheitsglas: Konformitätsbewertung - Produktnorm
13031-1:2003-09	Gewächshäuser - Bemessung und Konstruktion: Kulturgewächshäuser
13120:2014-09	Abschlüsse innen - Leistungs- und Sicherheitsanforderungen
13123-1:2001-10	Fenster, Türen und Abschlüsse - Sprengwirkungshemmung: Anforderungen und Klassifizierung: Stoßrohr
13123-2:2004-05	Fenster, Türen und Abschlüsse - Sprengwirkungshemmung - Anforderungen und Klassifizierung: Freilandversuch
13380:2015-07	Vorhangfassaden - Produktnorm
13501-1:2010-01	Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten: Klassifizierung mit den Ergebnissen aus den Prüfungen zum Brandverhalten von Bauprodukten
13501-2:2016-12	Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten: Klassifizierung mit den Ergebnissen aus den Feuerwiderstandsprüfungen, mit Ausnahme von Lüftungsanlagen
13501-5:2016-12	Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten: Klassifizierung mit den Ergebnissen aus Prüfungen von Bedachungen bei Beanspruchung durch Feuer von außen
13541:2012-06	Glas im Bauwesen - Sicherheitssonderverglasung - Prüfverfahren und Klasseneinteilung des Widerstandes gegen Sprengwirkung
14019:2016-11	Vorhangfassaden - Stoßfestigkeit - Leistungsanforderungen
14072:2004-02	Glas in Möbeln - Prüfverfahren
14178-1:2005-01	Glas im Bauwesen - Basiserzeugnisse aus Erdalkali-Silicatglas: Floatglas
14178-2:2005-01	Glas im Bauwesen - Basiserzeugnisse aus Erdalkali-Silicatglas: Produktnorm;
14179-1:2005-09	Glas im Bauwesen - Heißgelagertes thermisch vorgespanntes Kalknatron-Einscheibensicherheitsglas: Definition und Beschreibung
14179-2:2005-08	Glas im Bauwesen - Heißgelagertes thermisch vorgespanntes Kalknatron-Einscheibensicherheitsglas: Konformitätsbewertung - Produktnorm
14321-1:2005-09	Glas im Bauwesen - Thermisch vorgespanntes Erdalkali-Silicat-Einscheibensicherheitsglas: Definition und Beschreibung
14321-2:2005-10	Glas im Bauwesen - Thermisch vorgespanntes Erdalkali-Silicat-Einscheibensicherheitsglas: Konformitätsbewertung - Produktnorm
14351-1:2016-12	Fenster und Türen - Produktnorm, Leistungseigenschaften: Fenster und Außentüren
14428:2015-09	Duschabtrennungen - Funktionsanforderungen und Prüfverfahren
14449:2005-07	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas – Konformitätsbewertung - Produktnorm
15254-4:2013-10	Erweiterter Anwendungsbereich der Ergebnisse von Feuerwiderstandsprüfungen - Nichttragende Wände: Verglaste Konstruktionen
15254-6:2014-05	Erweiterter Anwendungsbereich der Ergebnisse von Feuerwiderstandsprüfungen - Nichttragende Wände: Vorhangfassaden
15269-1:2010-07	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Allgemeine Anforderungen
15269-2:2012-12	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Feuerwiderstandsfähigkeit von Drehflügeltüren aus Stahl
15269-3:2012-10	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Feuerwiderstandsfähigkeit von Drehflügeltüren und Fenstern aus Holz
15269-5:2012-05	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Feuerwiderstandsfähigkeit von verglasten Drehflügeltüren und zu öffnenden Fenstern mit Metall(rohr)rahmen
15269-7:2010-07	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Feuerwiderstandsfähigkeit von Schiebetoren aus Stahl
15269-10:2011-07	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Feuerwiderstandsfähigkeit von Rolltoren aus Stahl
15269-20:2009-12	Erweiterter Anwendungsbereich von Prüfergebnissen zur Feuerwiderstandsfähigkeit und/oder Rauchdichtigkeit von Türen, Toren und Fenstern einschließlich ihrer Baubeschläge: Rauchdichtigkeit von Drehflügeltüren und -toren aus Holz und Stahl sowie Metall- und Holzrahmentüren mit Verglasungen
15434:2010-07	Glas im Bauwesen - Produktnorm für lastübertragende und/oder UV-beständige Dichtstoffe (für geklebte Verglasungen und/oder Isolierverglasungen mit exponierten Dichtungen)
15651-1:2012-12	Fugendichtstoffe für nicht tragende Anwendungen in Gebäuden und Fußgängerwegen: Fugendichtstoffe für Fassadenelemente
15651-2:2012-12	Fugendichtstoffe für nicht tragende Anwendungen in Gebäuden und Fußgängerwegen: Fugendichtstoffe für Verglasungen
15651-5:2012-12	Fugendichtstoffe für nicht tragende Anwendungen in Gebäuden und Fußgängerwegen: Bewertung und Überprüfung der Leistungsbeständigkeit, Kennzeichnung und Etikettierung
15682-1:2013-10	Glas im Bauwesen - Heißgelagertes thermisch vorgespanntes Erdalkali-Silicat-Einscheibensicherheitsglas: Definition und Beschreibung
15682-2:2013-10	Glas im Bauwesen - Heißgelagertes thermisch vorgespanntes Erdalkali-Silicat-Einscheibensicherheitsglas: Konformitätsbewertung - Produktnorm
15683-1:2014-01	Glas im Bauwesen - Thermisch vorgespanntes Kalknatron-Profilbau-Sicherheitsglas: Definition und Beschreibung
15683-2:2014-02	Glas im Bauwesen - Thermisch vorgespanntes Kalknatron-Profilbau-Sicherheitsglas: Konformitätsbewertung - Produktnorm
16034:2014-10	Türen, Tore und Fenster - Produktnorm, Leistungseigenschaften - Feuer- und/oder Rauchschutzeigenschaften

16034:2018-02	Berichtigung 1: Türen, Tore und Fenster - Produktnorm, Leistungseigenschaften - Feuer- und/oder Rauchschutzeigenschaften
16035:2013-03	Baubeschläge - Leistungsbeschreibung - Identifizierung und Zusammenfassung der Prüfnachweise zur Unterstützung der Austauschbarkeit von Baubeschlägen für die Anwendung an feuerwiderstandsfähigen und/oder rauchdichten Toren, Türen und/oder zu öffnenden Fenstern
16337:2013-08	Möbelbeschläge - Festigkeit und Tragfähigkeit von Bodenträgern
ISO 717-1:2013-06	Akustik - Bewertung der Schalldämmung in Gebäuden und von Bauteilen: Luftschalldämmung
ISO 717-2:2013-06	Akustik - Bewertung der Schalldämmung in Gebäuden und von Bauteilen: Trittschalldämmung
ISO 868:2003-10	Kunststoffe und Hartgummi - Bestimmung der Eindruckhärte mit einem Durometer (Shore-Härte)
ISO 7345:1996-05	Wärmeschutz – Physikalische Größen und Definitionen
ISO 9251:1996-01	Wärmeschutz - Zustände der Wärmeübertragung und Stoffeigenschaften - Begriffe
ISO 10077-1:2018-01	Wärmetechnisches Verhalten von Fenstern, Türen und Abschlüssen - Berechnung des Wärmedurchgangskoeffizienten: Allgemeines
ISO 10077-2:2018-01	Wärmetechnisches Verhalten von Fenstern, Türen und Abschlüssen - Berechnung des Wärmedurchgangskoeffizienten: Numerisches Verfahren für Rahmen
ISO 10140-1:2016-12	Akustik - Messung der Schalldämmung von Bauteilen im Prüfstand: Anwendungsregeln für bestimmte Produkte
ISO 10140-2:2010-12	Akustik - Messung der Schalldämmung von Bauteilen im Prüfstand: Messung der Luftschalldämmung
ISO 10140-4:2010-12	Akustik - Messung der Schalldämmung von Bauteilen im Prüfstand: Messverfahren und Anforderungen
ISO 11600:2011-11	Hochbau - Fugendichtstoffe - Einteilung und Anforderungen von Dichtungsmassen
ISO 11664-1:2011-07	Farbmetrik: CIE farbmetrische Normalbeobachter
ISO 11664-1:2012-11	Berichtigung 1: Farbmetrik: CIE farbmetrische Normalbeobachter
ISO 11664-2:2011-07	Farbmetrik: CIE Normlichtarten
ISO 11664-3:2013-08	Farbmetrik: CIE-Farbwerte
ISO 11664-4:2012-06	Farbmetrik: CIE 1976 L*a*b* Farbenraum
ISO 11664-5:2017-01	Farbmetrik: CIE 1976 L*u*v*-Farbenraum und gleichabständige u', v'-Farbtafel
ISO 12543-1:2011-12	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas: Definitionen und Beschreibung von Bestandteilen
ISO 12543-2:2011-12	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas: Verbund-Sicherheitsglas
ISO 12543-3:2011-12	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas: Verbundglas
ISO 12543-4:2011-12	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas: Verfahren zur Prüfung der Beständigkeit
ISO 12543-5:2011-12	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas: Maße und Kantenbearbeitung
ISO 12543-6:2012-09	Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas: Aussehen
ISO 12567-1:2010-12	Wärmetechnisches Verhalten von Fenstern und Türen - Bestimmung des Wärmedurchgangskoeffizienten mittels des Heizkastenverfahrens: Komplette Fenster und Türen
ISO 12631:2018-01	Wärmetechnisches Verhalten von Vorhangfassaden - Berechnung des Wärmedurchgangskoeffizienten
ISO 13788:2013-05	Wärme- und feuchtetechnisches Verhalten von Bauteilen und Bauelementen - Raumseitige Oberflächentemperatur zur Vermeidung kritischer Oberflächenfeuchte und Tauwasserbildung im Bauteilinneren - Berechnungsverfahren
ISO 11439:2007-11	Entwurf: Glas im Bauwesen - Anforderungen für die Verglasung - Verglasungsklötze
ISO 14438:2002-09	Glas im Bauwesen - Bestimmung des Energiebilanz-Wertes - Berechnungsverfahren
ISO 16283-1:2014-06	Akustik - Messung der Schalldämmung in Gebäuden und von Bauteilen am Bau: Luftschalldämmung
ISO 16283-2:2016-05	Akustik - Messung der Schalldämmung in Gebäuden und von Bauteilen am Bau: Trittschalldämmung
ISO 16283-3:2016-09	Akustik - Messung der Schalldämmung in Gebäuden und von Bauteilen am Bau: Fassadenschalldämmung
ISO 52022-1:2018-01	Energieeffizienz von Gebäuden - Wärmetechnische, solare und tageslichtbezogene Eigenschaften von Bauteilen und Bauelementen: Vereinfachtes Berechnungsverfahren zur Ermittlung der solaren und tageslichtbezogenen Eigenschaften von Sonnenschutz in Kombination mit Verglasungen
ISO 52022-3:2018-01	Energieeffizienz von Gebäuden - Wärmetechnische, solare und tageslichtbezogene Eigenschaften von Bauteilen und Bauelementen: Detailliertes Berechnungsverfahren zur Ermittlung der solaren und tageslichtbezogenen Eigenschaften von Sonnenschutz in Kombination mit Verglasungen

**) Rückziehung der erstgenannten Normenausgaben und Ersatz durch EN 1279-1 bis 6:2018-10 zum Zeitpunkt des Redaktionsschlusses geplant, jedoch noch nicht vollzogen*

A 5. ISO-Normen (Internationale Standards)

9050:2003-08	Glas im Bauwesen - Bestimmung von Lichttransmissionsgrad, direktem Sonnenlichttransmissionsgrad, Gesamttransmissionsgrad der Sonnenenergie und Ultraviolettransmissionsgrad sowie der entsprechenden Verglasungsfaktoren
11479-1:2011-10	Glass in building — Coated glass —: Physical defects
11479-2:2011-10	Glass in building — Coated glass —: Colour of façade
11485-1:2011-12	Glas im Bauwesen - Gebogenes Glas: Terminologie und Begriffe
11485-2:2011-12	Glas im Bauwesen - Gebogenes Glas: Qualitätsanforderungen
11485-3:2014-09	Glass in building - Curved glass - Part 3: Requirements for curved tempered and curved laminated safety glass

A 6. Leitlinien für die europäische technische Zulassung (ETAG)

ETAG 002-1:2001	Geklebte Glaskonstruktionen: Gestützte und ungestütze Systeme
ETAG 002-2:2002	Geklebte Glaskonstruktionen (SSGS): Beschichtete Aluminiumsysteme
ETAG 002-3:2003	Geklebte Glaskonstruktionen (SSGS): Systeme mit thermisch getrennten Profile

A 7. Technische Richtlinien und Merkblätter

A 7.1. Richtlinien

ift VE-06/01:2003-01	Beanspruchungsgruppen für die Verglasung von Fenstern
ift VE 08/3:2014-08	Beurteilungsgrundlage für geklebte Verglasungssysteme
ift DI-01/1:2008-02	Verwendbarkeit von Dichtstoffen: Prüfungen von Materialen im Kontakt mit dem Isolierglas-Randverbund
ift DI-02/1:2009-03	Verwendbarkeit von Dichtstoffen: Prüfungen von Materialen im Kontakt mit der Kante von Verbund- und Verbundsicherheitsglas
SIGAB 002:2017-03	Sicherheit mit Glas: Anforderungen an Glasbauteile
SIGAB 003:2012-06	Isolierglas: Dimensionierung von Glasdicken
SIGAB 005:2012-06	Brandschutzverglasung
BIV TR 1	Dichtstoffe für Verglasungen und Anschlussfugen
BIV TR 7	Verglasung mit Profilbauglas Leitfaden zur Planung und Ausführung der Montage
BIV TR 8	Verkehrssicherheit mit Glas
BIV TR 10	Fachliche Begriffe Glaserhandwerk
BIV TR 11	Spiegel-Handhabung und Montage
BIV TR 14	Einteilung der Glaserzeugnisse
GUV-SR 2001	Richtlinien für Schulen
GUV-SR 2002	Richtlinien für Kindergärten
GUV-R1 / 111	Sicherheitsregeln für Bäder (Schwimmbäder)
GUV-I 56	Treppen
GUV SI 8027	Mehr Sicherheit bei Glasbruch
VdS 2163	Einbruchhemmende Verglasungen
VdS 2270	Anforderungen an Alarmgläser
VdS 3029	Richtlinien für Einbruch-Meldeanlagen
VdS 2078	Errechnung der Kühllast, Ermittlung des b-Faktors
VdS 2719	Schalldämmung von Fenstern

A 7.2. Merkblätter

BF 001 Ind.ex 1 / 2010	Kompass für geklebte Fenster
BF 002/2008	Richtlinie zum Umgang mit Mehrscheiben-Isolierglas
BF 003 Index 2 / 2017	Leitfaden zur Verwendung von Dreifach-Isolierglas
BF 004 Index 3 / 2016	Kompass ‚Warme Kante'
BF 008/2010	Einbauempfehlungen für integrierte Systeme im Mehrscheiben-Isolierglas
BF 009/2011	Leitfaden für thermisch gebogenes Glas im Bauwesen
BF 010/2011	ESG-H – ein geregeltes und fremdüberwachtes Bauprodukt auf höchstem Sicherheitsniveau
BF 013/2013	Verbundsicherheitsglas (VSG) für die Anwendung im Bauwesen
BF 015/2013	Richtlinie zur Beurteilung der visuellen Qualität von emaillierten Gläsern
BF 016/2013	Beurteilung von Sprossen im SZR
BF 021/2017	Gebrauchstauglichkeit linienförmig gelagerter Gläser
UNIGLAS	Beurteilung der visuellen Qualität von sandgestrahlten Gläsern
UNIGLAS	Glas verträgt viel – aber nicht alles

A 8. ON Regeln (ONR) für Österreich

22000	Gebäude mit besonderen brandschutztechnischen Anforderungen (Hochhäuser)
41010	Präsentation von Kunstgegenständen in Vitrinen

Abkürzungen:

BF Bundesverband Flachglas e.V.
BIV Bundesinnungsverband des Glaserhandwerks, Hadamar
DIN Deutsches Institut für Normung
EN Europäische Norm
ETAG European Technical Approval Guideline
GUV Gesetzliche-Unfallversicherung
ift Institut für Fenstertechnik e.V.,Rosenheim
SO Internationale Standard Organisation
VDI Verein Deutscher Ingenieure
VdS Schadenverhütung GmbH
VOB Verdingungsordnung für Bauleistung

Sofern in vorgenannten Regelwerken auf weitere Richtlinien, Technische Regeln oder Normen verwiesen wird, gilt sinngemäß jeweils die Version mit dem letzten Ausgabedatum

Index of terms

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