Things to Know

General Processing Guidelines

Miscellaneous

In addition to the processing instructions for the respective Stabalux systems, it is also important to consider the regulations in place for the steel, metal and glass-processing industries. We also refer to the importance of adhering to the applicable standards. Neither the standards and rules listed in the following nor the index of addresses make any claim to completeness. European standards have been and will continue to be introduced within the process of European harmonisation. In places they will replace national standards. We make efforts to ensure that our processors are up-to-date with standards. It is nevertheless the responsibility of the user to obtain information on the latest standards and rules that are important to their work.

Technical advice, support in planning and quotations

All suggestions, tender, design and installation proposals, material calculations, static calculations and such like provided by Stabalux employees in the course of consultancy, correspondence or the preparation of documents are submitted in good faith and to the best of their knowledge. Processors must review such ancillary services critically and seek approval from the principal or architect if necessary.

Requirements in regard to operation, storage, processing and training

Companies must possess equipment designed for the processing of steel and aluminium in order to manufacture flawless components. This equipment must be designed in such a way that any damage to the profiles during processing, storage and removal is avoided. All components must be stored dry; in particular, they must be kept away from building detritus, acids, lime, mortar, steel shavings and such like. In order to be satisfy the requirements of the latest technology, employees must be enabled to acquire the necessary training through literature, courses or seminars.

The processing company is solely responsible for calculating all dimensions. It is also necessary to carry out and commission the review of static calculations of the load-bearing profiles and anchoring and to validate details, connections and such like in diagrams.

Glass

The glass types is selected based on the mandatory requirements of structural engineering. The glass thicknesses must be defined according to the “Technical rules for linearly mounted glazing wind”, with due consideration of the wind loads.
Glazing must be installed in a materially and technically correct manner in accordance with the relevant standards.

Cleaning / maintenance

Although cleaning of the glass surfaces themselves is not part of their maintenance, it is nevertheless essential to ensure the good working order and service life of the products.

Cleaning and protection during the building phase

- The contractor is responsible for cleaning during the building phase. The mounted elements should be cleaned thoroughly before acceptance.
- Coarse dirt must be cleaned off immediately using sufficient water.
- Any cleaning performed must be compatible with the materials.
- Standard solvents such as methylated spirits or isopropanol can be used to remove sealant residue.
- Anodized aluminium parts must be protected before non-hardened plaster, mortar or cement are applied, i.e. any residue must be removed immediately, as the alkali reactions they cause may otherwise cause irremovable staining.
- Mechanical damage to the anodised surface cannot be repaired. You are therefore advised to handle the aluminium parts with care.

General Processing Guidelines

- For this reason, we recommend you take suitable precautionary measures. Adhesive plastic foil, peelable lacquer or self-weathering clear varnish provide a degree of protection. Any adhesive tape applied must be compatible with the surfaces; particular care must be taken with painted surfaces in this respect.

Cleaning after acceptance and during permanent use

The client is responsible for proper cleaning after acceptance, i.e. after partial acceptance already; it is important to clean all accessible components at this point.

- Clean, warm water should be used for cleaning in order to prevent any scratching by the dirt particles.
- Removal of adhesive labels and spacers
- Neutral (pH values between 5 and 8) household and glass detergents also help. Alkali and acidic chemical detergents and any containing fluoride must not be used. It is imperative to avoid destroying the corrosion protection on the components.
- Grease and sealant residue ca be removed using standard solvents (methylated spirits, isopropanol). The use of benzene and other thinners is not permitted, as they may cause irreparable damage.
- Use of clean and soft cleaning sponges, cloths, leather cloths or squeegees. All scouring materials and abrasive detergents are unsuitable ad cause permanent damage.
- The manufacturer's instructions must be adhered to on all accounts in the handling of coated glass and single-pane security glass.
- It is permitted to use neutral detergents with added polish on painted surfaces (e.g. car polish). These agents must be silicone-free; test them first on a concealed surface.
- The seals are essentially maintenance-free. Their durability can be ensured by the use of special cleaning lotion to prevent the material from becoming brittle.
- The manufacturer's instructions must be adhered to in particular for all fitted parts such as timber and aluminium windows and doors. The rebates must be cleaned on all accounts and spaces must be left to allow water to run off.

Cleaning intervals

Cleaning should be performed regularly, depending on the level of environmental pollution. Basic cleaning must be performed at least once annually. Stabalux recommends 6-monthly cleaning in order to preserve the attractive appearance of painted surfaces, i.e. the structure as a whole.

Maintenance

Facades and their fitted parts such as windows and doors must remain in permanent good working order. Mandatory measures to preserve good working order and to prevent material and personal damage are defined in the national construction codes and construction product ordinances.

The generic term 'maintenance' describes the areas of servicing/care, inspection, repair and improvements. The following addresses the topics of servicing/care and inspection in greater detail. These factors are essential to guarantee fitness for purpose and secure use and hence to ensure sustainable preservation of value. Accessibility for subsequent maintenance must be included in the planning of a construction project or refurbishment.

Particular reference is made at this point to VFF the leaflets WP.1 – WP.5 by Verband der Fenster- und Fassadenhersteller e.V. They contain information for windows / doors and other installations, as well as templates for contracts and correspondence. Information and templates can also be obtained from ift – Institut für Fenstertechnik Rosenheim. The contact details are listed in the address section.

General Processing Guidelines

Servicing/care and inspection obligations

The facade manufacturer (contractor) accepts the warranty for the supplied and installed products after acceptance as defined in the contractual undertakings. The warranty will be void in the event that a failure to perform servicing and care properly or at all leads to defects and damage. This applies also to the improper use of a component.

The contractor is not automatically obliged to provide servicing/care and inspection if there is no specific contractual agreement to do so. The national construction codes make it the duty of the principal/owner to maintain the construction products and components. The client must inform the principal/owner in this respect if they are not the same person/entity. The contractor deals at all times only with the client.

However, the contractor is obliged to make the client aware of maintenance issues. It is advisable to fulfil this duty in writing before the contracts are signed and to submit more detailed updates as the building work progresses. All documents on this issue must be submitted no later than upon presentation of the final invoice. Alternatively, the contractor can offer a maintenance contract and therein accept contractually defined servicing/care and inspection duties. The obligation to perform maintenance begins with the acceptance.

Maintenance measures

All components must be checked to ensure their fitness for purpose, as well as for deformation and damage. All facilities relevant to safety must be checked. Damage must be repaired immediately.

Fixed glazing on facades

- Material-specific examination of the supporting profiles for damage and deformation. e.g.: Metal: Weld seams, open joints, cracks, mechanical strength.
- Timber: Timber flaws (loose knots and protruding knot plugs); moisture damage, fungus and/or insect infestation, open joints, cracks, mechanical strength.
- Check of component connections (e.g. mullion/transom connections), reinforcements and structural attachments (e.g. connection plates, assuming they are accessible when installed).
- Check of structural attachment joints and seals.
- Assessment of the filling elements (panes, panels) to ensure proper mounting and absence of damage.
- Check of seals for proper mounting, sealant properties and ageing caused by brittleness.
- Test of the clamp connection to hold the filling elements. They include the screw fittings and clip strips.
- Visual inspection of the surface of the structure (coatings, corrosion).
- Good working order of all drainage systems, component ventilation systems and pressure equalisation openings.

General Processing Guidelines

Movable facade components

Roller blinds, ventilation, movable and rigid solar shading are fitted to facades in addition to doors and windows. These components must be checked in the same way as the fixed glazing elements. Moreover, all parts with relevance to safety and moving parts must be assessed to ensure they are mounted properly, are in good working order and do not exhibit wear. They include:

- Drive units (manual, electric)
- Fittings
- Door hinges
- Locking parts and latches
- Screw fittings
- Lubrication/greasing to ensure smooth operation of movable parts

The manufacturer's instructions must be adhered to in particular for all fitted parts.

Inspection intervals

The following table contains recommended inspection intervals, published as an assistance by ift Rosenheim. The distinction between "safety-relevant" and "general" inspections refers to fittings.

Stabalux recommends an interval of one year for fixed glazing.
The manufacturer's instructions are authoritative for installed parts. VFF leaflet WP.03 provides form templates for components requiring maintenance and intervals for the materials used.

Recommended inspection intervals		
	Safety-relevant inspection	**General inspection**
School or hotel buildings	6-monthly	6-monthly / yearly
Office and public buildings	6-monthly / yearly	yearly
Residential buildings	yearly / every 2 years	yearly / every 2 years / measures as stipulated by the client

Maintenance protocol

A protocol must be kept of the findings of the inspection, the implementation of servicing and care and the necessary repairs. It must list all checked parts/components and contain specific and general comments. Information on the property, the component and its precise location in the building must be recorded in order to ensure clear allocation.
VFF leaflet WP.03 also has form templates designed for this purpose.

Product documents

You will find all of the information you require on Stabalux systems in our catalogue documents. The sections "System" and "Processing Instructions" contain important information in particular.

The product information, operating instructions, servicing/care instructions and cleaning recommendations published by the respective manufacturer must be adhered to for other components.

Addresses

Verband der Fenster- und Fassadenhersteller e.V.
Walter-Kolb-Straße 1-7
60594 Frankfurt am Main
www.window.de

Informationsstelle Edelstahl Rostfrei
Sohnstr. 65
40237 Düsseldorf
www.edelstahl-rostfrei.de

DIN Deutsches Institut für Normung e.V.
Burggrafenstraße 6
10787 Berlin
www.din.de

Institut für Fenstertechnik e.V. (ift)
Theodor-Gietl-Straße 7-9
83026 Rosenheim
www.ift-rosenheim.de

DIN standards, available from Beuth-Verlag GmbH
Burggrafenstraße 6
10787 Berlin
www.beuth.de

Bundesverband Metall-Vereinigung
Deutscher Metallhandwerke
Ruhrallee 12
45138 Essen
www.metallhandwerk.de

DIN Deutsches Institut für Normung e.V.
Kolonnenstraße 30 L
10829 Berlin
www.dibt.de

IFBS-Industrieverband für Bausysteme im Metallleichtbau
Max-Planck-Str. 4
40237 Düsseldorf
www.ifbs.de

GDA, Gesamtverband der Aluminiumindustrie e.V.
Am Bonneshof 5
40474 Düsseldorf
www.aluinfo.de

Bundesinnungsverband des Glaserhandwerks
An der Glasfachschule 6
65589 Hadamar
www.glaserhandwerk.de

Beratung Feuerverzinken
Sohnstr. 40
40237 Düsseldorf

Deutsche Forschungsgesellschaft für Oberflächenbehandlung e.V.
Arnulfstr. 25
40545 Düsseldorf
www.dfo-online.de

Schweißtechnische Lehr- und Versuchsanstalt Duisburg des Dt. Verbandes für Schweißtechnik e.V.
Postfach 10 12 62
47012 Duisburg
www.slv-duisburg.de

Deutscher Stahlbauverband DSTV
Sohnstraße 65
40237 Düsseldorf
www.deutscherstahlbau.de

DVS – Deutscher Verband für Schweißen und verwandte Verfahren e.V.
Aachener Straße 172
40223 Düsseldorf
www.die-verbindungs-spezialisten.de

Deutscher Schraubenverband e.V
Goldene Pforte 1
58093 Hagen
www.schraubenverband.de

Studiengesellschaft Stahlanwendung e.V.
Sohnstr. 65
40237 Düsseldorf
www.stahlforschung.de

Stahl-Informations-Zentrum
Postfach 10 48 42
40039 Düsseldorf
www.bauen-mit-stahl.de

Passivhaus Institut Dr. Wolfgang Feist
Rheinstr. 44/46
64283 Darmstadt
www.passiv.de

Standards

Index of applicable standards and regulations

DIN EN 1991	Eurocode 1, Actions on structures
DIN EN 1993	Eurocode 3, Design of steel structures
DIN EN 1995	Eurocode 5, Design of timber structures
DIN EN 1999	Eurocode 9, Design of aluminium structures
DIN EN 572	Glass in building
DIN EN 576	Aluminium and aluminium alloys
DIN EN 573	Aluminium and aluminium alloys - Chemical composition and form of wrought products
DIN EN 485	Aluminium and aluminium alloys - Sheet, strip and plate
DIN EN 755	Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles
DIN 1960	German construction contract procedures (VOB) - Part A
DIN 1961	German construction contract procedures (VOB) - Part B
DIN 4102	Fire behaviour of building materials and building components
DIN 4108	Thermal insulation and energy economy in buildings
DIN 4109	Sound insulation in buildings
DIN EN 12831	Heating systems in buildings — Method for calculation of the design heat load
DIN 7863	Elastomor glazing and panel gaskets for windows and claddings
DIN 16726	Plastic sheets - Testing
DIN EN 10025	Hot rolled products of structural steels
DIN EN 10250	Open die steel forgings for general engineering purposes
DIN 17611	Anodized products of aluminium and wrought aluminium alloys
DIN EN 12020	Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 and EN AW-6063
DIN 18055	Criteria for the use of windows and exterior doors
DIN 18273	Building hardware - Lever handle units for fire doors and smoke control doors - Terms and definitions, dimensions, requirements, testing and marking
DIN 18095	Smoke control doors
DIN 18195	Water-proofing of buildings
DIN 18202	Tolerances in building construction - Buildings
DIN 18203	Tolerances in building construction
DIN 18335	German construction contract procedures (VOB) - Part C: General technical specifications in construction contracts (ATV) - Structural steelwork
DIN 18336	German construction contract procedures (VOB) - Part C: ATV - Sealing work
DIN 18357	German construction contract procedures (VOB) - Part C: ATV - Fittings work
DIN 18360	German construction contract procedures (VOB) - Part C: ATV - Metal work
DIN 18361	German construction contract procedures (VOB) - Part C: ATV - Glazing work
DIN 18364	German construction contract procedures (VOB) - Part C: ATV - Corrosion protection on steel structures
DIN 18421	German construction contract procedures (VOB) - Part C: ATV - Insulation of service installations
DIN 18451	German construction contract procedures (VOB) - Part C: ATV - Scaffolding work
DIN 18516	Cladding for external walls, ventilated at rear
DIN 18540	Sealing of exterior wall joints in building using joint sealants
DIN 18545	Sealing of glazing with sealants

Standards

Index of applicable standards and regulations

DIN EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles
DIN EN 12487 aluminium	Corrosion protection of metals - Rinsed and non-rinsed chromate conversion coatings on and aluminium alloys
DIN EN ISO 10140	Acoustics - Laboratory measurement of sound insulation of building elements
DIN EN 356	Glass in building - Security glazing - Testing and classification of resistance against manual attack
DIN EN 1063	Glass in building - Security glazing - Testing and classification of resistance against bullet attack
DIN EN 13541	Testing and - Security glazing - classification of resistance against explosion pressure
DIN 52460	Sealing and glazing
DIN EN ISO 12567	Thermal performance of windows and doors - Determination of thermal transmittance by the hot-box method
DIN EN ISO 12944	Paints and varnishes - Corrosion protection of steel structures by protective paint systems
DIN 55634	Paints, varnishes and coatings - Corrosion protection of supporting thin-walled building components made of steel
DIN EN 107	Test procedures for windows: mechanical test
DIN EN 1026	Windows and doors - air permeability - test method
DIN EN 1027	Windows and doors - watertightness - test method
DIN EN 10162	Cold-rolled steel sections - Technical delivery conditions - Dimensional and cross-sectional tolerances
DIN EN 949	Windows and curtain walling, doors, blinds and shutters - Determination of the resistance to soft and heavy body impact for doors
DIN EN 1363	Fire resistance tests
DIN EN 1364	Fire resistance tests for non-loadbearing elements
DIN EN 1522	Window, doors, barriers - bullet resistance - requirements and classification
DIN EN 1523	Window, doors, barriers - bullet resistance - test procedures
DIN EN 1627	Pedestrian doorsets, windows, curtain walling, grilles and shutters - Burglar resistance - Requirements and classification
DIN EN 1628	Pedestrian doorsets, windows, curtain walling, grilles and shutters - Burglar resistance - Test method for the determination of resistance under static loading
DIN EN 1629	Pedestrian doorsets, windows, curtain walling, grilles and shutters - Burglar resistance - Test method for the determination of resistance under dynamic loading
DIN EN 1630	Pedestrian doorsets, windows, curtain walling, grilles and shutters - Burglar resistance - Test method for the determination of resistance to manual burglary attempts
DIN EN 10346	Continuously hot-dip coated steel flat products for cold forming
DIN EN 10143	Continuously hot-dip coated steel sheet and strip Tolerances on dimensions and shape
DIN EN 12152	Curtain walling - Air permeability - Performance requirements and classification
DIN EN 12153	Curtain walling - Air permeability - Test methods

Standards

Index of applicable standards and regulations

DIN EN 12154	Curtain walling - Watertightness - Performance requirements and classification
DIN EN 12155	Curtain walling - Watertightness - Laboratory test under static pressure
DIN EN 12179	Curtain walls – Resistance to wind load - Test methods
DIN EN 12207	Window und doors – Air permeability – Classification
DIN EN 12208	Window und doors – Watertightness – Classification
DIN EN 12210	Window und doors – Resistance to wind load – Classification
DIN EN 12211	Windows and doors – Resistance to wind load – Test methods
DIN EN 13116	Curtain walls – Resistance to wind load - Performance requirements
DIN EN 13830	Curtain walls – Product standard
DIN EN 14019	Curtain walls – Impact resistance
DIN EN ISO 12631	Thermal performance of windows and doors - Determination of thermal transmittance - Simplified procedure
DIN 18200	Assessment of conformity for construction products - Initial type testing and factory production control, Certification of construction products by certification body
DIN 1249	Glass in building; glass edges; concept, characteristics of edge types and finishes
DIN EN 485	Aluminium and aluminium alloys - Sheet, strip and plate
DIN EN 1748	Glass in building - Special basic products
DIN 52210	Testing of acoustics in buildings - Airborne impact and sound insulation, measurement of level difference
DIN 52619	Testing of thermal insulation; Determination of thermal resistance and heat transfer transition coefficient of windows, measured on the frame
DIN 18008	Glass in Building - Design and construction rules for the use of fall-secured glazings
DIN 18008	Construction rules for linearly supported glazings
GEG	Buildung Energy Act

Guidelines for the Design and Application of Roof Waterproofing

International Quality Regulations For The Coating of Building Components on Steel and Hot-tip Galvanized Steel; GSB International e.V.

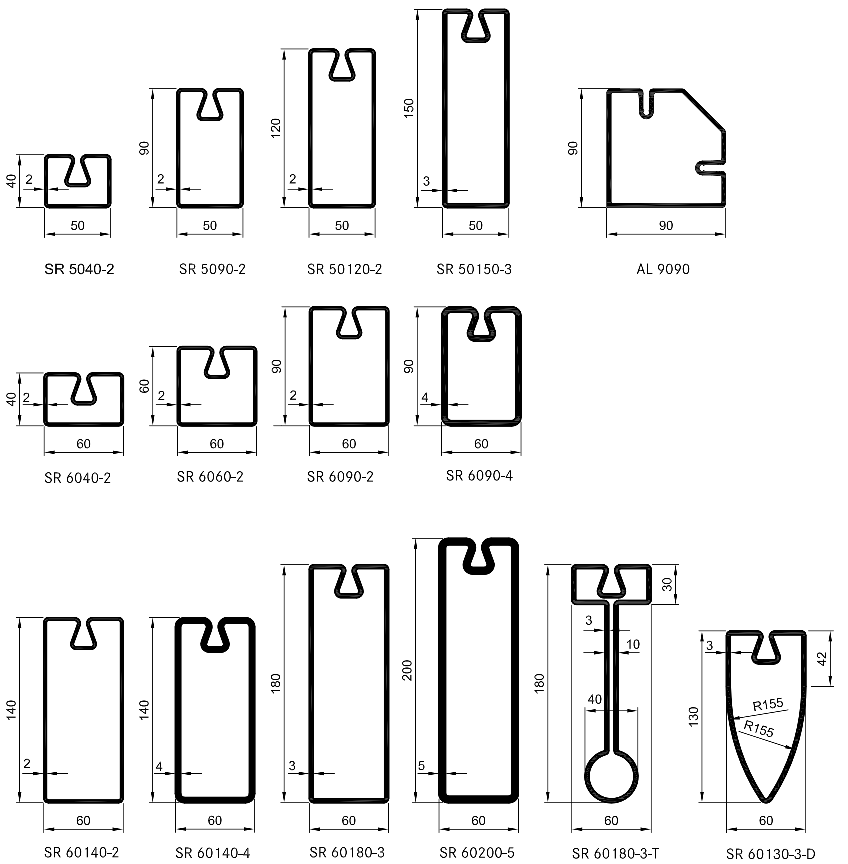
Bundesinnungsverband des Glaserhandwerks

Leaflets by Stahl-Informations-Zentrum, Düsseldorf

Leaflets by the Verband der Fenster- und Fassadenhersteller, Frankfurt am Main

Threaded tubes

Profile overview



TI-S_9.2_005.dwg

Threaded tube quality

Steel

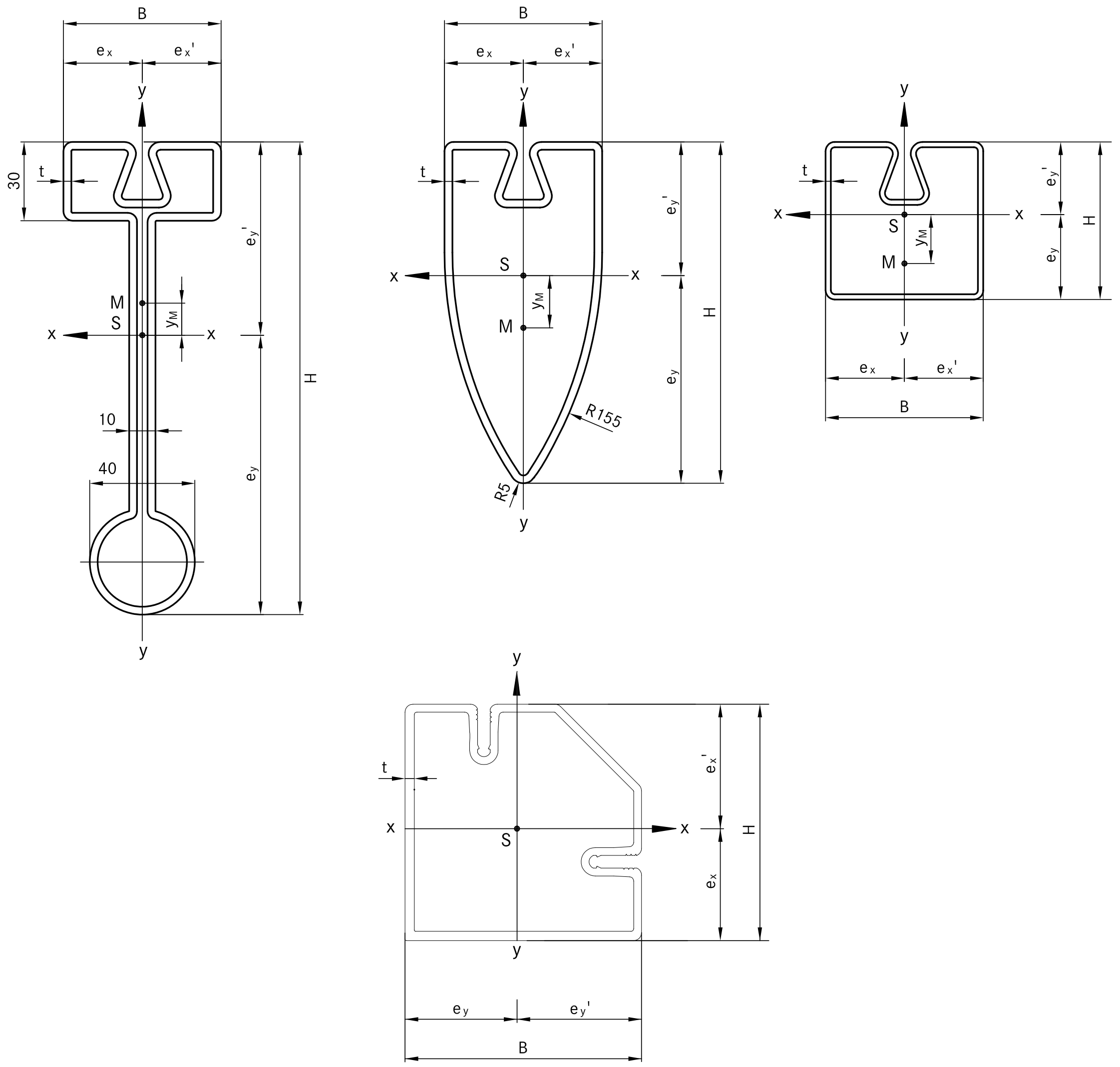
- Delivery of the tubes is organised according to DIN EN 10021, and they are generally made of sendzimir-galvanized hot or cold-rolled strip in grade S 280.
- The zinc coating is approx. 275 g/m² in accordance with DIN EN 10162. The insides of the tubes are also galvanized. The thickness of the zinc coating is therefore approx. 20 µm.
- The tubes are manufactured within the tolerances defined in DIN ISO 2768.
- Welding seams from production are automatically re-galvanized during manufacture. The threaded tube SR 60200-5 is laser-welded for manufacturing reasons. This welding seam is not usually re-galvanized.
- When storing the tubes, it is important to ensure sufficient ventilation. Due to the danger of white rust developing, galvanised materials should never be covered with tarpaulins or other types of covers. Any packaging used for transporting the galvanised tubes must be immediately removed upon arrival. Please be aware that the appearance of any white rust does not constitute grounds for a complaint.

- Material parameters::

Yield strength	$f_{y,k}$	= 280	N/mm²
Elastic modulus	E	= 210000	N/mm²
Shear modulus	E	= 81000	N/mm²
Thermal expansion coefficient	αT	= 12×10^{-6}	N/mm²

Threaded tubes

Geometric cross-sections and cross-section parameters



TI-S_9.2_005.dwg

Threaded tubes

Cross-sectional values

Profile - Number	H	B	t	U	U_B [1)]	g	A	e_y	e_y'	I_x	e_x	e_x'	I_y
-	mm	mm	mm	m²/m	m²/m	kg/m	cm²	cm	cm	cm⁴	cm	cm	cm⁴
SR 5040-2	40	50	2	0,224	0,131	3,41	4,35	2,06	1,94	**8,67**	2,50	2,50	12,31
SR 5090-2	90	50	2	0,324	0,231	4,98	6,35	4,94	4,06	**64,84**	2,50	2,50	23,84
SR 50120-2	120	50	2	0,384	0,291	5,93	7,55	6,56	5,44	**134,54**	2,50	2,50	30,75
SR 50150-3	150	50	3	0,446	0,351	10,27	13,08	8,17	6,83	**349,93**	2,50	2,50	54,11
SR 6040-2	40	60	2	0,244	0,141	3,73	4,75	2,06	1,94	**10,12**	3,00	3,00	18,92
SR 6060-2	60	60	2	0,284	0,181	4,36	5,55	3,23	2,77	**26,78**	3,00	3,00	25,66
SR 6090-2	90	60	2	0,344	0,241	5,30	6,75	4,91	4,09	**72,66**	3,00	3,00	35,75
SR 6090-4	90	60	4	0,332	0,242	10,03	12,78	4,86	4,14	**128,70**	3,00	3,00	63,63
SR 60130-3-D	130	60	3	0,384	0,280	8,82	11,24	7,91	5,09	**191,74**	3,00	3,00	49,05
SR 60140-2	140	60	2	0,444	0,341	6,87	8,75	7,60	6,40	**218,64**	3,00	3,00	52,58
SR 60140-4	140	60	4	0,432	0,342	13,17	16,78	7,53	6,47	**399,20**	3,00	3,00	95,04
SR 60180-3-T	180	60	3	0,552	0,447	12,77	16,27	10,64	7,36	**556,02**	3,00	3,00	29,14
SR 60180-3	180	60	3	0,526	0,421	12,16	15,48	9,72	8,28	**609,18**	3,00	3,00	95,48
SR 60200-5	200	60	5	0,554	0,462	21,13	26,91	10,68	9,32	**1237,34**	3,00	3,00	159,86
AL 9090	90	90	3,5	0,420	0,207	3,50	12,93	4,26	4,74	**138,95**	4,26	4,74	138,95

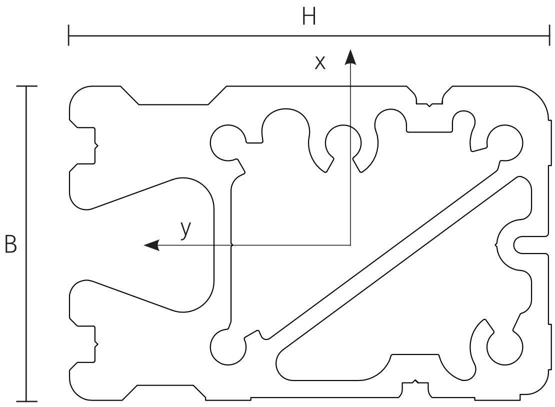
STABALUX

Transom connectors

9.2
2

Geometric cross-sections and cross-section parameters

Profile - Number	H	B	g	A	I_y	I_x
-	mm	mm	kg/m	cm²	cm⁴	cm⁴
SR 5040-2	35.0	45.4	2.468	9.139	21.2	9.1
SR 5090-2	85.0	45.4	4.342	16.082	41.6	116.1
SR 50120-2	115.0	45.4	5.727	21.211	54.4	274.5
SR 50150-3	143.0	43.4	5.863	21.714	54.2	446.7
SR 6040-2	35.0	55.4	3.126	11.576	36.5	11.7
SR 6060-2	55.0	55.4	4.098	15.179	41.7	53.0
SR 6090-2	85.0	55.4	5.465	20.239	73.9	148.5
SR 6090-4	81.0	51.4	4.542	16.824	54.6	109.0
SR 60140-2	135.0	55.4	7.458	27.621	105.3	524.9
SR 60140-4	131.0	51.4	6.452	23.896	80.6	413.7
SR 60180-3	173.0	53.4	7.773	28.788	107.4	923.2
SR 60180-5	169.0	49.4	6.794	25.163	84.2	742.9
SR 60200-5	189.0	49.4	7.209	26.7	90.8	992.6



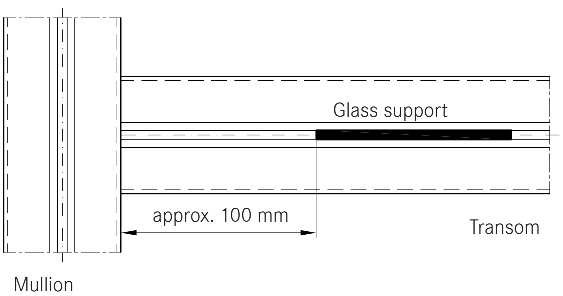
STABALUX

Glass support

Miscellaneous

- Glass supports are used to transfer the self-weight loads exerted by the glazing into the transom of a facade system.
- Fitness for purpose is usually authoritative in the selection of a glass support; it is usually defined by a limit value of glass support deflection.
- The load-bearing capacity is frequently several times the load defined as limit value for deflection.
- Therefore, a failure of the facade structure and a risk of personal injury are excluded under normal circumstances. This is why the building inspectorate has not defined any particular requirements for the use of glass supports and their connections.

The glass supports and glazing are positioned according to glass industry guidelines and guidelines by IfT Rosenheim. The reference value for attaching the glass support is approx. 100 mm from the end of the transom. However, it is important to ensure that there is no collision with the screw fittings of the clamping connection. The additional information contained in section 1.2.7 – Processing information must be observed.



The glass supports that Stabalux can deliver are components tested for load-bearing capacity and fitness for purpose. These tests were conducted by the firm Feldmann + Weynand GmbH in Aachen. The tests were performed in the experiments hall for steel and lightweight metal structures at RWTH Aachen. The components were also tested by the Institut für Stahlbau Leipzig GmbH, Leipzig.
The measured deflection of f_{max} = 2 mm below the theoretical point of attack exerted by the consequent panel weight was applied as the limit value for glass support deflection. The location of the point of attack is identified using eccentricity „e“.

Glass support types and threaded tubes

The Stabalux SR system uses four different types and three techniques for attaching glass supports:

- Welded glass supports are made of a flat piece of steel which is hammered into the screw channel and then welded on all sides.
- Insert glass supports GH 0281 and GH 0282. The geometry of the glass supports is such that they can be inserted in the screw channel without requiring additional fixing or fastening.
- Glass support GH 5051, consisting of an upper and a lower part. The load is transferred via the screw fitting and into the screw channel of the threaded tube.
- Screw-in glass supports GH 5201 and GH5202. The load is transferred via the screw fitting and into the screw channel of the threaded tube. These are only permissible for 5 mm inner seals and must be screwed through the screw channel.

Refer to Section 9.2.1 – Cross-sections for more information on the threaded tubes.

Eccentricity „e“

The height of the inner seal and the glass structure, i.e. the centre of gravity of the glass pane is determined by the eccentricity „e“. The unit „e“ describes the distance between the front edge of the threaded tube and the theoretical load transfer line.

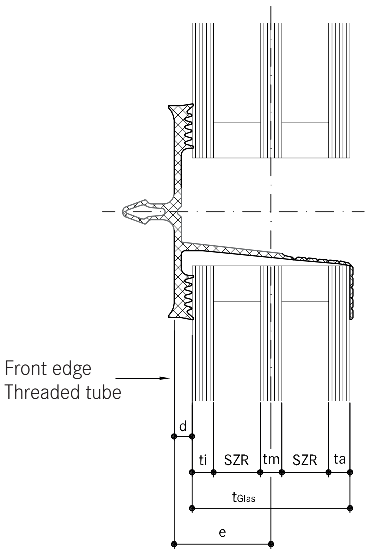
STABALUX

Glass support

9.2
3

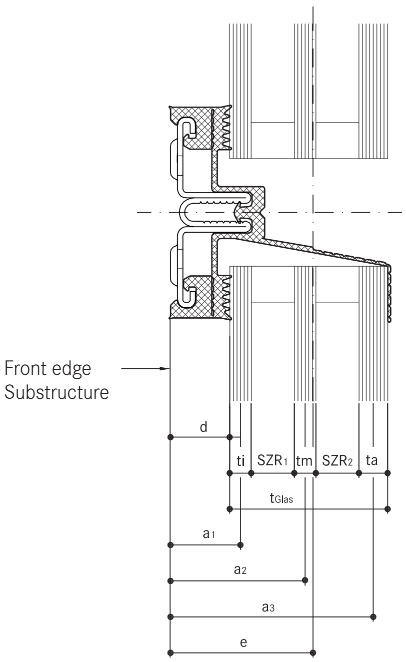
Diagram of the glass structure / Abbreviations used

Symmetrical glass structure
Example of System SR

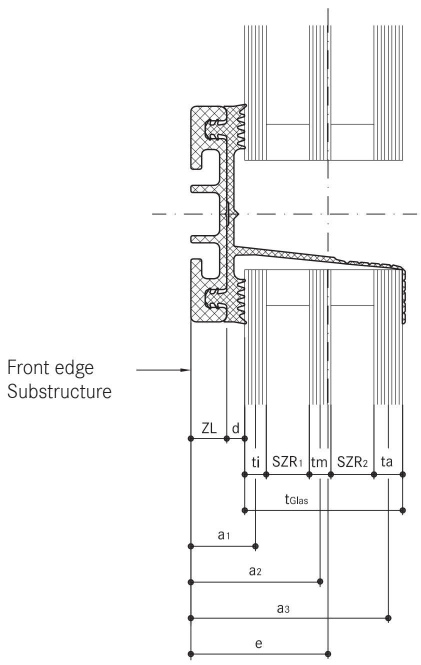


d = Height of the inner seal
ZL = Height of the spacer strip (10 mm)
t_{Glass} = Total glass thickness
ti = Thickness of the inner pane
tm = Thickness of the middle pane
ta = Thickness of the outer pane
SZR_1 = Space between panes 1
SZR_2 = Space between panes 2
a_1 = Distance from the front edge of the steel profile to the centre of the inner pane
a_2 = Distance from the front edge of the steel profile to the centre of the middle pane
a_3 = Distance from the front edge of the steel profile to the centre of the outer pane
G = Pane weight
G_L = Load share

Asymmetrical glass structure
Example System AK-S



Asymmetrical glass structure
Example System ZL-S



STABALUX

Glass support

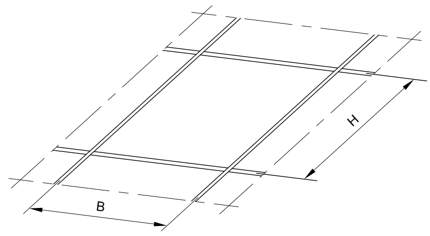
9.2
3

Identification of the permitted pane weight

1. Calculation of the pane weight

Surface of the pane = W x H in [m²]
Aggregate glass thickness = ti + tm + ta [m]
Specific glass weight = $\gamma \approx 25.0$ [kN/m³]

→ Pane weight [kg] = (W x H) x (ti + tm + ta) x γ x 100



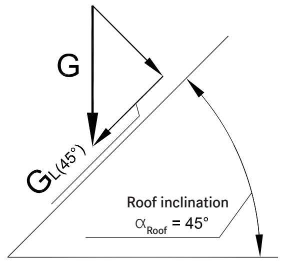
2. Calculation of the load share on the glass support

The load share of the glass weight in vertical glazing is 100 %.
The load share of inclined glazing is reduced, depending on the angle.

→ Pane weight [kg] x sin(α)

Table 18 states the sine value for known inclination angles.

Table 19 states the sine value for known percentage inclination.



3. Calculation of eccentricity

System SR / System: AK-S

Symmetrical glass structure

e = d + (ti + SZR + tm + SZR + ta)/2

Asymmetrical glass structure

a1 = d + ti/2
a2 = d + ti + SZR1 +tm/2
a3 = d + ti + SZR1 +tm + SZR2 + ta/2
e = (ti x a1 +tm x a2 + ta x a3)/(ti +tm + ta)

System ZL-S

Symmetrical glass structure

e = d + ZL + (ti + SZR + tm + SZR + ta)/2

Asymmetrical glass structure

a1 = d + ZL + ti/2
a2 = d + ZL + ti + SZR1 +tm/2
a3 = d + ZL + ti + SZR1 +tm + SZR2 + ta/2
e = (ti x a1 +tm x a2 + ta x a3)/(ti +tm + ta)

4. Test

Tables 1 - 17 state the permitted pane weight based on the calculated eccentricity „e“.

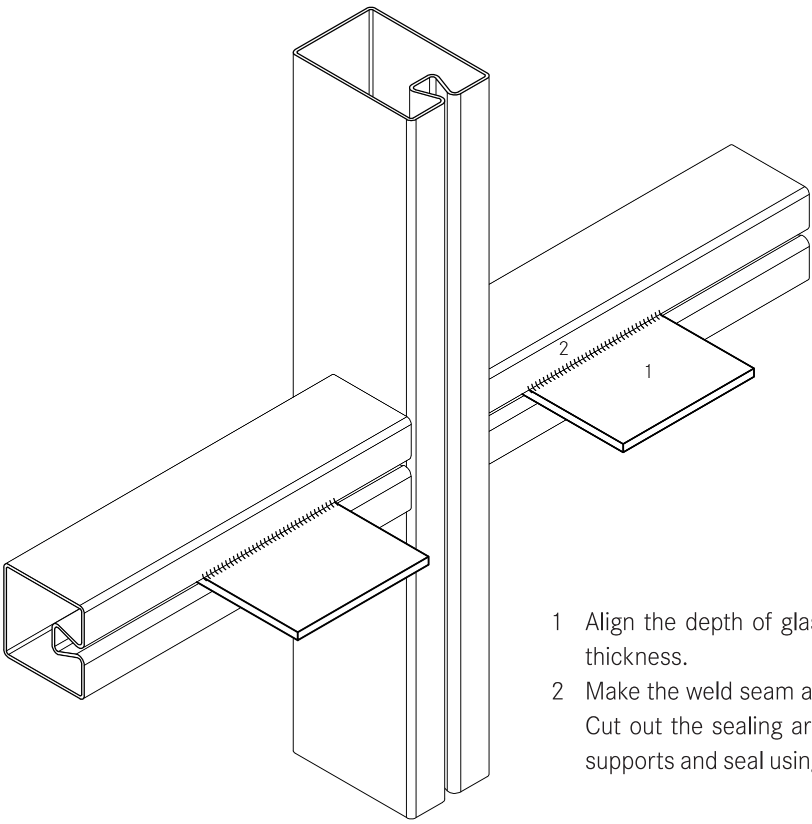
Note:

Tables 1 - 17 enable calculation of eccentricity for symmetrical glass structures.

Glass support

Welded glass supports

- The tested glass support must be cut to measure from flat steel, grade S235, with a material thickness of 5 mm.
- Glass supports in the width B = 150 mm and B = 200 mm are tested.
- The depth of the glass supports is determined by the thickness of the glass, the height of the inner seal and the insertion depth.
- The welding seam must cover the entire cross-section.
- The glass supports must be positioned at right angles to the threaded tube.
- In most cases it will be necessary to manufacture welded glass supports on site; it is important to ensure sufficient corrosion protection in this regard.
- If the length of the glass support is more than 100 mm, blocks should be placed along the entire length of the glass support to ensure equal load distribution.



1 Align the depth of glass support with the glass thickness.
2 Make the weld seam as even as possible:
Cut out the sealing around the holes for the glass supports and seal using Stabalux connection paste.

TI-S_9.2_002.dwg

STABALUX

Glass support

9.2
3

Permitted pane weight

- Table 1 lists the permitted pane weights.
- The width of the glass supports, the wall thickness of the threaded tubes and the mullion-transom joint influence the permitted pane weights.
- Table 1 may only be used if there is a rigid mullion-transom joint (e.g. welded connection). This prevents any further sagging of the glass supports from the transom twist in the area of the transom-mullion connection.
- The values apply to glass supports with the width B = 150 mm and threaded tubes with the wall thickness t ≥ 2 mm. Glass supports with the width B = 200 mm are only permitted together with threaded tubes with the wall thickness t ≥ 4 mm.

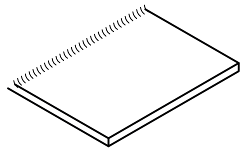


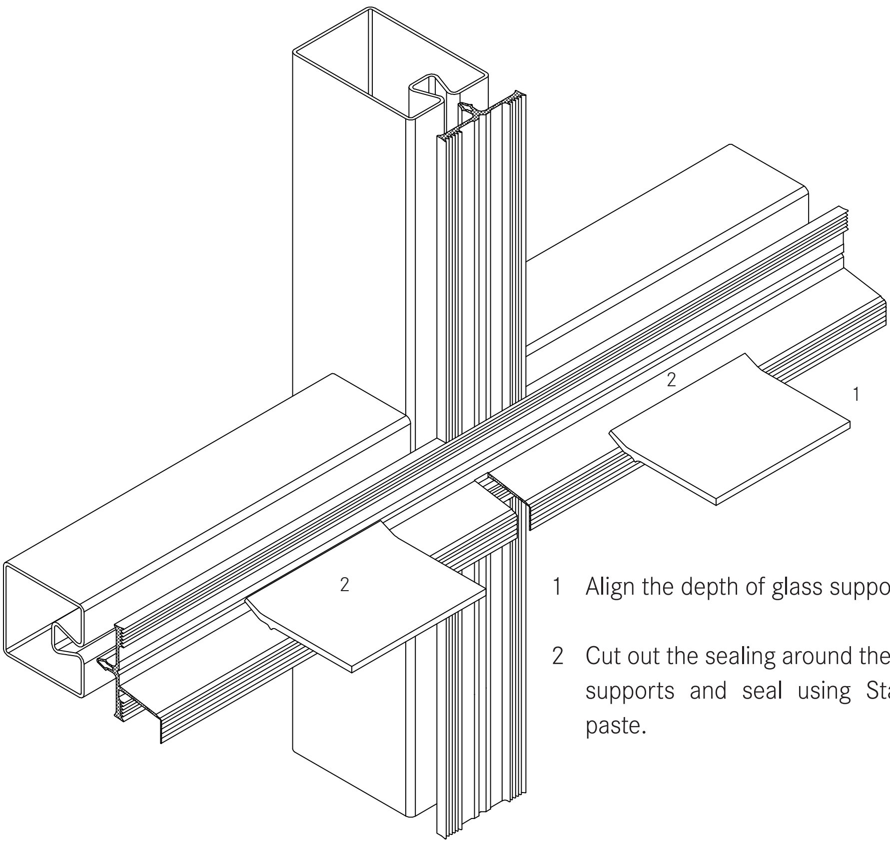
Table 1:Welded glass supports, rigid mullion-transom joint

Row	Total glass thickness t_{glass} for Single-pane or symmetrical glass structure			Eccentricity "e"	Permitted pane weight G (kg)	
	Inner seal height				Wall thickness of the transom 2.0 mm ≤ t < 4.0 mm Welded glass supports Thickness t = 5 mm Width B = 150 mm	Wall thickness of the transoms t ≥ 4.0 mm Welded glass supports Thickness t = 5 mm Width B = 200 mm
	5 mm	10 mm [1)]	12 mm	mm	kg	kg
1	≤ 20	≤ 10	≤ 6	15	**2513**	**2654**
2	22	12	8	16	**2219**	**2493**
3	24	14	10	17	**1966**	**2349**
4	26	16	12	18	**1753**	**2222**
5	28	18	14	19	**1574**	**2107**
6	30	20	16	20	**1420**	**2003**
7	32	22	18	21	**1288**	**1909**
8	34	24	20	22	**1174**	**1824**
9	36	26	22	23	**1074**	**1746**
10	38	28	24	24	**986**	**1674**
11	40	30	26	25	**909**	**1607**
12	42	32	28	26	**856**	**1546**
13	44	34	30	27	**856**	**1490**
14	46	36	32	28	**856**	**1437**
15	48	38	34	29	**856**	**1388**
16	50	40	36	30	**856**	**1342**
17	52	42	38	31	**856**	**1299**
18	54	44	40	32	**856**	**1258**
19	56	46	42	33	**805**	**1221**
20	58	48	44	34	**758**	**1185**
21	60	50	46	35	**716**	**1151**
22	62	52	48	36	**676**	**1119**
23	64	54	50	37	**640**	**1089**

Glass support

Inset glass support

- Certified system components consist of the insert glass supports GH 0281 and GH 0282 that differ in terms of their support width.
- The geometry of the glass supports is such that they can be inserted in the screw channel without requiring additional fixing or fastening.
- The depth of the glass support is T = 60 ; it must be cut to measure, depending on the glass thickness used and the height of the inner seal.
- The glass supports are manufactured using aluminium in grade EN AW 6082 T6.
- If the length of the glass support is more than 100 mm, blocks should be placed along the entire length of the glass support to ensure equal load distribution.



1 Align the depth of glass support with the glass thickness

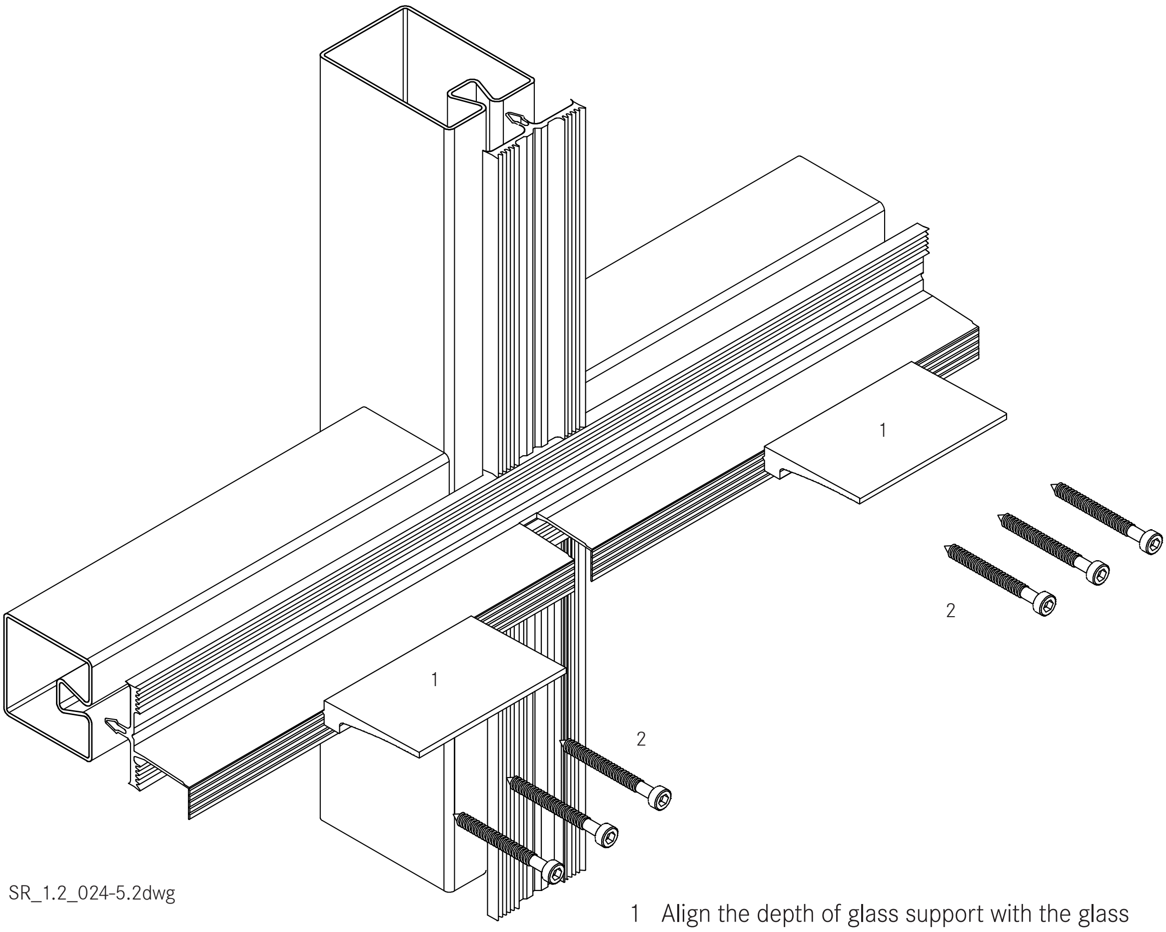
2 Cut out the sealing around the holes for the glass supports and seal using Stabalux connection paste.

TI-S_9.2_003.dwg

Glass support

Bolted glass support

- The tested glass supports GH 5201 and GH 5202 differ in terms of their support width.
- Stainless steel system screws Z 0118 with a length 40 mm are used to make the corresponding screw connection. Depending on the glass support 3 or 6 Stabalux system screws are necessary.
- The bottom part of the glass support is bolted directly on to the transoms. Since the screwing of the glass supports is performed in the screw channel plus penetration of the rear wall, higher weights can be achieved.
- Pre-drill the threaded tubes with Ø5.5 mm with a distance of 33 mm.
- The glass supports are only suitable for 5 mm inner seals.
- The usable depth of the glass supports is 62 mm and needs to be adjusted according to the glass thickness.
- The glass supports are manufactured using aluminium in grade EN AW 6060 T66.



SR_1.2_024-5.2dwg

1 Align the depth of glass support with the glass thickness.

2 Screws must penetrate the rear wall and be properly tightened. We recommend screwing from the center to the outside.

Glass support

Permitted pane weight

- Tables 2 to 9 list the permitted pane weights.
- Besides the glass structure and the inner seal, the width of the glass supports, the wall thickness of the threaded tubes and the mullion/transom connection influence the permitted pane weights.
- The information in Tables 2, 3 and 4 is only valid if the mullion-transom joint is rigid (e.g. welded connection). This prevents any further sagging of the glass supports from the transom twist in the area of the mullion-transom joint.
- Tables 5 to 9 consider the deformation caused by attachment to the mullion-transom joint. These values may only be used if the bolted mullion-transom joint is made using the system transom retainers RHT.
- The values provided in the table were determined from the findings of a large number of tests. The findings of two test series' are overlaid additionally for the combination of insertion glass support/ bolted mullion-transom joint. The load deformation curves from the tests were linearised in 3 intervals. Application of the 5% fractile value ensures that the linearised load deformation curve is shown on the safe side. Extrapolation formulae that deliver secure values were applied in order to obtain the load deformation curves for any eccentricities between 15 mm and 32 mm. They reveal a rise in permissible pane weights in some cases as the eccentricity grows larger.

Glass support

9.2
3

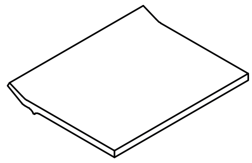
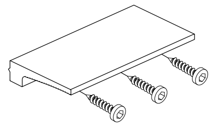


Table 2:
GH 0281 / GH 0282, rigid mullion-transom joint

Row	Total glass thickness t_{glass} for Single-pane or symmetrical glass structure			Eccentricity "e"	Permitted pane weight G (kg)			
	Inner seal height				Wall thickness of the transoms 2.0 mm ≤ t < 4.0 mm		Wall thickness of the transoms t ≥ 4.0 mm	
					Glass support GH 0281 Width 100 mm	Glass support GH 0282 Width 150 mm	Glass support GH 0281 Width 100 mm	Glass support GH 0282 Width 150 mm
	5 mm	10 mm	12 mm	mm	kg	kg	kg	kg
1	≤ 20	≤ 10	≤ 6	15	899	1286	988	975
2	22	12	8	16	817	1148	881	914
3	24	14	10	17	734	1032	791	861
4	26	16	12	18	664	934	715	817
5	28	18	14	19	604	851	650	817
6	30	20	16	20	552	779	595	817
7	32	22	18	21	508	717	547	817
8	34	24	20	22	469	662	504	780
9	36	26	22	23	434	615	467	773
10	38	28	24	24	404	572	435	771
11	40	30	26	25	377	534	430	780
12	42	32	28	26	360	501	435	789
13	44	34	30	27	363	504	441	799
14	46	36	32	28	368	511	447	809
15	48	38	34	29	373	517	445	817
16	50	40	36	30	378	524	460	817
17	52	42	38	31	383	530	464	817
18	54	44	40	32	387	536	469	817
19	56	46	42	33	368	510	445	792
20	58	48	44	34	351	486	423	757

Glass support

Table 3:
GH 5201, rigid mullion-transom joint



Row	Total glass thickness t_{glass} for single-pane or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)						
			System 50			System 60			
			Wall thickness of the transoms			Wall thickness of the transoms			
	Inner seal height		t ≥ 2 mm		t ≥ 3 mm	t ≥ 2 mm	t ≥ 3 mm	t ≥ 4 mm	t ≥ 5 mm
			SR5040-2	SR5090-2 SR50120-2	SR50150-3	SR6040-2 SR6060-2 SR6090-2 SR60140-2	SR60180-3	SR6090-4 SR60140-4	SR60200-5
	5 mm	mm	kg	kg	kg	kg	kg	kg	kg
1	≤ 38	≤ 24	404	334	594	334	594	594	594
2	40	25	395	329	580	329	580	580	580
3	42	26	387	324	565	324	565	565	565
4	44	27	378	319	551	319	551	551	551
5	46	28	370	314	537	314	537	537	537
6	48	29	361	309	522	309	522	522	522
7	50	30	353	304	508	304	508	508	508
8	52	31	344	299	494	299	494	494	494
9	54	32	336	294	479	294	479	479	479
10	56	33	328	289	465	289	465	465	465
11	58	34	319	284	451	284	451	451	451
12	60	35	311	279	436	279	436	436	436
13	62	36	302	274	422	274	422	422	422
14	64	37	294	269	407	269	407	407	407

Glass support

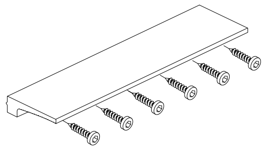
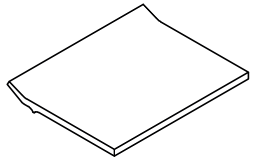
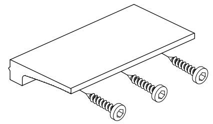


Table 4:
GH 5202, rigid mullion-transom joint

Row	Total glass thickness t_{glass} for single-pane or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)							
			System 50			System 60				
	Inner seal height		Wall thickness of the transoms			Wall thickness of the transoms				
			t ≥ 2 mm		t ≥ 3 mm	t ≥ 2 mm	t ≥ 3 mm	t ≥ 4 mm		t ≥ 5 mm
			SR5040-2	SR5090-2 SR50120-2	SR50150-3	SR6040-2 SR6060-2 SR6090-2 SR60140-2	SR60180-3	SR6090-4	SR60140-4	SR60200-5
	5 mm	mm	kg	kg	kg	kg	kg	kg	kg	kg
1	≤ 38	≤ 24	404	334	594	334	594	594	578	578
2	40	25	398	333	586	333	586	586	568	568
3	42	26	393	331	577	331	577	577	559	559
4	44	27	387	330	569	330	569	569	551	551
5	46	28	382	328	561	328	561	561	542	542
6	48	29	377	327	552	327	552	552	533	533
7	50	30	371	325	544	325	544	544	525	525
8	52	31	366	324	536	324	536	536	516	516
9	54	32	361	322	527	322	527	527	507	507
10	56	33	355	320	519	320	519	519	499	499
11	58	34	350	319	511	319	511	511	490	490
12	60	35	344	317	502	317	502	502	481	481
13	62	36	339	316	494	316	494	494	473	473
14	64	37	334	314	486	314	486	486	464	464

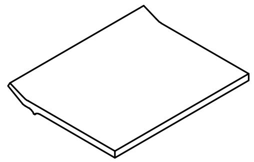
Table 5:
GH 0281 (width 100 mm), bolted mullion-transom joint with inner seal 5 mm, 10 mm, 12 mm
GH 5201 (width 100 mm), bolted mullion-transom joint with inner seal 5 mm

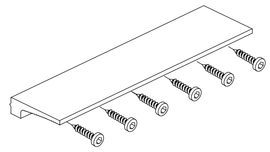




Row	Total glass thickness t_{glass} for Single-pane or symmetrical glass structure – Inner seal height			Eccentricity „e“	Permitted pane weight G (kg) – Transom retainer (RHT) made of aluminium				Permitted pane weight G (kg) – Transom (RHT) made of steel				
					System 50		System 60		System 50		System 60		
					RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile
	5	10	12		9009/5040-2 9109/5040-2	9009/5090-2 9009/50120-2 9109/5090-2 9109/50120-2	9010/6040-2 9110/6040-2	9010/6060-2 9010/6090-2 9010/60140-2 9110/6060-2 9110/6090-2 9110/60140-2	9007/5040-2	9027/5090-2 9027/50120-2 9027/50150-2 9015/50150-3	9008/6040-2 9008/6060-2 9008/6080-2K 9026/60130-3-D	9023/6090-2 9014/60140-2 9025/60180-3	9011/6090-4 9012/60140-4 9013/60180-5 9013/60200-5
	mm	mm	mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg
1	≤ 20	≤ 10	≤ 6	15	128	153	188	253	167	167	175	231	235
2	22	12	8	16	128	151	185	253	165	165	172	226	230
3	24	14	10	17	127	150	182	253	163	162	170	221	226
4	26	16	12	18	126	148	179	251	161	160	167	216	221
5	28	18	14	19	125	146	176	244	158	157	165	210	216
6	30	20	16	20	124	144	173	236	156	155	162	205	211
7	32	22	18	21	123	142	169	229	153	152	159	200	206
8	34	24	20	22	122	140	166	222	151	150	156	195	201
9	36	26	22	23	120	138	162	215	148	147	153	190	196
10	38	28	24	24	119	136	159	208	145	145	150	185	191
11	40	30	26	25	117	133	156	202	142	142	147	180	186
12	42	32	28	26	116	131	152	195	140	139	144	175	186
13	44	34	30	27	115	130	151	193	139	138	143	173	188
14	46	36	32	28	117	132	153	195	140	140	145	175	190
15	48	38	34	29	118	133	154	197	142	141	147	177	192
16	50	40	36	30	119	135	156	199	144	143	148	179	194
17	52	42	38	31	121	136	158	201	145	145	150	181	197
18	54	44	40	32	122	138	160	204	147	146	152	183	199
19	56	46	42	33	119	135	155	197	143	143	148	177	193
20	58	48	44	34	117	131	151	190	140	139	144	172	187

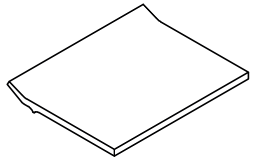
Table 6:
GH 0282 (width 150 mm), bolted mullion-transom joint with inner seal 5 mm, 10 mm, 12 mm
GH 5202 (width 200 mm), bolted mullion-transom joint with inner seal 5 mm

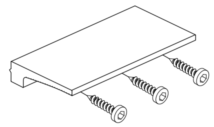




Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure			Eccentricity „e“	Permitted pane weight G (kg)								
	Inner seal height				Transom retainer (RHT) made of aluminium				Transom (RHT) made of steel				
					System 50		System 60		System 50		System 60		
					RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile
	5	10	12		9009/5040-2 9109/5040-2	9009/5090-2 9009/50120-2 9109/5090-2 9109/50120-2	9010/6040-2 9110/6040-2	9010/6060-2 9010/6090-2 9010/60140-2 9110/6060-2 9110/6090-2 9110/60140-2	9007/5040-2	9027/5090-2 9027/50120-2 9027/50150-2 9015/50150-3	9008/6040-2 9008/6060-2 9008/6080-2K 9026/60130-3-D	9023/6090-2 9014/60140-2 9025/60180-3	9011/6090-4 9012/60140-4 9013/60180-5 9013/60200-5
	mm	mm	mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg
1	≤ 20	≤ 10	≤ 6	15	133	159	197	253	174	179	186	248	260
2	22	12	8	16	133	159	196	253	173	178	185	244	258
3	24	14	10	17	132	158	194	253	172	176	183	240	257
4	26	16	12	18	132	157	193	253	171	174	181	237	255
5	28	18	14	19	131	156	191	253	170	172	179	233	253
6	30	20	16	20	131	155	189	253	168	170	177	228	250
7	32	22	18	21	130	154	186	253	167	167	174	224	248
8	34	24	20	22	130	152	184	253	165	165	172	220	245
9	36	26	22	23	129	151	181	249	163	162	170	216	242
10	38	28	24	24	128	149	178	243	161	160	167	211	238
11	40	30	26	25	127	148	175	236	159	158	165	207	240
12	42	32	28	26	126	146	173	230	157	156	163	202	243
13	44	34	30	27	127	147	174	231	158	157	164	204	246
14	46	36	32	28	128	149	176	234	160	159	166	206	249
15	48	38	34	29	130	150	178	237	162	161	168	208	251
16	50	40	36	30	131	152	180	239	163	163	169	211	253
17	52	42	38	31	132	153	182	242	165	165	171	213	255
18	54	44	40	32	133	155	184	245	167	167	173	215	258
19	56	46	42	33	131	152	180	237	164	163	170	210	254
20	58	48	44	34	130	149	175	230	160	160	166	204	250

Table 7:
GH 0281 (width 100 mm), bolted mullion-transom joint with inner seal 5 mm, 10 mm, 12 mm
GH 5201 (width 100 mm), bolted mullion-transom joint with inner seal 5 mm





Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure			Eccentricity „e“	Permitted pane weight G (kg)														
					System 50				System 60										
					Wall thickness mullion profile				Wall thickness mullion profile										
					t ≥ 2 mm				t ≥ 2 mm						t ≥ 3 mm				t ≥ 5 mm
	Inner seal height				Transom retainer				Transom retainer						Transom retainer				Transom retainer
	5	10	12		RHT 5040-2	RHT 5090-2	RHT 50120-2	RHT 50150-3	RHT 6040-2	RHT 6060-2	RHT 6090-2	RHT 6090-4	RHT 60140-2	RHT 60140-4	RHT 60140-2	RHT 60140-4	RHT 60180-3	RHT 60180-5	RHT 60200-5
	mm	mm	mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
1	≤ 20	≤ 10	-	15	282	316	348	348	359	360	431	444	348	356	376	389	397	409	571
2	22	12	8	16	268	303	333	333	359	345	409	422	333	342	356	369	378	391	535
3	24	14	10	17	256	291	319	319	358	331	388	402	319	328	338	351	361	373	500
4	26	16	12	18	244	280	306	306	339	317	369	382	306	315	320	333	344	357	468
5	28	18	14	19	233	268	293	293	322	294	351	364	293	303	304	317	328	341	439
6	30	20	16	20	223	258	281	281	306	292	333	347	281	295	289	301	313	326	413
7	32	22	18	21	213	248	269	269	291	280	316	331	269	279	274	287	299	312	389
8	34	24	20	22	204	238	259	259	277	269	300	315	259	268	261	274	286	299	367
9	36	26	22	23	195	229	248	248	264	258	284	299	248	258	249	261	273	286	347
10	38	28	24	24	188	220	238	238	252	248	270	285	238	248	237	249	261	274	329
11	40	30	26	25	180	212	229	229	240	239	257	271	229	239	227	238	249	262	316
12	42	32	28	26	173	204	220	220	229	228	245	267	220	236	217	235	238	259	315
13	44	34	30	27	169	200	216	216	223	223	241	269	216	237	212	236	233	261	319
14	46	36	32	28	168	201	217	217	224	224	243	270	217	238	213	238	236	263	322
15	48	38	34	29	166	201	218	218	223	225	244	272	218	238	214	239	238	265	326
16	50	40	36	30	165	202	219	219	223	224	246	274	219	239	216	241	240	267	329
17	52	42	38	31	164	202	220	220	222	224	248	275	220	240	217	242	243	268	333
18	54	44	40	32	163	203	220	220	221	224	250	276	220	241	219	243	245	270	337
19	56	46	42	33	158	197	214	214	214	218	242	269	214	234	211	235	238	263	325
20	58	48	44	34	153	191	208	208	207	212	234	261	208	228	204	228	231	256	315

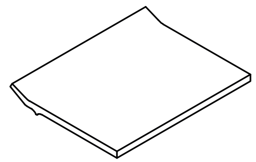


Table 8:
GH 0282, bolted mullion-transom joint

Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure			Eccentricity „e“	Permitted pane weight G (kg)														
	Inner seal height				System 50				System 60										
					Wall thickness mullion profile				Wall thickness mullion profile										
					t ≥ 2 mm				t ≥ 2 mm						t ≥ 3 mm				t ≥ 5 mm
					Transom retainer				Transom retainer						Transom retainer				Transom retainer
	5	10	12		RHT 5040-2	RHT 5090-2	RHT 50120-2	RHT 50150-3	RHT 6040-2	RHT 6060-2	RHT 6090-2	RHT 6090-4	RHT 60140-2	RHT 60140-4	RHT 60140-2	RHT 60140-4	RHT 60180-3	RHT 60180-5	RHT 60200-5
	mm	mm	mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
1	≤ 20	≤ 10	-	15	292	344	382	382	359	389	482	532	382	414	427	479	445	492	749
2	22	12	8	16	289	333	369	369	359	376	461	513	369	403	408	461	428	477	715
3	24	14	10	17	277	322	356	356	359	362	441	495	356	392	390	445	411	463	682
4	26	16	12	18	265	311	343	343	359	349	422	477	343	381	373	428	395	448	651
5	28	18	14	19	254	301	331	331	359	337	404	460	331	370	356	413	380	434	621
6	30	20	16	20	244	290	320	320	346	325	387	443	320	359	341	398	365	420	593
7	32	22	18	21	235	281	309	309	331	314	371	428	309	349	326	383	351	407	567
8	34	24	20	22	226	272	298	298	317	303	355	413	298	339	312	369	338	394	542
9	36	26	22	23	217	263	288	288	304	293	341	398	288	330	299	356	325	382	518
10	38	28	24	24	209	254	278	278	291	283	327	384	278	320	287	344	313	370	496
11	40	30	26	25	202	246	269	269	280	274	314	382	269	319	275	343	301	370	495
12	42	32	28	26	195	238	260	260	269	264	302	382	260	320	264	344	290	371	499
13	44	34	30	27	192	237	259	259	266	262	300	383	259	320	263	345	290	373	502
14	46	36	32	28	190	237	259	259	264	262	301	383	259	321	265	347	291	375	506
15	48	38	34	29	188	238	260	260	263	261	301	383	260	322	266	348	293	377	509
16	50	40	36	30	187	238	261	261	262	261	302	383	261	322	268	349	295	378	512
17	52	42	38	31	185	238	262	262	260	260	302	383	262	323	269	351	296	380	515
18	54	44	40	32	183	239	263	263	259	260	303	383	263	323	270	352	298	381	518
19	56	46	42	33	178	233	256	256	251	253	294	374	256	317	262	343	290	373	503
20	58	48	44	34	173	227	249	249	244	247	285	365	249	310	254	335	282	365	489

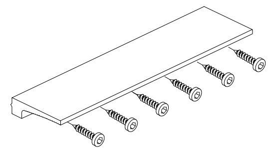


Table 9:
GH 5202, bolted mullion-transom joint

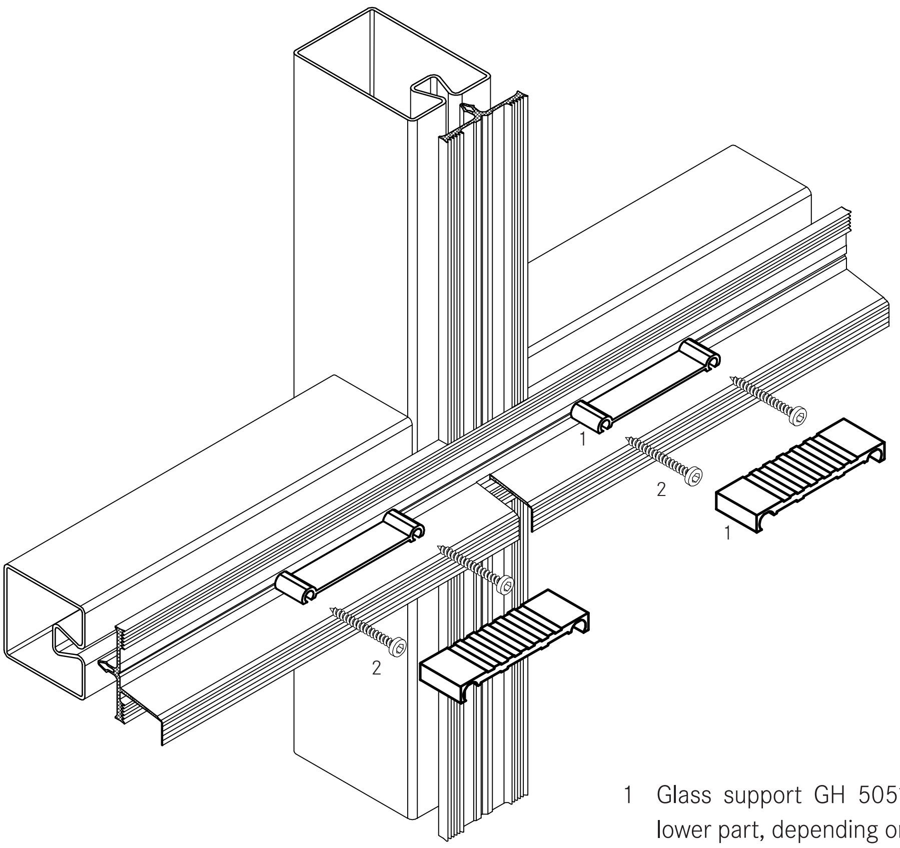
Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure / Inner seal height	Eccentricity „e“	Permitted pane weight G (kg)														
			System 50				System 60										
			Wall thickness mullion profile				Wall thickness mullion profile										
			t ≥ 2 mm				t ≥ 2 mm						t ≥ 3 mm				t ≥ 5 mm
			Transom retainer				Transom retainer						Transom retainer				Transom retainer
			RHT 5040-2	RHT 5090-2	RHT 50120-2	RHT 50150-3	RHT 6040-2	RHT 6060-2	RHT 6090-2	RHT 6090-4	RHT 60140-2	RHT 60140-4	RHT 60140-2	RHT 60140-4	RHT 60180-3	RHT 60180-5	RHT 60200-5
	5 mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
1	≤ 20	15	292	344	348	382	348	348	348	532	348	414	348	479	445	492	678
2	22	16	289	333	346	369	346	346	346	513	346	403	346	461	428	477	669
3	24	17	277	322	345	356	345	345	345	495	345	392	345	445	411	463	660
4	26	18	265	311	343	343	343	343	343	477	343	381	343	428	395	448	651
5	28	19	254	301	331	331	342	337	342	460	331	370	342	413	380	434	621
6	30	20	244	290	320	320	341	325	341	443	320	359	341	398	365	420	593
7	32	21	235	281	309	309	331	314	339	428	309	349	326	383	351	407	567
8	34	22	226	272	298	298	317	303	338	413	298	339	312	369	338	394	542
9	36	23	217	263	288	288	304	293	336	398	288	330	299	356	325	382	518
10	38	24	209	254	278	278	291	283	327	384	278	320	287	344	313	370	496
11	40	25	202	246	269	269	280	274	314	382	269	319	275	343	301	370	495
12	42	26	195	238	260	260	269	264	302	382	260	320	264	344	290	371	499
13	44	27	192	237	259	259	266	262	300	383	259	320	263	345	290	373	502
14	46	28	190	237	259	259	264	262	301	383	259	321	265	347	291	375	506
15	48	29	188	238	260	260	263	261	301	383	260	322	266	348	293	377	509
16	50	30	187	238	261	261	262	261	302	383	261	322	268	349	295	378	512
17	52	31	185	238	262	262	260	260	302	383	262	323	269	351	296	380	515
18	54	32	183	239	263	263	259	260	303	383	263	323	270	352	298	381	518
19	56	33	178	233	256	256	251	253	294	374	256	317	262	343	290	373	503
20	58	34	173	227	249	249	244	247	285	365	249	310	254	335	282	365	489

Glass support

9.2
3

Glass support GH 5051 - bolted glass support, two-part

- Certified system components of the two-part glass support GH 5051 consist of the bottom parts GH 0260 to GH 0262 and the top parts GH 0263 to GH 0268.
- The bottom parts of the glass support are bolted directly on to the transoms. A distinction is made between two types of screw fitting. The screws are fastened in the screw channel in variant (A). Variant (B) can support greater loads, as it involves fastening the screw fitting in the screw channel plus penetrating the rear wall.
- The two-part glass supports are only suitable for slim glass panes with a maximum eccentricity „e“ = 20 mm.
- The two-part glass supports GH 5051 are manufactured using aluminium in EN AW 6060 T66.
- Stainless steel system screws Z 0118 are used to make the corresponding screw connection.



1 Glass support GH 5051 with upper and lower part, depending on glass thickness.

2 Screws, depending on the pane weight and glass thickness.
Do not deform the inner seal when tightening the screws.

TI-S_9.2_004.dwg

Glass support

9.2
3

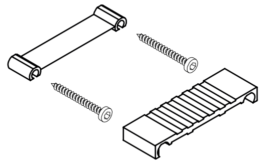


Table 10:
GH 5051, rigid mullion-transom joint

Row	Total glass thickness t_{Glass} for single-pane or symmetrical glass structure			Eccentricity „e“	Permitted pane weight G (kg)	
	Inner seal height				Screw fittings variant (A)	Screw fittings variant (B)
	5	**10** [1]	**12**			
-	**mm**	**mm**	**mm**	**mm**	**kg**	**kg**
1	≤ 20	≤ 10	-	15	**232**	**270**
2	22	12	8	16	**218**	**253**
3	24	14	10	17	**205**	**239**
4	26	16	12	18	**185**	**225**
5	28	18	14	19	**166**	**213**
6	30	20	16	20	**150**	**203**

1) Panes must have a total glass thickness of at least 16 mm in inclined glazing.

Larger values than e = 20 mm are not permitted if the two-part glass supports GH 5051 are installed.

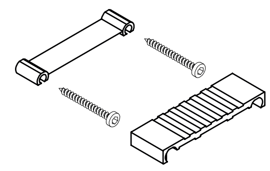


Table 11:
GH 5051, bolted mullion-transom joint

Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure – Inner seal height			Eccentricity „e“	Permitted pane weight G (kg)							
					Transom retainer (RHT) made of aluminium				Transom (RHT) made of steel			
					System 50		System 60		System 50		System 60	
					RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile	RHT/SR profile
	5	10 [1]	12		9009/5040-2 9109/5040-2	9009/5090-2 9009/50120-2 9109/5090-2 9109/50120-2	9010/6040-2 9110/6040-2	9010/6060-2 9010/6090-2 9010/60140-2 9110/6060-2 9110/6090-2 9110/60140-2	9007/5040-2	9027/5090-2 9027/50120-2 9027/50150-2 9015/50150-3	9008/6040-2 9008/6060-2 9008/6080-2K 9026/60130-3-D	9023/6090-2 9011/6090-4 9014/60140-2 9012/60140-4 9025/60180-3 9013/60180-5 9013/60200-5
	mm	mm	mm	mm	kg	kg	kg	kg	kg	kg	kg	kg
					Screw fittings variant (A) - Screwing the lower part in the screw channel							
1	≤ 20	≤ 10	-	15	81	93	108	139	99	98	102	124
2	22	12	8	16	78	88	102	129	94	93	96	116
3	24	14	10	17	75	84	96	120	89	89	91	109
4	26	16	12	18	71	80	90	111	84	84	86	102
5	28	18	14	19	68	75	85	103	79	79	81	95
6	30	20	16	20	65	72	81	97	76	75	77	89
					Screw fittings variant (B) - Screwing the lower part in the screw channel and penetrating the back wall							
7	≤ 20	≤ 10	-	15	91	105	125	169	113	113	117	148
8	22	12	8	16	88	101	119	158	108	108	112	140
9	24	14	10	17	85	97	114	149	104	104	108	132
10	26	16	12	18	83	95	110	143	101	101	105	128
11	28	18	14	19	83	95	110	143	101	101	105	128
12	30	20	16	20	83	95	110	143	101	101	105	128

1) Panes must have a total glass thickness of at least 16 mm in inclined glazing.

Larger values than e = 20 mm are not permitted if the two-part glass supports GH 5051 are installed.

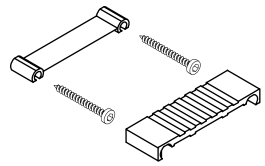


Table 12:
GH 5051, bolted mullion-transom joint

Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure			Eccentricity "e"	Permitted pane weight G (kg)														
	Inner seal height				System 50				System 60										
					Wall thickness mullion profile				Wall thickness mullion profile										
					t ≥ 2 mm				t ≥ 2 mm						t ≥ 3 mm				t ≥ 5 mm
					Transom retainer				Transom retainer						Transom retainer				Transom retainer
	5	10 [1]	12		RHT 5040-2	RHT 5090-2	RHT 50120-2	RHT 50150-3	RHT 6040-2	RHT 6060-2	RHT 6090-2	RHT 6090-4	RHT 60140-2	RHT 60140-4	RHT 60140-2	RHT 60140-4	RHT 60180-3	RHT 60180-5	RHT 60200-5
	mm	mm	mm	mm	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
					Screw fittings variant (A) - Screwing the lower part in the screw channel														
1	≤ 20	≤ 10	-	15	139	149	157	157	166	157	175	175	157	157	169	169	178	178	199
2	22	12	8	16	127	137	144	144	151	144	159	159	144	144	154	154	163	163	179
3	24	14	10	17	117	126	133	133	138	132	145	145	133	133	141	141	149	149	162
4	26	16	12	18	107	116	121	121	125	121	132	132	121	121	128	128	137	137	146
5	28	18	14	19	99	107	112	112	115	111	120	120	112	112	118	118	126	126	133
6	30	20	16	20	92	100	104	104	106	103	111	111	104	104	109	109	116	116	121
					Screw fittings variant (B) - Screwing the lower part in the screw channel and penetrating the back wall														
7	≤ 20	≤ 10	-	15	169	185	197	197	212	197	226	226	197	197	216	216	218	218	268
8	22	12	8	16	156	171	182	182	194	182	207	207	182	182	199	199	200	200	242
9	24	14	10	17	144	159	169	169	178	168	190	190	169	169	183	183	185	185	221
10	26	16	12	18	137	152	161	161	168	160	180	180	161	161	173	173	176	176	208
11	28	18	14	19	135	151	160	160	166	158	179	179	160	160	172	172	175	175	207
12	30	20	16	20	132	150	159	159	164	157	178	178	159	159	172	172	174	174	203

1) Panes must have a total glass thickness of at least 16 mm in inclined glazing.

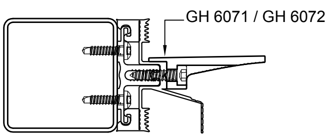
Larger values than e = 20 mm are not permitted if the two-part glass supports GH 5051 are installed.

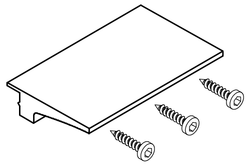
STABALUX

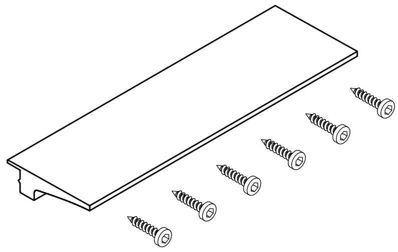
Glass support

9.2
3

Table 13:
GH 6071 & 6072, Ak 5010 and AK 6010 bolted on to steel







Row	Total glass thickness t_{Glass} for single glazing or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)			
			AK 5010		AK 6010	
			Wall thickness of the profiles t ≤ 2.0 mm		Wall thickness of the profiles t ≤ 2.0 mm	
	Inner seal height		Glass support GH 6071 Width 100 mm	Glass support GH 6072 Width 200 mm	Glass support GH 6071 Width 100 mm	Glass support GH 6072 Width 200 mm
	16,5 mm	mm	kg	kg	kg	kg
1	≤ 24	28,5	**786**	**1145**	**920**	**1145**
2	26	29,5	**765**	**1109**	**884**	**1073**
3	28	30,5	**746**	**1075**	**852**	**1056**
4	30	31,5	**727**	**1041**	**818**	**1041**
5	32	32,5	**710**	**1006**	**785**	**1021**
6	34	33,5	**692**	**972**	**751**	**972**
7	36	34,5	**675**	**936**	**718**	**936**
8	38	35,5	**660**	**902**	**684**	**902**
9	40	36,6	**645**	**868**	**651**	**868**
10	42	37,5	**618**	**833**	**618**	**833**
11	44	38,5	**584**	**798**	**584**	**798**
12	46	39,5	**551**	**764**	**551**	**764**
13	48	40,5	**517**	**729**	**512**	**729**
14	50	41,5	**484**	**695**	**484**	**695**
15	52	42,5	**450**	**659**	**450**	**659**
16	54	43,5	**416**	**625**	**416**	**625**
17	56	44,5	**384**	**591**	**383**	**591**
18	58	45,5	**349**	**555**	**350**	**555**
19	60	46,5	**317**	**484**	**317**	**484**

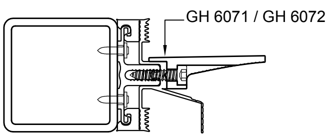
The eccentricity column “e” must be used to calculate the permitted pane weight if the glass structure is asymmetrical.

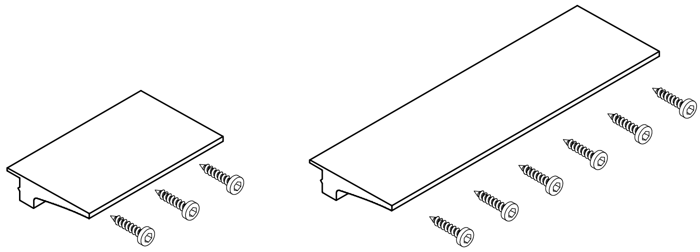
STABALUX

Glass support

9.2
3

Table 14:
GH 6071 & 6072, AK 5010 andAK 6010 bolted on to steel with Hilti cartridge-fired pins





Row	Total glass thickness t_{Glass} for single glazing or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)			
			AK 5010		AK 6010	
			Wall thickness of the profiles t ≤ 2.0 mm		Wall thickness of the profiles t ≤ 2.0 mm	
	Inner seal height		Glass support GH 6071 Width 100 mm	Glass support GH 6072 Width 200 mm	Glass support GH 6071 Width 100 mm	Glass support GH 6072 Width 200 mm
	16,5 mm	mm	kg	kg	kg	kg
1	≤ 24	28,5	**518**	**1330**	**887**	**1330**
2	26	29,5	**504**	**1289**	**858**	**1289**
3	28	30,5	**490**	**1247**	**829**	**1247**
4	30	31,5	**477**	**1206**	**800**	**1206**
5	32	32,5	**465**	**1163**	**770**	**1163**
6	34	33,5	**453**	**1121**	**742**	**1121**
7	36	34,5	**442**	**1080**	**712**	**1080**
8	38	35,5	**432**	**1038**	**683**	**1038**
9	40	36,6	**421**	**997**	**655**	**997**
10	42	37,5	**412**	**956**	**625**	**956**
11	44	38,5	**402**	**913**	**596**	**913**
12	46	39,5	**393**	**871**	**566**	**871**
13	48	40,5	**384**	**830**	**537**	**830**
14	50	41,5	**376**	**788**	**508**	**788**
15	52	42,5	**368**	**747**	**478**	**747**
16	54	43,5	**360**	**704**	**450**	**704**
17	56	44,5	**353**	**662**	**421**	**662**
18	58	45,5	**346**	**621**	**391**	**621**
19	60	46,5	**340**	**556**	**363**	**579**

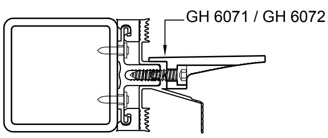
The eccentricity column “e” must be used to calculate the permitted pane weight if the glass structure is asymmetrical.

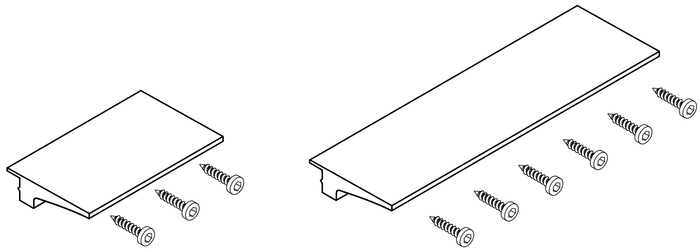
STABALUX

Glass support

9.2
3

Table 15:
GH 6071 & 6072, AK 6020 welded on to steel





Row	Total glass thickness t_{Glass} for single glazing or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)	
			AK 6020	
	Inner seal height		Wall thickness of the profiles t ≤ 3.0 mm	
			Glass support GH 6071 Width 100 mm	Glass support GH 6072 Width 200 mm
	16,5 mm	mm	kg	kg
1	≤ 24	28,5	**1093**	**1452**
2	26	29,5	**1053**	**1404**
3	28	30,5	**1013**	**1358**
4	30	31,5	**973**	**1315**
5	32	32,5	**932**	**1265**
6	34	33,5	**892**	**1219**
7	36	34,5	**852**	**1173**
8	38	35,5	**812**	**1126**
9	40	36,6	**770**	**1080**
10	42	37,5	**730**	**1034**
11	44	38,5	**690**	**987**
12	46	39,5	**638**	**941**
13	48	40,5	**584**	**893**
14	50	41,5	**530**	**847**
15	52	42,5	**476**	**790**
16	54	43,5	**422**	**716**
17	56	44,5	**368**	**644**
18	58	45,5	**314**	**572**
19	60	46,5	**260**	**500**

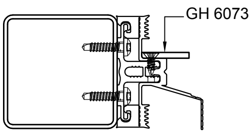
The eccentricity column “e” must be used to calculate the permitted pane weight if the glass structure is asymmetrical.

STABALUX

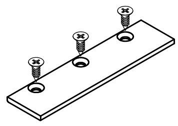
Glass support

9.2
3

Table 16:
GH 6073, AK 5010/AK 6010 attached to steel

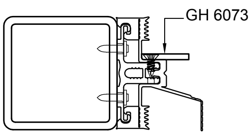


AK 5010/AK 6010 screwed on steel

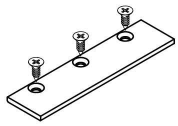


GH 6073

Row	Total glass thickness t_{Glass} for single glazing or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)	
			AK 5010	AK 6010
	Inner seal height		Wall thickness of the profiles t ≤ 2.0 mm	Wall thickness of the profiles t ≤ 2.0 mm
			Glass support GH 6073 Width 100 mm	Glass support GH 6073 Width 100 mm
	16,5 mm	mm	kg	kg
1	≤ 18	25,5	**764**	**832**



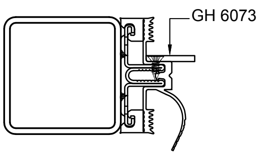
AK 5010/AK 6010 fastened with Hilti fixing bolts



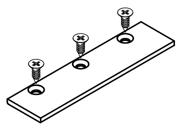
GH 6073

Row	Total glass thickness t_{Glass} for single glazing or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)	
			AK 5010	AK 6010
	Inner seal height		Wall thickness of the profiles t ≤ 4.0 mm	Wall thickness of the profiles t ≤ 4.0 mm
			Glass support GH 6073 Width 100 mm	Glass support GH 6073 Width 100 mm
	16,5 mm	mm	kg	kg
1	≤ 18	25,5	**764**	**832**

Table 17:
GH 6073, AK 6020 welded on to steel



AK 6020 welded on steel



GH 6073

Row	Total glass thickness t_{Glass} for single glazing or symmetrical glass structure	Eccentricity „e“	Permitted pane weight G (kg)
			AK 6020
	Inner seal height		Wall thickness of the profiles t ≤ 3.0 mm
			Glass support GH 6073 Width 100 mm
	16,5 mm	mm	kg
1	≤ 18	25,5	**1006**

STABALUX

Glass support

Table 18:
Sine values

Angle (in °)	Sine	Angle (in °)	Sine	Angle (in °)	Sine	Angle (in °)	Sine	Angle (in °)	Sine
1	0.017	21	0.358	41	0.656	61	0.875	81	0.988
2	0.035	22	0.375	42	0.669	62	0.883	82	0.990
3	0.052	23	0.391	43	0.682	63	0.891	83	0.993
4	0.070	24	0.407	44	0.695	64	0.899	84	0.995
5	0.087	25	0.423	45	0.707	65	0.906	85	0.996
6	0.105	26	0.438	46	0.719	66	0.914	86	0.998
7	0.122	27	0.454	47	0.731	67	0.921	87	0.999
8	0.139	28	0.469	48	0.743	68	0.927	88	0.999
9	0.156	29	0.485	49	0.755	69	0.934	89	1.000
10	0.174	30	0.500	50	0.766	70	0.940	90	1.000
11	0.191	31	0.515	51	0.777	71	0.946		
12	0.208	32	0.530	52	0.788	72	0.951		
13	0.225	33	0.545	53	0.799	73	0.956		
14	0.242	34	0.559	54	0.809	74	0.961		
15	0.259	35	0.574	55	0.819	75	0.966		
16	0.276	36	0.588	56	0.829	76	0.970		
17	0.292	37	0.602	57	0.839	77	0.974		
18	0.309	38	0.616	58	0.848	78	0.978		
19	0.326	39	0.629	59	0.857	79	0.982		
20	0.342	40	0.643	60	0.866	80	0.985		

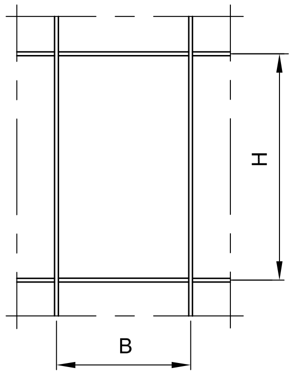
Table 19:
% inclination relative to the angle in °

%	Angle (in °)	%	Angle (in °)	%	Angle (in °)	%	Angle (in °)	%	Angle (in °)
1	0.57	21	11.86	41	22.29	61	31.38	81	39.01
2	1.15	22	12.41	42	22.78	62	31.80	82	39.35
3	1.72	23	12.95	43	23.27	63	32.21	83	39.69
4	2.29	24	13.50	44	23.75	64	32.62	84	40.03
5	2.86	25	14.04	45	24.23	65	33.02	85	40.36
6	3.43	26	14.57	46	24.70	66	33.42	86	40.70
7	4.00	27	15.11	47	25.17	67	33.82	87	41.02
8	4.57	28	15.64	48	25.64	68	34.22	88	41.35
9	5.14	29	16.17	49	26.10	69	34.61	89	41.67
10	5.71	30	16.70	50	26.57	70	34.99	90	41.99
11	6.28	31	17.22	51	27.02	71	35.37	91	42.30
12	6.84	32	17.74	52	27.47	72	35.75	92	42.61
13	7.41	33	18.26	53	27.92	73	36.13	93	42.92
14	7.97	34	18.78	54	28.37	74	36.50	94	43.23
15	8.53	35	19.29	55	28.81	75	36.87	95	43.53
16	9.09	36	19.80	56	29.25	76	37.23	96	43.83
17	9.65	37	20.30	57	29.68	77	37.60	97	44.13
18	10.20	38	20.81	58	30.11	78	37.95	98	44.42
19	10.76	39	21.31	59	30.54	79	38.31	99	44.71
20	11.31	40	21.80	60	30.96	80	38.66	100	45.00

Glass support

Example for the calculation of vertical glazing with an asymmetrical glass structure

The following example is merely an example for the use of the glass supports and does not represent validation of the other components used



Specifications:

Transom profile: Threaded tube, t = 4.0 mm

Mullion-transom joint: welded

Glass pane format:	W x H	= 2.00 m x 3.00 m = 6.00 m²
Glass structure: (bullet-resistant glass, security class FB 4 NS)		
	ti / SZR / ta	= 47 mm / 8 mm / 6 mm
	ti + ta	= 53 mm = 0.053 m
	t_{Glass}	**= 61 mm**

Calculation of the pane weight:

Specific weight of the glass:	γ	≈ 25.0 kN/m³
Pane weight:	**G**	= 6.00 x 25.0 x 0.053 = 7.95 kN **≈ 795 kg**

Calculation of eccentricity „e":

Height of the inner seal:	d	= 5.0 mm
	a1 = 5 + 47/2	= 28.5 mm
	a2 = 5 + 47 + 8 + 6/2	= 63.0 mm
	e = (47 x 28.5 + 6 x 63)/53	**= 32.41 ≈ 32 mm**

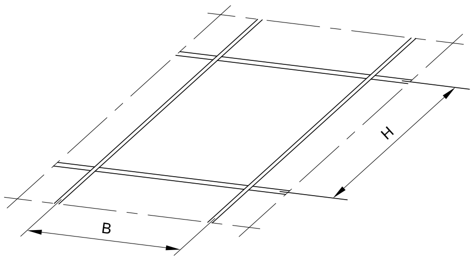
Result:

based on Table 1, row 18: per. G = 856 kg > G = 795 kg	**Welded glass supports | W = 150 mm**
based on Table 2, row 18: per. G = 817 kg > G = 795 kg	**GH 0282 | W = 150 mm**

Glass support

Example for the calculation of vertical glazing with a symmetrical glass structure

The following example is merely an example for the use of the glass supports and does not represent validation of the other components used

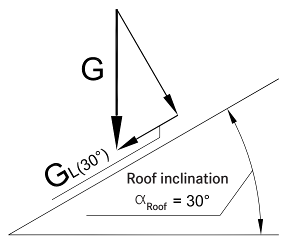


Specifications

Inclination of the roof surface:	α_{Roof}	**= 30 °**
Transom profile: Threaded tube SR 6090-2		
Transom retainer: Steel RHT 9023		
Glass pane format:	W x H	= 2.00 m x 2.50 m = 5.00 m²
Glass structure:	ti / SZR / ta	= 10 mm / 16 mm / 10 mm
	ti + ta	= 20 mm = 0.020 m
	$\mathbf{t_{Glass}}$	**= 36 mm**

Calculation of the pane weight

Specific weight of the glass:	ψ	≈ 25.0 kN/m³
Pane weight:	G	= 5.00 x 25.0 x 0.020 = 2.50 kN ≤ 250 kg
The roof inclination exerts the following load share on the glass support:	$G_{L(30°)}$	= 250 x sin 30 ° = **125 kg**
Calculation of eccentricity „e":		
Height of the inner seal:	d	= 10.0 mm
	e	= 10 + 36/2 = **28 mm**



Result:

based on Table 5, row 14: per. G = 175 kg > $G_{L(30°)}$ = 125 kg	Glass support GH 281 | B = 100 mm
based on Table 6, row 14: per. G = 206 kg > $G_{L(30°)}$ = 125 kg	Glass support GH 282 | B = 150 mm

Demand for tested and approved products

Introduction

Principals, planners and processors demand the use of tested and approved products. Construction laws also demand that the building products satisfy the requirements of the Construction Products List (BRL). Glass facades and glass are defined under technical regulations, including for:

- Stability
- Fitness for purpose
- Thermal insulation
- Fire protection
- Sound insulation

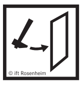
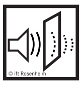
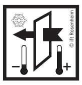
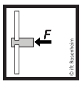
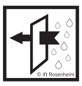
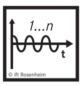
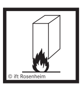
This validation has been provided for Stabalux facades and roofs. Our production sites and suppliers are quality-certified and guarantee excellent product quality. Moreover, Stabalux GmbH continuously monitors its products and provides additional validation of the properties and special functions of its facade systems. Prestigious test centres and institutes support the company in its quality assurance.

- Institut für Fenstertechnik, Rosenheim
- Institut für Stahlbau, Leipzig
- Materialprüfungsamt NRW, Dortmund
- Materialprüfanstalt für das Bauwesen, Braunschweig
- Materials Testing Institute, University of Stuttgart, Stuttgart
- Beschussamt Ulm
- KIT Steel & Lightweight Structures Research Center for Steel, Timber & Masonry, Karlsruhe
- Institut für Energieberatung, Tübingen
- Institut für Wärmeschutz, Munich
- and many more in Europe and overseas.

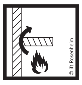
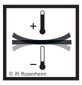
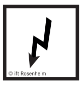
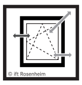
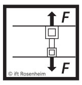
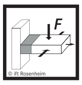
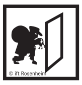
Overview of all tests and approvals

Introduction

The tests we perform help the processor gain access to the market and form the basis for the certifications required by the manufacturer/processor. Their use is only permitted if you have accepted our Terms and Conditions for the Use of Test Reports and Test Certificates. Stabalux will provide these terms and conditions and other templates on request, e.g. declarations of conformity.

Ift Icon	Requirements according to EN 13830	CE	Info
	**Air permeability**	CE	See product passport
	**Driving rain resistance**	CE	See product passport
	**Resistance to wind load**	CE	See product passport
	**Impact resistance** if explicitly required in the CE mark	CE	See product passport
	**Airborne sound insulation** if explicitly required in the CE mark	CE	Refer to Sec. 9
	**Heat transition** Details for U_{cw} value; from the system provider, in-house calculation of U_f values	CE	on request (refer to Sec. 9)
	**Self-weight** according to EN 1991-1-1; must be determined by the manufacturer	CE	by static validation (refer to Sec. 9)
	**Resistance to horizontal loads** The curtain facade must withstand dynamic horizontal loads according to EN 1991-1-1; must be determined by the manufacturer	CE	by static validation
	**Water vapour permeability**	CE	Validation may be necessary in individual cases
	**Durability** no test needed	CE	Information on proper maintenance of the facade
	**Fire resistance** if explicitly required in the CE mark, classification according to EN 13501-2; The European regulations have equal standing and apply in addition to the national regulations (e.g. DIN 4102). Fitness for purpose is still determined based on national regulations. Hence there is no declaration on the CE mark; use general building authorisation as necessary.	CE	
	**Fire behaviour** if explicitly required in the CE mark Validation for all installed materials according to EN 13501-1	CE	

Overview of all tests and approvals

Ift Icon	Requirements according to EN 13830	CE	Info
	**Fire spread** if explicitly required in the CE mark Validation in expert assessments		
	**Thermal shock resistance** if explicitly required in the CE mark Validation by the manufacturer/glass supplier		
	**Potential equalisation** if specifically required in the CE mark (for metal-based curtain walls when mounted on buildings with a height in excess of 25 m)		
	**Seismic safety** If specifically required in the CE mark Validation by the manufacturer		
	**Building and thermal movement** The party organising the tender must specify the building movements, including the movement of the building joints, that the curtain wall will have to carry.		
Ift Icon	**Other requirements**	**CE**	**Info**
	**Dynamic driving rain test** According to ENV 13050		see product passport
	**Proof of fitness for purpose of mechanical connections** **Clamp connection to the attachment** Stabalux threaded tube Stabalux add-on channel		regulated nationally in general building authorisa-tions (abZ); abZ available on request
	**Proof of fitness for purpose of mechanical connection** T-connection mullion/transom Stabalux threaded tube		regulated nationally in general building authorisa-tions (abZ); abZ available on request
	**Burglary-resistant facades** **Resistance class RC2 / RC3** according to DIN EN1627		Test reports and expert assessments on request
	**Bullet resistance** **Facade resistance classes FB3, FB3 NS, FB4, FB4 NS, FB6, FB6 NS** According to DIN EN 15xxx		Validation available on request
Ift Icon	**Miscellaneous**	**CE**	**Info**
	Steel profiles for use in indoor swimming pools		
	other statements with tests completed (material testing / stress testing / compatibility testing)		
Ift Icon	**Fire resistance requirements / national regulations**	**CE**	**Info**
	Fire protection facade Stabalux System SR (threaded tubes) → F30 Stabalux T profile → F30 Stabalux System H (timber) → G30 / F30		regulated nationally in general building authorisa-tions (abZ); abZ available on request

Overview of all tests and approvals

Example of a declaration of conformity for fire protection glazing abZ 19.14-xxxx

Declaration of conformity

- **Name and address of the company that produced the fire protection glazing (object of the approval):**

  ____

  ____

  ____

  ____

- Building site, i.e. building:

  ____

  ____

  ____

  ____

- Date of production: ______________________________

- **Required fire resistance class for the fire protection glazing: F30**

This is to confirm that

- the **fire protection glazing** and all of its components were manufactured, installed and labelled professionally and with adherence to all provisions of the general building authorisation no.: **Z-19.14-xxxx** by DIBt dated ______________ (and any provisions contained in the notifications of changes and additions dated ______________________________),
  and

- that construction products used for the manufacture of the object of this authorisation satisfy the provisions of this general building authorisation and are labelled as required. This applies equally to parts of the object of this approval for which the authorisation may have imposed conditions.

____________________ ____________________

(Place, date) (Company / signature)

(This certification must be submitted to the principal for forwarding to the construction supervision authorities as required.)

Overview of all tests and approvals

Example of an assembly certificate “burglar-resistant facades”

Assembly certificate
according to DIN EN 1627

Company: ....

Address: ....

....

certifies that the burglar-resistant components listed hereafter were installed according to the specification of the assembly instructions (appended with the test report)

in the property: ....

Address: ....

....

.

Part	Location in the property:	Resistance class	Particulars

....
Date Stamp Signature

BauPV / DOP / ITT / FPC / CE

Construction Products Regulation (BauPV)

Regulation (EU) No 305/2011 regarding the harmonisation of construction products was introduced on 1 July 2013, replacing Regulation No 89/106/EEC, which had applied until then.

Regulation 305/2011 defines the terms under which construction products may be “placed on the market” in all European member states. Its ratification in national law is therefore not necessary. The purpose of Regulation 305/2011 is to ensure the safety of structures for humans, animals and the environment. The harmonised standard provides precise definitions of essential performance characteristics, as well as product and test standards for construction products. This ensures largely comparable performance characteristics throughout Europe.

The harmonised standard EN 13830 applies to curtain walls.

Regulation No 89/106 was mainly used to demonstrate to customers that a product conformed to the harmonised European standard. In contrast, Regulation No 305/2011 demands the issue of a Declaration of Performance, which the manufacturer must submit to the customer as assurance of the essential performance characteristics.

Besides the declaration of performance, Regulation No 305/2011 continues to demand, in line with Regulation No 89/106:

- an initial type test (ITT) of the products
- a factory production control (FPC) by the manufacturer
- a CE mark

Declaration of Performance

The declaration of performance (LE, i.e. DoP = Declaration of Performance) under Regulation No 305/2011 replace the declaration of conformity used until now according to Regulation No 89/106. It is the central document with which the manufacturer of the curtain wall accepts responsibility and provides assurances for the conformity of declared performances.

The manufacturer must use this declaration of performance to obtain CE labelling for the facade before it is entitled to place the construction product on the market. The CE mark confirms that a declaration of performance exists. Described properties of the curtain wall are stated in both of these documents, the declaration of performance and the CE mark. The declaration of performance and the CE mark must be unequivocally associated.

Only the manufacturer of the facade is entitled to submit the declaration of performance.

At least one essential characteristic must be stated in the declaration of performance. A dash is added to the corresponding field if one essential characteristic does not apply, but is defined by a limit value. The entry “npd” (no performance determined) is not permitted in these cases.

It is advisable to state the performances as listed in the property’s individual requirement specifications.

A declaration of performance under Regulation No 305/2011 can only be issued once the product has been manufactured, and not during the bidding phase. The declaration of performance must be presented in the language of the member state to which the construction product will be delivered.

The declaration of performance is handed over to the customer.

Declarations of performance must be archived for at least 10 years.

The requirements placed in curtain walls are defined in the harmonised standard EN 13830. All performances relating to the characteristics addressed in this standard must be determined if the manufacturer intends their declaration. This does not apply if the standard contains instructions for the statement of performances without testing (e.g. for the use of existing data, for classification without further testing and for the use of generally acknowledged performance values).

BauPV / DOP / ITT / FPC / CE

Manufacturers are entitled to group their products as families for the purpose of assessment. But this applies only if the findings in regard to one or more characteristic/s of a given product within a family can be considered representative of the same characteristic/s of all products within the same family. Hence, the essential characteristics can be determined using representative test specimens in what is known as the (ITT = Initial Type Test); this is then used as a reference base.

Insofar as the manufacturers procures construction products from a system provider (often called the system distributor), and provided this entity has suitable legal authorisation, the system provider may accept responsibility for the determination of the product type in regard to one or several essential characteristics of an end product that is subsequently manufactured and/or assembled by the processors in their plants. This is predicated on an agreement between the parties. This agreement may be a contract, a license or any other form of written accord that provides an unequivocal assignment of the component manufacturer's responsibility and liability (the system distributor on the one hand, and the company assembling the end product on the other). In this case, the system distributor must subject the "assembled product", consisting of components that it or another party has manufactured, to a determination of product type and must thereafter present the test report to the manufacturer of the product that is actually placed on the market.

The findings of the determination of product type must be documented in test reports. The manufacturer must keep all test reports for at least 10 years following the data of final manufacture of the curtain wall kit to which the report refers.

[Initial Type Test = ITT]

An initial type test (ITT) involves the determination of product characteristics according to the European product standard for curtain walls, EN 13830. The initial type test can be performed on representative test specimens by means of measurement, calculation or another method described in the product standard. It is usually acceptable in this respect to perform the initial type test on a representative element of the product family to determine one or more performance characteristics.

The manufacturer must commission accredited test institutes to conduct initial type tests. The details are defined in the product standard EN 13830. Any deviations from the tested element are the responsibility of the manufacturer and must not lead to a deterioration of the performance characteristics.

The European Commission allows the system providers to perform this initial type test on their own systems as a service, and to submit the findings to their customers for use in the declaration of performance and in the CE mark.

Initial type tests have been performed on the individual Stabalux systems to determine the product characteristics. The manufacturer (e.g. metal worker) is entitled, under certain conditions (e.g. use of the same components, incorporation of the processing guidelines in the factory production control, etc.), to use the initial type test made available by the system provider.

The following conditions are defined for the submission of test certificates to the processor:

- The product is manufactured using the same components with identical characteristics as the test specimen presented in the initial type test.
- The processor carries the full responsibility for conformity with the system provider's processing guidelines and for the correct manufacture of the construction product placed on the market.
- The system provider's processing guidelines are integral elements of the factory production control applied by the processor (manufacturer).
- The manufacturer is in possession of the test reports with which it carries out CE marking of its products, and is entitled to use these reports.
- The manufacturer must commission a notified body with the testing insofar as the tested product is not representative of the product that is placed on the market.

The processor may only use the test certificates if it has entered into an agreement with the system provider, in which the processor undertakes to use the elements in accordance with the processing instructions and only in connection with the articles defined by the system provider (e.g. material, geometry).

BauPV / DOP / ITT / FPC / CE

9.3
3

Factory production control

[Factory Production Control = **FPC**]

The manufacturer/processor is obliged to establish a system of factory production control (FPC) in its plants in order to ensure that the identified performance characteristics stated in the test reports in reference to the products are adhered to.

It must install operating procedures and work instructions that systematically define all data, requirements and regulations that concern the products. Moreover, a responsible person must be appointed for the production facility, and this person must be suitably qualified to check and the confirm the conformity of the manufactured products.

The manufacturer/processor must provide suitable test equipment and/or devices for this purpose.

The manufacturer/processor must perform the following steps in the factory production control (FPC) for curtain walls (without fire and smoke resistance requirements) in accordance with EN 13830:

Establishment of a documented production control system that is suitable for the product type and the production conditions

- Review that all necessary technical documents and processing instructions are available
- Definition and validation of raw materials and components
- In-process control and examinations in the frequency defined by the manufacturer
- Review and examinations of finished products/components in the frequency defined by the manufacturer
- Description of measures to be undertaken in the event of non-conformity (corrective measures)

The results of the factory production control (FPC) must be documented, assessed and archived, and must contain the following data:

- Product designation (e.g. construction project, precise specification of the curtain facade)
- Documents or references to technical records and processing guidelines as required
- Test methods (e.g. statement of the work stages and test criteria, documents and samples)
- Test findings and comparison with the requirements as necessary
- Measures to be undertaken in the event of non-conformity as necessary
- Date of product completion and date of product testing
- Signature of the investigator and the person responsible for factory production control

The records must be kept for a period of 5 years.

The following applies to companies certified according to DIN EN ISO 9001: this standard will only be recognised as an FPC system if it is adjusted to satisfy the requirements of the product standard EN 13830.

CE mark

A CE mark may only be awarded if there is a declaration of performance. The CE mark may only list performances that were also declared in the declaration of performance. Any characteristics declared as “npd” or “–” in the declaration of performance must not be listed on the CE mark.

The product standard does not require that all components of the curtain wall are designated and marked individually. The CE mark must be easily legible, of a sufficient size and attached to the facade permanently. Alternatively, the mark can be attached to the accompanying documents.

Only the manufacturer of the facade is entitled to issue the CE mark.

Note:
The statements above only apply to glazing without fire-resistance properties. The manufacturer must submit an EU Declaration of Conformity issued by an external certification body for fire-resistant glazing.

BauPV / DOP / ITT / FPC / CE

9.3
3

CE mark template

CE		CE mark, comprising the “CE” logo
Facade Construction John Doe John Doe Street 1 12345 John Doe City		Name and registered address of the manufacturer or logo (DoP item 4)
13		The last two numerals of the year in which the mark was first attached
Germany		
Stabalux (System)		Product’s clear identification code (DoP item 1)
LE/DoP no.: 001/CPR/01.07.2013		Reference number of the declaration of performance
EN 13830		Number of the applied European standard as stated in the EU Official Journal (DoP item 7)
Assembly set for curtain facades for use outdoors		Intended purpose of the product as stated in the European standard (DoP item 3)
Fire behaviour	npd	Level or class of stated performance **(Do not declare higher performance characteristics than required in the specifications!)** (DoP item 9)
Fire resistance	npd	
Fire spread	npd	
Driving rain resistance	RE 1650 Pa	
Resistance to self-weight	000kN	
Resistance to wind load	2.0 kN/m²	
Impact resistance	E5/I5	
Thermal shock resistance	ESG	
Resistance to horizontal loads	000kN	
Air permeability	AE	
Heat transition coefficient	0.0 W/(m²K)	
Airborne sound insulation	0.0 dB	
First tests conducted and classification reports prepared by: **ift Rosenheim NB no. 0757**		Identification number of the certified test laboratory (DoP item 8)

BauPV / DOP / ITT / FPC / CE

Declaration of performance template

Declaration of Performance			
LE/DoP no.: 021/CPR/01.07.2013			
1.	Product's identification code:		Stabalux (System)
2.			from the manufacturer
3.	Intended purpose:		Assembly set for curtain facades for use outdoors
4.	Manufacturer		Facade Construction John Doe John Doe Street 1 12345 John Doe City
5.	Authorised person:		./.
6.	System or system requiring assessment of constancy of performance:		3
7.	Harmonised standard:		EN 13830:2003
8.	Notified body:		Ift Rosenheim NB no. 0757 conducted the first tests as notified test laboratory in conformity system 3 and thereupon issued the test and classification reports.
9.	Essential characteristics:		
Essential characteristic: (Section EN 13830)		Performance	**Harmonised technical specification**
9.1	Fire behaviour (Sec. 4.9)	npd	EN 13830:2003
9.2	Fire resistance (Sec. 4.8)	npd	
9.3	Spread of fire (Sec. 4.10)	npd	
9.4	Driving rain resistance (Sec. 4.5)	RE 1650 Pa	
9.5	Resistance to self-weight (Sec. 4.2)	npd	
9.6	Resistance to wind load (Sec. 4.1)	2.0 KN/m²	
9.7	Impact resistance	E5/I5	
9.8	Thermal shock resistance	npd	
9.9	Resistance to horizontal loads	npd	
9.10	Air permeability	AE	
9.11	Heat transition	U_f = 0.0 W/m²K	
9.12	Airborne sound insulation	0.0 dB	
10.	The performance of the product according to Numbers 1 and 2 corresponds to the declared performance according to Number 9.		

Exclusively the manufacturer according to number 4 is responsible for preparing the Declaration of Performance.
Signed for and on behalf of the manufacturer by:

John Doe City, 01/07/2013 ppa. Joh Doe, Management

DIN EN 13830 / Explanations

Definition of a curtain wall

EN 13830 defines the "curtain wall" to mean:

"[...] usually consists of vertical and horizontal structural members, connected together and anchored to the supporting structure of the building and infilled, to form a lightweight, space enclosing continuous skin, which provides, by itself or in conjunction with the building construction, all the normal functions of an external wall, but does not take on any of the load bearing characteristics of the building structure."

The standard applies to curtain facades that are parallel to the vertical structure of the building surface, to those that deviate from the vertical by up to 15°. Inclined glazing elements included in the curtain facade may be enclosed.

Curtain facades (mullion-transom constructions) are comprised of a number of components and/or prefab units that are not assembled to create a finished product until they reach the building site.

Properties, i.e. controlled characteristics in EN 13830

The purpose of the CE mark is to ensure adherence to basic safety requirements placed in the facade and to enable free traffic of goods in Europe. The product standard EN 13830 defines and regulates the essential characteristics of these basic safety requirements as mandated properties:

- Resistance to wind load
- Self-weight
- Impact resistance
- Air permeability
- Driving rain resistance
- Airborne sound insulation
- Heat transition
- Fire resistance
- Fire behaviour
- Fire spread
- Durability
- Water vapour permeability
- Potential equalisation
- Seismic safety
- Thermal shock resistance
- Building and thermal movement
- Resistance to dynamic horizontal loads

So-called initial type testing must be performed in order to validate the essential characteristics. They are performed either by the notified body (e.g. ift Rosenheim) or by the manufacturer (processor), depending on the specific characteristic type. Other requirements may apply to characteristics in specific properties, which then must be validated also.

The method applied to perform the testing and the type of classification are defined in product standard EN 13830, which makes frequent references to European standards. In some case the product standard itself defines the test methods.

The characteristics and their significance

The requirements are defined in the product standard DIN EN 13830. The following contains excerpts or summaries.

The excerpts are taken from the German version of the currently valid standard, DIN EN 13830-2003-11. The draft standard prEN 13830 was published in its German version in June 2013. Besides editing, the document was revised thoroughly from a technical perspective as well, which means that the following passages will need to be checked and may require revision once the standard has been introduced.

Resistance to wind load

"Curtain walls must be sufficiently stable to withstand the positive and negative wind loads applied during a test according to DIN E 12179 and upon which planning for the fitness for purpose is based. They must safely transmit the wind loads underlying the planning to the building structure by way of the fastening elements installed for this purpose. The wind loads underlying the planning are stated in the test according to EN 12179.
During exposure to the wind loads underlying the plan-

DIN EN 13830 / Explanations

ning, the maximum frontal deflection of the individual parts of the curtain wall frame between the support, i.e. anchor points, must not exceed L/200, i.e. 15, during a measurement according to EN 13116, depending on which is the smaller value."

The rated value for the CE mark is expressed in the unit [kN/m²].

We would like to point out that static validation for the specific property must be provided for each curtain wall system, regardless of the initial type testing.
It is also important to point out that the new draft standard intends to introduce an entirely new provision in regard to fitness for purpose, which will affect the dimensioning of the mullion-transom construction significantly.

$f \leq L/200$;	if ℓ = 3000 mm
$f \leq 5$ mm + $L/300$;	if 3000 mm < L < 7500 mm
$f \leq L/250$;	if ℓ = 7500 mm

This change in deformation limitation means that there may be different limits applicable to an infill (e.g. glass, composite insulation, etc.) and greater utilisation of the profile in terms of loadbearing capacity.

Self-weight
"Curtain walls must carry their own weight and all other connected pieces included in the original planning. They must safely transmit the weight to the building structure by way of the fastening elements installed for this purpose.

Self-weight must be determined according to EN 1991-1-1.

The maximum deflection of any horizontal primary beam due to vertical loads must not exceed L/500, i.e. 3 mm, depending on which is the smaller value."

The rated value for the CE mark is expressed in the unit [kN/m²].

We would like to point out that static validation for the specific property must be provided for each curtain wall system, regardless of the initial type testing.

The 3mm limit is deleted from the draft standard. It is nevertheless necessary to guarantee that any contact between the frame and the infill element is prevented in order to provide sufficient ventilation as necessary. Moreover, the required inset depth of the infill must also be guaranteed.

Impact resistance
"If demanded explicitly, tests must be performed according to EN 12600:2002, Part 5. The findings must be classified according to prEN 14019. The glass products must correspond to EN 12600."

The impact resistance class is determined internally and externally for the CE mark. The head in [mm] of the pendulum is used to define the class (e.g. class I4 for internal, class E4 for external).

A pendulum is caused to impact with critical points of the facade construction (central mullion, central transom, intersection between mullion/transom, etc.) from a certain height for the purpose of this test. Permanent deformation of the facade is permitted. But falling parts, holes or cracks are prohibited.

Air permeability
"Air permeability must be tested according to DIN EN 12153. The findings must be presented according to EN 12152."

The air permeability class is determined using the test pressure in [Pa] for the CE mark (e.g. class A4).

Watertightness
"Watertightness must be tested according to DIN EN 12155. The findings must be presented according to EN 12154."

The watertightness class is determined using the test pressure in [Pa] for the CE mark (e.g. class R7).

DIN EN 13830 / Explanations

Airborne sound insulation $R_w(C; C_{tr})$
"If demanded explicitly, the sound insulation level must be determined according to EN ISO 140-3. The findings must be presented according to EN ISO 717-1."

The rated value for the CE mark is expressed in the unit [dB].

Validation must be provided for each property.

Heat transmittance U_{cw}
"The method of assessing/calculating the heat transmittance of curtain walls and the suitable test methods are defined in prEN 13947."

The rated value for the CE mark is expressed in the unit [W/(m²·K)].

The U_{cw} value is dependent on the heat transfer coefficient U_f of the frame (mullion-transom construction of the facade) on the one hand, and on the heat transfer coefficient of the inset elements, for instance glass and its U_g value, on the other. Other factors also contribute, e.g. the edge bonding of the glass, etc., and the geometry (axis dimensions, number of mullions and transoms in the facade construction). The manufacturer/processor must validate the heat transfer coefficient U_{cw} in calculations or measurements. The system provider can also be requested to submit in-house calculations of the U_f values.

Validation must be provided for each property.

Fire resistance
"If demanded explicitly, the proof of fire resistance according to prEN 13501-2 must be classified."

The class of fire resistance for the CE mark is determined according to the function (E = integrity; EI = integrity and insulation), the direction of fire and the duration of fire resistance in [min] (e.g. class EI 60, i ↔ o).

However, there is no harmonised standard currently available, and it is therefore not possible to make a declaration in the CE
mark ("npd" = no performance determined).

The national system of "general building authorisation for fire resistance glazing" will therefore remain in this case, although it is not declared in the CE mark.

Fire spread
"If demanded explicitly, the curtain wall must include suitable devices that inhibit the spread of fire and smoke through openings in the curtain wall construction by means of the installation of structural base plates on the connections in all levels."

Validation must be provided for each property, for instance in the form of an expert assessment.

Durability
"The permanence and performance characteristics of the curtain wall are not tested; instead the testing refers to the level of correspondence between the materials and surfaces with what is considered state-of-the-art, or with European specifications for the materials or surfaces, insofar as they have been published."

The user must maintain and service the individual components of the facade in response to the natural ageing process. The manufacturer/processor must provide the user with suitable instructions for professional implementation (e.g., the facade should be cleaned regularly in order to safeguard its designated service life, etc.). It appears sensible in this respect for the manufacturer and user to conclude a maintenance contract.
Product instructions or relevant leaflets, e.g. published by VFF, must be observed in this respect.

Water vapour permeability
"Vapour barriers according to the relevant European standards must be included in order to control the defined and ascertained hydrothermal conditions in the building."

Validation must be provided for each property. There is no specific description of performance for this feature; hence, no accompanying information on the CE mark is necessary.

DIN EN 13830 / Explanations

Potential equalisation
“Watertightness must be tested according to DIN EN 12155. The findings must be presented according to EN 12154.”

Validation must be provided for each property; it is declared in SI units [Ω].

Seismic safety
“If necessary in the specific case, the seismic safety mist be determined according to the Technical Specifications or other requirements defined for the location of use.”

Validation must be provided for each property.

Thermal shock resistance
“A suitable glass, e.g. hardened or pre-tensioned glass according to European standards, must be used insofar as the glass is required to exhibit resilience to temperature fluctuation.”

Validation must be provided for each property and refers exclusively to the glass installed in the property.

Building and thermal movement
“The design of the curtain wall must be capable of absorbing thermal movements and movements of the structure in such a way that destruction of facade elements or impairment of the performance characteristics do not occur. The party organising the tender must specify the building movements, including the movement of the building joints, that the curtain wall will have to carry.”

Validation must be provided for each property.

Resistance to dynamic horizontal loads
The curtain wall must withstand dynamic horizontal loads at the level of the sillpiece according to EN 1991-1-1.”

Validation must be provided for each property, and can be verified by way of static validation produced by calculation. It is important to consider in this respect that the height of the sillpiece will vary under national regulations. The value is expressed in [kN] at height (H in [m]) of the sillpiece.

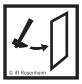
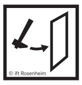
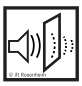
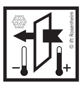
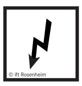
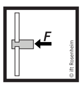
DIN EN 13830 / Explanations

Classification matrix

The table shown in the following contains classifications of the characteristics for curtain walls according to EN 13830 Part 6:

Note
It is not necessary to determine the performance of a component if this performance is irrelevant to its use. In this respect, the manufacturer/processor merely adds "npd – no performance determined" in the accompanying papers; alternatively, the characteristics can also be omitted. This option does not apply to limit values.

The classification of characteristics for the curtain wall according to the aforementioned specifications must take place for each structure individually, irrespective of whether the system is standard or was produced specifically for the project.

No.	Ift Icon	Designation	Units	Class or rated value	
1		**Resistance to wind load**	kN/m²	npd	Rated value
2		**Self-weight**	kN/m²	npd	Rated value
3		**Impact resistance** inside with head in mm	(mm)	npd	I0 | I1 | I2 | I3 | I4 | I5 – | 200 | 300 | 450 | 700 | 950
4		**Impact resistance** outside with head in mm	(mm)	npd	E0 | E1 | E2 | E3 | E4 | E5 – | 200 | 300 | 450 | 700 | 950
5		**Air permeability** with test pressure Pa	(Pa)	npd	A1 | A2 | A3 | A4 | AE 150 | 300 | 450 | 600 | > 600
6		**Watertightness** with test pressure Pa	(Pa)	npd	R4 | R5 | R6 | R7 | RE 150 | 300 | 450 | 600 | > 600
7		**Airborne sound insulation** Rw (C; Ctr)	dB	npd	Rated value
8		**Heat transition U_{cw}**	W / m²k	npd	Rated value
9		**Fire resistance** Integrity (E)	(min)	npd	E | E | E | E 15 | 30 | 60 | 90
10		**Integrity and insulation (EI)**	(min)	npd	EI | EI | EI | EI 15 | 30 | 60 | 90
11		**Potential equalisation**	Ω	npd	Rated value
12		**Resistance to lateral wind load**	kN at m height of the parapet bar	npd	Rated value

Surfaces with corrosion protection

Surfaces properties and corrosion protection

Mullion and transom facades usually receive a coloured coating for aesthetic reasons and to provide corrosion protection. Factory-side galvanization is used to improve the corrosion protection of Stabalux system profiles where necessary. There are four different ways of providing corrosion protection if one takes a closer look at the surfaces of system profiles.

1. Colour coating on steel with strip-galvanized surface – duplex systems (e.g. Stabalux threaded tubes)

2. Colour coating on steel with dip-galvanized surface – duplex system

3. galvanized surface without colour coating

4. Colour coating on steel with non-galvanized surface (e.g. Stabalux T profile)

Corrosiveness categories are defined in DIN EN ISO 12944 based on analyses of susceptibility to corrosion. The categories C1 to C5 describe the corrosion rates of zinc coatings when exposed to stress of varying degrees (see Fig. 1).

Use in indoor swimming pools

Stabalux threaded tubes can be used in indoor swimming pools, provided a duplex system is applied for corrosion protection.
An expertise has been published in this regard by Institut für Stahlbau Leipzig GmbH, entitled "Corrosion protection expertise for use of the Stabalux glass facade system in indoor swimming pools". We will gladly provide the document on request.

Corrosiveness category	Typical environment inside	Typical environment outside	Corrosion load	Average zinc corrosion
C 1	Heated building with neutral atmosphere, e.g. offices, shops, schools, hotels		insignificant	≤ 0.1 µm/a
C 2	Heated buildings in which condensation may gather, e.g. warehouses, sports halls	Heated buildings in which condensation may gather, e.g. warehouses, sports halls	low	> 0.1 to 0.7 µm/a
C 3	Production facilities with high humidity and some air contamination, e.g. food production systems, laundries, breweries, dairy farms	Urban and industrial atmosphere, moderate contamination with sulphur dioxide. Coastal areas with low salt contamination.	moderate	> 0.7 to 2.1 µm/a
C 4	Chemical facilities, swimming pools, boathouses above salt water	Industrial and coastal areas with moderate salt contamination	high	> 2.1 to 4.2 µm/a
C 5 -1	Buildings or areas with virtually permanent condensation and severe contamination.	Industrial areas with high humidity and an aggressive atmosphere.	very high (industry)	> 4.2 to 8.4 µm/a
C 5 - M	Buildings or areas with permanent condensation and severe contamination.	Coastal and offshore areas with high salt contamination	very high (maritime)	> 4.2 to 8.4 µm/a

Diagram: Excerpt from the brochure 'Duplex systems for corrosion protection' by Institut Feuerverzinken GmbH

Surfaces with corrosion protection

Duplex systems

DIN EN ISO 12944-5 define duplex systems as a "corrosion protection system comprising galvanization combined with one or several subsequent coatings." Both corrosion protection systems are ideal complements.

The protective effects of a duplex system are generally far longer than those of the individual coatings applied in the two systems. This is described as a synergy effect. Depending on the system, the consequent extension ranges between the factor 1.2 and 2.5.

The synergy effect associated with duplex systems provides the best conditions for the longest possible protection. But the relevant standards do not always provide helpful information in regard to the length of protection provided by these combined systems.

For instance, it is important to consider in this regard that DIN EN ISO 12944-5 merely describes the length of protection provided by the colour coating and not the length of protection afforded by the system as a whole.

The total length of protection is many times the values expressed in DIN EN ISO 12944-5 (see Fig.2). Modern duplex systems based on coatings according to DIN EN ISO 12944-5, i.e. zinc coatings according to DIN EN ISO 1461 usually provide corrosion protection for significantly longer than 15 years, and for over 50 years in some instances. This is due to the improved performance capabilities of these systems, but also to the reduced corrosive effects of the ambient atmosphere, which are standardised in DIN EN ISO 1944-2.

Batch galvanizing Surface preparation		Base coat(s)			Top coat(s), including intermediate coats (1st top coat)			Coating system		Expected duration of protection (refer to ISO 12944-1)														
R	SW	Bonding agent	Number of coats	Target coat thickness µm	Bonding agent	Number of coats	Target coat thickness µm	Number of coats	Total Target coat thickness µm	Corrosiveness category C2 K	C2 M	C2 L	C3 K	C3 M	C3 L	C4 K	C4 M	C4 L	C5-1 K	C5-1 M	C5-1 L	C5-M K	C5-M M	C5-M L
		PCV	-	-	PCV	1	80	1	80															
		PCV	1	40	PCV	1	80	2	120															
		PCV	1	80	PCV	1	80	2	160															
		PCV	1	80	PCV	2	160	3	240															
		AY	-	-	AY	1	80	1	80															
		AY	1	40	AY	1	80	2	120															
		AY	1	80	AY	1	80	2	160															
		AY	1	80	AY	2	160	3	240															
		-	-	-		1	80	1	80															
		-	-	-		2	120	2	120															
		EP	1	40		1	80	2	120															
		EP comb.	1	40		1	80	2	120															
		AY Hydro	1	40		1	80	2	120															
		-	-			2	160	2	160															
		EP	1	80		1	80	2	160															
		EP comb.	1	80		1	80	2	160															
		AY Hydro	1	80		1	80	2	160															
		-	-	-	EP	1	80	2	160															
					comb.+ PUR	1	80																	
		EP	1	80	EP or PUR	2	160	3																
		EP comb.	1	80	EP or PUR	2	160	3																
		AY Hydro	1	80	EP or PUR	2	160	3																

Examples of duplex systems with liquid coating substances (batch galvanization + coating)
Explanation: R=Clean, Sw=Sweep-blast, K=Short 2-5 years, M=Medium 5-15 years, L=Long >15 years

Diagram: Excerpt from the brochure 'Duplex systems for corrosion protection' by Institut Feuerverzinken GmbH

Introduction

Miscellaneous

The facade is an interface between inside and outside. It is frequently compared with the human skin that possesses the ability to respond spontaneously to external influences. A facade works in a similar way: it guarantees a comfortable environment for users inside the building, while positively influencing the building's energy management. The climactic conditions are crucial in this respect. The selection and design of a facade is therefore strongly dependent on its geographic location.

A planned facade must satisfy minimum heat insulation requirements according to the generally acknowledged rules of engineering if it is to be erected in line with the Building Energy Act (GEG) and DIN 4108 Thermal insulation and energy economy in buildings. This is because heat insulation affects the building and its users:

- the health of its users, e.g. by providing a hygienic atmosphere
- protection of the structural integrity against the climate-related effects of humidity and its follow-on damage
- energy consumption for heating and cooling
- and therefore the costs and climate protection

Particularly strict requirements are defined for heat insulation installed on facades in today's age of climate change. As a rule: A building will consume less energy and will therefore cause less environmental pollution due to CO_2 emissions if it possesses better structural heat insulation.

The entire facade and all of its components must be optimised in order to achieve ideal heat insulation, with low heat losses in winter and a salubrious room climate in the summer. This involves, for example, the use of suitable materials to reduce heat transmittance, the mounting of heat-insulated frame constructions or the installation of insulating glass. Important criteria in the planning phase therefore include the overall energy transmittance of glazing, depending on the size and orientation of the windows, the heat storage capacity of individual components and sun protection measures.

The glass thickness, the glass inset and the use of insulating blocks exert the largest influence on determination of the U_f values (heat transfer coefficient of the frame profiles). The Stabalux SR system can achieve U_f values of up to 0.62 W/(m²K). Even when the influence of screws is considered, the values remain excellent at U_f ≤ 1.0 W/(m² K).

Standards

Index of applicable standards and regulations

GEG	Law on saving energy and using renewable energies to generate heat and cold in buildings. (8 Aug 2020).
DIN 4108-2:	2013-02, Thermal protection and energy economy in buildings - Part 2:Minimum requirements to thermal insulation
DIN 4108-3:	2001-07, Thermal protection and energy economy in buildings - Part 3:Protection against moisture subject to climate conditions; Requirements and directions for design and construction
DIN 4108	Annex 2:2006-03, Thermal insulation and energy economy in buildings - Thermal bridges - Examples for planning and performance
DIN 4108-4:	Thermal protection and energy economy in buildings - Protection against heat and moisture, technical parameters
DIN EN ISO 10077-1:	2010-05, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1:Miscellaneous
DIN EN ISO 10077-2:	2012-06, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2:Numerical methods for frames
DIN EN ISO 12631:	2013-01, Thermal performance of windows and doors - Determination of thermal transmittance U_{cw}
DIN EN 673:	2011-04, Glass in building - Determination of thermal transmittance U_g
DIN EN ISO 10211:	2008-04, Thermal bridges in building construction - Heat flows and surface temperatures - Part 1: Detailed calculations (ISO 10211_2007); German version of EN ISO 10211:2007
DIN EN ISO 6946:	2008-04, Thermal resistance and thermal transmittance - Calculation method
DIN 18516-1:	2010-06, Cladding for external walls, ventilated at rear - Part 1: Requirements, principles of testing

Basis of the calculation

Definitions:

U - heat transfer coefficient

(also known as the thermal insulation value, U value, previously the k value) is a unit describing the transmittance of thermal energy through a single or multi-layer material when different temperatures prevail on either side. It states the power (so the volume of energy per time unit) that passes through a surface of 1 m² if the stationary air temperature on both sides differs by 1 K. Its SI unit is therefore:

W/(m²·K) (watts per square metre and kelvin).

The heat transfer coefficient is a specific parameter relating to a component. It is determined largely by the thermal conductivity and thickness of the material in use, but also by the heat radiation and convection on the surfaces.
Note: Measurement of the thermal transfer coefficient requires stationary temperatures to prevent any falsification of the measurement findings by the heat storage capacity of the material.

- The higher the heat transfer coefficient, the worse the heat insulation properties of the material.

λ

Thermal conductivity of a material

U_f value

The U_f value is the heat transfer coefficient of the frame. The f stands for frame. To calculate the U_f value, the window pane is replaced with a panel exhibiting: λ=0.035 W/(m·K).

U_g value

The U_g value is the heat transfer coefficient of the glazing.

U_p value

The U_p value is the heat transfer coefficient of the panel.

U_w value

The U_w value is the heat transfer coefficient of the window, comprising the $U_f$value of the frame and the U_g value of the glazing.

U_{cw} value

The U_{cw} value is the heat transfer coefficient of a curtain wall.

$\Psi_{f,g}$ value

Length-based heat transfer coefficient of the edge bonding (combination of frame and glazing).

Rs

The heat transfer resistance Rs (previously: 1/α) describes the resistance with which the border layer opposes the medium (usually air) surrounding the component to prevent the flow of heat.

Basis of the calculation

Definitions:

Rsi

Heat transfer resistance inside

Rse

Heat transfer resistance outside

Tmin

Minimum inside surface temperature to determine the absence of condensation on window connections. The Tmin of a component must be greater than the component's dew point.

f_{Rsi}

Used to determine the freedom of fungal growth on window connections.
The temperature factor f_{Rsi} is the difference between the temperature of the inside surface θsi of a component and the outside air temperature θe, relative to the temperature difference between the inside θi and outside air θe.

A variety of requirements must be adhered to in order to introduce design measures to reduce the risk of fungal growth.

For instance, for all constructive, shape-related and material-related thermal bridges that deviate from DIN 4108-2, the temperature factor f_{Rsi} at the least favourable point must satisfy the minimum requirement:
$f_{Rsi} \geq 0.70$.

Basis of the calculation

Calculated according to DIN EN ISO 12631

- Simplified assessment procedure
- Assessment of the individual components

Symbol	Size	Unit
A	Surface	m^2
T	Thermodynamic temperature	K
U	Heat transition coefficient	$W/(m^2 \cdot K)$
ℓ	Length	m
d	Depth	m
Φ	Heat flow	W
ψ	length-based heat transfer coefficient	$W/(m \cdot K)$
Δ	Difference	
Σ	Sum	
ε	emission level	
λ	thermal conductivity	$W/(m \cdot K)$
Indices		
g	Glazing	
p	Panel	
f	Frame	
m	Mullion	
t	Transom	
w	Window	
cw	Curtain wall	
Caption		
U_g, U_p	Heat transfer coefficient of fillings	$W/(m^2 \cdot K)$
U_f, U_t, U_m	Heat transfer coefficient of frame, mullion, transom	$W/(m^2 \cdot K)$
A_g, A_p	Surface proportion of filling	m^2
A_f, A_t, A_m	Surface proportions of frame, mullion, transom	
$\Psi_{f,g}$, $\Psi_{m,g}$, $\Psi_{t,g}$, Ψ_p	Length-based heat transfer coefficient based on the combined thermal effects between the glazing, panels and frames - mullion/transom	$W/(m \cdot K)$
$\Psi_{m,f}$, $\Psi_{t,f}$	Length-based heat transfer coefficient based on the combined thermal effects between the frames - mullion/transom	$W/(m \cdot K)$

Basis of the calculation

Assessment of the individual components

The method to assess the individual components involves dividing a representative element into surfaces with different thermal properties, e.g. glazing, opaque panels and frames. (...)
This method can be applied to curtain facades, e.g. element facades, mullion-transom facades and dry glazing. The method with assessment of the individual components is not suitable for SG glazing with silicone joints, rear-ventilated facades and SG glazing.

Formula

$$U_{cw} = \frac{\Sigma A_g U_g + \Sigma A_p U_p + \Sigma A_m U_m + \Sigma A_t U_t + \Sigma \ell_{fg} \Psi_{fg} + \Sigma \ell_{mg} \Psi_{mg} + \Sigma \ell_{tg} \Psi_{tg} + \Sigma \ell_p \Psi_p + \Sigma \ell_{mf} \Psi_{mf} + \Sigma \ell_{tf} \Psi_{tf}}{A_{cw}}$$

Calculation of the facade surface

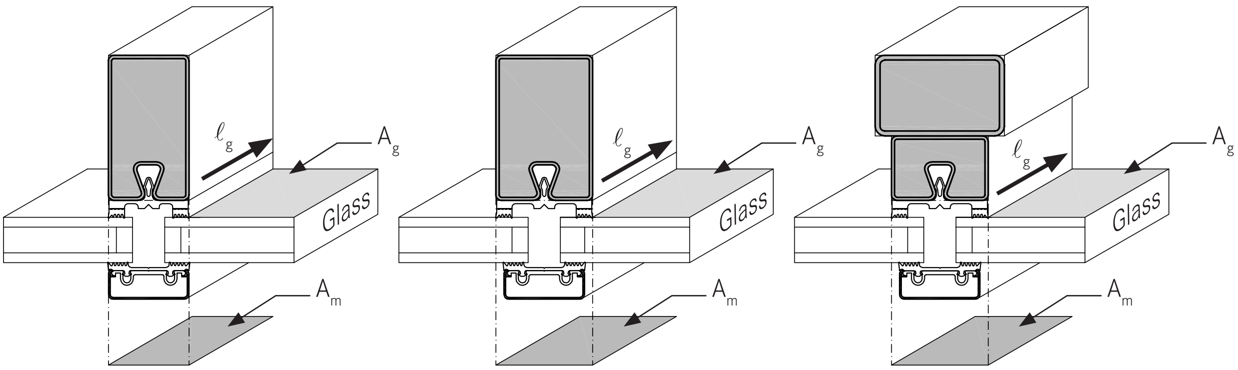
$$A_{cw} = A_g + A_p + A_f + A_m + A_t$$

Basis of the calculation

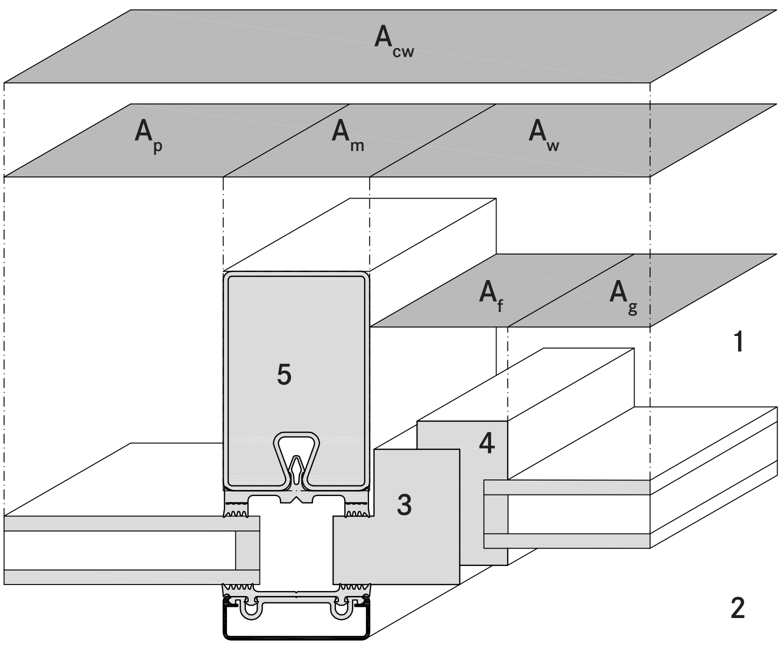
9.4
3

Glazed surfaces

The glazed surface A_g, i.e. the surface of the opaque panel A_p on a component, is the smaller of the surfaces visible on both sides. The areas in which the sealant overlaps the glazed surfaces is not considered.



Surface proportion of the frame, mullion and transom



Caption

1 Room-side
2 Outer side
3 Fixed frame
4 Movable frame
5 Mullion/transom

A_{cw} Surface of the curtain wall
A_p Surface of the panel
A_m Surface of the mullion
A_f Surface of the window
A_g Surface of the glazing
A_m Surface of the mullion

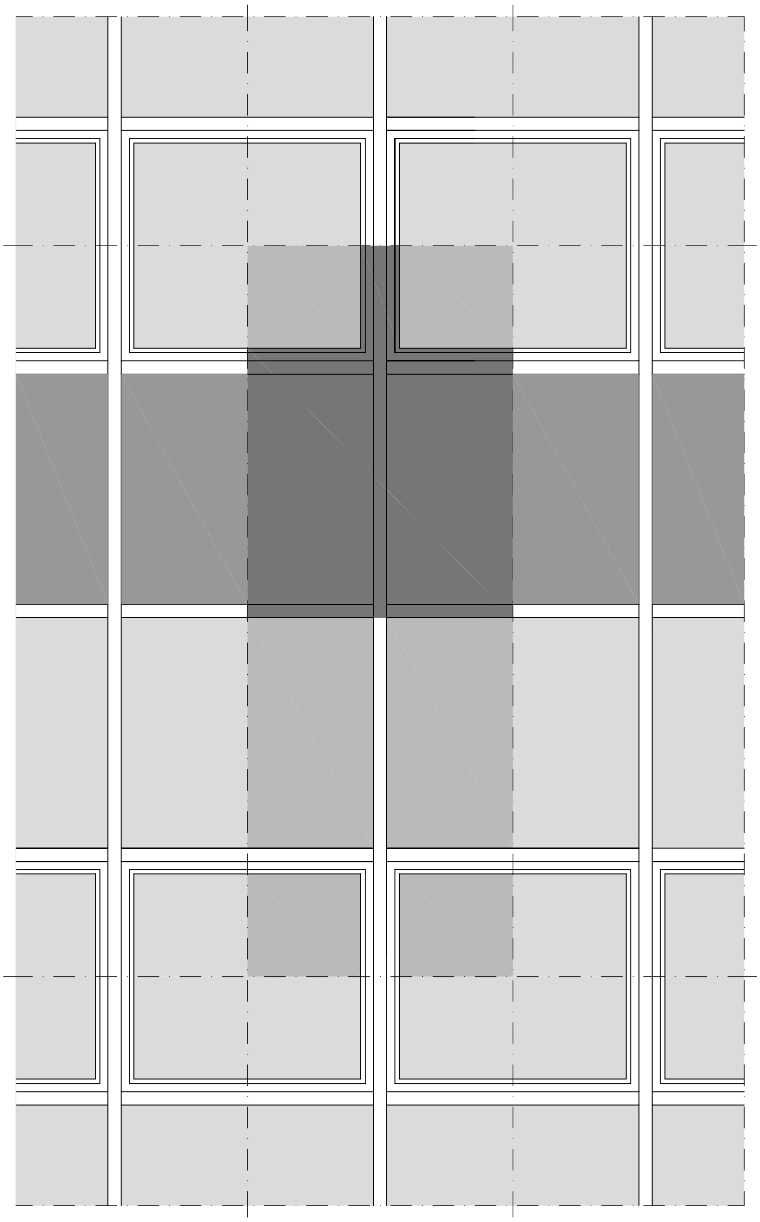
TI-S_9.4_001.dwg

Basis of the calculation

Planes in the geometric model (U)

A representative facade element is selected in order to calculate the heat transfer coefficient U for each area. This section must include all of the elements with varying thermal properties that are present in the facade. They include glazing, panels, parapets and their connections, as well as mullions, transoms and silicone joints.
The planes must have adiabatic borders. They may be:

- Symmetrical planes or
- Planes in which the thermal flow passes at right angles to the level of the curtain facade, i.e. where there are no edge influences (e.g. at an interval of 190 mm to the edge of a double-glazed window).

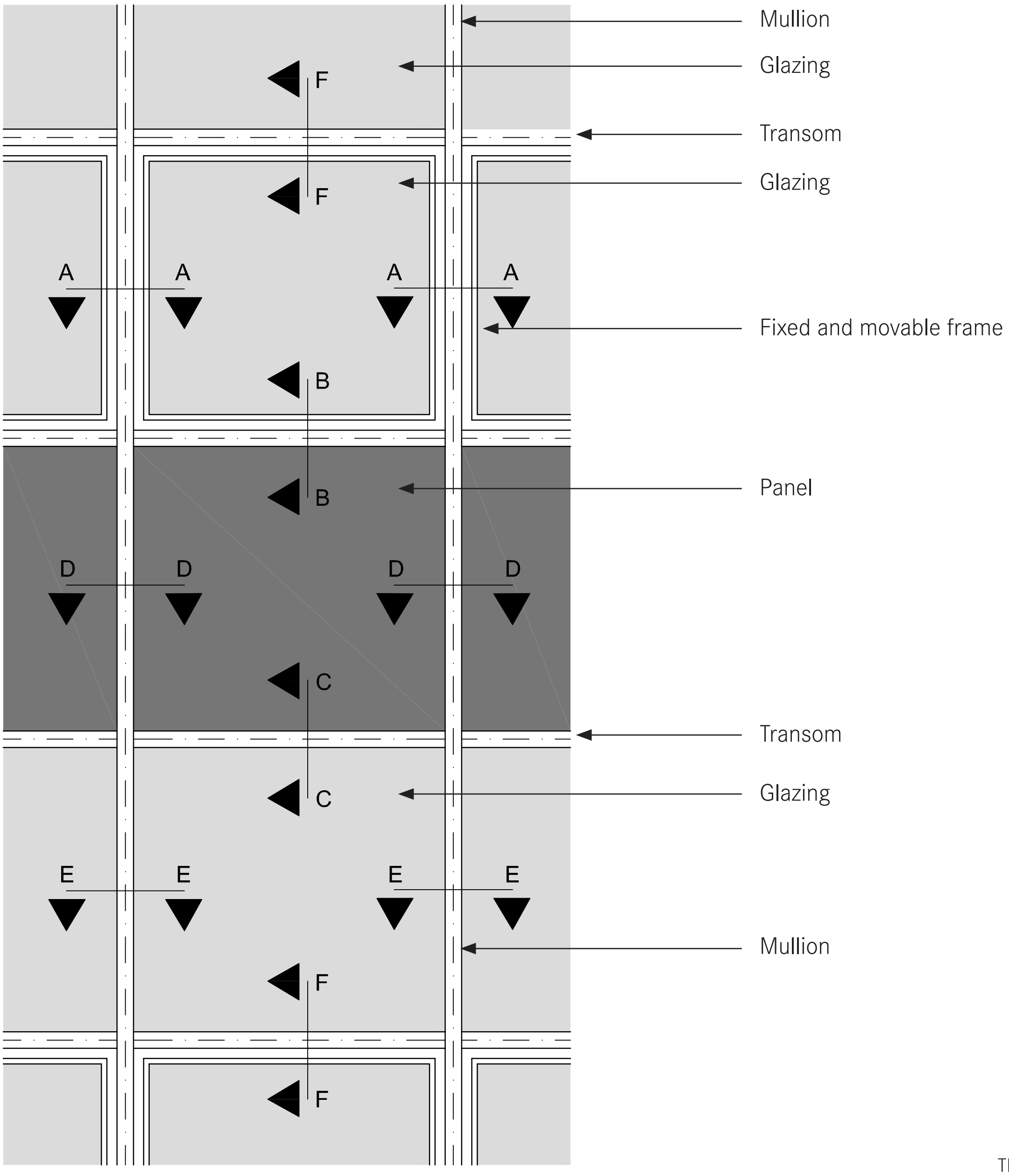


TI-S_9.4_001.dwg

Basis of the calculation

Limits of a representative reference part in a facade (U_{cw})

The representative reference element is divided into surfaces with different thermal properties in order to calculate the U_{cw}.

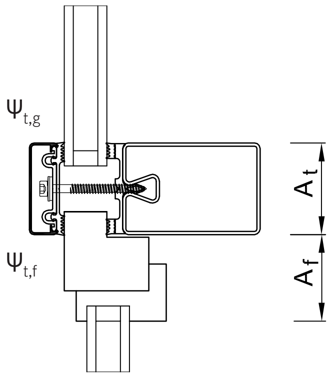


TI-S_9.4_001.dwg

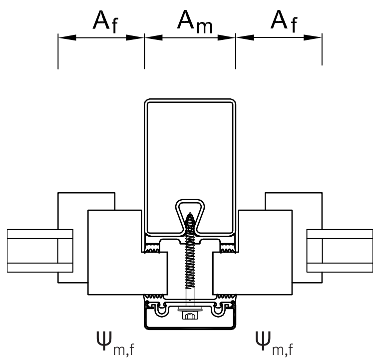
Basis of the calculation

Cuts

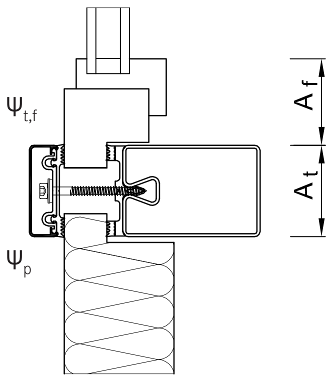
F - F



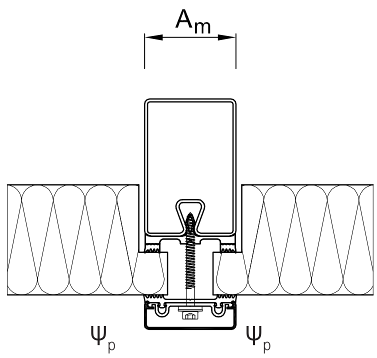
A - A



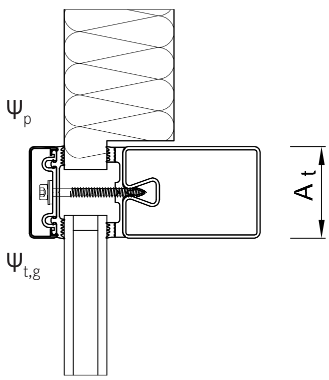
B - B



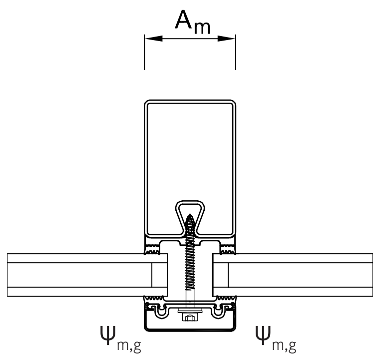
D - D



C - C



E - E



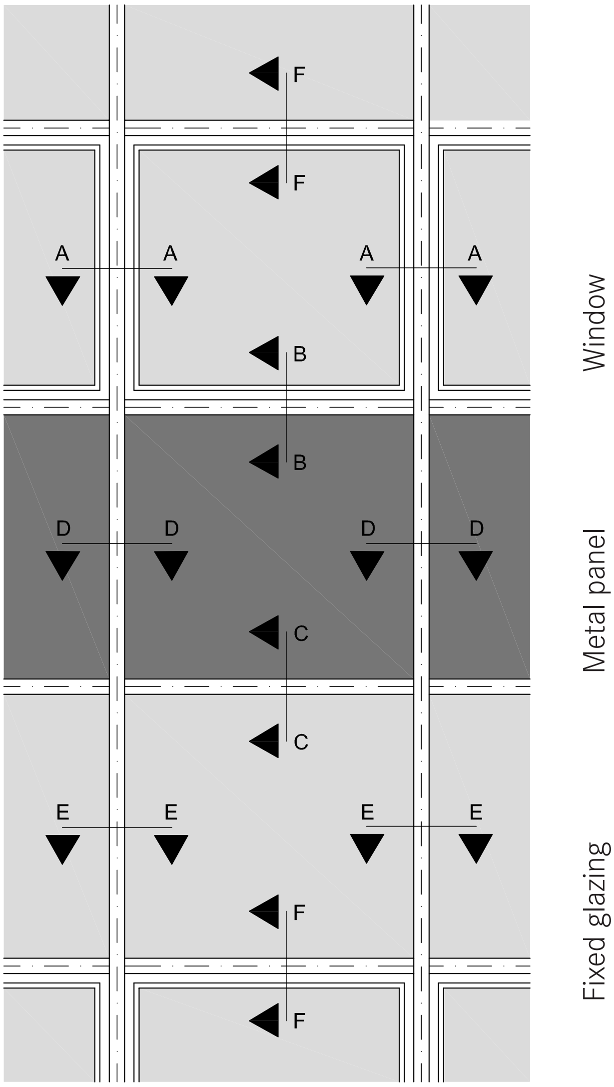
TI-S_9.4_001.dwg

Basis of the calculation

Calculation example

Facade section

The facade section is calculated within the axes with the dimensions W x H = 1200mm x 3300mm



TI-S_9.4_001.dwg

Basis of the calculation

Calculation example

Calculation of surfaces and lengths

Mullion, transom and frame:

Width of mullion (m)	50 mm
Width of transom (t)	50 mm
Width of window frame (f)	80 mm

$A_m = 2 \cdot 3.30 \cdot 0.025 = 0.1650\ m^2$

$A_t = 3 \cdot (1.2 - 2 \cdot 0.025) \cdot 0.025 = 0.1725\ m^2$

$A_f = 2 \cdot 0.08 \cdot (1.20 + 1.10 - 4 \cdot 0.025 - 2 \cdot 0.08) = 0.1650\ m^2$

Glass surface element - movable part:

$b = 1.20 - 2 \cdot (0.025 + 0.08) = 0.99\ m$

$h = 1.10 - 2 \cdot (0.025 + 0.08) = 0.89\ m$

$A_{g1} = 0.89 \cdot 0.99 = 0.8811\ m^2$

$l_{g1} = 2 \cdot (0.99 + 0.89) = 3.76\ m$

Panel surface element

$b = 1.20 - 2 \cdot 0.025 = 1.15\ m$

$h = 1.10 - 2 \cdot 0.025 = 1.05\ m$

$A_p = 1.15 \cdot 1.05 = 1.2075\ m^2$

$l_p = 2 \cdot 1.15 + 2 \cdot 1.05 = 4.40\ m$

Glass surface element - fixed part:

$b = 1.20 - 2 \cdot 0.025 = 1.15\ m$

$h = 1.10 - 2 \cdot 0.025 = 1.05\ m$

$A_p = 1.15 \cdot 1.05 = 1.2075\ m^2$

$l_p = 2 \cdot 1.15 + 2 \cdot 1.05 = 4.40\ m$

Calculation of the U_i values: example

U values	Determined based on the	Calculation value U_i [W/(m²·K)]
U_g (glazing)	DIN EN 673[1] / 674[2] / 675[2]	1.20
U_p (panel)	DIN EN ISO 6946[1]	0.46
U_m (Mullion)	DIN EN 12412-2[2] / DIN EN ISO 10077-2[1]	2.20
U_t (transom)	DIN EN 12412-2[2] / DIN EN ISO 10077-2[1]	1.90
U_f (frame)	DIN EN 12412-2[2] / DIN EN ISO 10077-2[1]	2.40
$\Psi_{f,g}$	DIN EN ISO 10077-2[1] / DIN EN ISO 12631 - 01.2013 Annex B	0.11
Ψ_p		0.18
$\Psi_{m,g}$ / $\Psi_{t,g}$		0.17
$\Psi_{m,f}$ / $\Psi_{t,f}$		0.07 - Type D2

[1] Calculation, [2] Measurement

Basis of the calculation

Calculation example

Results

	A [m²]	U_i [W/(m²·K)]	l [m]	ψ [W/(m·K)]	A · U [W/K]	ψ · l [W/K]
Mullion Transom Frame	A_m = 0.1650 A_t = 0.1725 A_f = 0.3264	U_m = 2.20 U_t = 1.90 U_f = 2.40			0.363 0.328 0.783	
Mullion-frame Transom-frame			$l_{m,f}$ = 2.20 $l_{t,f}$ = 2.20	$\psi_{m,f}$ = 0.07 $\psi_{t,f}$ = 0.07		0.154 0.154
Glazing: - movable - fixed	$A_{g,1}$ = 0.8811 $A_{g,2}$ = 1.2075	$U_{g,1}$ = 1.20 $U_{g,2}$ = 1.20	$l_{f,g}$ = 3.76 $l_{m,g}$ = 4.40	$\psi_{g,1}$ = 0.11 $\psi_{g,2}$ = 0.17	1.057 1.449	0.414 0.784
Panel	A_p = 1.2705	U_p = 0.46	l_p = 4.40	ψ_p = 0.18	0.556	0.792
Sum	**A_{cw} = 3.96**				**4.536**	**2.262**

$$U_{cw} = \frac{\Sigma A \cdot U + \Sigma \psi \cdot l}{A_{cw}} = \frac{4.536 + 2.626}{3.96} = 1.72\ W/(m2 \cdot K)$$

Basis of the calculation

Calculation of the ψ - values according to DIN EN ISO 12631- Annex B - Glazing

Type of mullion/transom	Type of glazing	
	Double or triple glazing (6mm glass), • uncoated glass • with air or gas gap	Double or triple glazing (6mm glass), • Glass with low emission level • Single coating with double glazing • Single coating with double glazing • with air or gas gap
	ψ [W/(m·K)]	ψ [W/(m·K)]
Table B.1	**Aluminium and steel spacers in mullion or transom profiles $\psi_{m,g}$, $\psi_{t,g}$**	
Timber-aluminium	0.08	0.08
Metal frame with thermal separation	d_i ≤ 100 mm: 0.13 d_i ≤ 200 mm: 0.15	d_i ≤ 100 mm: 0.17 d_i ≤ 200 mm: 0.19
Table B.2	**Spacer with improved thermal properties in the mullion or Transom profiles $\psi_{m,g}$, $\psi_{t,g}$**	
Timber-aluminium	0.06	0.08
Metal frame with thermal separation	d_i ≤ 100 mm: 0.09 d_i ≤ 200 mm: 0.10	d_i ≤ 100 mm: 0.11 d_i ≤ 200 mm: 0.12
Table B.3 Table based on DIN EN 10077-1	**Aluminium and steel spacers in window frames $\psi_{f,g}$ (also insert elements in facades)**	
Timber-aluminium	0.06	0.08
Metal frame with thermal separation	0.08	0.11
Metal frame without thermal separation	0.02	0.05
Table B.4 Table based on DIN EN 10077-1	**Spacer with improved thermal properties in the window frame $\psi_{f,g}$ (also insert elements in facades)**	
Timber-aluminium	0.05	0.06
Metal frame with thermal separation	0.06	0.08
Metal frame without thermal separation	0.01	0.04

d_i room-side depth of the mullion/transom

Basis of the calculation

Data sheet “Warm edge” (spacer with improved thermal properties) ψ values for windows*

Product name	Metal with thermal separation		Plastic		Timber		Timber/metal	
	V[1] U_g = 1.1	V[2] U_g = 0.7	V[1] U_g = 1.1	V[2] U_g = 0.7	V[1] U_g = 1.1	V[2] U_g = 0.7	V[1] U_g = 1.1	V[2] U_g = 0.7
Chromatech Plus (stainless steel)	0.067	0.063	0.051	0.048	0.052	0.052	0.058	0.057
Chromatech (stainless steel)	0.069	0.065	0.051	0.048	0.053	0.053	0.059	0.059
GTS (stainless steel)	0.069	0.061	0.049	0.046	0.051	0.051	0.056	0.056
Chromatech Ultra (stainless steel/polycarbonate)	0.051	0.045	0.041	0.038	0.041	0.040	0.045	0.043
WEB premium (stainless steel)	0.068	0.063	0.051	0.048	0.053	0.052	0.058	0.058
WEB classic (stainless steel)	0.071	0.067	0.052	0.049	0.054	0.055	0.060	0.061
TPS (polyisobutylene)	0.047	0.042	0.039	0.037	0.038	0.037	0.042	0.040
Thermix TX.N (stainless steel/plastic)	0.051	0.045	0.041	0.038	0.041	0.039	0.044	0.042
TGI Spacer (stainless steel/plastic)	0.056	0.051	0.044	0.041	0.044	0.043	0.049	0.047
Swisspacer V (stainless steel/plastic)	0.039	0.034	0.034	0.032	0.032	0.031	0.035	0.033
Swisspacer (stainless steel/plastic)	0.060	0.056	0.045	0.042	0.047	0.046	0.052	0.051
Super Spacer TriSeal (mylar foil/silicone foam)	0.041	0.036	0.035	0.033	0.034	0.032	0.037	0.035
Nirotec 015 (stainless steel)	0.066	0.061	0.050	0.047	0.051	0.051	0.057	0.056
Nirotec 017 (stainless steel)	0.068	0.063	0.051	0.048	0.053	0.053	0.058	0.058

V[1] - Double pane insulating glass U_g 1.1 W/(m²K)
V[2] - Triple pane insulating glass U_g 0.7 W/(m²K)

* Values calculated by University of Applied Sciences Rosenheim and **ift Rosenheim**

Basis of the calculation

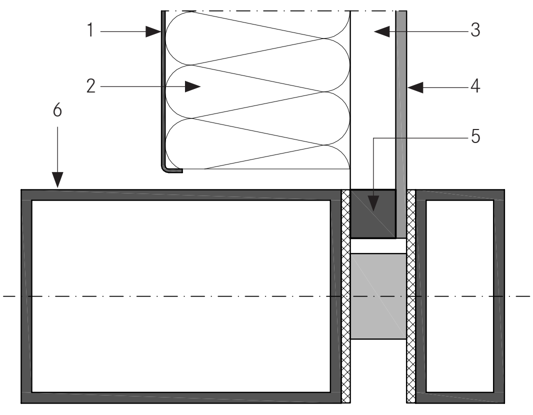
Calculation of the ψ - values according to DIN EN ISO 12631 - 12631 - Annex B - Panels

Table B.5
Values of the length-based heat transfer coefficient for the panel spacers ψ_p

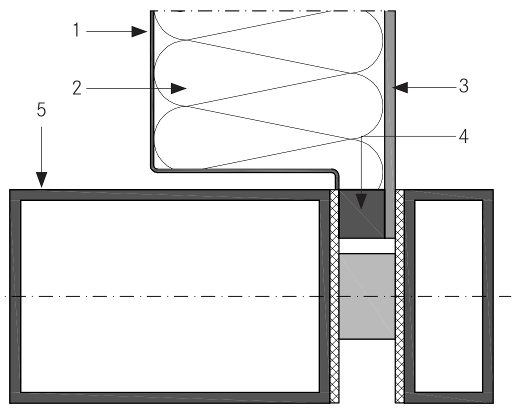
Type of filling Inside, i.e. outside panelling	Thermal conductivity of the spacer λ [W/(m·K)]	length-based heat transfer coefficient* ψ [W/(m·K)]
Panel type 1 with panelling: Aluminium/aluminium Aluminium/glass Steel/glass	-	0.13
Panel type 2 with panelling:		
Aluminium/aluminium	0.2 0.4	0.20 0.29
Aluminium/glass	0.2 0.4	0.18 0.20
Steel/glass	0.2 0.4	0.14 0.18

*It is permitted to use this value if no data is available from measurements or detailed calculations.

Panel type 1



Panel type 2



TI-S_9.4_001.dwg

Caption

1 Aluminium 2.5 mm/Steel 2.0 mm
2 Insulation λ= 0.025 to 0.04 W/(m·K)
3 Air-filled gap 0 to 20 mm
4 Aluminium 2.5 mm/Glass 6 mm
5 Spacer λ= 0.2 to 0.4 W/(m·K)
6 Aluminium

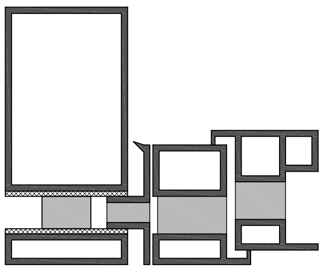
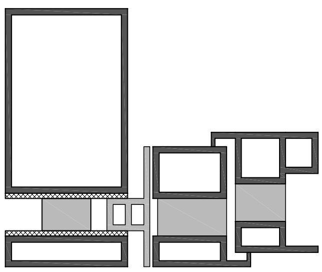
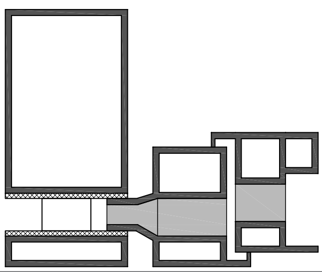
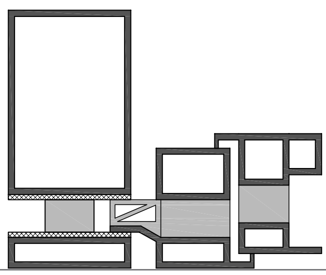
Caption

1 Aluminium 2.5 mm/Steel 2.0 mm
2 Insulation λ= 0.025 to 0.04 W/(m·K)
3 Aluminium 2.5 mm/Glass 6 mm
4 Spacer λ= 0.2 to 0.4 W/(m·K)
5 Aluminium

Basis of the calculation

Calculation of the ψ - values according to DIN EN ISO 12631 - 12631 - Annex B - Insert elements

Table B.6 Values of the length-based heat transfer coefficient for the connecting area of mullions/transoms and alu/steel frames $\psi_{m/t,f}$

Types of connection areas	Diagram	Description	Length-based heat transfer coefficient* $\psi_{m,f}$ or $\psi_{t,f}$ [W/(m·K)]
A		Installation of the frame in the mullion with an additional aluminium profile with thermal separation zone	0.11
B		Installation of the frame in the mullion with an additional profile with low thermal conductivity (e.g. polyamide 6.6 with a glass fibre content of 25%)	0.05
C1		Installation of the frame in the mullion with extension of the thermal separation of the frame	0.07
C2		Installation of the frame in the mullion with extension of the thermal separation of the frame (e.g. polyamide 6.6 with a glass fibre content of 25%)	0.07

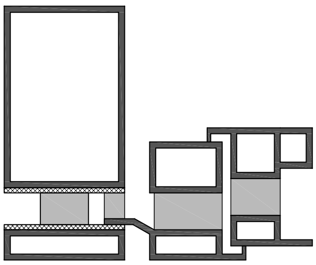
TI-S_9.4_001.dwg

Values for ψ not included in the table can be determined by numerical calculation according to EN ISO 10077-2.

Basis of the calculation

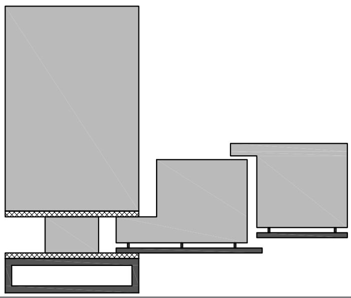
Calculation of the ψ - values according to DIN EN ISO 12631 1.2013 - Annex B - Insert elements

Table B.6 **Values of the length-based heat transfer coefficient for the connecting area of mullions/transoms and alu/steel frames $\psi_{m/t,f}$**

Types of connection areas	Diagram	Description	Length-based heat transfer coefficient* $\psi_{m,f}$ or $\psi_{t,f}$ [W/(m·K)]
D		Installation of the frame in the mullion with extension of the external aluminium profile. Filling material for the attachment with low thermal conductivity λ = 0.3 W/(m·K)	0.07

*It is permitted to use this value if no data is available from measurements or detailed calculations. These values only apply if the mullion/transom and the frame possess thermal zones and no other part of the frame without a thermal separation zone interrupts a thermal separation zone.

Table B.7 **Values of the length-based heat transfer coefficient for the connecting area of mullions/transoms and timber/aluminium frames $\psi_{m/t,f}$**

Types of connection areas	Diagram	Description	Length-based heat transfer coefficient* $\psi_{m,f}$ or $\psi_{t,f}$ [W/(m·K)]
A		U_m > 2.0 W/(m²·K)	0.02
B		U_m ≤ 2.0 W/(m²·K)	0.04

TI-S_9.4_001.dwg

Basis of the calculation

Heat transfer coefficient of glass (U_g) according to DIN EN 10077-1 - Annex C

Table C.2 Heat transfer coefficient of double and triple-pane insulating glazing with various gas fillings for glazing mounted vertically U_g

Glazing				Heat transition coefficient for various types of gas gaps* U_g [W/(m²·K)]		
Type	Glass	Standard emission level	Dimensions mm	Air	Argon	Krypton
Double pane insulating glazing	uncoated glass (Normal glass)	0.89	4-6-4	3.3	3.0	2.8
			4-8-4	3.1	2.9	2.7
			4-12-4	2.8	2.7	2.6
			4-16-4	2.7	2.6	2.6
			4-20-4	2.7	2.6	2.6
	One pane of coated glass	≤ 0.20	4-6-4	2.7	2.3	1.9
			4-8-4	2.4	2.1	1.7
			4-12-4	2.0	1.8	1.6
			4-16-4	1.8	1.6	1.6
			4-20-4	1.8	1.7	1.6
	One pane of coated glass	≤ 0.15	4-6-4	2.6	2.3	1.8
			4-8-4	2.3	2.0	1.6
			4-12-4	1.9	1.6	1.5
			4-16-4	1.7	1.5	1.5
			4-20-4	1.7	1.5	1.5
	One pane of coated glass	≤ 0.10	4-6-4	2.6	2.2	1.7
			4-8-4	2.2	1.9	1.4
			4-12-4	1.8	1.5	1.3
			4-16-4	1.6	1.4	1.3
			4-20-4	1.6	1.4	1.4
	One pane of coated glass	≤ 0.05	4-6-4	2.5	2.1	1.5
			4-8-4	2.1	1.7	1.3
			4-12-4	1.7	1.3	1.1
			4-16-4	1.4	1.2	1.2
			4-20-4	1.5	1.2	1.2
Triple-pane insulating glazing	uncoated glass (Normal glass)	0.89	4-6-4-6-4	2.3	2.1	1.8
			4-8-4-8-4	2.1	1.9	1.7
			4-12-4-12-4	1.9	1.8	1.6
	2 panes coated	≤ 0.20	4-6-4-6-4	1.8	1.5	1.1
			4-8-4-8-4	1.5	1.3	1.0
			4-12-4-12-4	1.2	1.0	0.8
	2 panes coated	≤ 0.15	4-6-4-6-4	1.7	1.4	1.1
			4-8-4-8-4	1.5	1.2	0.9
			4-12-4-12-4	1.2	1.0	0.7
	2 panes coated	≤ 0.10	4-6-4-6-4	1.7	1.3	1.0
			4-8-4-8-4	1.4	1.1	0.8
			4-12-4-12-4	1.1	0.9	0.6
	2 panes coated	≤ 0.05	4-6-4-6-4	1.6	1.2	0.9
			4-8-4-8-4	1.3	1.0	0.7
			4-12-4-12-4	1.0	0.8	0.5

* Gas concentration 90%

Basis of the calculation

Summary

The following information is needed to calculate the U_{cw}:

U values	Determined based on the	source
U_g (glazing)	DIN EN 673[1] / 674[2] / 675[2]	Manufacturer's specifications
U_p (panel)	DIN EN ISO 6946[1]	Manufacturer's specifications
U_m (Mullion)	DIN EN 12412-2[2] / DIN EN ISO 10077-2[1]	Stabalux documents / or individual calculation*
U_t (transom)	DIN EN 12412-2[2] / DIN EN ISO 10077-2[1]	Stabalux documents / or individual calculation*
U_f (frame/window)	DIN EN 12412-2[2] / DIN EN ISO 10077-2[1]	Manufacturer's specifications
$\Psi_{f,g}$ Ψ_p $\Psi_{m,g}$ / $\Psi_{t,g}$ $\Psi_{m,f}$ / $\Psi_{t,f}$	DIN EN ISO 10077-2[1] / DIN EN ISO 12631 - 01.2013 Annex B	Calculation according to DIN EN 10077-2 if the spacer for the glazing is known, otherwise according to DIN EN ISO 12631 - 01.2013 Annex B or itf table "Warm Edge" Calculation according to DIN EN 10077-2 if the structure is known, otherwise according to DIN EN ISO 12631 - 1.2013 Annex B
Facade geometry or a representative facade section with all dimensions and fillings as in the glass/panel/installation element		Planner's specifications

[1] Calculation, [2] Measurement
* Stabalux Customer Service

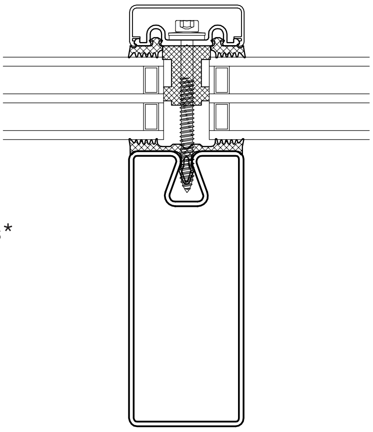
U_f values

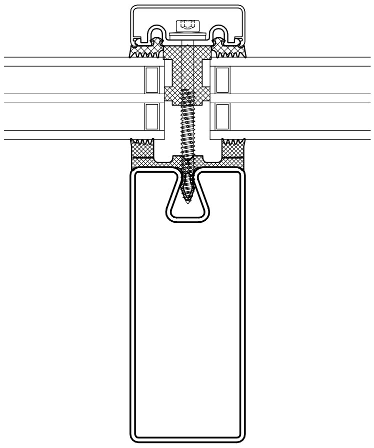
Determination of the U_f values according to DIN EN 10077-2

Stabalux SR

50120-2
Glass inset 15

Values without effect of screws*





System	5 mm seal				12 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator		U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 5024	GD 1934	GD 1934		GD 5024	GD 1934
SR-50120-2-**24**-15	(Z0606)	1.112	1.921	1,541	(Z0606)	1,055	1,904	1,572
SR-50120-2-**26**-15	(Z0606)	1.072	1.891	1,512	(Z0606)	1,023	1,868	1,541
SR-50120-2-**28**-15	(Z0606)	1.027	1.850	1,407	(Z0606)	0,986	1,825	1,491
SR-50120-2-**30**-15	(Z0606)	0.991	1.812	1,432	(Z0606)	0,961	1,785	1,466
SR-50120-2-**32**-15	(Z0606)	0.943	1.778	1,407	(Z0606)	0,945	1,761	1,425
SR-50120-2-**34**-15	(Z0606)	0.931	1.754	1,375	(Z0605)	0,790	1,729	1,410
SR-50120-2-**36**-15	(Z0606)	0.909	1.722	1,355	(Z0605)	0,771	1,705	1,387
SR-50120-2-**38**-15	(Z0605)	0.778	1.702	1,331	(Z0605)	0,746	1,678	1,363
SR-50120-2-**40**-15	(Z0605)	0.746	1.672	1,305	(Z0605)	0,741	1,652	1,334
SR-50120-2-**44**-15	(Z0605)	0.704	1.624	1,265	(Z0605)	0,683	1,609	1,298
SR-50120-2-**48**-15	(Z0605)	0.660	1.586	1,230	(Z0605)	0,660	1,571	1,257
SR-50120-2-**52**-15	(Z0605)	0.651	1.571	1,207	(Z0605)	0,645	1,544	1,237
SR-50120-2-**56**-15	(Z0605)	0.637	1.546	1,170	(Z0605)	0,633	1,515	1,211

* **Effects of screws per piece 0.00499 W/K, for System 50 mm and with screw spacing of 250 mm = + 0.3** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

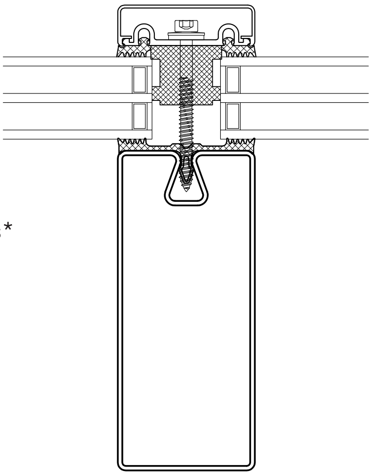
U_f values

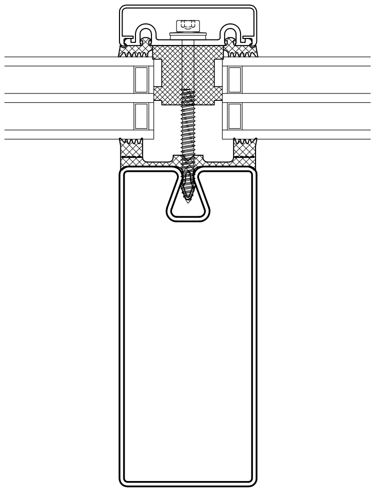
Determination of the U_f values according to DIN EN 10077-2

Stabalux SR

60140-2
Glass inset 15

Values without effect of screws*





System	5 mm seal				12 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator		U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 6024	GD 1934	GD 1934		GD 6024	GD 1934
SR-60140-2-**24**-15	(Z0608)	1.104	2.240	1,658	(Z0608)	1,048	2,221	1,696
SR-60140-2-**26**-15	(Z0608)	1.068	2.209	1,628	(Z0608)	1,022	2,178	1,667
SR-60140-2-**28**-15	(Z0608)	1.031	2.170	1,592	(Z0608)	0,995	2,140	1,632
SR-60140-2-**30**-15	(Z0608)	1.001	2.137	1,560	(Z0608)	0,974	2,120	1,601
SR-60140-2-**32**-15	(Z0608)	0.981	2.112	1,537	(Z0608)	0,963	2,085	1,579
SR-60140-2-**34**-15	(Z0608)	0.960	2.085	1,507	(Z0607)	0,785	2,058	1,554
SR-60140-2-**36**-15	(Z0608)	0.949	2.063	1,486	(Z0607)	0,759	2,040	1,534
SR-60140-2-**38**-15	(Z0607)	0.770	2.042	1,466	(Z0607)	0,738	2,020	1,513
SR-60140-2-**40**-15	(Z0607)	0.742	2.016	1,443	(Z0607)	0,716	1,997	1,490
SR-60140-2-**44**-15	(Z0607)	0.706	1.981	1,410	(Z0607)	0,687	1,944	1,456
SR-60140-2-**48**-15	(Z0607)	0.680	1.950	1,381	(Z0607)	0,669	1,923	1,426
SR-60140-2-**52**-15	(Z0607)	0.664	1.921	1,357	(Z0607)	0,656	1,900	1,401
SR-60140-2-**56**-15	(Z0607)	0.655	1.898	1,335	(Z0607)	0,648	1,852	1,379

* **Effects of screws per piece 0.00499 W/K, for System 60 mm and with screw spacing of 250 mm = + 0.3** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

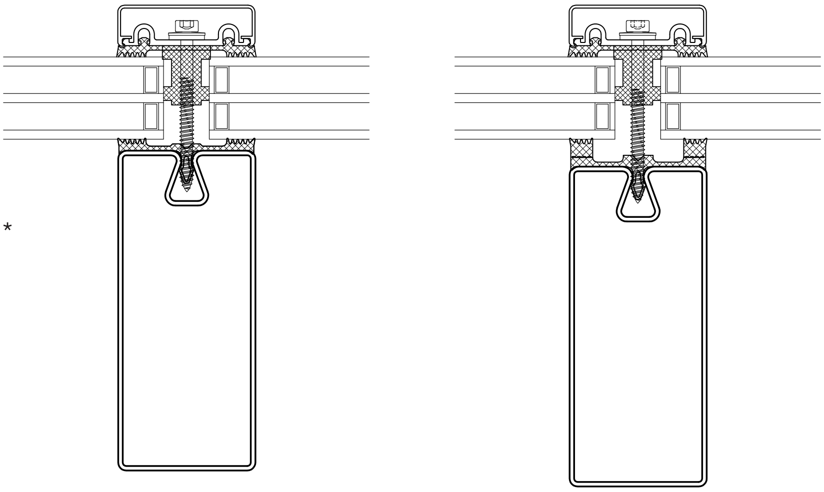
U_f values

Determination of the U_f values according to DIN EN 10077-2

Stabalux SR

**60140-2
Glass inset 20**

Values without effect of screws*



System	5 mm seal				12 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator		U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 6024	GD 1934	GD 1934		GD 6024	GD 1934
SR-60140-2-**24**-20	(Z0608)	1.103	1.761	1,512	(Z0608)	1,045	1,774	1,517
SR-60140-2-**26**-20	(Z0608)	1.058	1.718	1,468	(Z0608)	1,011	1,716	1,483
SR-60140-2-**28**-20	(Z0608)	1.014	1.670	1,422	(Z0608)	0,971	1,658	1,434
SR-60140-2-**30**-20	(Z0608)	0.974	1.627	1,380	(Z0608)	0,943	1,644	1,394
SR-60140-2-**32**-20	(Z0608)	0.947	1.594	1,349	(Z0608)	0,924	1,605	1,364
SR-60140-2-**34**-20	(Z0608)	0.916	1.560	1,316	(Z0607)	0,792	1,579	1,336
SR-60140-2-**36**-20	(Z0608)	0.893	1.532	1,288	(Z0607)	0,765	1,547	1,309
SR-60140-2-**38**-20	(Z0607)	0.773	1.505	1,261	(Z0607)	0,740	1,522	1,284
SR-60140-2-**40**-20	(Z0607)	0.742	1.476	1,232	(Z0607)	0,714	1,489	1,235
SR-60140-2-**44**-20	(Z0607)	0.698	1.430	1,187	(Z0607)	0,678	1,435	1,209
SR-60140-2-**48**-20	(Z0607)	0.664	1.391	1,150	(Z0607)	0,651	1,401	1,171
SR-60140-2-**52**-20	(Z0607)	0.637	1.356	1,117	(Z0607)	0,631	1,365	1,136
SR-60140-2-**56**-20	(Z0607)	0.617	1.328	1,087	(Z0607)	0,614	1,333	1,109

* **Effects of screws per piece 0.00499 W/K, for System 60 mm and with screw spacing of 250 mm = + 0.3** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

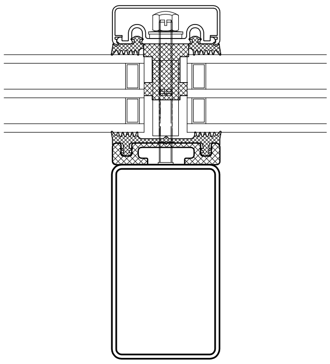
U_f values

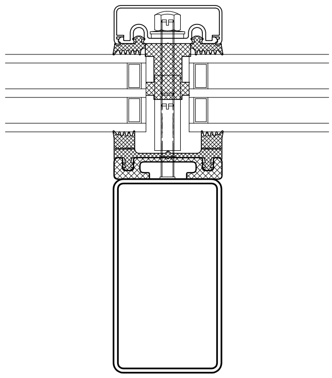
Determination of the U_f values according to DIN EN 10077-2

Stabalux ZL-S

5090-2
Glass inset 15

Values without effect of screws*





System	5 mm seal				12 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator		U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 5024	GD 1934	GD 1934		GD 5024	GD 1934
ZL-S-5090-2-**24**-15	(Z0608)	1.031	1.614	1.348	(Z0608)	1.007	1.702	1.431
ZL-S-5090-2-**26**-15	(Z0608)	0.994	1.588	1.32	(Z0608)	0.979	1.669	1.407
ZL-S-5090-2-**28**-15	(Z0608)	0.955	1.555	1.287	(Z0608)	0.947	1.64	1.372
ZL-S-5090-2-**30**-15	(Z0608)	0.921	1.526	1.257	(Z0608)	0.916	1.588	1.343
ZL-S-5090-2-**32**-15	(Z0608)	0.9	1.507	1.238	(Z0608)	0.907	1.586	1.322
ZL-S-5090-2-**34**-15	(Z0608)	0.874	1.484	1.215	(Z0607)	0.775	1.558	1.299
ZL-S-5090-2-**36**-15	(Z0608)	0.858	1.466	1.196	(Z0607)	0.751	1.542	1.279
ZL-S-5090-2-**38**-15	(Z0607)	0.743	1.448	1.177	(Z0607)	0.728	1.521	1.26
ZL-S-5090-2-**40**-15	(Z0607)	0.716	1.426	1.155	(Z0607)	0.703	1.497	1.233
ZL-S-5090-2-**44**-15	(Z0607)	0.675	1.396	1.125	(Z0607)	0.669	1.463	1.203
ZL-S-5090-2-**48**-15	(Z0607)	0.645	1.37	1.099	(Z0607)	0.646	1.432	1.167
ZL-S-5090-2-**52**-15	(Z0607)	0.622	1.349	1.078	(Z0607)	0.63	1.408	1.15
ZL-S-5090-2-**56**-15	(Z0607)	0.606	1.327	1.057	(Z0607)	0.612	1.383	1.113

* **Effects of screws per piece 0.00083 W/K, for System 50 mm and with screw spacing of 250 mm = + 0.07** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

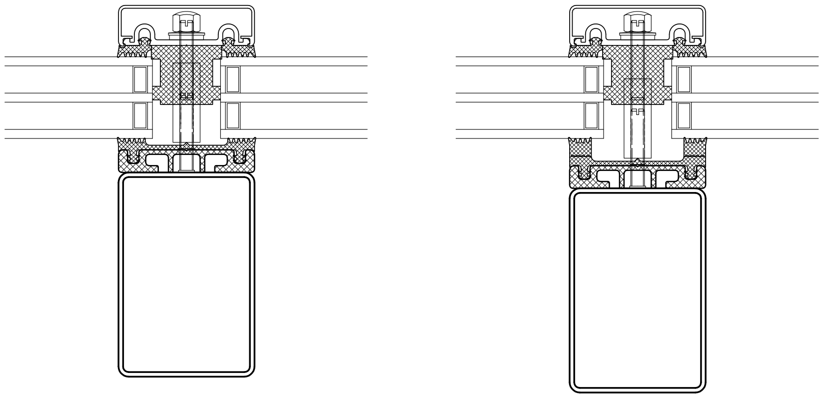
U_f values

Determination of the U_f values according to DIN EN 10077-2

Stabalux ZL-S

6090-2
Glass inset 15

Values without effect of screws*



System	5 mm seal				12 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator		U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 6024	GD1934	GD 1934		GD 6024	GD1934
ZL-S-6090-2-**24**-15	(Z0608)	1.013	1.775	1.389	(Z0608)	0.981	1.842	1.468
ZL-S-6090-2-**26**-15	(Z0608)	0.982	1.755	1.367	(Z0608)	0.958	1.822	1.447
ZL-S-6090-2-**28**-15	(Z0608)	0.948	1.727	1.341	(Z0608)	0.933	1.792	1.421
ZL-S-6090-2-**30**-15	(Z0608)	0.92	1.703	1.316	(Z0608)	0.911	1.768	1.396
ZL-S-6090-2-**32**-15	(Z0608)	0.901	1.688	1.3	(Z0608)	0.9	1.751	1.377
ZL-S-6090-2-**34**-15	(Z0608)	0.881	1.667	1.281	(Z0607)	0.753	1.731	1.36
ZL-S-6090-2-**36**-15	(Z0608)	0.868	1.653	1.265	(Z0607)	0.731	1.714	1.344
ZL-S-6090-2-**38**-15	(Z0607)	0.731	1.638	1.25	(Z0607)	0.711	1.696	1.326
ZL-S-6090-2-**40**-15	(Z0607)	0.703	1.619	1.232	(Z0607)	0.689	1.678	1.309
ZL-S-6090-2-**44**-15	(Z0607)	0.67	1.593	1.206	(Z0607)	0.66	1.648	1.282
ZL-S-6090-2-**48**-15	(Z0607)	0.643	1.57	1.184	(Z0607)	0.641	1.623	1.259
ZL-S-6090-2-**52**-15	(Z0607)	0.625	1.551	1.166	(Z0607)	0.63	1.602	1.239
ZL-S-6090-2-**56**-15	(Z0607)	0.614	1.533	1.149	(Z0607)	0.602	1.579	1.220

* **Effects of screws per piece 0.00083 W/K, for System 60 mm and with screw spacing of 250 mm = + 0.05** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

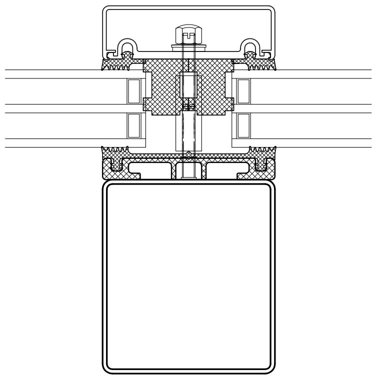
U_f values

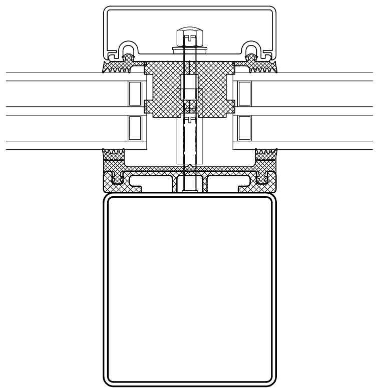
Determination of the U_f values according to DIN EN 10077-2

Stabalux ZL-S

8090-2
Glass inset 20

Values without effect of screws*





System	5 mm seal				12 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator		U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 8024	GD 1934	GD 1934		GD 8024	GD 1934
ZL-S-8090-2-**24**-20	(Z0608)	0.952	1.609	1.376	(Z0608)	0.934	1.717	1.467
ZL-S-8090-2-**26**-20	(Z0608)	0.923	1.59	1.356	(Z0608)	0.913	1.694	1.443
ZL-S-8090-2-**28**-20	(Z0608)	0.893	1.566	1.331	(Z0608)	0.889	1.675	1.416
ZL-S-8090-2-**30**-20	(Z0608)	0.867	1.541	1.309	(Z0608)	0.868	1.651	1.399
ZL-S-8090-2-**32**-20	(Z0608)	0.848	1.531	1.295	(Z0608)	0.856	1.634	1.383
ZL-S-8090-2-**34**-20	(Z0608)	0.829	1.514	1.277	(Z0607)	0.720	1.614	1.365
ZL-S-8090-2-**36**-20	(Z0608)	0.816	1.495	1.261	(Z0607)	0.7	1.598	1.343
ZL-S-8090-2-**38**-20	(Z0607)	0.694	1.481	1.248	(Z0607)	0.681	1.585	1.333
ZL-S-8090-2-**40**-20	(Z0607)	0.671	1.465	1.232	(Z0607)	0.663	1.568	1.317
ZL-S-8090-2-**44**-20	(Z0607)	0.64	1.445	1.207	(Z0607)	0.632	1.537	1.288
ZL-S-8090-2-**48**-20	(Z0607)	0.615	1.425	1.187	(Z0607)	0.618	1.512	1.262
ZL-S-8090-2-**52**-20	(Z0607)	0.598	1.408	1.169	(Z0607)	0.605	1.49	1.244
ZL-S-8090-2-**56**-20	(Z0607)	0.585	1.391	1.152	(Z0607)	0.595	1.475	1.229

* **Effects of screws per piece 0.00083 W/K, for System 80 mm and with screw spacing of 250 mm = + 0.04** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

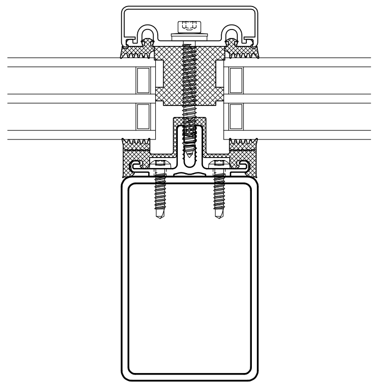
U_f values

Determination of the U_f values according to DIN EN 10077-2

Stabalux AK-S

5090-2
Glass inset 12

Values without effect of screws*



System	16.5 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 5024	GD 1934
AK-S-6090-2-**24**-15	(Z0608)	1,876	2,810	2,184
AK-S-6090-2-**26**-15	(Z0608)	1,866	2,719	2,108
AK-S-6090-2-**28**-15	(Z0608)	1,833	2,638	2,033
AK-S-6090-2-**30**-15	(Z0608)	1,804	2.565	1,967
AK-S-6090-2-**32**-15	(Z0608)	1,445	2,507	1,917
AK-S-6090-2-**34**-15	(Z0608)	1,432	2,450	1,867
AK-S-6090-2-**36**-15	(Z0608)	1,428	2,401	1,825
AK-S-6090-2-**38**-15	(Z0607)	1,419	2,357	1,786
AK-S-6090-2-**40**-15	(Z0607)	1,413	2,311	1,745
AK-S-6090-2-**44**-15	(Z0607)	1,396	2,240	1,683
AK-S-6090-2-**48**-15	(Z0607)	1,100	2,181	1,632
AK-S-6090-2-**52**-15	(Z0607)	1,081	2,131	1,589
AK-S-6090-2-**56**-15	(Z0607)	1,083	2,086	1,520

* **Effects of screws for System 50 mm and with screw spacing of 250 mm = + 0.15** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

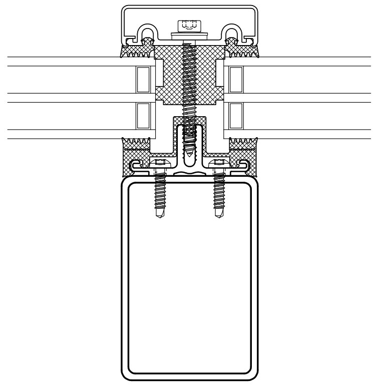
U_f values

Determination of the U_f values according to DIN EN 10077-2

Stabalux AK-S

6090-2
Glass inset 15

Values without effect of screws*



System	16.5 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 6024	GD 1934
AK-S-6090-2-**24**-15	(Z0608)	1,542	2,758	2,132
AK-S-6090-2-**26**-15	(Z0608)	1,503	2,671	2,057
AK-S-6090-2-**28**-15	(Z0608)	1,461	2,587	1,983
AK-S-6090-2-**30**-15	(Z0608)	1,126	2,508	1,920
AK-S-6090-2-**32**-15	(Z0608)	1,076	2,456	1,840
AK-S-6090-2-**34**-15	(Z0608)	1,075	2,399	1,791
AK-S-6090-2-**36**-15	(Z0608)	1,054	2,351	1,746
AK-S-6090-2-**38**-15	(Z0607)	1,035	2,305	1,705
AK-S-6090-2-**40**-15	(Z0607)	1,016	2,260	1,673
AK-S-6090-2-**44**-15	(Z0607)	0,989	2,189	1,612
AK-S-6090-2-**48**-15	(Z0607)	0,739	2,129	1,561
AK-S-6090-2-**52**-15	(Z0607)	0,719	2,078	1,519
AK-S-6090-2-**56**-15	(Z0607)	0,703	2,033	1,478

* **Effects of screws for System 60 mm and with screw spacing of 250 mm = + 0.15** W/(m²·K)
Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

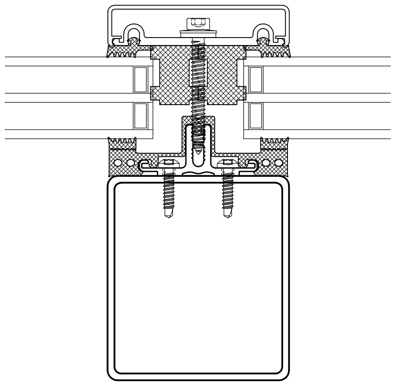
U_f values

Determination of the U_f values according to DIN EN 10077-2

Stabalux AK-S

8090-2
Glass inset 20

Values without effect of screws*



System	16.5 mm seal			
	U_f (W/m²K) with isolator		U_f (W/m²K) without isolator	
Outer seal	GD 1934		GD 8024	GD 1932
AK-S-8090-2-**24**-20	(Z0608)	1.103	2,585	2,134
AK-S-8090-2-**26**-20	(Z0608)	1.058	2,509	2,066
AK-S-8090-2-**28**-20	(Z0608)	1.014	2,422	1,998
AK-S-8090-2-**30**-20	(Z0608)	0.974	2,368	1,941
AK-S-8090-2-**32**-20	(Z0608)	0.947	2,319	1,893
AK-S-8090-2-**34**-20	(Z0608)	0.916	2,268	1,847
AK-S-8090-2-**36**-20	(Z0608)	0.893	2,223	1,808
AK-S-8090-2-**38**-20	(Z0607)	0.773	2,183	1,771
AK-S-8090-2-**40**-20	(Z0607)	0.742	2,142	1,734
AK-S-8090-2-**44**-20	(Z0607)	0.698	2,068	1,673
AK-S-8090-2-**48**-20	(Z0607)	0.664	2,020	1,619
AK-S-8090-2-**52**-20	(Z0607)	0.637	1,972	1,581
AK-S-8090-2-**56**-20	(Z0607)	0.617	1,928	1,543

* **Effects of screws for System 80 mm and with screw spacing of 250 mm = + 0.11** W/(m²·K)
  Screw effects according to ebök (12.2008)

TI-S_9.4_002.dwg

Humidity protection in the glass facade

Humidity protection

The highest demands are placed in the design of a modern mullion-transom facade, which can only be satisfied through competent planning and careful execution. The physical task of a structurally intact facade is to create a healthy room climate.
Heat insulation properties and humidity protection are among the most important characteristics of an intact outer shell around a structure. In principle, the following structure is applied in the design of a facade: water-repellent on the outside, sealed on the inside. This allows humidity precipitating on the component to diffuse outwards.

The Stabalux facade systems softly pack installed elements like panes, panels or opening elements between sealing profiles and then attach them to the mullion-transom construction using clamping strips. The so-called rebate is produced in the clamping area between the installed elements. This rebate must be vapour-proof toward the room and sealed again the penetration of water from the side exposed to the weather. Room-side vapour-proof qualities are mandatory. Warm room air flowing into the rebate can produce condensation as it cools.
It is not possible to explicitly exclude the possibility that condensation will form in our latitudes. The Stabalux insulation geometries safely transport any damp and condensation that penetrates due to imprecise assembly and changes through temperature fluctuation out of the rebate without it entering the construction.
There must be an opening at the highest and lowest points of the rebate. The opening in the rebate should exhibit a diameter of at least 8 mm and, designed as a slot, should have the dimensions 4 x 20 mm. Insulating glass manufacturers, standards and regulations require there to be a sufficiently ventilated rebate with pressure equalisation openings. This applies also to glazing with sealants, e.g. silicone.

Airtightness is also an important factor in connection with thermal insulation. Heat losses will be lower if the external wall is sealed. Room air exchange and extraction of warm air should take place exclusively through targeted ventilation in window openings and ventilation systems.
The Stabalux glazing system possesses outstanding sealant properties, as demonstrated in external testing. Stabalux facade systems are also suitable for the most exposed applications, e.g. on high-rise buildings.

Specifications

Stabalux SR and Stabalux ZL-S		F30 / facade 5 mm sealing height	Facades with inclinations up to 20°; overlapping inner sealing	Roof up to 2° inclination
System widths		**50, 60 mm**	**50, 60 mm**	**50, 60 mm**
 **Air permeability EN 12152**		AE	AE	AE
 **Watertightness EN 12154/ENV 13050**	static dynamic	RE 1650 Pa 250 Pa/750 Pa	RE 1650 Pa 250 Pa/750 Pa	RE 1350 Pa*

*the test was carried out using a water volume of 3.4 ℓ/(m² min) - above the amount required by the standard

Humidity protection in the glass facade

Terms

Water vapour / condensation

Water vapour is a term used to describe the gaseous aggregate state produced by the evaporation of water. One cubic metre (m^3) of air can only absorb a limited quantity of water vapour. The amount rises with the temperature. When air cools, it is no longer able to hold the same quantity of water. The excess water condenses, hence converting from its gaseous to its liquid state. The temperature at which this effect occurs is called the temperature of dew point, or simply the dew point.
When the inside temperature of 20°C with relative humidity of 50% cools to 9.3°C, the relative humidity rises to 100%. Condensation will precipitate if the air or contact surfaces (thermal bridges) continue to cool down. The air is no longer able to absorb the water in the form of water vapour.

Relative humidity f

The maximum volume of water vapour is rarely encountered in practice. Merely a certain percentage is reached. This is known as relative humidity, which is also temperature-dependent. It rises when the temperature falls and falls when the temperature rises, with otherwise constant levels of moisture.
Example:
A mixture of water vapour and air of 1 m^3 at 0°C has a relative humidity of 100% if it contains 4.9 g of water. A reduction in relative humidity occurs if the temperature rises, for instance to 20°C, if water absorption does not increase. At this temperature, an atmosphere with 100% relative humidity would be able to hold no more than 17.3 g, so 12.4 g more, of water. But given that additional moisture is not added, the 4.9 g of moisture contained in the cold air would now represent relative humidity of 28%.

Water vapour pressure

Besides relative humidity, the prevalent pressure is another important factor in the diffusion process. The water vapour produces pressure that rises with the volume of water vapour contained in the air. The conditions for water molecules to condensate will be more favourable if the water vapour saturation pressure is exceeded, hence lowering the pressure.

Water vapour diffusion

Water vapour diffusion describes the proper motion of water vapour through construction materials. Variations in water vapour pressures on either side of the component trigger this mechanism. The water vapour held in the air migrates from the side with the higher pressure toward the side with the lower vapour pressure. Here, the water vapour pressure depends on the temperature and the relative humidity.

Important:A vapour block (e.g. metal foil) and similar installations can entirely prevent the transport of water vapour through the material, but they cannot stop the passage of heat!

Water vapour diffusion resistance coefficient μ

The quotient of the water vapour diffusion transfer coefficient in the air and the water vapour diffusion transfer coefficient in a substance. It therefore expresses the factor by which the water vapour diffusion resistance of the considered material is greater than that of the lay of air in the same thickness and temperature resting on the material. The water vapour diffusion resistance coefficient is a material property.*

Thickness of the air layer equivalent to the water vapour diffusion s_d

Thickness of a resting layer of air possessing the same water vapour diffusion resistance as the considered construction component, i.e. the component comprising several layers. It determines the resistance to water vapour diffusion. The thickness of the air layer equivalent to the water vapour diffusion is a layer, i.e. component property. It is defined for a component layer using the following formula:

$s_d = \mu \cdot d$*

* Excerpt from DIN 4180-3

Humidity protection in the glass facade

The water vapour is unable to diffuse evenly through all components. Hence the fall in pressure is not the same across the entire wall cross-section. The fall in pressure is large in impermeable materials and small in permeable materials. This phenomenon is precisely what the dimensionless water vapour diffusion resistance coefficient μ describes: The water vapour diffusion resistance of a material is μ times larger than the resting layer of air. So an air layer requiring the same diffusion resistance as the material would have to be μ times thicker than the material layer. The water vapour diffusion resistance coefficient μ is a material property and independent of the size (thickness) of the material. An example: The diffusion resistance of a layer of cellulose flakes with μ=2 and a thickness of 0.1 m is equivalent to an air layer with a thickness of 2×10 cm = 0.2 m. This “diffusion-equivalent air layer thickness”, calculated using μ, is known as the S_d value.In other words:The S_d value of a component describes how thick the air layer resting on the component would have to be (in metres) to possess a diffusion resistance equal to the component.The S_d value is therefore a component-specific property and depends on the type of construction component and its thickness.

Temperature factor f_{Rsi}

Used to determine the freedom of fungal growth on window connections.
The temperature factor f_{Rsi} is the difference between the temperature of the inside surface θsi of a component and the outside air temperature θe, relative to the temperature difference between the inside θi and outside air θe.

A variety of requirements must be adhered to in order to introduce design measures to reduce the risk of fungal growth. For instance, for all constructive, shape-related and material-related thermal bridges that deviate from DIN 4108-2, the temperature factor fRsi at the least favourable point must satisfy the minimum requirement **of f_{Rsi} ≥ 0.70:**

Water vapour convection

Transfer of water vapour in a gaseous mixture by movements of the gaseous mixture as a whole, e.g. moist air, caused by the overall pressure gradient. Overall pressure gradients can occur, for instance, due to circumferential flow in the building through joints and leakages between inner rooms and their environments, or between ventilated layers of air (forced convection), i.e. due to differences in temperature and hence air density in ventilated and non-ventilated layers of air (free convection)*

Regulations

- DIN 4108 Thermal protection and energy economy in buildings
- DIN 4108-3 Protection against moisture subject to climate conditions; Requirements and directions for design and construction
- DIN 4108-4 Hygrothermal design values
- DIN 4108-7 Airtightness of building, requirements, recommendations and examples for planning
- DIN 18361 Glazing work (VOB Part C)
- DIN 18360 Metal work (VOB Part C)
- DIN 18545 Sealing of glazing with sealants
- Building Energy Act (GEG)
- DIN EN ISO 10211: Thermal bridges in building construction
- Passive house standard
- DIN EN ISO Thermal and moisture behaviour of construction materials and products
- DIN EN 12086 Thermal insulating products for building applications - Determination of water vapour transmission properties

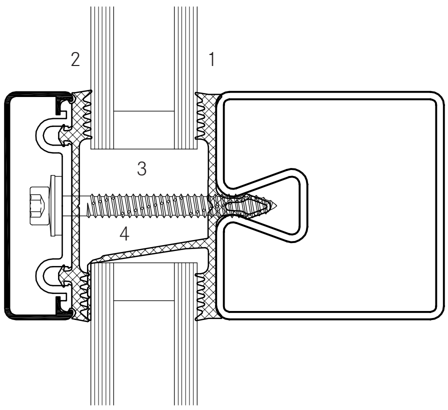
* Excerpt from DIN 4180-3

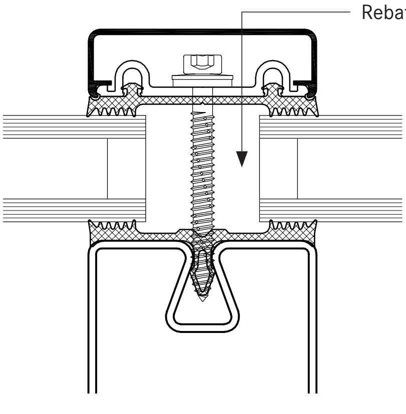
Humidity protection in the glass facade

General requirementsfor glass constructions

A glass construction that separates climates must transport the diffusing water vapour from the inside to the outside. This process should not produce condensation when possible. The wall must be permeable for diffusion travelling from the inside to the outside. This requires the following individual measures:

1. An inner sealing section with the greatest possible vapour diffusion resistance.
2. An outer sealing section with the lowest possible vapour diffusion resistance.
3. A suitable design of the rebates to enable convective removal of moisture.
4. Also a suitable design of the rebates to enable targeted removal of condensation.
5. Diffusion channel control also in the area connecting with the adjacent structure.





Important notes:

Experience has shown that absolute water and vapour imperviousness is not possible in a mullion-transom structure. Imprecise assembly of the sealant sections to the building connections may be possible sources of moisture damage. This may allow moisture to act directly on the room-side surfaces of thermal bridges and hence lead to the formation of condensation. In addition, damage may also be caused by the direct effects of moisture and elevated vapour pressure in the rebate with negative implications for the edge bonding of the inset elements. Water vapour may then penetrate the area between the panes.

Example:Leaks in profile surfaces may cause 20 litres of water to precipitate on an element measuring 1.35 (b) x 3.5 (h) during a dew period lasting 60 days.

It is essential to ensure that the rebate is produced precisely in order to prevent damage in the long term. This enables to rapid and unobstructed removal of moisture caused by precipitation and dew. Slab insulation must not prevent effective ventilation of the rebate! The slab insulation must be selected such that there is a gap of at least 10 mm to the lower edge of the rebate in order to provide ventilation and to extract condensation.

The edge bonding with the glazing must be selected carefully in order to prevent thermal bridges on profiles that may cause condensation and above all fungal growth in the hollow cavities. A favourable U_f value* for the profile is not sufficient on its own to guarantee the absence of dew. The ψ value* may be equally crucial. This depends on the type of edge bonding. Aluminium edge bonding is the least favourable. Therefore, the absence of dew must be checked when aluminium edge bonding is used. This applies in particular when the facade is adjacent to rooms with high humidity, e.g. bathrooms.

* see section on Thermal Insulation

Humidity protection in the glass facade

Inner sealing section

Construction materials are vapour-proof according to DIN EN 12086, i.e. DIN EN ISO 12572, if they exhibit an air layer thickness equivalent to water vapour diffusion of S_d von ≥ 1500 m. Standard glazing sealants are unable to provide these values. Nevertheless, the layer inhibiting diffusion can be considered adequate for the application described here if it accommodates layer thicknesses S_d of ≥ 30 m. In order to determine the air layer thickness equivalent to water vapour diffusion S_d, it is necessary to obtain the water vapour diffusion resistance coefficient μ and the component thickness.
Abutted points on seals are comparably impermeable as the entire sealant cross-section, provided they are glued using the “SG joint paste” recommended by Stabalux.
Vapour-proof connections with the structure must be positioned as far away from the room side as possible in order to prevent moisture penetrating the structure. (See Fig. 1) Additional film on the weather side (i.e., an external 2nd film) may only be used if driving rain or rising water cannot be kept out by other means. Vapour-permeable films must be used in this context. Layer thicknesses S_d of no more than 3 m shall be considered vapour-permeable for our constructions.

The following table shows several examples of materials.

Outer sealing sections

The primary purpose of the external sealant is to keep out driving rain. Nevertheless, it is essential to ensure that convection openings provide a diffusion gradient from the inside to the outside. (See Fig. 2 and 3)

Convection flow

The rebates in Stabalux mullion-transom constructions are always ventilated. Ventilation is ensured by openings in the lower and upper ends in the area of the mullions. These openings, which are produced by design, must be impervious to driving rain.
The horizontal rebates are ventilated via the connections in the cross joints, i.e. openings in the cover strips. Should additional ventilation be required in the area of the transom (e.g. where panes are only supported on 2 sides or where transom length is ℓ ≥ 2 m), then this ventilation should be created by making holes in the cover strip and/or using notches on the lower sealing lips of the outer seal.

Material		Gross density	μ - Water vapour diffusion coefficient	
		kg/m³	dry	Damp
Air		1.23	1	1
Plaster		600-1500	10	4
Concrete		1800	100	60
Metal/glass		-	∞	∞
Mineral wool		10-200	1	1
Timber		500	50	20
Polystyrene		1050	100000	100000
Butyl rubber		1200	200000	200000
EPDM		1400	11000	11000

μ - is a value stated without dimensions. The higher the **μ** value, the greater the vapour-proof properties of the substance. It is multiplied with the thickness of the construction material to produce the component-based value $S_d = \mu \cdot d$

The S_d value of a component describes how thick the air layer resting on the component would have to be (in metres) to possess an equal diffusion resistance as the component.

Humidity protection in the glass facade

Design details

Fig. 1 Ceiling connection

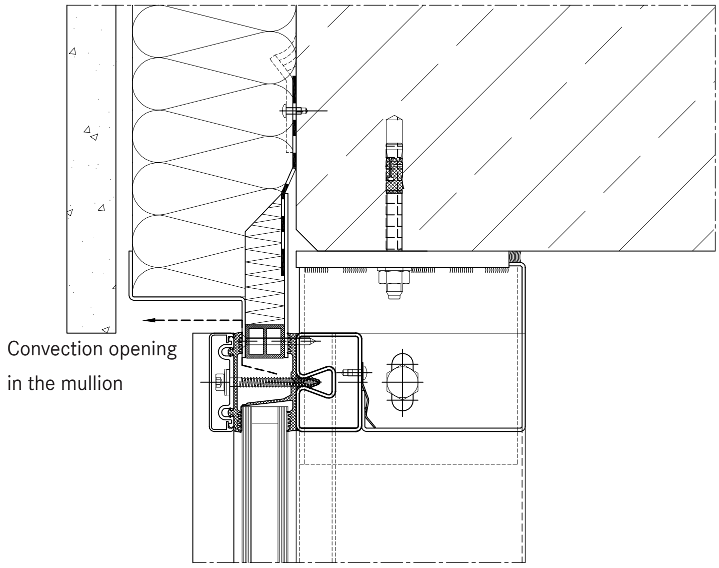
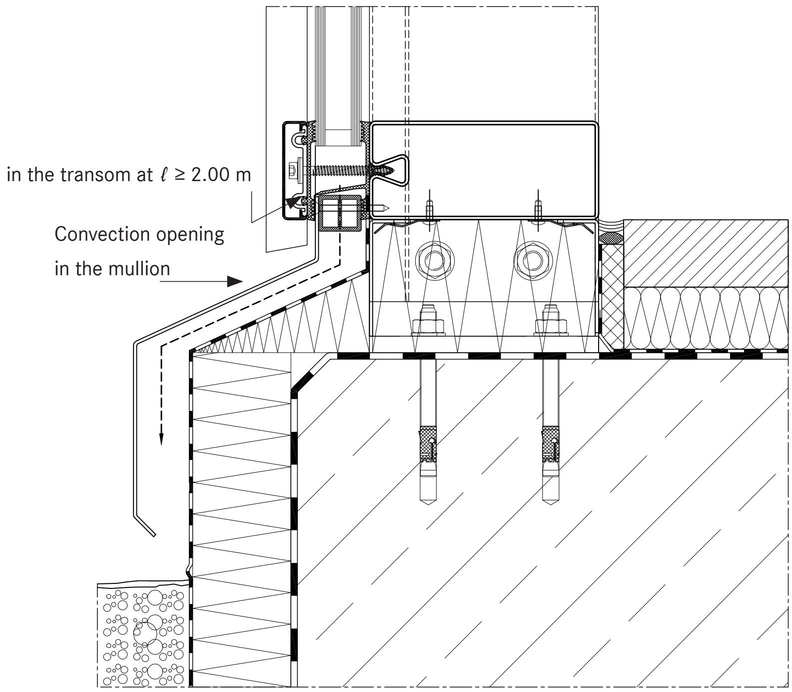


Fig. 2 Foot



Humidity protection in the glass facade

9.5
1

Dew point temperature depending on the temperature and relative humidity (excerpt from DIN 4108-5 Table 1)

Air temperature in C°	Dew point temperature θ s[1] in C° at relative humidity as a % of														
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
30	10.5	12.9	14.9	16.8	18.4	20.0	21.4	22.7	23.9	25.1	26.2	27.2	28.2	29.1	30.0
29	9.7	12.0	14.0	15.9	17.5	19.0	20.4	21.7	23.0	24.1	25.2	26.2	27.2	28.1	29.0
28	8.8	11.1	13.1	15.0	16.6	18.1	19.5	20.8	22.0	23.2	24.2	25.2	26.2	27.1	28.0
27	8.0	10.2	12.2	14.1	15.7	17.2	18.6	19.9	21.1	22.2	23.3	24.3	25.2	26.1	27.0
26	7.1	9.4	11.4	13.2	14.8	16.3	17.6	18.9	20.1	21.2	22.3	23.3	24.2	25.1	26.0
25	6.2	8.5	10.5	12.2	13.9	15.3	16.7	18.0	19.1	20.3	21.3	22.3	23.2	24.1	25.0
24	5.4	7.6	9.6	11.3	12.9	14.4	15.8	17.0	18.2	19.3	20.3	21.3	22.3	23.1	24.0
23	4.5	6.7	8.7	10.4	12.0	13.5	14.8	16.1	17.2	18.3	19.4	20.3	21.3	22.2	23.0
22	3.6	5.9	7.8	9.5	11.1	12.5	13.9	15.1	16.3	17.4	18.4	19.4	20.3	21.2	22.0
21	2.8	5.0	6.9	8.6	10.2	11.6	12.9	14.2	15.3	16.4	17.4	18.4	19.3	20.2	21.0
20	1.9	4.1	6.0	7.7	9.3	10.7	12.0	13.2	14.4	15.4	16.4	17.4	18.3	19.2	20.0
19	1.0	3.2	5.1	6.8	8.3	9.8	11.1	12.3	13.4	14.5	15.5	16.4	17.3	18.2	19.0
18	0.2	2.3	4.2	5.9	7.4	8.8	10.1	11.3	12.5	13.5	14.5	15.5	16.3	17.2	18.0

1) Approximate linear interpolation is permitted

Sound insulation in the glass facade

Sound insulation

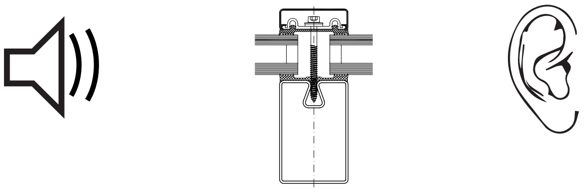
The noise insulating properties of a facade depend on a variety of factors, each of which affects the properties in a different way. Unfortunately it is not possible to summarise these complex interdependencies in simple and universally valid forms. The task of the planner is to expertly select the optimum design on a case-by-case basis. Different combinations of frame profiles, glazing strips and sound insulating glass have vastly different effects on noise insulation. Investigations and measurements performed by us are just examples of a huge range of possibilities and serve only as a guideline.

Terms

Sound insulation
Measures to reduce noise transmission from a source to a person. Sound insulation is the term used if the source of noise and the person are located in different rooms. Sound absorption is used if the source of noise and the person are located in the same room. Sound insulation distinguishes between airborne sound insulation and structure-borne sound insulation.

Airborne sound insulation
Airborne sound insulation describes the process of preventing the penetration of outside noise. Airborne noise mainly travels into the room through walls, ceilings, windows and doors.

Structure-borne sound insulation
Structure-borne sound insulation is sound insulation within the building. Structure-borne sound is mainly transmitted by pipes, footfall or circumferential facade mullions.



Noise source (e.g. street noise) | Sound-insulating Component | Receiver

Regulations

DIN 4109, sound insulation in buildings, regulates the matters pertaining to sound insulation under public law. The sound insulation classes described in VDI Guideline 2719, sound insulation of windows and additional fixtures, are often used as well. The measurement of sound insulation in buildings and of components takes place according to DIN EN ISO 717-1.
We refer to ongoing harmonisation of European standards and possible changes.

Airborne sound insulation

Airborne sound insulation is the capability of a component (wall, ceiling or window) to prevent the penetration of airborne sound. It is therefore expressed in the unit decibels [dB], referring to the degree of sound insulation R and the sound level difference D in a defined frequency range.

Sound insulation degree R [dB]
This value describes the sound insulation of components. The measurement is performed in a laboratory setting according to EN ISO 140. It determines the acoustic properties for each one-third octave band between 100 and 3150 Hz (16 values).

Assessed sound insulation level R_w [dB]
The assessed sound insulation level R_w is used to determine the sound insulation of glass facades.

$R_{w,R}$ values: This index weights the 16 measured values of the sound insulation level R in terms of their impact on the human ear. Here, $R_{w,P}$ is the value determined in the laboratory testing. DIN 4109 demands that the calculated value $R_{w,R} = R_{w,P} - 2$ db is determined and entered in the Construction Components List.

R'_w values: According to DIN 52210, they are sound insulation values determined for the building. For building certification, the minimum values for overall sound insulation may be exceeded by 5 dB.

Sound insulation in the glass facade

Spectrum adjustment values C and C_{tr}
These indices are corrective values for

(C) Pink noise = same sound level across the entire frequency spectrum;

(C_{tr}) Street noise = standardised urban street noise.

System Stabalux SR and Stabalux T profiles

The tests we commissioned from the independent test institute ift-Rosenheim are intended to provide an overview of the sound insulation characteristics that Stabalux system facades exhibit. The tests are performed with standard grids on single-part facade elements and on large facade elements. Measurements were performed using a variety of sound insulation glazings in accordance with the standard sound insulation requirements.

- Standard insulating glass (6/12/6) without additional sound insulation measures

- Sound insulating glass (8 VSG SI/16/10) CLIMAPLUS SILENCE WS 34/45 with sound insulation film in VSG (laminated safety glass)

- Sound insulating glass (12 VSG SI/24/8) CLIMAPLUS SILENCE WS 45/50 with sound insulation film in VSG (laminated safety glass)

The glazings we used are representative of a large variety of products by different manufacturers. It is not mandatory that the system manufacturer uses these glass types.

The following table shows the sound insulation characteristics of Stabalux facade profiles and the sound insulation values of the facades. The complexity of individual construction projects means that a precise assessment by experts and possibly measurements on the ground will usually be required.

We are glad to provide our individual test reports as required.

Profile system	Profile values	Glass values	Glass structure	Facade values		Sound insulation class according to VDI Regulation 2719
				Test format 1.23 x 1.48 m	Expansive facade elements	
	R_w (C;C_{tr})	R_w (C;C_{tr})		R_w (C;C_{tr})	R_w	
	dB	dB		dB	dB	
SR 50	37 (-1;-2)	32	6/12/6	34 (-1;-3)	33	2
		45 (-2;-6)	8VSG SI/16/10	43 (-1;-4)	41	3-4
		50 (-2;-8)	12VSG SI/24/8VSG SI	48 (-1;-4)	45	4-5
SR 60	37 (-2;-4) 38 (-1;-3)**	32	6/12/6	34 -2;-4)	33	2
		45 (-2;-6)	8VSG SI/16/10	42 (-1;-4)	40	3-4
		50 (-2;-8)	12VSG SI/24/8VSG SI	47 (-2;-5)	44	4-5
T 50	42 (-1;-3)	32	6/12/6	34 (-1;-3)*	33	2
		45 (-2;-6)	8VSG SI/16/10	43 (-1;-4)*	41	3-4
		50 (-2;-8)	12VSG SI/24/8VSG SI	48 (-1;-4)*	45	4-5
T 60		32	6/12/6	34 -2;-4)*	33	2
		45 (-2;-6)	8VSG SI/16/10	42 (-1;-4)*	40	3-4
		50 (-2;-8)	12VSG SI/24/8VSG SI	47 (-2;-5)*	44	4-5

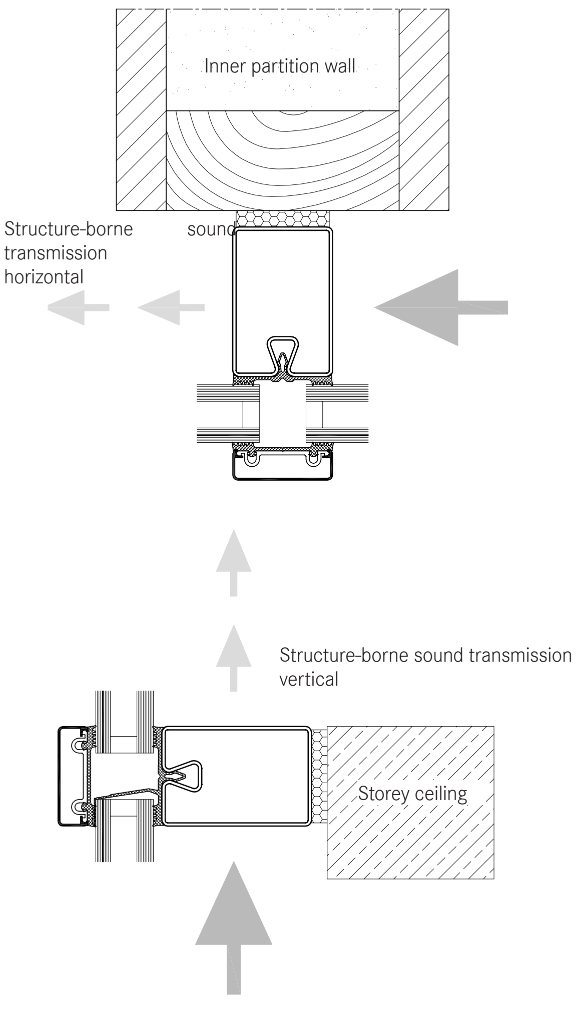
* the values for facades with Stabalux T-profiles were prepared based on comparative measurements and expert assessments.
** threaded tubes with thick walls exhibit improved sound insulation properties (e.g. SR 60180-5)

Sound insulation in the glass facade

Structure-borne sound insulation

Structure-borne sound insulation is necessary wherever the transmission of noise between rooms is disturbing. Mullions and transoms frequently separate rooms and storeys. Thick facade profiles are rarely wanted due to their unsightly appearance. It is therefore advisable to obtain information on the structure-borne sound insulation characteristics.

Institut für Fenstertechnik in Rosenheim conducted a variety of tests in this respect. In his diploma thesis, Mr Michael Bächle prepared foundations and drafted proposals for the improvement of structure-borne sound insulation characteristics.



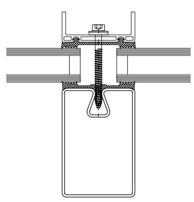
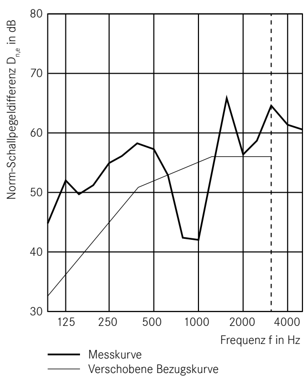
Standard sound level difference

DIN EN ISO 140-3 *) addresses the measurement of sound insulation in buildings and of components. The sound level difference between the transmitting and the receiving room is described as the standard sound level difference. For the purposes of calculation, the sound level difference $D_{n,e,w}$ is converted into the assessed sound insulation value R_w.

*) The tests were carried out according to this standard. The standard has since been replaced by DIN EN ISO 15186.

Measurement protocols

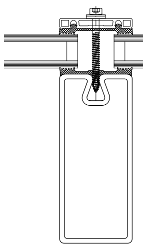
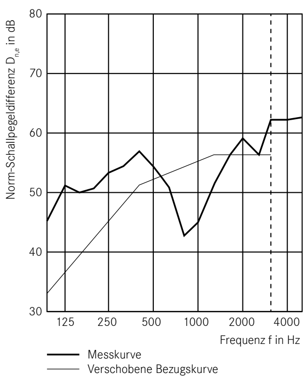
The measurement protocol below shows the sound level difference of the non-insulated threaded tube profile SR 6090-2. The profiles SR 60140-4 and SR 60180-5 are on the following page.

Standard sound level difference according to DIN EN ISO 140-10	
Profile diagram	**Profile description**
	Manufacturer's code: B-1001 Type: Mullion profile Material: Steel Dimensions: 1480 x 90 x 60 [mm] Material thickness: 2.2 mm Weight: 10 kg Hollow body: 82 x 52 [mm] Surface: galvanized
	Measurement circumstances:
	Test date: 30.08.2001 Reference surface A_0: 10 m² Volume V_E 101.3 m³ Volume V_s 109.9 m³ Test noise Pink noise Climate: 25 °C, 52%
Measure: (Description)	Mullion profile; 1480 x 90 x 60 [mm]
Diagram	
Result:	$D_{n,e,w}$ $(C;C_{tr})$ = 52 (-3;-5) dB

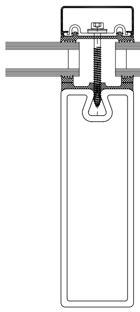
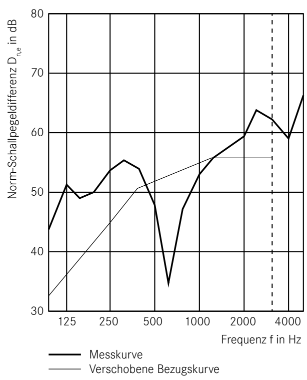
Sound insulation in the glass facade

Measurement protocols

Standard sound level difference according to DIN EN ISO 140-10

Profile diagram	Profile description	
	Manufacturer's code:	B-1002
	Type:	Mullion profile
	Material:	Steel
	Dimensions:	1480 x 140 x 60 [mm]
	Material thickness:	4 mm
	Weight:	21.26 kg
	Hollow body:	135 x 52 [mm]
	Surface:	galvanized
	Measurement circumstances:	
	Test date:	30.08.2001
	Reference surface A_0:	10 m²
	Volume V_E	101.3 m³
	Volume V_s	109.9 m³
	Test noise	Pink noise
	Climate:	21 °C, 46%
Measure:	Mullion profile; 1480 x 140 x 60 [mm]	
Diagram		
Result:	**Dn,e,w (C;Ctr) = 52 (-2;-4) dB**	

Standard sound level difference according to DIN EN ISO 140-10

Profile diagram	Profile description	
	Manufacturer's code:	B-1003
	Type:	Mullion profile
	Material:	Steel
	Dimensions:	1480 x 180 x 60 [mm]
	Material thickness:	5.2 mm
	Weight:	30.62 kg
	Hollow body:	169.6 x 49.6 [mm]
	Surface:	galvanized
	Measurement circumstances:	
	Test date:	30.08.2001
	Reference surface A_0:	10 m²
	Volume V_E	101.3 m³
	Volume V_s	109.9 m³
	Test noise	Pink noise
	Climate:	21 °C, 46%
Measure: (Description)	Mullion profile; 1480 x 180 x 60 [mm]	
Diagram		
Result:	**Dn,e,w (C;Ctr) = 52 (-6;-7) dB**	

Sound insulation in the glass facade

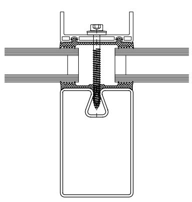
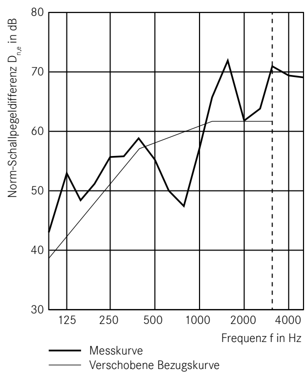
Measures to improve structure-borne sound insulation

The measures have shown that packing the hollow bodies with plasterboard or quartz sand improves sound insulation. Plasterboard minimises, and quartz sand eliminates, specifically the perceptible intruder resonance. The following shows the measurement protocols for the packed specimens.

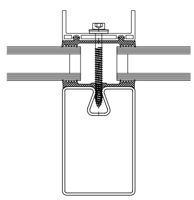
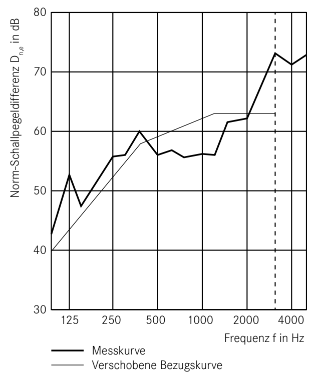
A quartz sand and plasterboard packing improve the performance compared with an unfilled state. In particular, this prevents the intruder resonance in a range of 500 - 100 Hz, which is a known phenomenon of hollow profiles, albeit not a specific problem of steel profiles.

Packing the profiles can contribute to an improvement, especially if particularly strict sound insulation properties between the rooms must be satisfied.

packed with plasterboard

Standard sound level difference according to DIN EN ISO 140-10		
Profile diagram	**Profile description**	
	Manufacturer's code: Type: Material: Dimensions: Material thickness: Weight: Hollow body: Surface:	B-1001 Mullion profile Steel 1480 x 90 x 60 [mm] 2.2 mm 11.97 kg 85.6 x 55.6 [mm] galvanized
	Measurement circumstances:	
	Test date: Reference surface A_0: Volume V_E Volume V_s Test noise Climate:	01.10.2001 10 m² 101.3 m³ 109.9 m³ Pink noise 22 °C, 51%
Measure:	Plasterboard; 2 x 9.5 mm, compressed additionally by a circumferential, foam cord	
Diagram		
Result:	**Dn,e,w (C;Ctr) = 58 (-3;-5) dB**	

packed with quartz sand

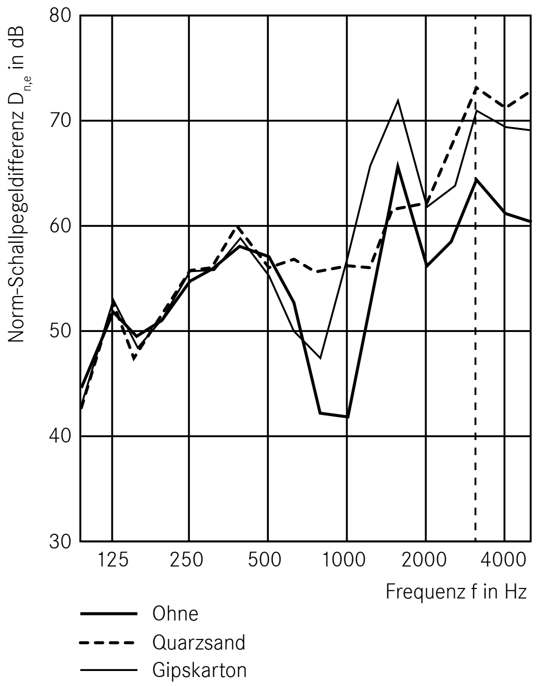
Standard sound level difference according to DIN EN ISO 140-10		
Profile diagram	**Profile description**	
	Manufacturer's code: Type: Material: Dimensions: Material thickness: Weight: Hollow body: Surface:	B-1001 Mullion profile Steel 1480 x 90 x 60 [mm] 2.2 mm 20.21 kg 85.6 x 55.6 [mm] galvanized
	Measurement circumstances:	
	Test date: Reference surface A_0: Volume V_E Volume V_s Test noise Climate:	01.10.2001 10 m² 101.3 m³ 109.9 m³ Pink noise 22 °C, 51%
Measure: (Description)	Quartz sand filling	
Diagram		
Result:	**Dn,e,w (C;Ctr) = 59 (-1;-3) dB**	

Sound insulation in the glass facade

Summarised table with assessed sound insulation unit R_w

The following table provides another overview of the structure-borne sound insulation characteristics of the Stabalux threaded tubes. We would gladly provide you with our complete set of measurement data.

Profile	Measure	$D_{n,e,w}$ ($C;C_{tr}$)	R_w ($C;C_{tr}$)
		dB	dB
SR 6090-2	without	52 (-3;-5)	34 (-4;-6)
SR 6090-2	Plasterboard filling	58 (-3;-5)	40 (-2;-4)
SR 6090-2	Quartz sand filling	59 (-1;-3)	41 (-1;-3)



Overview

Fire protection glazing for facades und roofs

The development of Stabalux glazing into fire-resistant systems primarily addressed technical requirements relating to fire resistance. A secondary aspect was to create filigree and economic solutions.
Tests and authorisations from the competent institutes allow the use of Stabalux fire-resistance glazing in Germany and France. Its installation elsewhere in Europe must be clarified on a case-by-case basis. Tests conducted in Great Britain also permit its use in countries that recognise the “British Standard”, for instance large parts of Asia.

Overview of fire protection approvals

System	Class	Application	Glass type	Maximum glass dimensions in portrait format	Maximum glass dimensions in landscape format	Filling, maximum dimensions	Roof dimensions / maximum height	Country	Approval Number
				mm x mm	mm x mm	mm x mm	m		
Stabalux System SR	G 30	Roof	Pyroswiss	1000 x 2100	1000 x 1000	-	depending on roof shape as stated in the authorisation	D	Z-19.14-1235
	F 30	Facade	Pyrostop	1400 x 2300	2300 x 1400	-	5.00	D	Z-19.14-1451
	G 30	Facade	Fire Gard lite	1425 x 2200	-	-	3.05	GB	TE 203444
	G 60	Facade	all glazing tested in “BS 476”			-	3.00	GB	CC 89534
	F 30	Facade	all glazing tested in “BS 476”			-	3.00	GB	CC 93421
	F 60	Facade	all glazing tested in “BS 476”			-	3.00	GB	CC 93421
	F 120	Facade	Contraflam N2 Pyrobel	1445 x 1455	-	-	3.00	GB	WARRAS C118196
	F 120	Facade	Pyrostop	1445 x 1455	-	-	3.00	GB	WARRAS C115886
Stabalux T profiles	G 30	Roof	Pyroswiss	1000 x 2100	1000 x 1000	-	depending on roof shape as stated in the authorisation	D	Z-19.14-1235
	F 30	Facade	Pyrostop	1400 x 2300	2300 x 1400	-	5.00	D	Z-19.14-1451

Overview

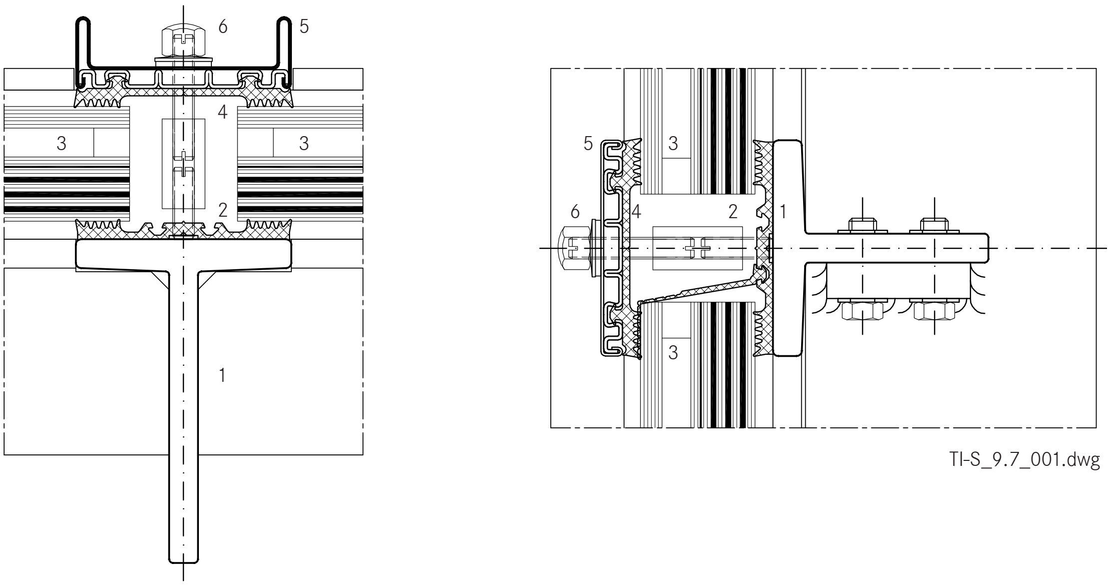
Stabalux systems in fire protection

The constructive details are stated in the respective building authorisation.

As a rule, Stabalux fire-resistance glazing provides the following benefits:

- The optical appearance of a normal facade is preserved.
- The use of a stainless steel bottom strip with concealed screw fittings enables the installation of all clipped upper screws.
- The test of stainless steel cover strips also allows visible screw fittings.
- Stabalux SR preserves all of the benefits of a design and assembly with threaded tubes.
- Besides as storey-high fire-resistant glazing, the Stabalux SR system was also tested as a curtain facade across multiple storeys.

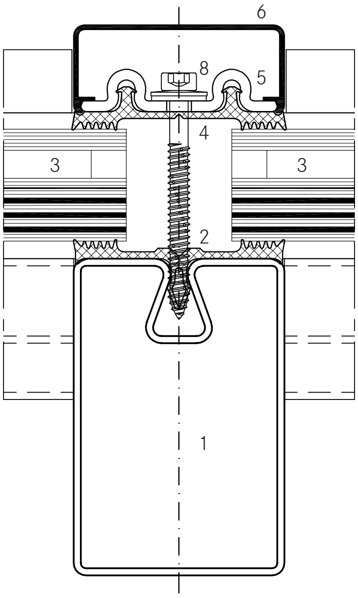
Stabalux T profiles

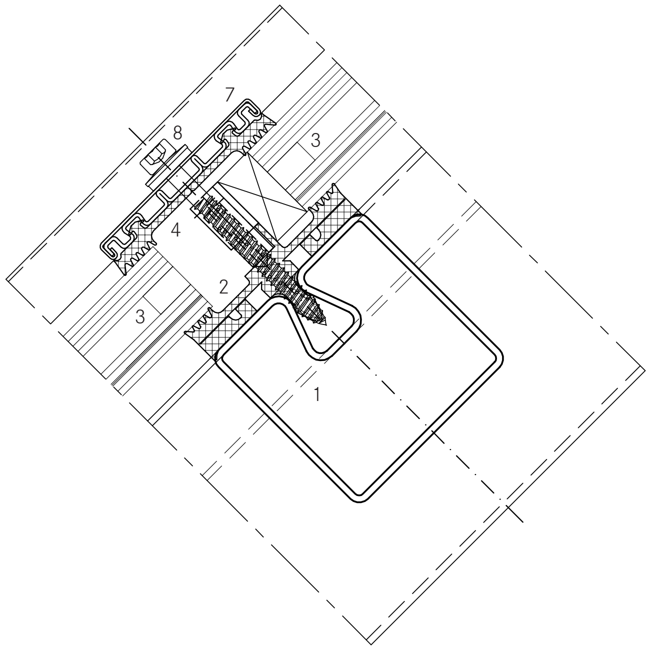


1 Stabalux T profile
2 Fire seals inside
3 Fire protection glass
4 Fire seals outside
5 Cover strip
6 Screw fittings

Overview

Stabalux System SR





1 Threaded tube
2 Fire seals inside
3 Fire protection glass
4 Fire seals outside
5 Stainless steel bottom strip
6 Upper strip
7 Cover strip
8 Screw fittings

TI-S_9.7_001.dwg

Construction law / Standardisation

Structural fire protection according to the Federal State Building Order

The German constitution or Basic Law assigns the building code to the competencies of the federal states, and not to national government. Provisions concerning preventative fire protection in structures are therefore governed under the Federal State Building Order, the corresponding implementing provisions and a series of regulations and administrative ordinances.

Fire-resistant glazing is based on the following requirements of the General Building Order (MBO):

General requirements – Sec. 3 (1)
Structures must be arranged, constructed, modified and maintained such that they do not endanger public order and safety, in particular the life, limb and natural foundations of life.

Fire protection – Sec. 14
Structures must be arranged, constructed, modified and maintained such that the emergence of fire and the spread of fire and smoke (fire spread) are prevented and that the rescue of persons and animals and effective efforts to extinguish the fire are enabled.

The core statements can be taken to infer requirements for:

- the flammability of the construction materials used;
- the duration of fire resistance based on classifications for construction materials and components;
- the imperviousness of covers on openings;
- the arrangement, location and design of emergency exits.

Basics and requirements

Fire protection in buildings means the protection of life and limb and of commercial assets. Therefore, the manufacture and marketing of technical systems for fire protection requires sufficient expertise.

The following elaborations are intended to assist in the understanding of regulations applicable on the territory of the Federal Republic of Germany and how they relate to the current implementation regulations and the national German standard DIN 4102 “Fire behaviour of building materials and building components” in the area of fire-resistant glazing. Terms and definitions used in the harmonised series of European standards DIN EN 13501 “Fire classification of construction products and building elements” are also explained. This standard, as well as various other test standards (e.g. DIN EN 1364), now provide European provisions for the characterisation of the fire behaviour of construction materials (construction products) and components (types) and the definition of terms and tests. However, the European standards differ in places from the German DIN 4102 series, sometimes even substantially. It is therefore to be expected that the German and European classifications will continue to coexist as valid standards for some time to come.

The regulations under construction laws place demands in the fire behaviour of building materials and components. Intended as technical regulations within construction, the standards define these individual terms used in construction laws more precisely. They contain the conditions for assigning a construction material to a certain classification according to its fire behaviour, and what this classification will be called. Moreover, they explain the test arrangements for components and how they are classified in fire-resistance classes.

Technical classification of the components (construction types) in fire resistance classes according to DIN 4102, i.e. DIN EN 13501

According to DIN 4102-1, construction materials are assigned to the classes A (A1, A2 - not combustible) and B (flammable), with a further distinction in B1 for not easily flammable, B2 for flammable and B3 for easily flammable, depending on their fire behaviour. It is always prohibited to use easily flammable construction materials. It is also important to bear in mind that the fire behaviour when installed is authoritative. For instance, a roll of wallpaper is easily flammable, but not easy to set on fire when it is stuck to the wall.
In contrast, the European standard DIN EN 13501-1 assigns construction materials, i.e. products, to seven

Construction law / Standardisation

classes (A1, A2, B, C, D, E and F). The European standard also defines smoke development (s = smoke) and dripping while burning (d = droplets) as additional test and classification characteristics. The three characteristics are further assigned to three grades:

Smoke development s

s1: no/hardly any smoke development
s2: limited smoke development
s3: unlimited smoke development

Flaming droplets d

d0: no dripping
d1: no sustained dripping
d2: significant dripping

The following table shows the construction material classes according to DIN 4102-1 and DIN EN 13501-1 in a direct comparison. This comparison reveals another important aspect, namely that the classes according to the German/European standards are not entirely equivalent due to the different/additional test procedures.

Table 1: Allocation to classes according to the fire behaviour of construction materials / products (without flooring) according to DIN 4102-1, i.e. DIN EN 13501-1

Building inspectorate requirements	**European class according to DIN EN 13501-1**		**German class according to DIN 4102-1**	**Stabaluxproducts according to DIN 4102**
“No flammability"	A1		A1	SR, AL, AK, Screws, Cover strips
	A2	s1, d0	A2	
“Low flammability"	B, C	s1, d0	B1	Cross bars, wooden cylinder
	A2, B, C A2, B, C	s2, d0 s3, d0		
	A2, B, C A2, B, C	s1, d1 s1, d2		
	A2, B, C	s3, d2		
“Normal flammability"	D E	s1/s2/s3, d0	B2	H*, seals*, Insulating blocks
	D D E	s1/s2/s3, d1 s1/s2/s3, d2 d2		
“High flammability"	F		B3	ZL

*higher building material classes possible

Construction law / Standardisation

Technical classification of the components (construction types) in fire resistance classes according to DIN 4102 or DIN EN 13501

- German standard DIN 4102

The fire resistance classes of components, i.e. construction elements, are defined according to their fire behaviour. This is based on components fire tests according to DIN 4102-2 or other part of the 4102 standard.

Three items of information are used to describe the fire behaviour:

- The letter describes the type of classified component; for instance, “F” stands for supporting and space-enclosing components that are required to satisfy particular requirements in terms of fire resistance. They include walls, ceilings, struts, joists, stairwells and such like. “F” also stands for non-supporting interior walls.
- A number then states the duration of fire resistance. The various gradations (30, 60, 90, 120 and 180) specify the minimum duration in minutes during which a component must satisfy the defined requirements in a fire test.
- In addition to these classifications, DIN 4102 has another indicator to describe the fire behaviour of the main construction materials used in the component.

A The component consists exclusively of non-combustible construction materials.
AB All of the essential parts of the component consist of construction materials belonging to class A; construction materials in class B can be used otherwise.
B Essential parts of the component consists of flammable materials.

These three items of information produce the fire-resistance classes for components as defined in DIN 4102-2. The adjacent table shows the classification, the short name and a comparison of the “building inspectorate requirements”.

Table 2:
Fire resistance classes of components according to DIN 4102-2 and their relevance under building inspectorate requirements (excerpt from DIN 4102-2, Tab. 2)

Building inspectorate requirements	Fire resistance class according to DIN 4102-2	Short description according to DIN 4102-2
Fire-retardant	Fire resistance class F 30	F 30-B
	Fire resistance class F 30 and mainly composed of “non-combustible” construction materials	F 30-AB
Fire-retardant and composed of “non-combustible” construction materials	Fire resistance class F 30 and composed of “non-combustible” construction materials	F 30-A
Highly fire-retardant	Fire resistance class F 60 and mainly composed of “non-combustible” construction materials	F 60-AB
	Fire resistance class F 60 and composed of “non-combustible” construction materials	F 60-A
not easily flammable	Fire resistance class F 90 and mainly composed of “non-combustible” construction materials	F 90-AB
Not easily flammable and composed of “non-combustible” construction materials	Fire resistance class F 90 and composed of “non-combustible” construction materials	F 90-A
	Fire resistance class F 120 and composed of “non-combustible” construction materials	F 120-A
	Fire resistance class F 180 and composed of “non-combustible” construction materials	F 180-A

Classification of special components according to DIN 4102:

Some sections of DIN 4102 define requirements and tests for special components that also specify certain fire resistance classes. They include, in particular:

DIN 4102	Component	Fire resistance class
Part 3	External wall elements	W30 TO W180
Part 5	Fire barriers	T30 TO T180
Part 6	Ventilation lines and flaps	L30 TO L120
Part 9	Cable fire shields	S30 TOS180
Part 11	Pipe cladding and pipe firestops, installation shafts and barriers in their inspection openings	R30 TO R120 I30 TO I 120
Part 12	System integrity of electrical cables	E30 TO E90
Part 13	**Fire resistant glazing G glazing F glazing**	**G30 TO G120 F30 TO F120**

Construction law / Standardisation

European standard DIN EN 13051

Similar to the classification of fire behaviour for construction materials/construction products, the classification of fire behaviour for construction components/construction types according to the European standard DIN EN 13051, Parts 1 and 2, is more complex than in the German standard DIN 4102.

- It applies an equivalent method of letters and numbers to indicate the classification. Again the numbers indicate the duration of fire resistance in minutes, whereby the European classification system considers more intervals of time (20, 30, 45, 60, 90, 120 180 and 240 minutes).
- The letters describe the assessment criteria based on the type of component. But there is no indication for the essential construction materials used in the component.
- Other groups of letters provide additional information to describe the classification criteria.

Table 3: European classification criteria for the fire resistance of components, i.e. designs according to DIN EN 13501 (excerpt)

Abbreviation	Criterion	Application
R (Resistance)	Carrying capacity	
E (Etancheite)	Protective barrier	
I (Insulation)	Thermal insulation (when exposed to fire)	to describe the fire resistance capability
W (Radiation)	Limitation in heat transmission	
M (Mechanical)	Mechanical effects on the walls (impact stress)	
S (Smoke)	Limitation in smoke permeability (density, leakage rate)	Smoke protection doors (as additional requirement, also for fire barriers), ventilation systems, including flaps
C (Closing)	Self-closing property (with number of load cycles), including permanent function	Smoke protection doors, fire barriers (including barriers for transport systems)
P	Maintenance of power supply and/or signal transmission	Electrical cable systems in general
K1, K2	Fire protection capacity	Wall and ceiling panelling (fire protection panelling)
I1, I2	Different thermal insulation criteria	Fire barriers (including barriers for transport systems)
i → o i ← o i ↔ o (in-out)	Direction of the fire resistance duration	Non-supporting outside walls, installation shafts/ducts Ventilation systems, i.e. flaps
a ↔ b (above-below)	Direction of the fire resistance duration	Suspended ceilings
v_e h_0 vertical, horizontal)	Classified for vertical/horizontal installation	Ventilation lines/flaps

Construction law / Standardisation

Combined with the type of component, the fire resistance duration and additional data, there is now a broad variety of European fire resistance classes that did not exist at the time of the national classification system.
Table 4 lists a selection of components with their assigned fire-resistance classes according to DIN EN 13501, Parts 2 and 3. The first column refers to the building inspectorate requirements that are based on the provisions set forth in the Federal State Building Orders.
Details concerning the fire resistance classes according to DIN 4102 are shown in italics as a "comparison". The varying test and assessment procedures applied to fire resistance classes according to German and European standards mean that a complete comparability is not possible; hence the values are intended merely to provide guidance.
In summary, although the European classification and test standards on the fire behaviour of components/construction types can be used to test and classify on a European level, and although they exist as equals to the German DIN 4102 standard, fitness for purpose remains controlled by national regulations. It is therefore of the utmost importance to define and describe all requirements unequivocally during the phase of coexistence.

Table 4: Fire resistance classes of selected components according to DIN EN 13501 Part 2 and Part 3

Building inspectorate requirements	**Supporting components**		**Non-supporting interior walls**	**Non-supporting exterior walls**	**Self-supporting suspended ceilings**	**Fire barriers (also in transport systems)**
	without protective barrier	with protective barrier				
Fire-retardant	R 30 *F 30*	REI 30 *F 30*	EI 30 *F 30*	E 30 (i → o) EI 30 (i ← o) *W 30*	E 30 (a → b) EI 30 (a ← b) EI 30 (a ↔ b) *F 30*	EI2 30-C *T 30*
Highly fire-retardant	R 60 *F 60*	REI 60 *F 60*	EI 60 *F 60*	E 60 (i → o) EI 60 (i ← o) *W 60*	E 60 (a → b) EI 60 (a ← b) EI 60 (a ↔ b) *F 60*	EI2 60-C *T 60*
not easily flammable	R 90 *F 90*	REI 90 *F 90*	EI 90 *F 90*	E 90 (i → o) EI 90 (i ← o) *W 90*	E 90 (a → b) EI 90 (a ← b) EI 90 (a ↔ b) *F 90*	EI2 90-C *T 90*
Fire resistance after 120 min	R 120 *F 120*	REI 120 *F 120*				
Fire wall		REI 90-M *F 90*	EI 90-M *F 90*			

Column 1 shows the assignment to the building inspectorate requirements
Content shown in italics indicates the comparable fire resistance classes according to DIN 4102

Construction law / Standardisation

Product-specific classifications and terms

The following section provides a more precise definition of some terms, as the standards regulate a large number of construction materials/products, i.e. components/building types and at the same time influence construction law regulations.

Fire-resistant glazing
Fire-resistant glazings are components comprising one or several translucent elements, installed in a frame with holder and enclosed within sealing and fastening elements prescribed by the manufacturer. The product can only be considered fire-resistant glazing if it consists of the entirety of these constructive elements and complies with all prescribed dimensions and dimensional tolerances.

Fire-resistant glazing in fire resistance class F (F glazing)
The term F glazing applies to all translucent building components in a vertical, inclined or horizontal alignment that are designed not merely to prevent the spread of fire and smoke as designated in their fire resistance duration, but also to stop transmittance of heat radiation.

Fire resistance glazing in fire resistance class G (G glazing)
The term F glazing applies to all translucent building components in a vertical, inclined or horizontal alignment that are designed merely to prevent the spread of fire and smoke as designated in their fire resistance duration. Transmittance of heat radiation is merely impeded.

Fire-retardant glazing
Fire-retardant glazing is the name give to fire-resistant glazing that satisfies at least the requirements of F 30. It stipulates that fire-retardant glazing shall be F glazing that is impervious to heat radiation for a period of at least 30 minutes in accordance with the requirements of DIN 4102 Part 13.

Fireproof glazing
Fireproof is the name give to fire-resistant glazing that satisfies at least the requirements of F 90. It stipulates that fire-retardant glazing shall be F glazing that is impervious to heat radiation for a period of at least 90 minutes in accordance with the requirements of DIN 4102 Part 13.

“Fire resistance” glazing
Glazing described as fire-resistant provides a room barrier according to DIN 4102 Part 13 in the case of fire, but it permits the transmittance of heat and hence is not used with the building inspectorate designations or “fire-retardant” and “fireproof”. This includes all G glazing

Fire resistance classes according to DIN 4102

Fire resistance duration in minutes	F glazing	G glazing
≥ 30	F 30	G 30
≥ 60	F 60	G 60
≥ 90	F 90	G 90
≥ 120	F 120	G 120

The following terms and classifications are equivalent to the European provisions: The letters R, E, I and W are used to describe the fire resistance capability. S and C describe criteria applicable to fire doors and fire barriers.

R (Resistance / Loadbearing capacity)
The capability of a component to withstand fire stress from one or several sides without losing stability.

E (Étanchéité / Room barrier)
The capability of a component to act as a barrier to a room and to withstand fire stress from one side. It prevents the spread of fire to the side away from the fire caused by the passage of flames or substantial quantities of hot gases that would lead to combustion on the side away from the fire or in adjacent material.

W (Radiation / Radiation reduction)
The capability of a component to act as a barrier to a room and to withstand fire stress from one side such that the heat radiation measured on the side away from the fire remains below a certain value for a defined period.

Construction law / Standardisation

I (Isolation)
The capability of a construction component to withstand fire load applied from just one side without transferring the fire due to an excessive transmittance of heat from the fire side to the side opposite the fire, thus leading to combustion in the side opposite the fire or of adjacent materials, as well as the capability to present a sufficiently strong thermal barrier for the period defined in the classification in order to protect the lives of persons located in the vicinity of the structural element.

S (Smoke)
The capability of a construction component to restrict the movement of hot or cold gases or smoke from one side to the other.

C (Closing)
The capability of a construction component to automatically close an opening (either after each opening or only in cases of fire) in the event of the emergence of fire or smoke.

Classification of the fire resistance of non-loadbearing fire resistant glazing enclosing a space

a) Curtain walls and exterior walls (EN 1364-2, EN 1364-4)

Fire resistance duration in minutes	E glazing	EW glazing	EI glazing
15	E-15		EI-15
20		EW-20	EI-20
30	E-30	EW-30	EI-30
45	E-45		EI-45
60	E-60	EW-60	EI-60
90	E-90		EI-90

Curtain walls and exterior walls can be tested in different ways from both sides:

- Fire exposure from inside:
  Uniform temperature curve

- Fire exposure from outside:
  A temperature/time curve equivalent to ETK to 600°C and then even for the rest of the Test duration.

The following abbreviation describes the direction of fire resistance

"i → o" / inside - outside
"i → o" / outside - inside
"i → o" / inside and outside

The classification of curtain facades and exterior walls usually refers to both loads.

b) Partition walls (EN 1364-1)

Fire resistance duration in minutes	E glazing	EW glazing	EI glazing
15			EI-15
20	E-20	EW-20	EI-20
30	E-30	EW-30	EI-30
45			EI-45
60	E-60	EW-60	EI-60
90	E-90		EI-90
120	E-120		EI-120
180			EI-180
240			EI-240

c) Fire barriers (EN 1634-1)

Fire resistance duration in minutes	E glazing	EW glazing	EI glazing
15	E-15		EI-15
20		EW-20	EI-20
30	E-30	EW-30	EI-30
45	E-45		EI-45
60	E-60	EW-60	EI-60
90	E-90		EI-90
120	E-120		EI-120
180	E-180		EI-180
240	E-240		EI-240

Classifications C and S may be necessary in addition for certain types of fire barrier.

Construction law / Standardisation

Validation process

Allocation of the DIN classifications within the Federal State Building Order
The terms used by the building inspectorate of “fire retardant” and “fire resistant” are not mentioned in DIN 4102. The federal states of Germany issued decrees to introduce DIN 4102 within building inspectorate procedures that specify whether components classified in fire resistance classes according to this standard should be considered “fire retardant” or “fire resistant”.

Official validation of fitness for purpose
The suitability of construction materials or components for the purpose of fire resistance in structural engineering must usually be provided in the form of a test certificate issued by an accredited test institute.
This does not apply to construction materials and components that are listed and classified in DIN 4102 Part 4. Components that cannot be assessed solely according to DIN 4102 require separate validation. Fire resistance glazing belongs in this category.

General construction test certificate (abP)
A general construction test certificate (abP) is a proof of fitness for purpose that is issued for a construction product whose use is not associated with the satisfaction of significant requirements in regard to the safety of structures, or for a construction product that can be assessed according to generally accepted test methodologies (Sect 19 (1) Model Building Code (MBO)). The Construction Product List A Part 1, Part 2 and Part 3 state in detail for which products an abP can be issued. Exclusively the test institutes accredited by the Deutsche Institut für Bautechnik (DIBt) or the most senior building inspectorate are entitled to issue an abP.
An abP cannot be issued for fire-resistant glazing.

General building authorisation (abZ)
General building authorisations (abZ) are issued for construction products and construction techniques that are governed by the Federal State Building Codes and for which there are no generally acknowledged rules of technology, in particular DIN standards, or that differ substantially from these rules. Exclusively the Deutsche Institut für Bautechnik issues general building authorisations on behalf of the federal states. They are a validation of the fitness for purpose, i.e. suitability for use, of an unregulated construction product or an unregulated construction technique in regard to the building inspectorate requirements defined in the Federal State Building Codes. Fire-resistance glazing is regulated by abZs.

Case-by-case approval
Case-by-case approval, known as ZiE, can be applied for if fire-resistance glazing approved by the building inspectorate is not available to satisfy a certain requirement. This applies also if the actual construction implemented differs from the approval. The case-by-case approval replaces the missing approval by the building inspectorate in an exceptional instance.

The principal must place an application for this approval with the senior building inspectorate in the respective federal state in which the project is being implemented. In most cases an application for case-by-case approval will be granted if test findings validate the fitness for purpose or if there are equivalent findings available elsewhere (assessor’s report), or if the effort involved in performing the tests is considered unreasonable and if the use in the intended construction technique is considered acceptance from a fire-resistance perspective.

The following page lists the competent bodies in the individual federal states.

Assessor’s report
An assessor’s report (GaS) if issued by a state-accredited test institute. It is considered a validation of fitness for purpose in place of testing, provided this can be ascertained by an expert’s opinion. It is submitted to the Deutsche Institut für Bautechnik, i.e. to the competent senior building inspectorate. The application for an assessor’s report should always take place in consultation with the senior building inspectorate. It is advisable to commission the report from the test institute that performed the fire tests for the respective approval. These are the following institutes for the approval of Stabalux systems:

STABALUX

Construction law / Standardisation

Test body	Telephone	Telefax
MPA NRW Materialprüfamt Nordrhein-Westfalen Außenstelle Erwitte, Auf den Thränen 2 D-59597 Erwitte	+49 (0)2943/8970 (Switchboard) +49 (0)2943/89715 (Mr Werner)	+49 (0)2943/89733
IBMB MPA Braunschweig Materialprüfamt für das Bauwesen Beethovenstraße 52 D-38106 Braunschweig	+49 (0)531/391/5472 (Switchboard) +49 (0)531/391 5909	+49 (0)531/391 8159

Competent authorities for the issue of approval in individual cases

Federal state	Ministry	Telephone	Telefax
Baden-Württemberg	Haus der Wirtschaft, Landesstelle für Bautechnik, Willy Bleicher Straße 19, D-70174 Stuttgart	+49 (0)711/1230 (Switchboard) +49 (0)711/123 3385	+49 (0)711/123 3388
Free State of Bavaria	Bayerisches Staatsministerium des Innern, -Oberste Baubehörde- Postfach 22 00 36, D-80535 Munich	+49 (0)89/219202 (Switchboard) +49 (0)89/2192 3449 (Dr Schubert) 089/2192/3496 (Hr. Keil)	+49 (0)89/2192 13498
Berlin	Senatsverwaltung für Stadtentwicklung –II- Prüfamt für Bautechnik und Rechtsangelegenheiten der Bauaufsicht, Abteilung 6E21 Württenbergische Straße 6, D-10702 Berlin	+49 (0)30/900 (Switchboard) +49 (0)30/90124809 (Dr Espich)	+49 (0)30/901 23 525
Brandenburg	Ministerium für Stadtentwicklung, Wohnen und Verkehr des Landes Brandenburg, Referat 24 Henning-von-Tresckow-Straße 2-8 D-14467 Potsdam	+49 (0)331/8660 (Switchboard) +49 (0)331/866 8333	+49 (0)331/866 8363
Free Hanseatic City of Bremen	Free Hanseatic City of Bremen Der Senator für Bau und Umwelt Ansgaritorstraße 2, D-28195 Bremen	+49 (0)421/3610 (Switchboard)	
Free Hanseatic City of Hamburg	Free Hanseatic City of Hamburg Amt für Bauordnung und Hochbau Stadthausbrücke 8, D-20355 Hamburg	+49 (0)40/428400 (Switchboard) +49 (0)40/428 40 3832	+49 (0)40/428403098
Hesse	Hessisches Ministerium für Wirtschaft, Verkehr und Landesentwicklung –Abteilung VII- Kaiser-Friedrich-Ring 75, D-65185 Wiesbaden	+49 (0)611/8150 (Switchboard) +49 (0)611/815 2941	+49 (0)611/815 2219
Mecklenburg-Vorpommern	Ministerium für Arbeit und Bau Mecklenburg-Vorpommern Abteilung II, Schloßstraße 6-8 D-19053 Schwerin	+49 (0)385/5880 (Switchboard) +49 (0)385/588 3611 (Mr Harder)	+49 (0)385/588 3625
Lower Saxony	Niedersächsisches Innenministerium, Abteilung 5 Lavesallee 6, D-30169 Hannover	+49 (0)511/1200 (Switchboard) +49 (0)511/120 2924 (Mr Bode) +49 (0)511/120 2925 (Mr Janke)	+49 (0)511/120 3093
North Rhine Westphalia	Ministerium für Städtebau und Wohnen, Kultur und Sport des Landes Nordrhein-Westfalen, Abteilung II, Elisabethstraße 5-11 D-40217 Düsseldorf	+49 (0)211/38430 (Switchboard) +49 (0)211/384 3222	+49 (0)211/384 3639
Rhineland Palatinate	Ministerium für Innen und Sport des Landes Rheinland-Pfalz Schillerstraße 3-5, D-55116 Mainz	+49 (0)6131/160 (Switchboard) +49 (0)6131/163406	+49 (0)6131/163447
Saarland	Ministerium für Umwelt, Oberste Bauaufsicht Keppelerstraße 18, D-66117 Saarbrücken	+49 (0)681/50100 (Switchboard) +49 (0)681/501 4771 (Ms Elleger)	+49 (0)681/501 4101
Saxony Anhalt	Ministerium für Wohnungswesen, Städtebau und Verkehr des Landes Sachsen-Anhalt, Abteilung II Turmschanzenstraße 30, D-39114 Magdburg	+49 (0)391/56701 (Switchboard) +49 (0)391/567 7421	

Construction law / Standardisation

Federal state	Ministry	Telephone	Telefax
Free State of Saxony	Sächsisches Staatsministerium des Innern, Abteilung 5, Referat 53 Wilhelm-Buck-Straße 2, D-01095 Dresden	+49 (0)351 / 5640 (Switchboard) +49 (0)351 / 643530 (Dr Fischer)	+49 (0)351 / 5643509
Schleswig-Holstein	Innenministerium des Landes Schleswig-Holstein, Bauaufsicht und Landesbauordnung, Referat IV 65 Düsternbrooker Weg 92, D-24105 Kiel	+49 (0)431 / 9880 (Switchboard) +49 (0)431 / 9883319 (Mr Dammann)	+49 (0)431 / 9882833
Thuringia	Oberste Bauaufsichtsbehörde im Thüringer Innenministerium Referat 50b, Bautechnik, Steigerstraße 24, D-99096 Erfurt	+49 (0)361 / 37900 (Switchboard) +49 (0)361 / 3793931 (Ms Müller)	+49 (0)361 / 3793048

Burglary-resistant facades

Recommendations for use

The selection of applicable resistance class must be made to reflect the individual hazard exposure, for instance the location of the property or the exposure of the particular element. The police services information centres and insurance providers offer assistance in this respect.
DIN EN 1627 assigns construction components to the resistance classes RC1 to RC6. They each define minimum requirements for the system and the mounted glazing and panels.

Regulations and testing

The standard DIN EN1627 defines the requirements for and classification of a burglary-resistant facade. The test methods used to determine resistance under static and dynamic load are defined in the standards DIN EN 1628 and DIN EN 1629. The test method for the determination of resistance to manual burglary attempts is defined in DIN EN 1630. Validation of adherence to the requirements set forth in the aforementioned standards must be obtained from an accredited test institute. The filling elements used are governed by the standard DIN EN 356.

Labelling and validation obligations

The system provider must submit assembly instructions and a test report as minimum requirements. An assessor's report clarifies the influence of deviations in or changes to the test specimens in respect of their capability to withstand burglary attempts.

An assembly certificate should be obtained from the facade manufacturer, confirming that assembly was performed professionally and according to the assembly instructions issued by the system provider. DIN EN 1627 contains a template for this purpose. Stabalux can also provide a suitable template. The assembly certificate must be submitted to the principal.

The processor can also, as a means of voluntary quality assurance, obtain certification according to DIN CERTCO or an alternative certification institute accredited according to DIN EN 45011.

In this case, construction components with burglary-resistant properties must be labelled permanently, for instance using a name plate attached discretely on the facade. The name plate must be clearly legible and have a minimum size of 105 mm x 18mm; it must contain the following information at least:

- Burglary-resistant component according to DIN EN 1627
- Achieved resistance class
- Product designation by the system provider
- Certification mark if applicable
- Manufacturer
- Test report number ..., date ...
- Notifying body, code as applicable
- Year of manufacture

Police services only recommend the use of a business certified by an accredited certification institute. The certification programme “Burglary protection”, which is available from DIN CERTCO, contains additional information on the issue of the “DIN tested” label.

Tested systems

• Stabalux SR	RC2, RC3
• Stabalux AK 5010	RC2
• Stabalux AK 6010	RC2
• Stabalux AK 6020	RC2

Burglary-resistant facades

9.8
1

Design

The most important properties in the construction of a burglary-resistant facade are:

- Use of tested panes and panels as filling elements.
- Definition of the inlay depth for the filling elements.
- Installation of lateral blocks to prevent displacement of the filling elements.
- Choice of stainless steel or aluminum clamping strips on the Stabalux SR system.
- Definition of the screw spacing and the screw depths
- Securing of the screws against loosening with Stabalux SR.

The appearance of burglar-resistant facades using Stabalux System SR and AK-S is the same as the normal construction.

- The same design options and styles are possible as with a normal construction.
- All upper strips can be used when fitting stainless steel bottom strips.
- All inner seal systems (1, 2 and 3 sections) can be used.
- All benefits of using threaded tubes are preserved.

Burglary-resistant facades

9.8
1

Assembly certificate
according to DIN EN 1627

Company: ....

Address: ....

....

certifies that the burglar-resistant components listed hereafter were installed
according to the specification of the assembly instructions (appended with the test report)

in the property: ....

Address: ....

....

.

Part	Location in the property:	Resistance class	Particulars

....
Date Stamp Signature

Burglary-resistant facades - RC2

Resistance class RC2

In Stabalux system SR, facades in resistance class RC2 can be mounted in the system widths 50 mm and 60 mm.

In the system Stabalux AK-S facades of resistance class RC2 can be built in the system widths 50 mm, 60 mm and 80 mm.

Compared with a normal facade, only a small manufacturing workload is needed in order to achieve resistance class RC2.

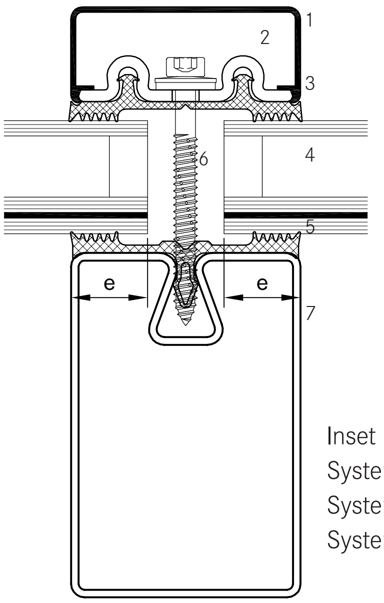
- Securing of the filling elements against lateral displacement.
- Arrangement and selection of the clamping strip screw fittings relative to the permissible axis dimensions in the fields.
- Securing of the clamping strip screw fitting against loosening.

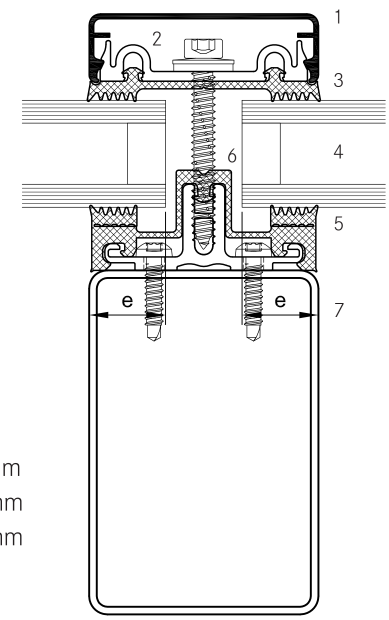
System articles and filling elements are only approved for use if they have been tested and received a positive assessment.

It is always necessary to validate that in the dimensions selected, the components used will satisfy the static requirements placed in the system for the specific project.

The design options for the facade remain preserved, as all aluminium upper strips that can be clipped on to the stainless steel bottom strips UL 5110 and UL 6110 can still be used.

Sealing systems
The inner sealing system for burglary-resistant facades can also use systems with 1 section or overlapping sealing systems with 2 or 3 sections.





Inset “e” of the filling element
System width 50 mm: e = 15 mm
System width 60 mm: e = 20 mm
System width 80 mm: e = 20 mm

1 Upper strip
2 Bottom strip (Stainless steel or aluminium)
3 Outer seal
4 Filling element
5 Inner seal
(e.g. with 1 drainage section)
6 System screw fittings
7 Threaded tube / substructure

TI-S_9.8_001.dwg

Burglary-resistant facades - RC2

9.8
2

Approved system articles for the Stabalux SR system

System components Stabalux SR	System width 50 mm	System width 60 mm
Mullion cross-section minimum dimensions	Threaded tube SR 5090-2	Threaded tube SR 6090-2
Transom cross-section Minimum dimensions	Threaded tube SR 5040-2	Threaded tube SR 6040-2
Mullion-transom joint	Welded connection or screwed t-connector according to the general building authori-sation	Welded connection or screwed t-connector according to the general building authori-sation
Inner seal mullions	e.g. GD 5201	e.g. GD 6202, GD 6222
		e.g. GD 6206
	e.g. GD 5314	e.g. GD 6314, GD 6324
	e.g. GD 5315	e.g. GD 6315, GD 6325
Inner seal transom (with connected transom flag)	e.g. GD 5203, GD 5204	e.g. GD 6204, GD 6205
		e.g. GD 6224, GD 6225
		e.g. GD 6303
	e.g. GD 5317	e.g. GD 6318, GD 6328
Outer seal mullion	e.g. GD 1932, GD 5024, GD 5122 WK	e.g. GD 1932, GD 6024, GD 6122 WK
Outer seal transom	e.g. GD 1932, GD 5054, GD 5122 WK	e.g. GD 1932, GD 6054, GD 6122 WK
Clamping strips	UL 5009, UL 5110 Stainless steel	UL 6009, UL 6110 Stainless steel
Screw fittings for clamping strips	System screws (cylinder head screw with sealing washer , internal hex, stainless steel, e.g. Z 0156)	System screws (cylinder head screw with sealing washer , internal hex, stainless steel, e.g. Z 0156)
Glass support	Inset glass support (e.g. GH 0281), two-part glass supports GH 5051 (e.g. bottom part GH 0262 / upper part GH 0268)	Inset glass support (e.g. GH 0281), two-part glass supports GH 5051 (e.g. bottom part GH 0262 / upper part GH 0268)
Lateral blocks	e.g. Z 1061	e.g. Z 1061
Screw locks *)	Z 0093, stainless steel ball ø 5mm	Z 0093, stainless steel ball ø 5mm
Superglue *)	Z 0055	Z 0055

*) For other options, refer to the section “Securing clamping strip screw fittings against loosening“

Burglary-resistant facades - RC2

Approved system articles for the Stabalux AK-S system

System components Stabalux AK-S	System width 50 mm	System width 60 mm	System width 80 mm [1)]
Mullion cross-section minimum dimensions	Steel profile, width b = 50 mm height at least H = 40 mm	Steel profile, width b = 60 mm height at least H = 40 mm	Steel profile, width b = 80 mm height at least H = 40 mm
Transom cross-section minimum dimensions	Steel profile, width b = 50 mm height at least H = 40 mm	Steel profile, width b = 60 mm height at least H = 40 mm	Steel profile, width b = 80 mm height at least H = 40 mm
Inner seal mullions	GD 5071	GD 6071	GD 8071
Inner seal transom (with connected transom)	GD 5072	GD 6072	GD 8072
	GD 5073	GD 6073	GD 8073
Outer seal mullion	z.B. GD 5024, GD 1932	z.B. GD 6024, GD 1932	z.B. GD 8024, GD 1932
Outer seal transom	z.B. GD 5054, GD 1932	z.B. GD 6054, GD 1932	z.B. GD 1932
Clamping strips	UL 5009	UL 6009	UL 8009
Screw fittings for clamping strips	System screws (cylinder head screw with sealing washer, internal hex, stainless steel, e.g. Z 0155)	System screws (cylinder head screw with sealing washer, internal hex, stainless steel, e.g. Z 0155)	System screws (cylinder head screw with sealing washer, internal hex, stainless steel, e.g. Z 0155)
Glass supports	GH 6071, GH 6072	GH 6071, GH 6072	GH 6071, GH 6072
Lateral blocks	e.g. Z 1061 or blocks b x h = 24 mm x 20 mm Length ℓ = 120 mm, cut from PUR recycling material (e.g. Purenit, Phonotherm)	e.g. Z 1061 or blocks b x h = 24 mm x 20 mm Lengthℓ = 120 mm, Cut from PUR recycling material (e.g. Purenit, Phonotherm)	Blocks b x h = 36 mm x 20 mm Length ℓ = 120 mm, cut from PUR recycling material (e.g. Purenit, Phonotherm)
Screw locks	not necessary	not necessary	not neccessary

1) System articles for the system width 80 mm available only on request

Burglary-resistant facades - RC2

Filling elements

It is important to check on-site that the filling elements satisfy the static requirements of the project.

Glazing and panels must satisfy the requirements of at least DIN EN 356.

Glass

To satisfy resistance class RC2, it is necessary to fit impact-resistant glazing type P4A, as provided by the firm SAINT GOBAIN. The total structure of the glass has a thickness of approx. 30 mm.

- Product SGG STADIP PROTECT CP 410
- Resistance class P4A
- Multi-pane insulating glass, glass structure from outside in.
- 4 mm float /16mm SZR / 9.52 mm VSG
- Glass thickness Δ = 29,52 mm ≈ 30 mm
- Glass weight approx. 32 kg/m²

Panel

Panel structure:
3 mm aluminium sheet / 24 mm PUR (or comparable material) with reinforced edge bonding / 3 mm aluminium sheet. The total thickness is 30 mm.

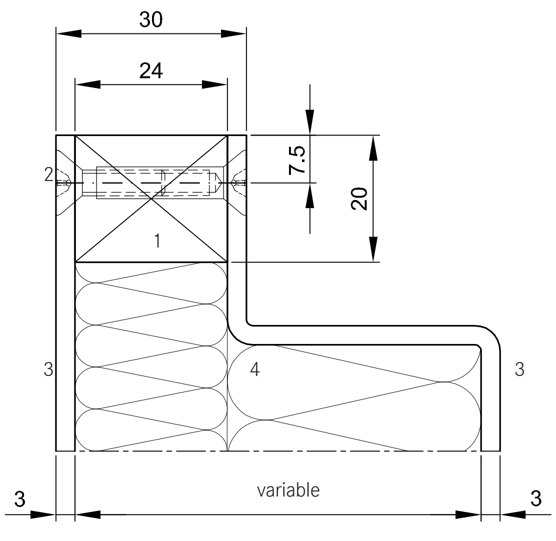
Edge bonding:

A circumferential edge of 24mm x 20 mm made of PUR recycling material (e.g. Purenit, Phonotherm) is inserted to reinforce the panels. Both sheets are screwed together in the area of the edge bonding; screws are positioned on each side in intervals of a ≤ 116 mm and screwed together along the entire length. Stainless steel screws Ø 3.9 mm x 38 mm can be used in this respect; they are cut off and ground down on the side not exposed to an attack. Fixing screws / nuts M4 can be used alternatively.

It is permitted, in order to satisfy additional requirements placed in the panel (e.g. in regard to thermal insulation), to deviate from the cross-section geometry shown in the diagram below. This applies only if the material thickness of the sheet aluminium t = 3 mm is preserved and the edge bonding is prepared as described above.

Inset of the filling elements

If the system width is 50 mm, the filling elements e = 15 mm must be installed. For system widths of 60 mm and 80 mm, the debut is set to e = 20 mm.



TI-S_9.8_003.dwg

1 Edge bonding
2 Screw fittings, e.g. fixing screw / nut M4
3 Aluminium sheet t = 3 mm
4 Insulation

STABALUX

Burglary-resistant facades - RC2

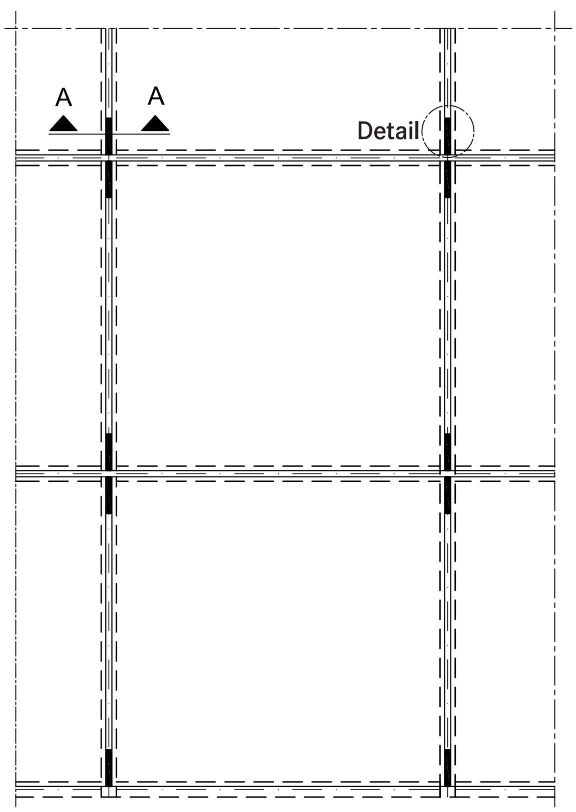
9.8
2

Lateral blocks on the filling elements

The filling elements must be secured against lateral displacement. Installation of a lateral, pressure-resistant blocks prevents any displacement of the filling elements in the event of manipulation.

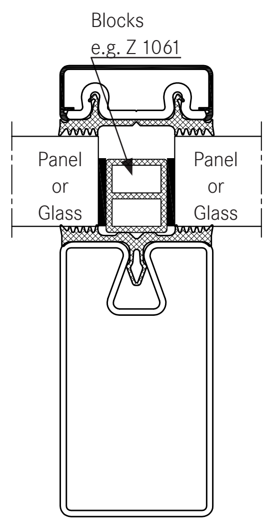
One block must be fitted in each corner of the mullion rebate. The blocks (art. no. Z 1061, plastic tubing h x w x d = 20 mm x 24 mm x 1.0, length ℓ = 120 mm) must be glued into the system. The glue used must be compatible with the edge bonding of the filling elements. The blocks can also be fixed in place by screwing them to the threaded tube.

The blocks can also be cut out of another pressure-resistant, non-absorbent material such as PUR recycling material (e.g. Purenit, Phonotherm).

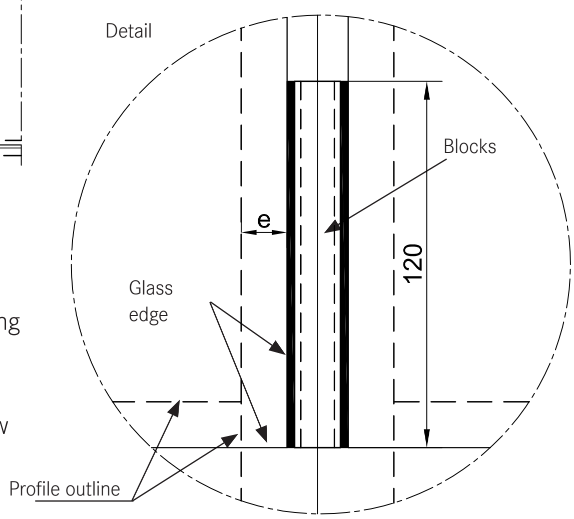


*) Glue in the blocks
(the glue must be compatible with the edge bonding of the filling elements)
or
Use fixing screw to secure the position in the screw channel

Cut A - A



Detail



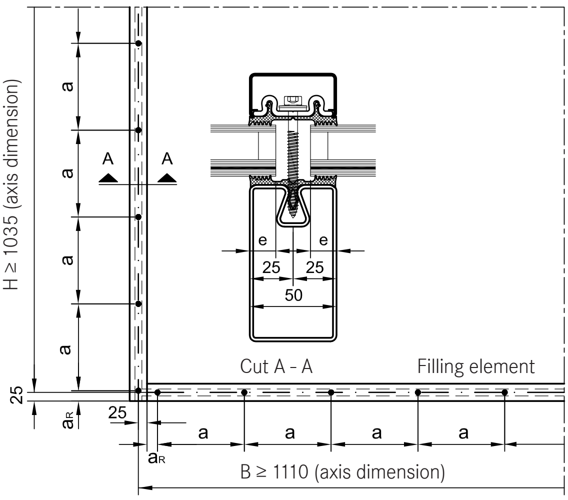
TI-S_9.8_004.dwg

Burglary-resistant facades - RC2

Screw fittings for clamping strips Stabalux SR with UL 5110 / UL 6110

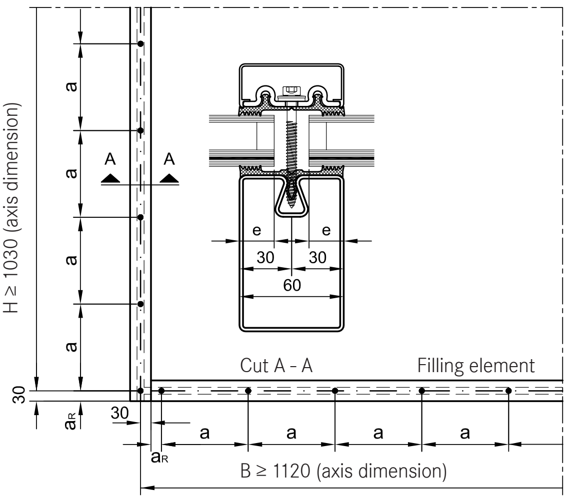
- The screw fittings are made in the screw channel.
- The screw length must be calculated for each project.
- The edge distance of the screw fittings for clamping strips is defined as a_R = 30 mm.
- The selection and arrangement of the screw fittings depends on the axis dimensions of the fields. The maximum distance between screws is a = 250 mm and must on accounts be exceeded.
- The following lists the edge dimensions and special factors of the edge sections in cases a to d.

Case a)
System width 50 mm – axis dimensions B ≥ 1110 mm and H ≥ 1035 mm
System width 60 mm – axis dimensions B ≥ 1120 mm and H ≥ 1030 mm



System width	**50 mm**
Edge distances	a_R = 30 mm
Number of screws	n ≥ 5
Screw spacing	a ≤ 250 mm.
Inset	e = 15 mm

There is no limit on the axis dimensions B and H.



System width	**60 mm**
Edge distances	a_R = 30 mm
Number of screws	n ≥ 5
Screw spacing	a ≤ 250 mm.
Inset	e = 20 mm

There is no limit on the axis dimensions B and H.

TI-S_9.8_005.dwg

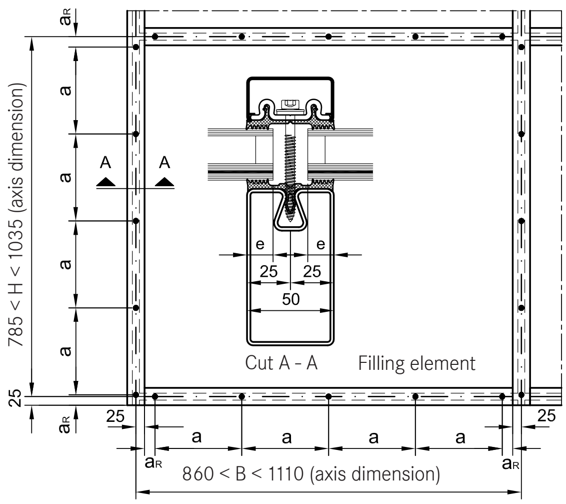
STABALUX

Burglary-resistant facades - RC2

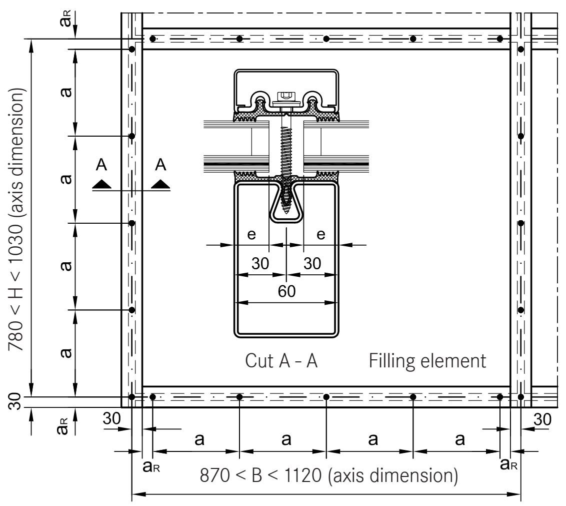
9.8
2

Case b)
System width 50 mm – axis dimensions 860 mm < B < 1110 mm and 785 mm < H < 1035 mm
System width 60 mm – axis dimensions 870 mm < B < 1120 mm and 780 mm < H < 1030 mm

The spacing between screws is defined as a ≤ 250 mm. n = 5 screws must on all accounts be fitted to each side of the field, irrespective of the upper limit of a = 250.



System width	**50 mm**
Edge distances	a_R = 30 mm
Number of screws	n ≥ 5
Screw spacing	a ≤ 250 mm.
Inset	e = 15 mm



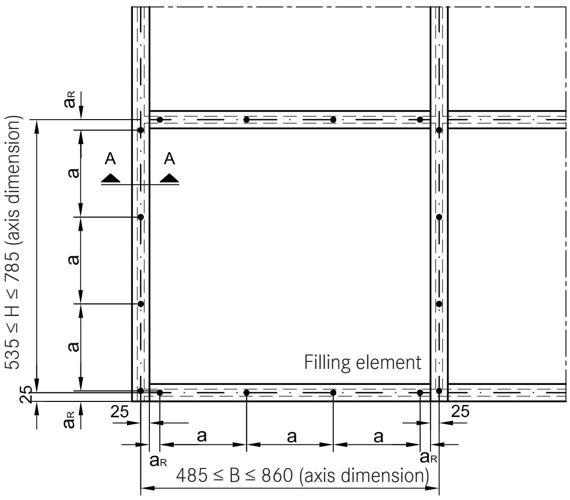
System width	**60 mm**
Edge distances	a_R = 30 mm
Number of screws	n ≥ 5
Screw spacing	a ≤ 250 mm.
Inset	e = 20 mm

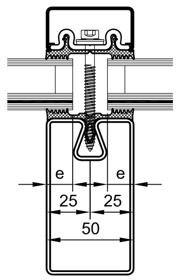
TI-S_9.8_005.dwg

Burglary-resistant facades - RC2

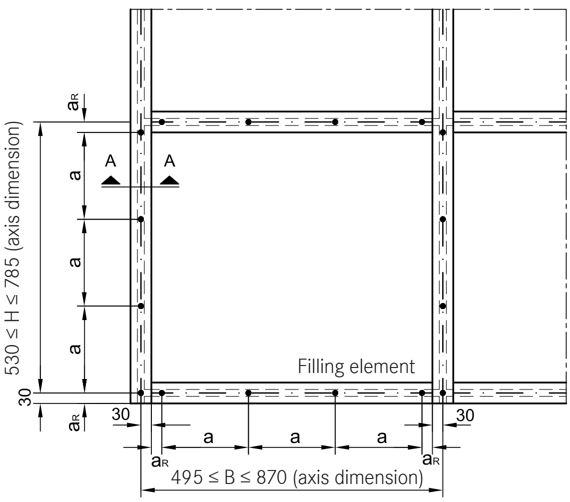
Case c)
System width 50 mm – axis dimensions 485 mm ≤ B ≤ 860 mm and 535 mm ≤ H ≤ 785 mm
System width 60 mm – axis dimensions 495 mm ≤ B ≤ 870 mm and 530 mm ≤ H ≤ 780 mm

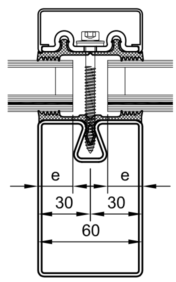
The spacing between screws is defined as 125 mm ≤ a ≤ 250 mm. N = 4 screws must on all accounts be fitted to each side of the field, irrespective of the upper limit of a = 250.




Cut A - A

System width	50 mm
Edge distances	a_R = 30 mm
Number of screws	n = 4
Screw spacing	125 mm ≤ a ≤ 250 mm
Inset	e = 15 mm




Cut A - A

System width	60 mm
Edge distances	a_R = 30 mm
Number of screws	n = 4
Screw spacing	125 mm ≤ a ≤ 250 mm
Inset	e = 20 mm

TI-S_9.8_005.dwg

Burglary-resistant facades - RC2

Case d)
System width 50 mm – axis dimensions B < 485 mm and H < 535 mm
System width 60 mm – axis dimensions B < 495 mm and H < 530 mm

Fields with the axis dimensions B < 485 mm and H < 535 mm for system width 50, and fields with the axis dimensions B < 495 mm and H < 530 mm for system width 60 mm are prohibited.

Securing clamping strip screw fittings against loosening

The following measures must be taken to secure the screw heads (e.g. Stabalux system screws art. no. Z 0156, cylinder head Ø 10 mm with internal hex) against manipulation.

- Hammer in stainless steel balls Ø 5.50 mm (procured on the building site).
- Apply glue to the stainless steel balls Ø 5.00 mm (art. no. Z 0093) type instant glue (art. no. Z 0055).
- Drill out the screw heads.

If stainless steel balls are used to as a safety measure, it is important to pay attention in the selection of the clamping strip that there is sufficient space for the screw head and that the stainless steel balls can protrude.

STABALUX

Burglary-resistant facades - RC2

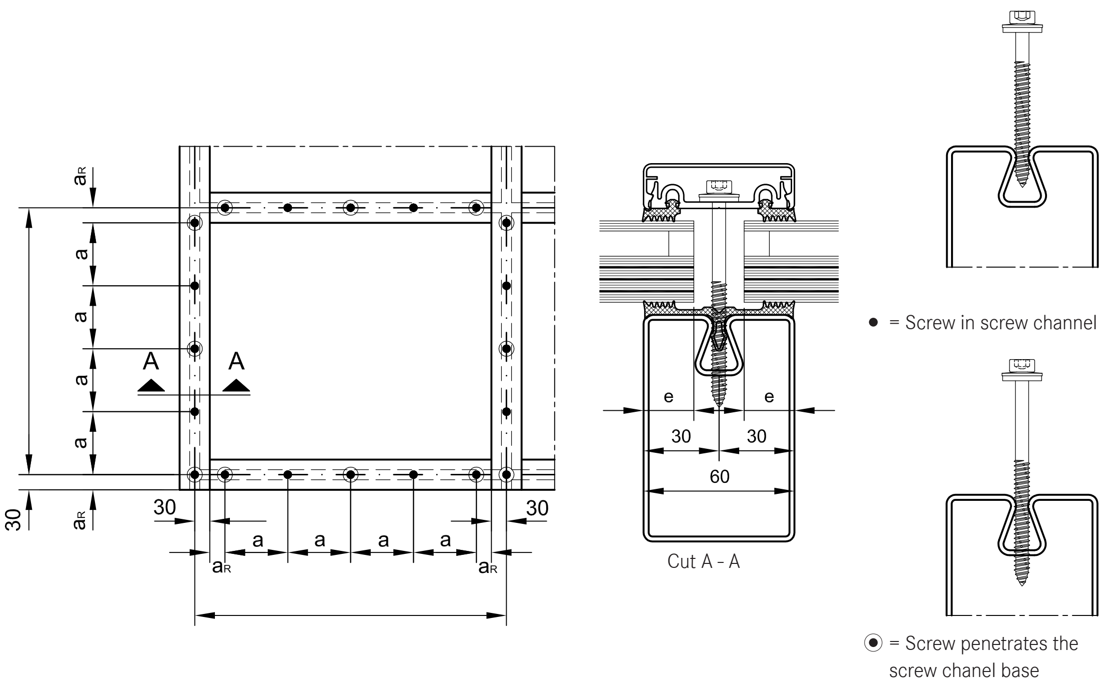
9.8
2

Screw fittings for clamping strips Stabalux SR with UL 5009 / UL 6009

- The screw fitting are made in the screw channel.
- The screw length must be calculated for each project.
- The edge distance of the screw fittings for clamping strips is defined as a_R = 30 mm.
- The selection and arrangement of the screw fittings depends on the axis dimensions of the fields. The maximum distance between screws is a = 125 mm and must on accounts be exceeded.
- The axis dimesnions B and H can be selected indefinitely, the minimum field size is 485 x 535 mm. There must be at least 5 screws per side.
- The first and last screw on the clamping strip must be screwed in the screw channel and through the screw channel base. In addition, every second screw must penetrate the screw channel base. For this purpose, a hole Ø 4 mm must be pre-drilled in the screw channel base.

Securing clamping strip screw fittings against loosening

It is not neccesary to secure the clamping strip screw fittings with the Stabalux SR system combined with the UL 5009 / UL 6009.



TI-S_9.8_005.dwg

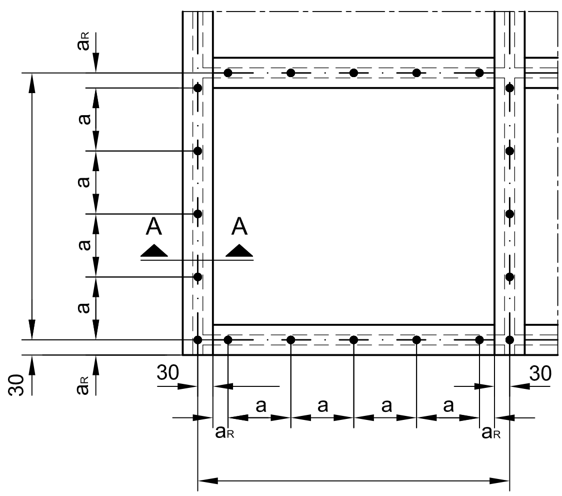
Burglary-resistant facades - RC2

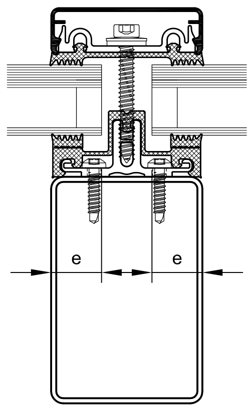
Screw fittings for clamping strips Stabalux AK-S

- The screw fitting are made in the screw channel.
- The screw length must be calculated for each project.
- The edge distance of the screw fittings for clamping strips is defined as a_R = 30 mm.
- The selection and arrangement of the screw fittings depends on the axis dimensions of the fields. The maximum distance between screws is a = 125 mm and must on accounts be exceeded.
- The axis dimesnions B and H can be selected indefinitely, the minimum field size is 485 x 535 mm. There must be at least 5 screws per side.

Securing clamping strip screw fittings against loosening

It is not neccesary to secure the clamping strip screw fittings with the Stabalux AK-S system.





Burglary-resistant facades - RC2

Assembly instructions Stabalux SR with UL 5110 / UL 6110

The processing instructions provided in Section 1.2 of the catalogue apply as a rule to the system Stabalux SR. The following items must be considered additionally and executed in the necessary stages of processing in order to satisfy the criteria of resistance class RC2.

1 Construction of the facade using the tested system articles and according to static requirements.

2 The panels must be impact-resistant according to DIN EN 356. Tested glazing of the type P4A, for instance by SGG STADIP PROTECT CP 410 with approx. 30 mm glass structure, must be used in order to obtain resistance class RC2. The panel structure must be the same as the tested panel structure.

3 The inset of the filling elements is e = 15 mm for threaded tubes in the system width 50 mm. The inset of the filling elements is e = 20 mm for threaded tubes in the system width 60 mm.

4 Blocks must be used to secure the filling elements against lateral displacement. To achieve this, blocks are needed in each filling corner in the rebate of the mullion.

5 Exclusively Stabalux system screws with sealing washers and internal hex may be used (e.g. article no. Z 0156).

The edge distance of the screw fittings for clamping strips is a_R = 30 mm and must be adhered to.

In field sizes with the axis dimensions **B ≥ 1110 mm** and **H ≥ 1035 mm** (system width 50 mm) and axis dimensions **B ≥ 1120 mm** and **H ≥ 1030 mm** (system width 60 mm), the maximum distance between the screws must not be more than a = 250 mm.

In field sizes with the axis dimensions **860 mm < B < 1110 mm and 785 mm < H < 1035 mm** (system width 50 mm) and axis dimensions **870 mm < B < 1120 mm and 780 mm < H < 1030 mm** (system width 60 mm), the distance between the screws is defined as a ≤ 250 mm. n = 5 screws must on all accounts be fitted to each side of the field, irrespective of the upper limit of a = 250.

In field sizes with the axis dimensions **485 mm ≤ B ≤ 860 mm and 535 mm ≤ H ≤ 785 mm** (system width 50 mm) and axis dimensions **495 mm ≤ B ≤ 870 mm and 530 mm ≤ H ≤ 780 mm** (system width 60 mm), the distance between the screws is defined as a ≤ 250 mm. n = 4 Screws must on all accounts be fitted to each side of the field, irrespective of the upper limit of a = 250.

Fields with the axis dimensions **B < 485 mm and H < 535 mm** for system width 50, and fields with the axis dimensions **B < 495 mm and H < 530 mm** for system width 60 mm are prohibited.

6 Once the clamping strips have been fitted, it is important to make certain that the screws cannot be loosened in accordance with the requirements of resistance class RC2. This can be ensured by drilling out the screw heads or by hammering or gluing in steel balls.

7 The support of the mullions (head, foot and intermediate support) must be calculated with sufficient static leeway so that any forces applied during an attempted burglary can be absorbed with certainty. Accessible fixing screws must be secured against unauthorised loosening.

8 Burglary-resistant components are intended for installation in solid walls. The minimum requirements provided in DIN EN 1627 apply to wall connections.

Assignment of burglar-resistant components in resistance class RC2 to the walls

Resistance class of the burglary-resistant component according to DIN EN 1627	Surrounding walls							
	Masonry according to DIN 1053 – 1			Reinforced concrete according to DIN 1045		Aerated concrete wall		
	Rated thickness	Compressive strength class of the blocks	Mortar group	Rated thickness	Strength class	Rated thickness	Compressive strength class of the blocks	Execution
RC2	≥ 115 mm	≥ 12	II	≥ 100 mm	≥ B 15	≥ 170 mm	≥ 4	glued

Burglary-resistant facades - RC2

Assembly instructions Stabalux SR and AK-S with UL 5009 / UL 6009 / UL 8009*

The processing instructions provided in Section 1.2 of the catalogue apply as a rule to the system Stabalux AL. The following items must be considered additionally and executed in the necessary stages of processing in order to satisfy the criteria of resistance class RC2.

1 Construction of the facade using the tested system articles and according to static requirements.

2 The filling elements (glass and panel) must be impact-resistant according to DIN EN 356. Tested glazing of the type P4A, for instance by SGG STADIP PROTECT CP 410 with approx. 30 mm glass structure, must be used in order to obtain resistance class RC2. The panel structure must be the same as the tested panel structure.

3 The inset of the filling elements is e = 15 mm for timber profiles in the system width 50 mm.

4 Blocks must be used to secure the filling elements against lateral displacement. To achieve this, blocks are needed in each filling corner in the rebate of the mullion.

5 Exclusively Stabalux system screws with sealing washers and internal hex may be used (e.g. article no. Z 0156).

The edge distance of the screw fittings for clamping strips is a_R = 30 mm.

The maximum screw distance must not exceed the value a = 125 mm.

6 The glass supports are to be positioned so that they can be mounted between the screw grid of 125mm.

7 The support of the mullions (head, foot and intermediate support) must be calculated with sufficient static leeway so that any forces applied during an attempted burglary can be absorbed with certainty. Accessible fixing screws must be secured against unauthorised loosening.

8 Burglary-resistant components are intended for installation in solid walls. The minimum requirements provided in DIN EN 1627 apply to wall connections.

*) UL 8009 only in connection with Stabalux AK-S

Assignment of burglar-resistant components in resistance class RC2 to the walls

Resistance class of the burglary-resistant component according to DIN EN 1627	Surrounding walls							
	Masonry according to DIN 1053 – 1			Reinforced concrete according to DIN 1045		Aerated concrete wall		
	Rated thickness	Compressive strength class of the blocks	Mortar group	Rated thickness	Strength class	Rated thickness	Compressive strength class of the blocks	Execution
RC2	≥ 115 mm	≥ 12	II	≥ 100 mm	≥ B 15	≥ 170 mm	≥ 4	glued

STABALUX

Burglary-resistant facades - RC3

Resistance class RC3

In Stabalux system SR, facades in resistance class RC3 can be mounted in the system width 60 mm.

Compared with a normal facade, only a small manufacturing workload is needed in order to achieve resistance class RC3.

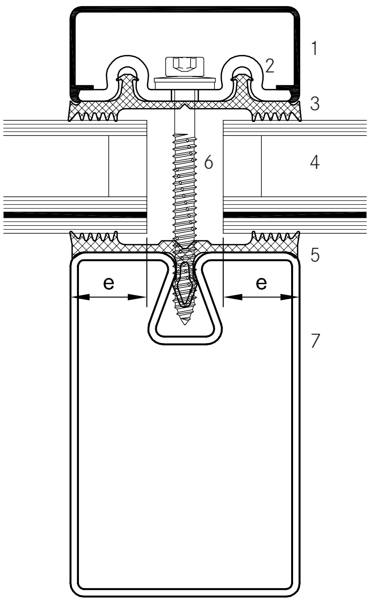
- Securing of the filling elements against lateral displacement.
- Arrangement and selection of the clamping strip screw fittings relative to the permissible axis dimensions in the fields.
- Securing clamping strip screw fittings against loosening.

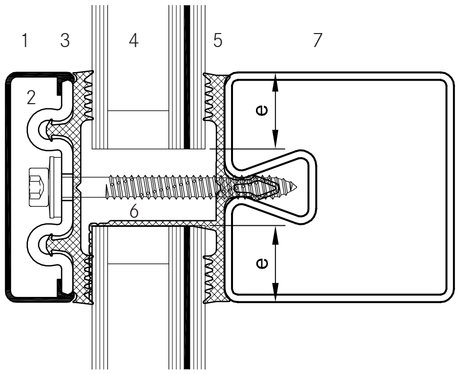
System articles and filling elements are only approved for use if they have been tested and received a positive assessment.

It is always necessary to validate that in the dimensions selected, the components used will satisfy the static requirements placed in the system for the specific project.

The design options for the facade remain preserved, as all aluminium upper strips that can be clipped on to the stainless steel bottom strip UL 6110 can still be used.

Sealing systems
The inner sealing system for burglary-resistant facades can also use systems with 1 section or overlapping sealing systems with 2 or 3 sections.





Inset “e” of the filling element
System width 60 mm: e = 20 mm

TI-S_9.8_002.dwg

1 Upper strip
2 Stainless steel bottom strip
3 Outer seal
4 Filling element
5 Inner seal
(e.g. with 1 drainage section)
6 System screw fittings
7 Threaded tube

Burglary-resistant facades - RC3

Approved system articles for the Stabalux SR system

System components Stabalux SR	System width 60 mm
Mullion cross-section minimum dimensions	Threaded tube SR 6090-2
Transom cross-section minimum dimensions	Threaded tube SR 6040-2
Mullion-transom joint	Welded connection or screwed t-connector according to the general building authori-sation
Inner seal mullions	e.g. GD 6202, GD 6222
	e.g. GD 6206
	e.g. GD 6314, GD 6324
	e.g. GD 6315, GD 6325
Inner seal transom (with connected transom flag)	e.g. GD 6204, GD 6205
	e.g. GD 6224, GD 6225
	e.g. GD 6303
	e.g. GD 6318, GD 6328
Outer seal mullion	GD 6122 WK
Outer seal transom	GD 6122 WK
Clamping strips	UL 6110, Stainless steel
Screw fittings for clamping strips	System screws (cylinder head screw with sealing washer , internal hex, stainless steel, e.g. Z 0156)
Glass support	Inset glass support (e.g. GH 0281), two-part glass supports GH 5051 (e.g. bottom part GH 0262 / upper part GH 0268)
Lateral blocks	e.g. Z 1061
Screw locks *)	Z 0093, stainless steel ball ⌀ 5mm
Superglue *)	Z 0055

*) For other options, refer to the section “Securing clamping strip screw fittings against loosening“

Burglary-resistant facades - RC3

Filling elements

It is important to check on-site that the filling elements satisfy the static requirements of the project.

Glazing and panels must satisfy the requirements of at least DIN EN 356.

Glass

To satisfy resistance class RC3, it is necessary to fit impact-resistant glazing type P6B, as provided by the firm SAINT GOBAIN, for example. The total structure of the glass has a thickness of approx. 32 mm.

- Product SGG STADIP PROTECT CP-SP 618
- Resistance class P6B
- Multi-pane insulating glass, glass structure from outside in.
- 4 mm float /10mm SZR / 18.28 mm VSG
- Glass thickness d = 32.28 mm ≈ 32 mm
- Glass weight approx. 53 kg/m^2

Panel

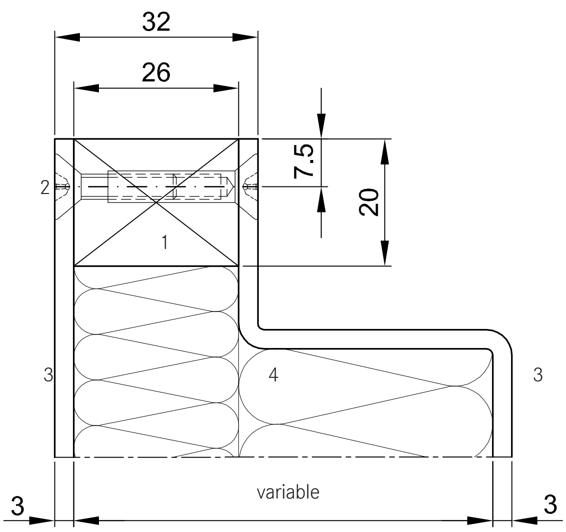
Panel structure:
3 mm aluminium sheet / 26 mm PUR (or comparable material) with reinforced edge bonding / 3 mm aluminium sheet. The total thickness is 32 mm.

Edge bonding:
A circumferential edge of 26mm x 20 mm made of PUR recycling material (e.g. Purenit, Phonotherm) or hard PVC is inserted to reinforce the panels. Both sheets are screwed together in the area of the edge bonding; screws are positioned on each side in intervals of a ≤ 100 mm and screwed together along the entire length.

It is permitted, in order to satisfy additional requirements placed in the panel (e.g. in regard to thermal insulation), to deviate from the cross-section geometry shown in the diagram below. This applies only if the material thickness of the sheet aluminium t = 3 mm is preserved and the edge bonding is prepared as described above.

Inset of the filling elements

The inlay of the filling elements is e = 20 mm



TI-S_9.8_003.dwg

1 Edge bonding
2 Screw fittings, fixing screw / nut M4
3 Aluminium sheet t = 3 mm
4 Insulation

STABALUX

Burglary-resistant facades - RC3

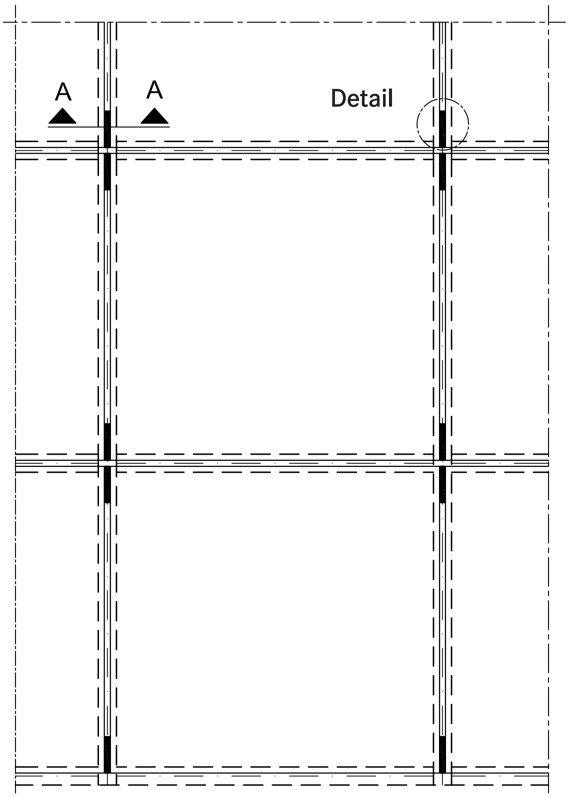
9.8
3

Lateral blocks on the filling elements

The filling elements must be secured against lateral displacement. Installation of a lateral, pressure-resistant blocks prevents any displacement of the filling elements in the event of manipulation.

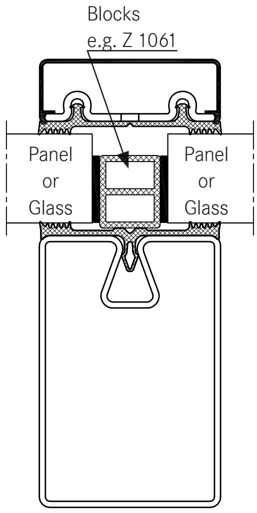
One block must be fitted in each corner of the mullion rebate. The blocks (art. no. Z 1061, plastic tubing h x w x d = 20 mm x 24 mm x 1.0, length ℓ = 120 mm) must be glued into the system. The glue used must be compatible with the edge bonding of the filling elements. The blocks can also be fixed in place by screwing them to the threaded tube.

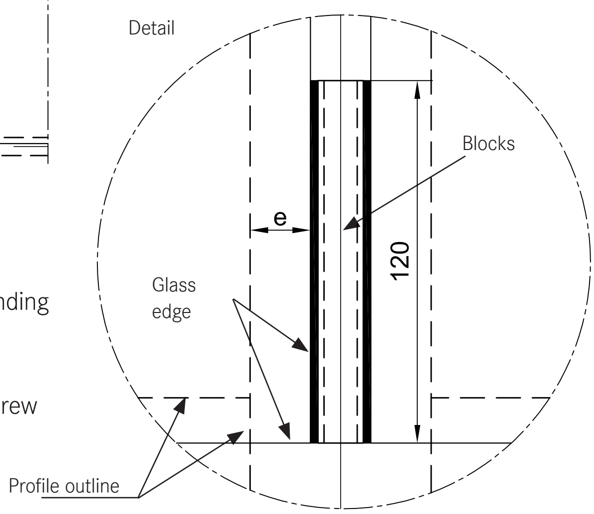
The blocks can also be cut out of another pressure-resistant, non-absorbent material such as PUR recycling material (e.g. Purenit, Phonotherm).



*) Glue in the blocks
(the glue must be compatible with the edge bonding of the filling elements)
or
Use fixing screw to secure the position in the screw channel

Cut A - A





TI-S_9.8_004.dwg

STABALUX

Burglary-resistant facades - RC3

9.8
3

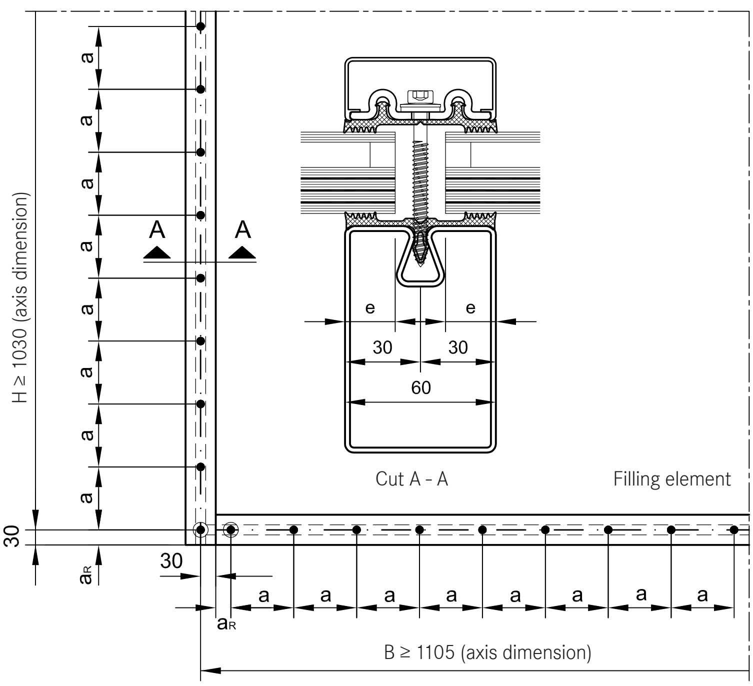
Screw fittings for clamping strips

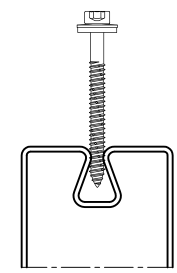
- The screw fittings are made in the screw channel, i.e. in the screw channel with penetration of the screw channel base.
- The screw length must be calculated for each case of use.
- The edge distance of the screw fittings for clamping strips is defined as a_R = 30 mm.
- The selection and arrangement of the screw fittings depends on the axis dimensions of the fields. The maximum distance between screws is a = 125 mm and must on no accounts be exceeded.
- The following lists the edge dimensions and special factors of the edge sections in cases a to d.

Case a)
System width 60 mm – axis dimensions B ≥ 1105 mm and H ≥ 1030 mm

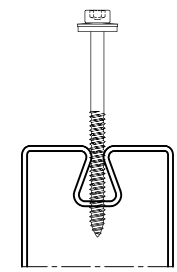
- There is no limit on the axis dimensions B and H.
- The first and last screw on each clamping strip must be fastened in the screw channel and through the base of the screw channel. A Ø 4 mm hole needs to be pre-drilled in the screw channel base for this purpose.

System width	**60 mm**
Edge distances	a_R = 30 mm
Number of screws	n ≥ 9
Screw spacing	a ≤ 125 mm.
Inset	e = 20 mm





• = Screw in the screw channel



⦿ = Screw fastened through the base of the screw channel

TI-S_9.8_005.dwg

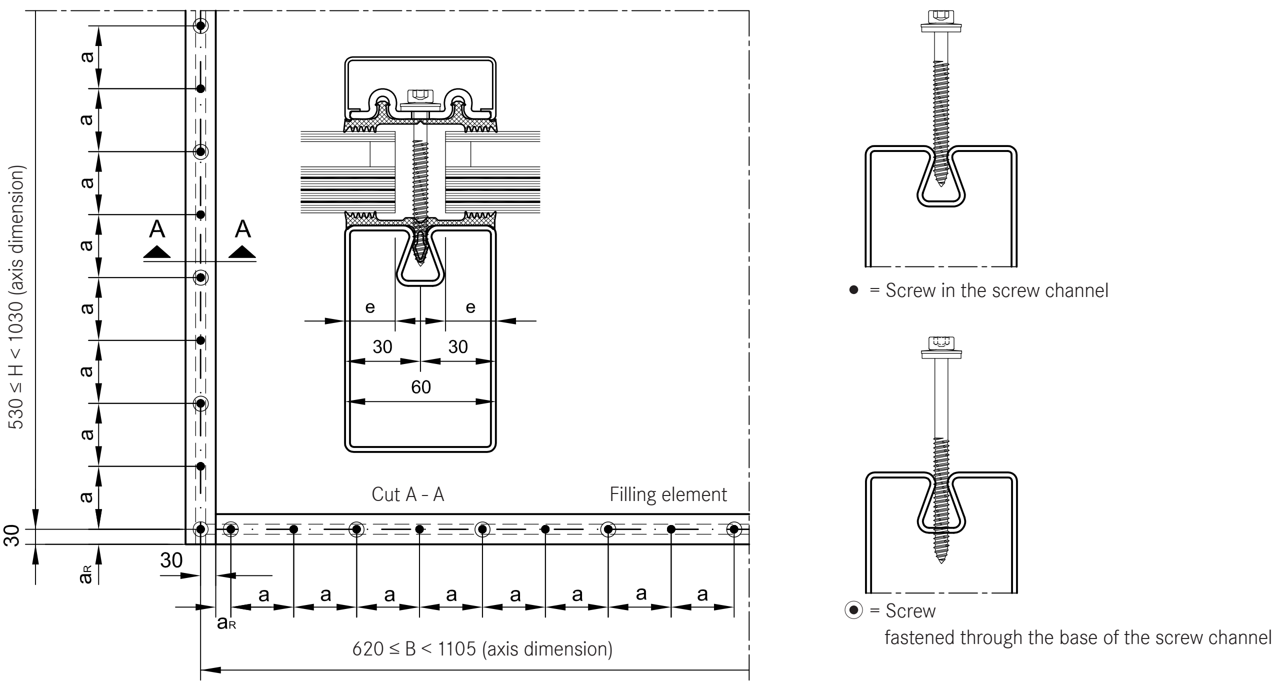
STABALUX

Burglary-resistant facades - RC3

Case b)
System width 60 mm – axis dimensions 620 mm ≤ B < 1105 mm and 530 mm ≤ H < 1030 mm

- The axis dimensions B and H are defined by the upper and lower limits of the lengths.
- The spacing between screws is defined as a ≤ 125 mm. n = 5 screws must on all accounts be fitted to each side of the field, irrespective of the upper limit of a = 125. The first and last screw on each clamping strip must be fastened in the screw channel and through the base of the screw channel. A ⌀ 4 mm hole needs to be pre-drilled in the screw channel base for this purpose. Fastening in the screw channel is sufficient for all other screws.

System width	**60 mm**
Edge distances	a_R = 30 mm
Number of screws	n ≥ 5
Screw spacing	a ≤ 125 mm
Inset	e = 20 mm



TI-S_9.8_005.dwg

Case c)
System width 60 mm – axis dimensions B < 620 mm and H < 530 mm

- Fields with the axis dimensions B < 620 mm and H < 530 mm are not permitted.

Burglary-resistant facades - RC3

Securing clamping strip screw fittings against loosening

The following measures must be taken to secure the screw heads (e.g. Stabalux system screws art. no. Z 0156 and Z 0162, cylinder head Ø 10 mm with internal hex) against manipulation.

- Hammer in stainless steel balls Ø 5.50 mm (procured on the building site).
- Apply glue to the stainless steel balls Ø 5.00 mm (art. no. Z 0093) type instant glue (art. no. Z 0055).
- Drill out the screw heads.

If stainless steel balls are used to as a safety measure, it is important to pay attention in the selection of the clamping strips that there is sufficient space for the screw head and that the stainless steel balls can protrude.

Burglary-resistant facades - RC3

Assembly instructions

The processing instructions provided in Section 1.2 of the catalogue apply as a rule to the system Stabalux SR. The following items must be considered additionally and executed in the necessary stages of processing in order to satisfy the criteria of resistance class RC3.

1 Construction of the facade using the tested system articles and according to static requirements.
2 The glazing must be burglary-resistant according to DIN EN 356. The panels must be impact-resistant according to DIN EN 356. The panel structure must be the same as the tested panel structure.
3 The inlay of the filling elements is e = 20 mm
4 Blocks must be used to secure the filling elements against lateral displacement. To achieve this, blocks are needed in each filling corner in the rebate of the mullion.
5 Exclusively Stabalux system screws with sealing washers and internal hex may be used (e.g. article no. Z 0156 and Z 0162).
The edge distance of the screw fittings for clamping strips is a_R = 30 mm and must be adhered to.
The maximum distance between the screws must not be more than a = 125 mm.
In field sizes with the axis dimensions B ≥ 1105 mm und H ≥ 1030 mm, the maximum distance between the screws must not be more than a = 125 mm. The first and last screw on each clamping strip with the edge distance a_R = 30 must be fastened in the screw channel and through the base of the screw channel. A Ø 4 mm hole needs to be pre-drilled for this purpose. The screws located in between are fastened in the screw channel. In field sizes with the axis dimensions 620 mm ≤ B < 1105mm und 530mm ≤ H < 1030 mm, n = 5 screws must on all accounts be fitted to each side of the field, irrespective of the upper limit of a = 125. The first and last screw on each clamping strip with the edge distance a_R = 30 must be fastened in the screw channel and through the base of the screw channel. A Ø 4 mm hole needs to be pre-drilled for this purpose. In addition, each second screw located between the outermost screws must also be fastened through the base of the screw channel. The screws located in between are fastened only in the screw channel.
Fields with the axis dimensions B < 620 mm and H < 530 mm are not permitted.
6 The glass supports must be positioned such that they can be installed between the screw grid of 125 mm.
7 Once the clamping strips have been fitted, it is important to make certain that the screws cannot be loosened in accordance with the requirements of resistance class RC3. This can be ensured by drilling out the screw heads or by hammering or gluing in steel balls.
8 The support of the mullions (head, foot and intermediate support) must be calculated with sufficient static leeway so that any forces applied during an attempted burglary can be absorbed with certainty. Accessible fixing screws must be secured against unauthorised loosening.
9 Burglary-resistant components are intended for installation in solid walls. The minimum requirements provided in DIN EN 1627 apply to wall connections.

Assignment of burglar-resistant components in resistance class RC3 to the walls

Resistance class of the burglary-resistant component according to DIN EN 1627	Surrounding walls							
	Masonry according to DIN 1053 – 1			Reinforced concrete according to DIN 1045		Aerated concrete wall		
	Rated thickness	Compressive strength class of the blocks	Mortar group	Rated thickness	Strength class	Rated thickness	Compressive strength class of the blocks	Execution
RC3	≥ 115 mm	≥ 12	II	≥ 120 mm	≥ B 15	≥ 240 mm	≥ 4	glued

Bullet-resistant facades

Bullet-resistant acc. to DIN EN 1522

Bullet resistance is necessary to protect life and is primarily used for personal and property protection. Examples are banks, security gates and embassies.
Bullet-resistant glazing provides resistance to certain handguns and their types of ammunition.
Tests are carried out exclusively at fire protection offices, the main tasks of which are the testing of handguns, their ammunition and fire tests. Shelling offices work together internationally according to the same norms and standards.

DIN EN 1522 for "Windows, doors, closures - bullet resistance, requirements and classification" differentiates between the seven resistance classes FB1 (lowest bullet resistance) to FB7 (highest bullet resistance) with regard to the classification and the requirements for testing with handguns and rifles.
There is also the distinction between

S (splintering, i.e. splintering occurs) or
NS (not splintering)

Classification acc. to DIN EN 1522 - (extract)

Class	Type of weapon	Caliber
FB 1	Rifle	22 LR
FB 2	Handgun	9 mm Luger
FB 3	Handgun	357 Mag.
FB 4	Handgun	357 Mag.
	Handgun	44 Rem. Mag.
FB 5	Rifle	5,56 x 45
FB 6	Rifle	5,56 x 45
		7,62 x 51
FB 7	Rifle	7,62 x 51

Glasses

Special laminated safety glass (VSG), which can withstand bullets is used. The glasses are classified according to the properties "splintering" (S) and "not splintering" (NS). Glass that does not splinter should always be installed for personal protection.
The basis of the glass tests are the standards DIN EN 356 and DIN EN 1063. The standards describe test methods and classification of the resistance to manual attack and fire. Often both demands are made at the same time. For information on manual attack, see Burglar Resistance.

Glazing with bullet-resistant properties must correspond to a resistance class according to DIN EN 1063 and be in accordance with DIN EN 1522 (see table).

Tested systems

The Stabalux SR system with a system width of 60 mm meets the criteria of classes FB3 NS / FB3 S; FB4 NS / FB4 S, as well as FB6 NS / FB6 S.

Depending on the class, special construction requirements must be met, see below.

Only tested component components may be processed and installed in accordance with the assembly instructions.

Bullet-resistant facades

9.9
1

Proved system articles Stabalux SR

Stabalux SR 60	FB3 S* / FB3 NS*	FB4 S* / FB4 NS*	FB6 S* / FB6 NS*
Certificate number:	S 08 0054 01/Z (FB3 S) S 08 0054 02/Z (FB3 NS)	S 08 0054 03/Z (FB3 S) S 08 0054 04/Z (FB3 NS)	S 08 0054 05/Z (FB3 S) S 08 0054 06/Z (FB3 NS)
Glass	e.g. Allstop BR3-S-42 (FB3 S) e.g. Allstop BR3-NS-41 (FB3 NS)	e.g. Allstop BR4-S-41 (FB3 S) e.g. Allstop BR4-NS-42 (FB3 NS)	e.g. Allstop BR6-S-41 (FB3 S) e.g. Allstop BR3-NS-41 (FB3 NS)
Glass inset	18mm	18mm	18mm
Mullion cross-section Minimum dimension	Threaded tube SR 6060-2	Threaded tube SR 6090-4	Threaded tube SR 6090-4
Transom cross-section Minimum dimension	Threaded tube SR 6040-2	Threaded tube SR 6090-4	Threaded tube SR 6090-4
T-connection	welded connection	welded connection	welded connection
Inner gasket mullion	e.g. GD 6202, GD 6222	e.g. GD 6202, GD 6222	e.g. GD 6202, GD 6222
Inner gasket transom	e.g. GD 6204, GD 6205	e.g. GD 6204, GD 6225	e.g. GD 6204, GD 6225
Outer gasket mullion	GD 6122 WK/F30/G30	GD 6122 WK/F30/G30	GD 6122 WK/F30/G30
Outer gasket transom	GD 6122 WK/F30/G30	GD 6122 WK/F30/G30	GD 6122 WK/F30/G30
Pressure plate	UL 6110 steel or stainless steel	UL 6110 stainless steel	UL 6110 stainless steel
Pressure plate screw connection	System screws made of stainless steel (with cylinder head Ø10mm, and sealing washer, e.g. Z 0161)	System screws made of stainless steel (with cylinder head Ø10mm, and sealing washer, e.g. Z 0161)	System screws made of stainless steel(with cylinder head Ø10mm, and sealing washer, e.g. Z 0164)
Glass supports	Welded glass support; Plug-in glass supports (e.g. GH 0281) from approval	Welded glass support; Plug-in glass supports (e.g. GH 0281) from approval	Welded glass support; Plug-in glass supports (e.g. GH 0281) from approval
Reinforcement of the pressure plate	-	Stainless steel bars 3 x 18 mm at the cross point about the bumps of the UL 6110	Stainless steel bars 3 x 18 mm at the cross point about the bumps of the UL 6110
Reinforcement of the rebate area	-	-	Aluminum profile 10 x 50mm

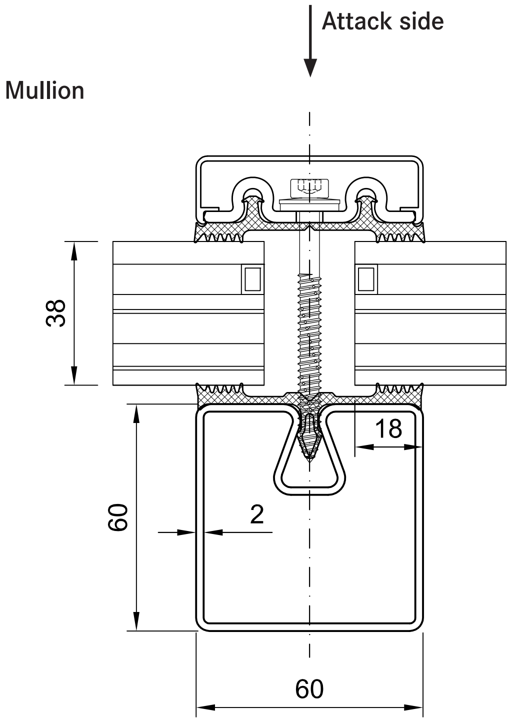
* The type of glasses determines the classification “splintering” (S) and “not splintering” (NS).

For personal protection glass that does not splinter should always be installed.

Bullet-resistant facades

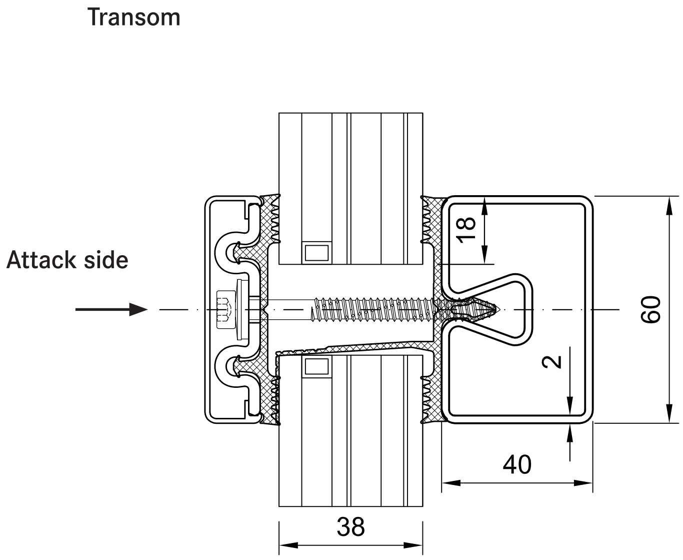
9.9
2

FB3 S - System structure



Glass inset	18 mm
e.g. OL 6013	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or Fireprotection)
Glass type	Allstop BR3-S-42
GD 6202	Inner gasket
SR 6060-2	Threaded tube
e.g. Z 0157	System screws with cylinder head 70 mm

Glass inset	18 mm
e.g. OL 6012	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or Fireprotection)
Glass type	Allstop BR3-S-42
GD 6204	Inner gasket
SR 6040-2	Threaded tube
e.g. Z 0157	System screws with cylinder head 70 mm



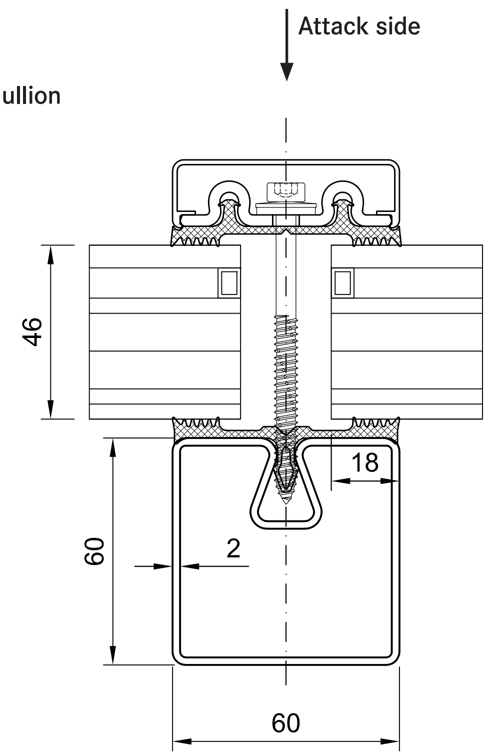
TI-S_9.9_001.dwg

Bullet-resistant facades

9.9
2

FB3 NS - System structure

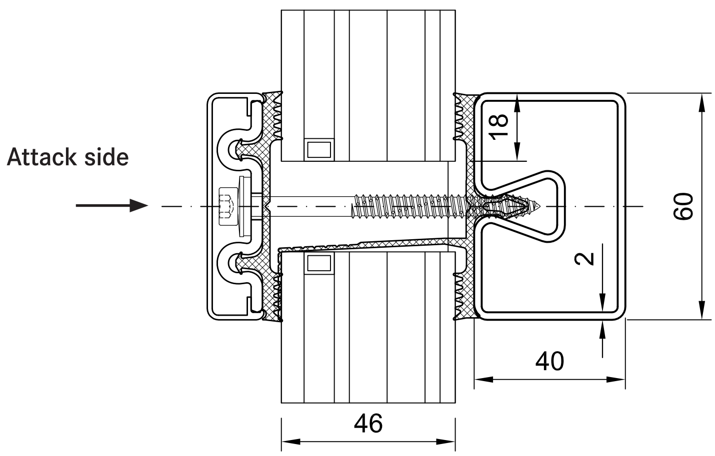
Mullion



Glass inset	18 mm
e.g. OL 6013	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR3-NS-41
GD 6202	Inner gasket
SR 6060-2	Threaded tube
e.g. Z 0157	System screws with cylinder head 70 mm

Glass inset	18 mm
e.g. OL 6012	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR3-NS-41
GD 6204	Inner gasket
SR 6040-2	Threaded tube
e.g. Z 0157	System screws with cylinder head 70 mm

Transom



TI-S_9.9_001.dwg

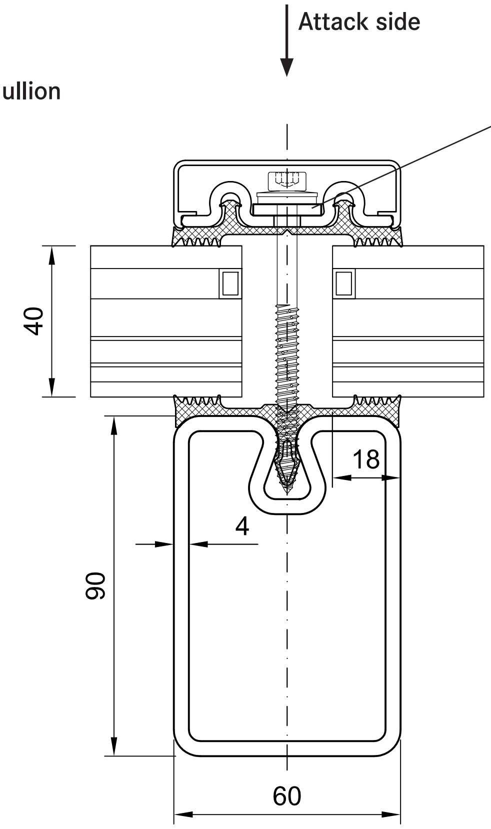
STABALUX

Bullet-resistant facades

9.9
2

FB4 S - System structure

Mullion

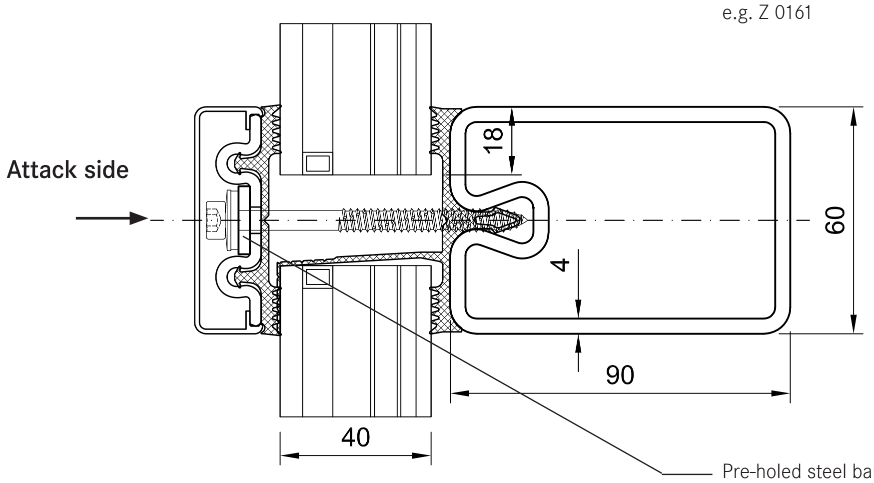


Pre-holed steel bars 18x3 mm, led over the side joints of UL 6110

Glass inset	18 mm
e.g. OL 6013	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR4-S-41
GD 6222	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0161	System screws with cylinder head 80 mm

Glass inset	18 mm
e.g. OL 6013	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR4-S-41
GD 6224	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0161	System screws with cylinder head 80 mm

Transom



Pre-holed steel bars 18x3 mm, led over the side joints of UL 6110

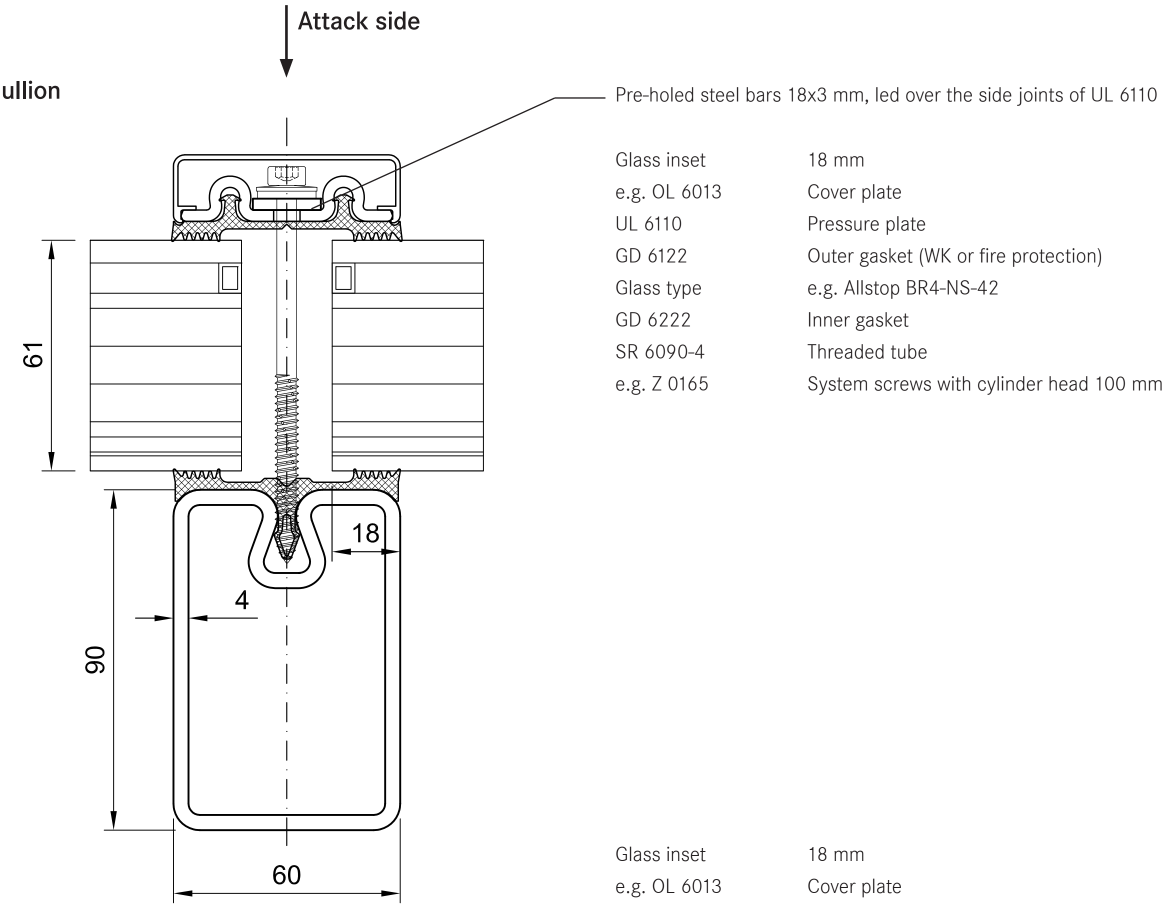
TI-S_9.9_001.dwg

Bullet-resistant facades

9.9
2

FB4 NS - System structure

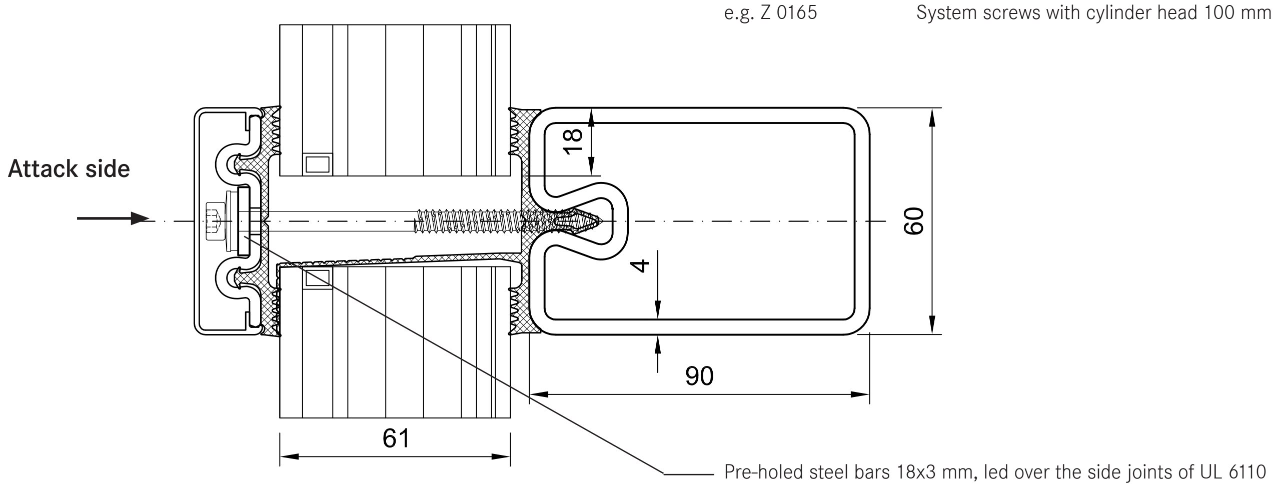
Mullion



Glass inset	18 mm
e.g. OL 6013	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR4-NS-42
GD 6222	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0165	System screws with cylinder head 100 mm

Transom

Glass inset	18 mm
e.g. OL 6013	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR4-NS-42
GD 6225	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0165	System screws with cylinder head 100 mm

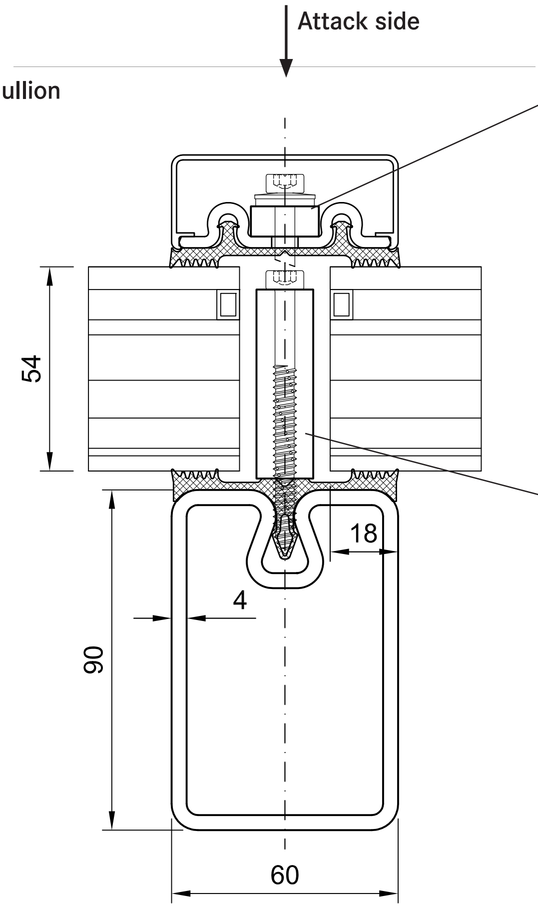


TI-S_9.9_001.dwg

Bullet-resistant facades

FB6 S - System structure

Mullion



Pre-holed steel bars 18x8 mm, led over the side joints of UL 6110

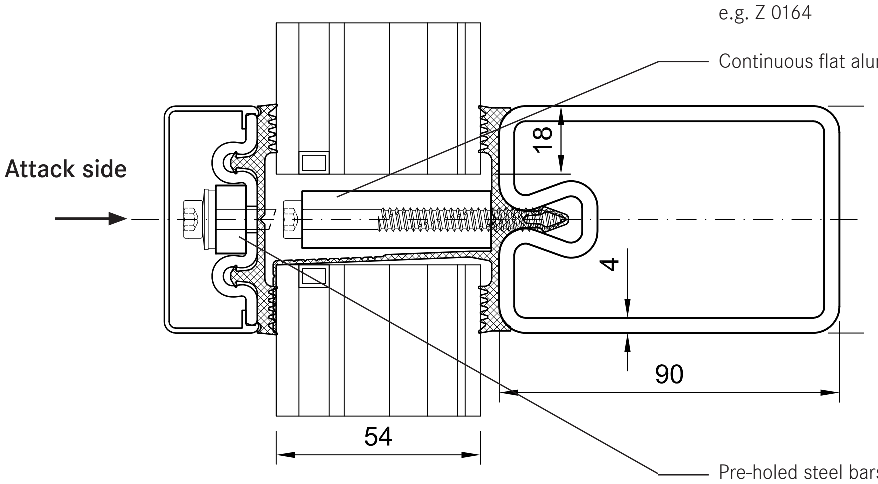
Glass inset	18 mm
e.g. OL 6014	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR6-S-41
GD 6222	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0164	System screws with cylinder head 95 mm

Continuous flat aluminum bar 10x50 mm

Transom

Glass inset	18 mm
e.g. OL 6014	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR6-S-41
GD 6225	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0164	System screws with cylinder head 95 mm

Continuous flat aluminum bar 10x50 mm



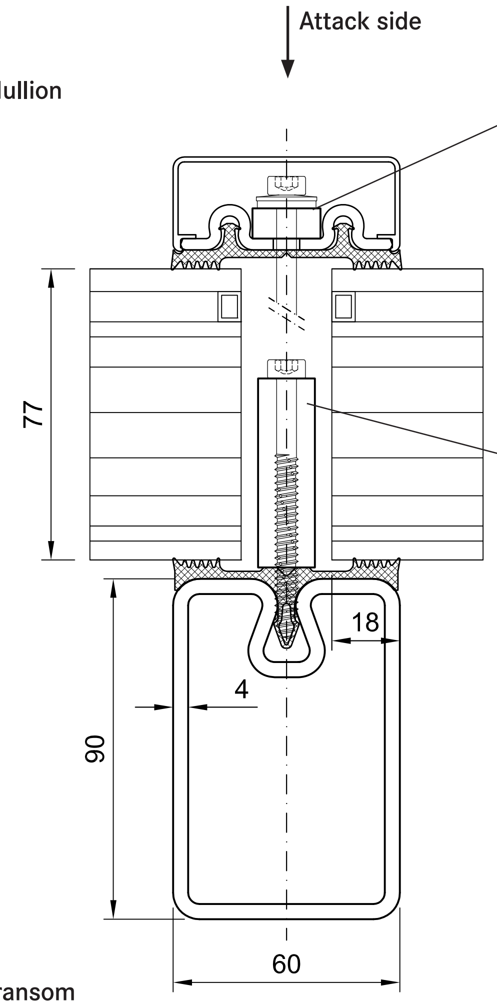
Pre-holed steel bars 18x8 mm, led over the side joints of UL 6110

TI-S_9.9_001.dwg

Bullet-resistant facades

FB6 NS - System structure

Mullion



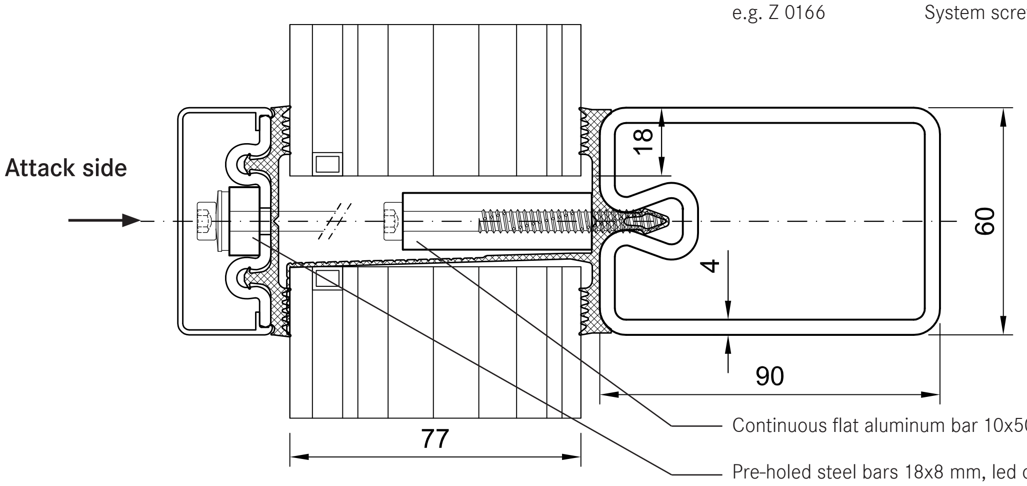
Pre-holed steel bars 18x8 mm, led over the side joints of UL 6110

Glass inset	18 mm
e.g. OL 6014	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR6-NS-41
GD 6222	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0166	System screws with cylinder head 120 mm

Continuous flat aluminum bar 10x50 mm

Transom

Glass inset	18 mm
e.g. OL 6014	Cover plate
UL 6110	Pressure plate
GD 6122	Outer gasket (WK or fire protection)
Glass type	e.g. Allstop BR6-NS-41
GD 6225	Inner gasket
SR 6090-4	Threaded tube
e.g. Z 0166	System screws with cylinder head 120 mm



Continuous flat aluminum bar 10x50 mm

Pre-holed steel bars 18x8 mm, led over the side joints of UL 6110

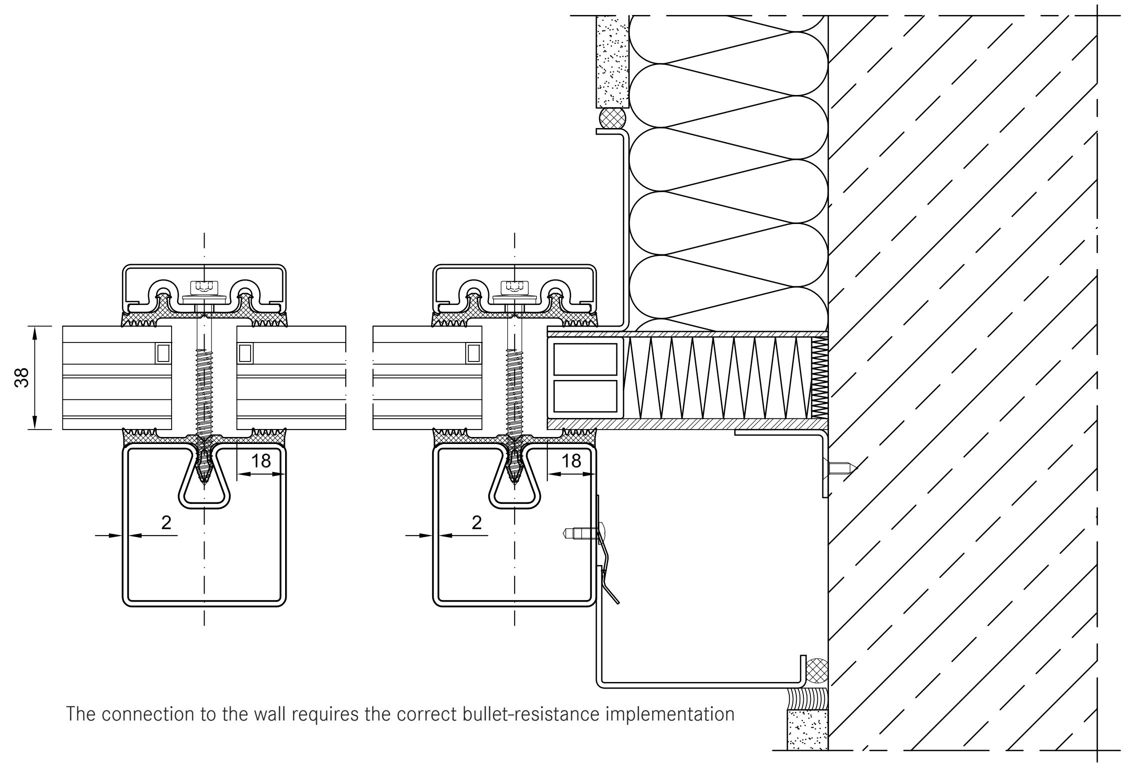
TI-S_9.9_001.dwg

STABALUX

Bullet-resistant facades

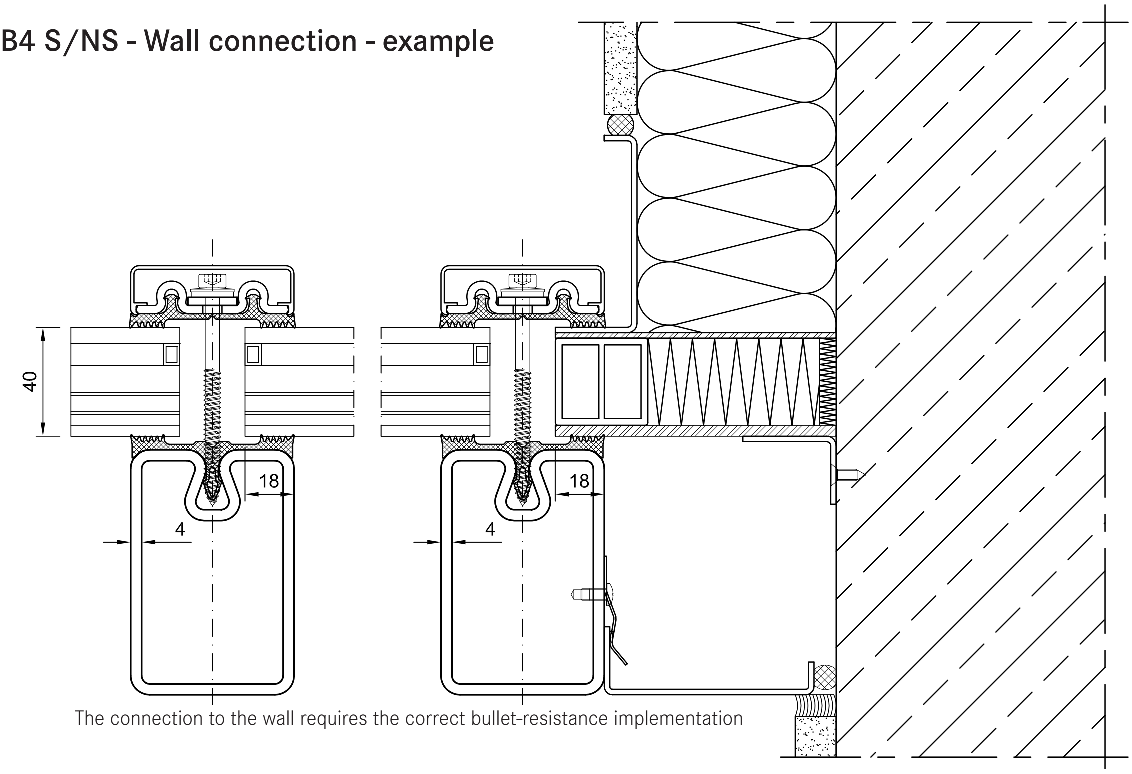
9.9
5

FB3 S/NS - Wall connection - example



The connection to the wall requires the correct bullet-resistance implementation

FB4 S/NS - Wall connection - example



The connection to the wall requires the correct bullet-resistance implementation

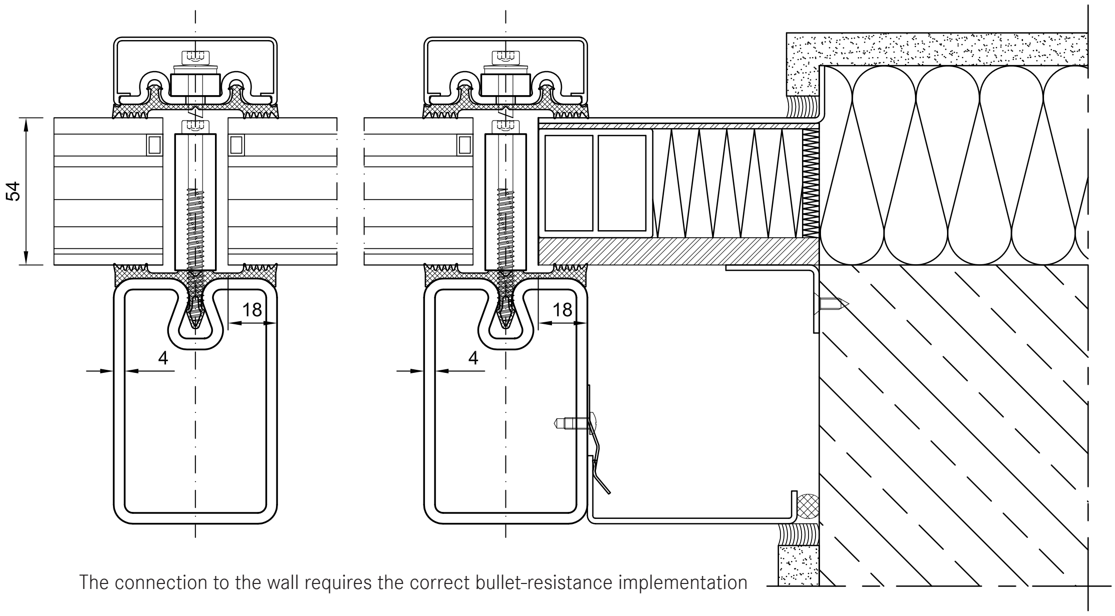
TI-S_9.9_001.dwg

STABALUX

Bullet-resistant facades

9.9
5

FB6 S/NS - Wall connection - example



The connection to the wall requires the correct bullet-resistance implementation

TI-S_9.9_001.dwg

Equipotential bonding and lightning protection for curtain walls

Introduction

A basic distinction must be made between equipotential bonding for personal protection (protective equipotential bonding) and extended equipotential bonding (lightning protection equipotential bonding).

In mullion-transom constructions, if required by ED 13830, the metal frame parts must be electrically connected to each other and connected to the protective equipotential bonding to ensure equipotential bonding for personal protection.

Lightning protection systems in accordance with EN 62305 protect against threats from extreme weather conditions. This requires extensive specialist planning.

The project planning and planning of the equipotential bonding and lightning protection system is not included in the scope of services of the facade manufacturer. The architect / planner must find out about the normative requirements for the building. The planning is to be provided by the electrical planner in good time. All standards and regulations must be observed.

An acceptance test is required before the electrical system is started up for the first time.

Terms

Equipotential bonding

Equipotential bonding is an electrically conductive connection that is intended to prevent or reduce different electrical potentials and thus electrical voltage between conductive bodies (e.g. water and heating pipes, antenna systems, electrical equipment). The equipotential bonding should limit all potential differences that occur to a permissible value.

Potential differences

Potential differences are voltages that can occur in the event of errors in the energy system and lightning discharges.

Lightning protection

Lightning protection means protective measures against the effects of lightning discharges on structures and people.

External lightning protection system

The external lightning protection system offers protection in the event of lightning discharges that occur directly in the protective system. It consists of an interception device, a down conductor device and an earthing system.

Discharge device

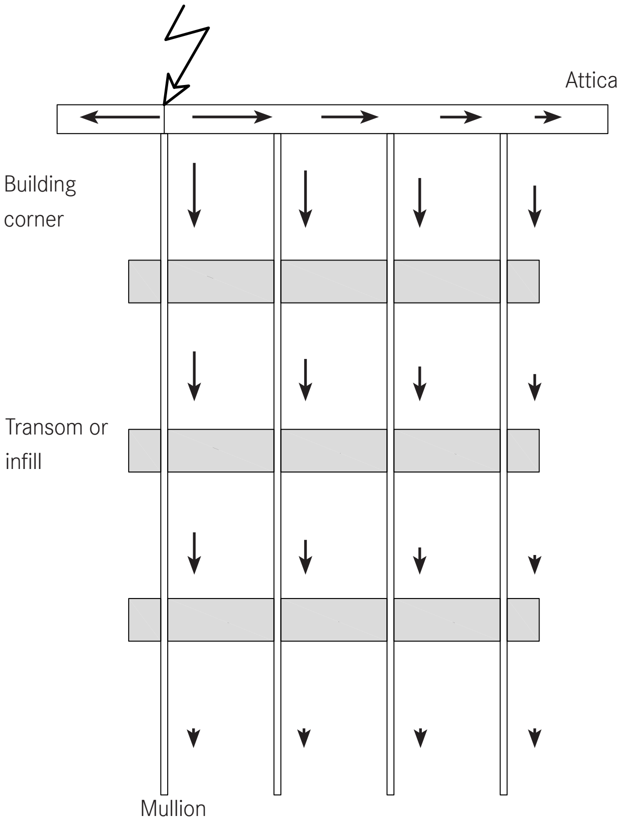
The arrester conducts the lightning current from the interception system to the earthing system. It consists of vertical down conductors that are evenly distributed over the circumference of the structure. Both separate lines and sufficiently dimensioned metal parts of the system to be protected can be used as conductors.

Regulations

- VFF Merkblatt 09.2009 "Potentialausgleich und Blitzschutz von Vorhangfassaden"
- Landesbauordnungen LBO
- Musterhochhausrichtlinie MHHR
- EN 13830 - Produktnorm für Vorhangfassaden
- VDE 0100-410: 2007 (IEC 60364-4-41: 2005, modifiziert) - regelt Schutzmaßnahmen gegen elektrischen Schlag
- VDE 0100-540: 2012-06 (IEC 60364-5-54: 2011, modifiziert) - regelt Erdungsanlagen, Schutzleiter, und Schutzpotentialausgleichsleiter
- EN 62305-3 / VDE 0185-305-3: 2011-10 - regelt Blitzschutz von baulichen Anlagen und Personen
- EN 62305-4 / VDE 0185-305-4: 2011-10 - regelt erweiterte Maßnahmen für bauliche Anlagen mit Anforderungen gegen elektromagnetische Blitzimpulse
- VdS 2010:2015-04 - Risikoorientierter Blitz- und Überspannungsschutz

Equipotential bonding and lightning protection for curtain walls

Distribution of the lightning current in the facade



Lightning strikes preferably at the highest point on the corner of the building. In order to avoid damage, the electricity must be routed to the earthing system via defined discharge devices. Electrically conductive components of the building can also be used for this purpose.

Constructive solutions

Equipotential bonding for personal protection

The equipotential bonding must prevent dangerous spark formation within the structure, which can occur due to fault currents in conductive parts of the system (e.g. due to a defective power line).

Sufficient equipotential bonding is achieved by connecting the metal frame parts of the facade to one another in an electrically conductive manner. Often the T-connections of the post-and-beam construction are sufficient for this.

In timber/aluminum constructions, the electrically conductive connection is often sufficient, e.g. via the vertical pressure plates, as the horizontal pressure plates are isolated by the expansion joints.

Appropriate transition bridges must be used for facade joints that cannot be designed electrically.

Alternatively, a separate drainage device (cables) can be placed in the cavities of the cover plates. The minimum cross-sections of the lines must be observed when selecting the cover plates.

To connect the facade components, metallic connecting elements must have the following minimum cross-sections in accordance with VDE 0100-540 are used:

Copper	5 mm^2
Aluminium	8 mm^2
Steel	16 mm^2

The required cross-sections can also be achieved using multiple connectors, e.g. Screws can be achieved. The cross section 16 mm^2 applies to the stainless steel screws. It corresponds to a Stabalux system screw with an outer diameter of 6.3 mm and a core diameter of 4.8 mm.

For the connection to the equipotential bonding system, appropriate transfer points must be coordinated and clearly defined as part of the planning. The necessary transfer points can be made either on the outside of the facade or on the inside of the facade. It is recommended to arrange the connections floor by floor.

Lightning protection with extended equipotential bonding

The lightning protection equipotential bonding is an extension of the equipotential bonding. Lightning protection equipotential bonding is the part of the internal lightning protection which, in the event of a lightning discharge in the lightning protection system or in the cables, ensures the safe integration of all cables introduced from the outside with the potential equalization system.

Equipotential bonding and lightning protection for curtain walls

If a mullion-transom construction is to be used as a natural component of the discharge device, this must be agreed separately and written out as a separate item in accordance with the service description, as different connections are required.

The equipotential bonding conductor for this connection must have the following min. Cross-sections according to EN 62305 have:

Copper	16 mm^2
Aluminium	25 mm^2
Steel	50 mm^2