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.: Steel: 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-Normblätter erhältlich beim Beuth-Verlag GmbH
Burggrafenstraße 6
10787 Berlin
www.beuth.de

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

Deutsches Institut für Bautechnik
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 2, Design of steel structures
DIN EN 1995	Eurocode 3, 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	Corrosion protection of metals - Rinsed and non-rinsed chromate conversion coatings on aluminium 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	Glass in building - Security glazing - Testing and classification 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	Assessmentofconformity 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
EnEV	Energy Saving Ordinance

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.

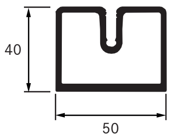
Bundesinnungsverband des Glaserhandwerks

Leaflets by Stahl-Informations-Zentrum, Düsseldorf

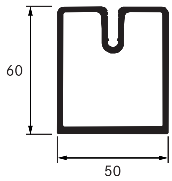
Leaflets by the Verband der Fenster- und Fassadenhersteller, Frankfurt am Main

Aluminum Profiles - 50mm

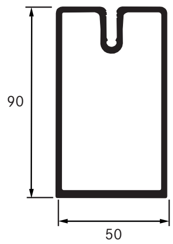
Profile overview



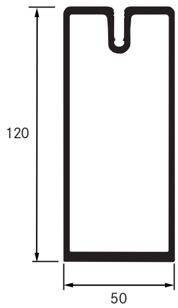
AL5040



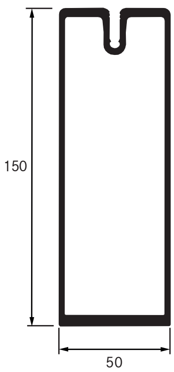
AL5060



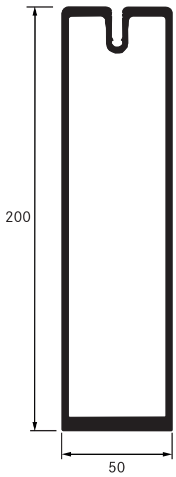
AL5090



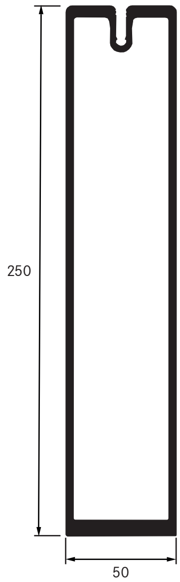
AL50120



AL50150



AL50200



AL50250

Quality of aluminum profiles

Aluminium

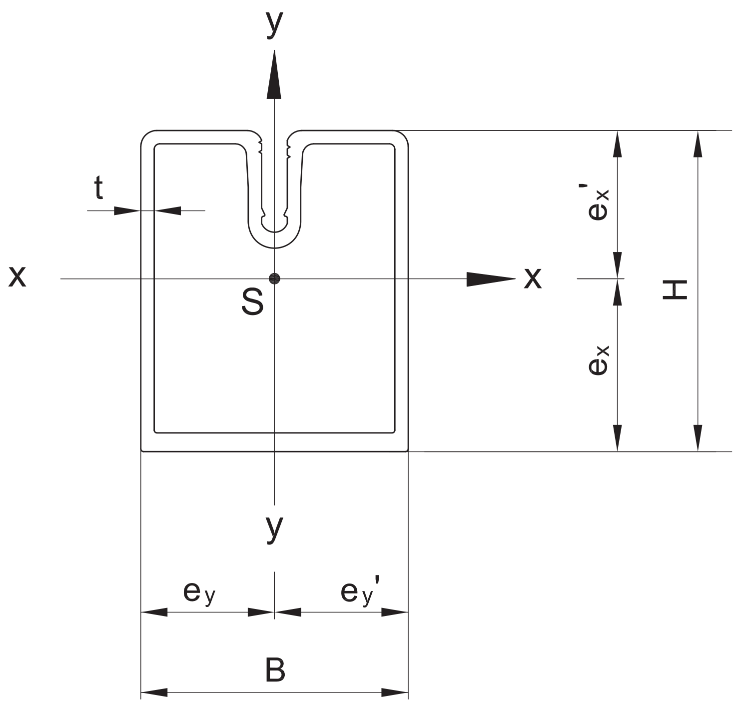
- The aluminum profiles supplied by us are generally made of EN AW 6060 according to DIN EN 573-3, condition T 66 according to DIN EN 755-2.
- The tubes are manufactured according to the tolerance standards DIN ISO 2768.
- Material parameters:

Yield strength	$f_{y,k}$	= 160	N/mm²
Elastic modulus	E	= 70000	N/mm²
Shear modulus	G	= 26100	N/mm²
Thermal expansion coefficient	α_T	= 24×10^{-6}	N/mm²

Threaded tubes

9.2
1

Geometric cross-sections and cross-section parameters



TI-AL_9.2_001.dwg

Threaded tubes

Cross-sectional values

Profile - Number	H	B	t min	t max	U	U_B 1)	g	A	e_y	e_y'	I_y	e_x	e_x'	I_x
–	mm	mm	mm	mm	m²/m	m²/m	kg/m	cm²	cm	cm	cm⁴	cm	cm	cm⁴
AL 5040	40	50	2.5	3.5	0.214	0.133	1.51	5.61	2.50	2.50	15.77	2.05	1.95	**12.23**
AL 5060	60	50	2.5	3.5	0.254	0.173	1.78	6.61	2.50	2.50	21.42	3.03	2.97	**33.14**
AL 5090	90	50	2.5	3.5	0.314	0.223	2.18	8.11	2.50	2.50	29.89	4.61	4.39	**89.83**
AL 50120	120	50	2.5	4.5	0.374	0.293	2.81	10.41	2.50	2.50	39.87	6.10	5.90	**208.52**
AL 50150	150	50	2.5	5	0.434	0.353	3.32	12.32	2.50	2.50	49.12	7.61	7.39	**380.78**
AL 50200	200	50	3	6.5	0.534	0.453	4.74	17.56	2.50	2.50	74.10	9.86	10.14	**904.95**
AL 50250	250	50	3.5	7.5	0.634	0.553	6.40	23.71	2.50	2.50	103.31	12.34	12.66	**1806.17**

1) Coating surface = visible surface of the profiles when mounted (without screw channel-side)

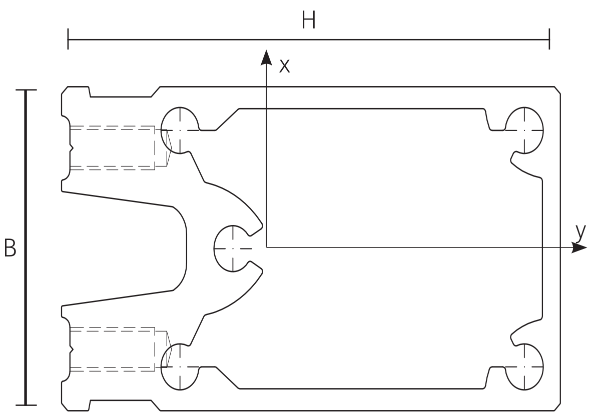
Things to Know
Preliminary static design

Transom connectors

9.2
2

Geometric cross-sections and cross-section parameters

Retainer	H	B	g	A	I_y	I_x
–	mm	mm	kg/m	cm²	cm⁴	cm⁴
TVA 5040	33.0	44.4	2.49	9.25	7.28	**19.03**
TVA 5060	53.0	44.4	2.99	11.10	24.1	**28.12**
TVA 5090	83.0	44.4	3.48	12.90	31.83	**93.10**
TVA 50120	111.0	44.4	3.93	14.58	39.04	**201.67**
TVA 50150	140.0	44.4	4.40	16.32	46.51	**371.48**

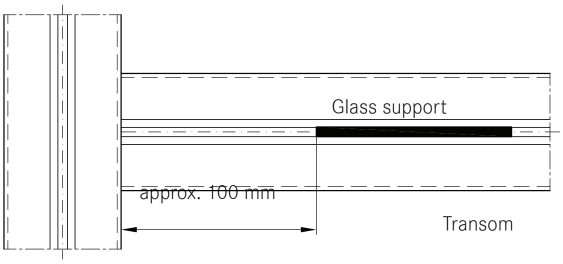


Glass support

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 component tested for load-bearing capacity and fitness for purpose. For this purpose, the engineering office IPU Karlsruhe was commissioned. The tests were carried out at the Research Institute for Steel, Wood and Stone of the Karlsruhe Institute of Technology (KIT).

The measured deflection of fmax = 3 mm below the theoretical point of attack exerted by the consequent pane 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

The Stabalux AL system uses two different types and techniques for attaching glass supports:

- Insert glass supports GH 5101 and GH 5102. The geometry of the glass supports is such that they can be inserted in the screw channel without requiring additional fixing or fastening.
- Screw-in glass support 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 the inner seal GD 5203 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.

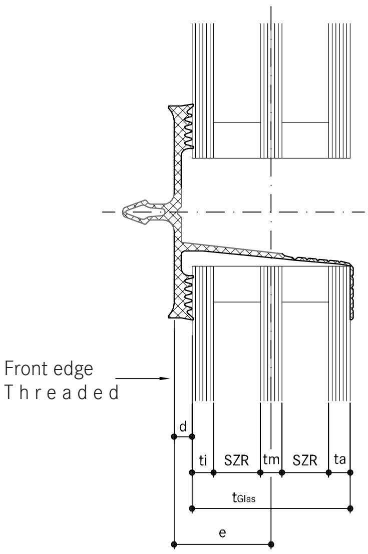
STABALUX

Glass support

9.2
3

Diagram of the glass structure / Abbreviations used

Symmetrical glass structure
Example of System AL



d = Height of the inner seal
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
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

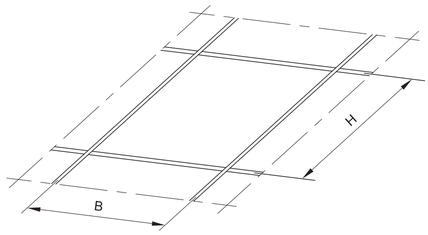
Glass support

Identification of the permitted pane weight

1. Calculation of the pane weight

Surface of the pane = B x H in [m²]
Aggregate glass thickness= ti + tm + ta [m]
Specific glass weight = $\gamma \approx 25{,}0$ [kN/m³]

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



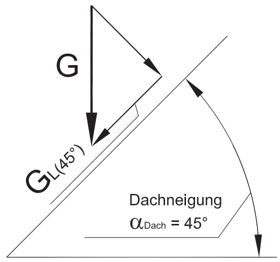
2. Calculation of the load share on the glass support

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 5 states the sine value for known inclination angles.

Table 6 states the sine value for known percentage inclination.



3. Calculation of eccentricity

System AL
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)

4. Test

Tables 1 - 14 state the permitted pane weight based on the calculated eccentricity “e”.

Note:

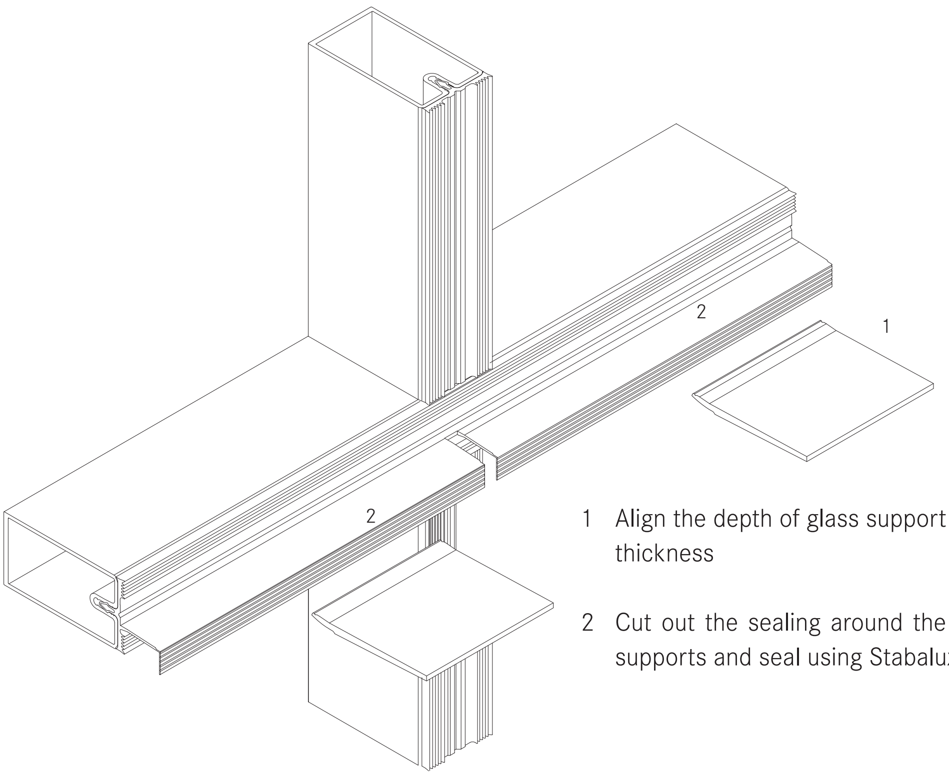
Tables 1 - 14 enable calculation of eccentricity for symmetrical glass structures.

Things to Know
Preliminary static design

Glass support

Inset glass support

- Certified system components consist of the insert glass supports GH 5101 and GH 5202 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 = 72mm ; 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 grade EN AW 6060 T66.
- 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-AL_9.2_002.dwg

Things to Know
Preliminary static design

Glass support

Permitted pane weight

- Table 1, Table 2, Table 3 and Table 4 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 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 linearized in 3 intervals. Application of the 5% fractile value ensures that the linearized 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.

Things to Know
Preliminary static design

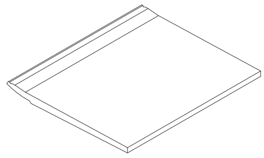
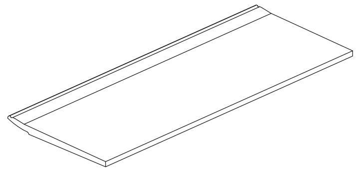


Table 1:
GH 5101

Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure		Eccentricity "e"	Permitted pane weight G (kg)		
	Inner seal height			Transom profile made of aluminum		
	5	12		AL 5040	AL 5060 / 5090 / 50120	AL 50150 / 50200 / 50250
	mm	mm	mm	kg	kg	kg
1	≤ 20	≤ 6	15	352	508	485
2	22	8	16	347	498	476
3	24	10	17	341	489	468
4	26	12	18	335	479	460
5	28	14	19	330	469	451
6	30	16	20	324	459	443
7	32	18	21	319	449	434
8	34	20	22	313	439	426
9	36	22	23	307	429	417
10	38	24	24	302	419	409
11	40	26	25	296	409	400
12	42	28	26	291	399	392
13	44	30	27	285	389	384
14	46	32	28	279	379	375
15	48	34	29	274	370	367
16	50	36	30	268	360	358
17	52	38	31	263	350	350
18	54	40	32	257	340	341
19	56	42	33	251	330	333
20	58	44	34	246	320	325
21	60	46	35	240	310	316
22	62	48	36	235	300	308
23	64	50	37	229	290	299
24	66	52	38	223	280	291
25	68	54	39	218	270	282
26	70	56	40	212	260	274
27	72	58	41	206	250	265
28	74	60	42	201	241	257
29	76	62	43	195	231	249
30	78	64	44	190	221	240
31	80	66	45	184	211	232
32	82	68	46	178	201	223

Things to Know
Preliminary static design

Table 2:
GH 5102

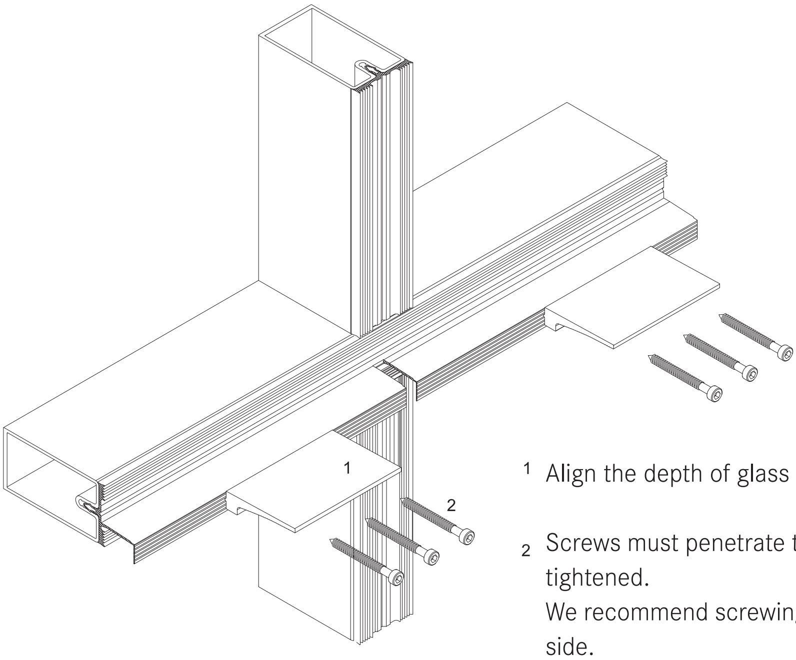


Row	Total glass thickness t_{Glass} for Single-pane or symmetrical glass structure		Eccentricity "e"	Permitted pane weight G (kg)		
	Inner seal height			Transom profile made of aluminum		
	5	12		AL 5040	AL 5060 / 5090 / 50120	AL 50150 / 50200 / 50250
	mm	mm	mm	kg	kg	kg
1	≤ 20	≤ 6	15	352	498	469
2	22	8	16	347	490	464
3	24	10	17	341	481	458
4	26	12	18	335	473	452
5	28	14	19	330	464	447
6	30	16	20	324	455	441
7	32	18	21	319	447	436
8	34	20	22	313	438	430
9	36	22	23	307	430	425
10	38	24	24	302	421	419
11	40	26	25	296	413	414
12	42	28	26	291	404	408
13	44	30	27	285	395	402
14	46	32	28	279	387	397
15	48	34	29	274	378	391
16	50	36	30	268	370	386
17	52	38	31	263	361	380
18	54	40	32	257	353	375
19	56	42	33	251	344	369
20	58	44	34	246	335	363
21	60	46	35	240	327	358
22	62	48	36	235	318	352
23	64	50	37	229	310	347
24	66	52	38	223	301	341
25	68	54	39	218	293	336
26	70	56	40	212	284	330
27	72	58	41	206	275	325
28	74	60	42	201	267	319
29	76	62	43	195	258	313
30	78	64	44	190	250	308
31	80	66	45	184	241	302
32	82	68	46	178	232	297

Glass support

Bolted glass support

- The tested glass supports GH 5201 and GH 5202 differ in terms of their support width.
- The bottom part of the glass support are bolted directly on to the transoms. Since the screwing of the glass supports in the screw channel plus penetration of the rear wall is performed, higher weights can be achieved.
- The glass supports are only suitable for the inner seal GD 5203
- The glass supports are manufactured using aluminiumin grade EN AW 6060 T66.
- Stainless steel system screws are used to make the corresponding screw connection.



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.

TI-AL_9.2_003.dwg

Things to Know
Preliminary static design

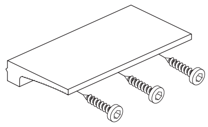


Table 3:
GH 5201 with GD 5203

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 (TVA) made of aluminium		
	5		AL 5040	AL 5060 / 5090 / 50120	AL 50150 / 50200 / 50250
	mm	mm	kg	kg	kg
1	≤ 20	15	501	588	534
2	22	16	492	579	526
3	24	17	484	570	519
4	26	18	475	560	512
5	28	19	466	551	504
6	30	20	458	542	497
7	32	21	449	533	490
8	34	22	440	524	483
9	36	23	432	515	475
10	38	24	423	521	468
11	40	25	415	409	461
12	42	26	406	501	453
13	44	27	397	491	446
14	46	28	389	480	439
15	48	29	380	470	432
16	50	30	371	460	424
17	52	31	363	450	417
18	54	32	354	440	410
19	56	33	346	430	403
20	58	34	337	420	395
21	60	35	328	409	388
22	62	36	320	399	381
23	64	37	311	389	373
24	66	38	302	379	366
25	68	39	294	369	359
26	70	40	285	359	352
27	72	41	277	349	344
28	74	42	268	338	337
29	76	43	259	328	330
30	78	44	251	318	323
31	80	45	242	308	315
32	82	46	234	298	308

Things to Know
Preliminary static design

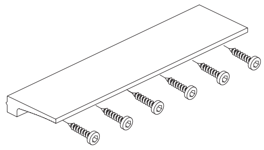


Table 4:
GH 5202 with GD 5203

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 (TVA) made of aluminium		
	5		AL 5040	AL 5060 / 5090 / 50120	AL 50150 / 50200 / 50250
	mm	mm	kg	kg	kg
1	≤ 20	15	501	548	542
2	22	16	492	541	537
3	24	17	484	534	531
4	26	18	475	527	526
5	28	19	466	520	520
6	30	20	458	513	515
7	32	21	449	505	509
8	34	22	440	498	504
9	36	23	432	491	498
10	38	24	423	484	493
11	40	25	415	477	487
12	42	26	406	470	481
13	44	27	397	463	476
14	46	28	389	456	470
15	48	29	380	449	465
16	50	30	371	442	459
17	52	31	363	435	454
18	54	32	354	428	448
19	56	33	346	421	443
20	58	34	337	414	437
21	60	35	328	407	432
22	62	36	320	400	426
23	64	37	311	393	421
24	66	38	302	386	415
25	68	39	294	379	410
26	70	40	285	372	404
27	72	41	277	365	399
28	74	42	268	358	393
29	76	43	259	350	388
30	78	44	251	343	382
31	80	45	242	336	377
32	82	46	234	329	371

Glass support

9.2
3

Table 5:
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 6:
% inclination relative to the angle in °

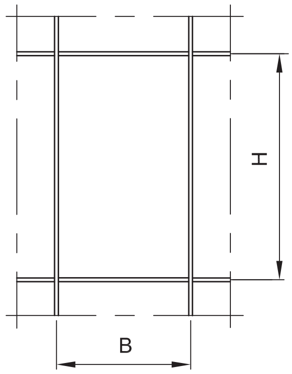
%	Angle (in °)	%	Angle (in °)	%	Angle (in °)	%	Angle (in °)	%	Angle (in °)
1	0.57	21	11.86	41	22.29	61	31.38	81	39.01
2	1.15	22	12.41	42	22.78	62	31.80	82	39.35
3	1.72	23	12.95	43	23.27	63	32.21	83	39.69
4	2.29	24	13.50	44	23.75	64	32.62	84	40.03
5	2.86	25	14.04	45	24.23	65	33.02	85	40.36
6	3.43	26	14.57	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

STABALUX

Glass support

9.2
3

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: Stabalux AL 5060

Mullion-transom joint: TVA 5060

Glass pane format:	W x H	= 1,50 m x 2,50 m = 3,75 m²
Glass structure:		
	ti / SZR / ta	= 12 mm / 8 mm / 16 mm
	ti + ta	= 28 mm = 0,028 m
	t_{Glass}	= **36 mm**

Calculation of the pane weight:

Specific weight of the glass:	γ	≈ 25,0 kN/m³
Pane weight:	**G**	= 3,75 x 25,0 x 0,036 = 3,375 kN **≈ 344 kg**

Calculation of eccentricity "e":

Height of the inner seal:	d	= 5,0 mm
	a1 = 5 + 12/2	= 11 mm
	a2 = 5 + 12 + 8 + 16/2	= 33,0 mm
	e = (12 x 11 + 16 x 33)/28	**= 23,57 ≈ 24 mm**

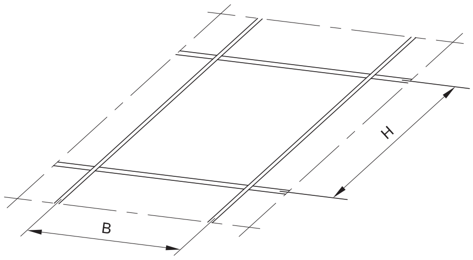
Result:

based on Table 4, row 10: per. G = 376 kg > G = 344 kg — Bolted glass support GH 5202 | B = 200 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

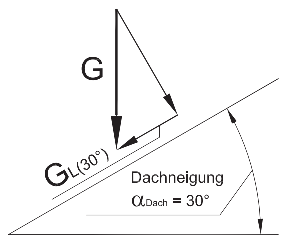
Inclination of the roof surface:	α_{Roof}	= 30°
Transom profile: Stabalux AL 5040		
Mullion-transom joint: TVA 5040		
Glass pane format:	W x H	= 1,25m x 2,00m = 2,50 m²
Glass structure:	ti / SZR / ta	= 10 mm / 16 mm / 10 mm
	ti + ta	= 20 mm = 0,020 m
	$\mathbf{t_{Glass}}$	**= 36 mm**

Calculation of the pane weight

Specific weight of the glass:	γ	≈ 25,0 kN/m³
Pane weight:	G	= 2,50 x 25,0 x 0,020 = 1,25 kN **≈ 127 kg**
The roof inclination exerts the following load share on the glass support:	$G_{L(30°)}$	= 127 x sin 30° **= 63,5 kg**

Calculation of eccentricity "e":

Height of the inner seal:	d	= 10,0 mm
	e	= 10 + 36/2 **= 28 mm**



Result:

Based on Table 1, Row 14: **per. G = 214 kg > $G_{L(30°)}$ = 63,5 kg**	Glass support 5101 | B = 100 mm
Based on Table 3, Row 14: **per. G = 304 kg > $G_{L(30°)}$ = 63,5 kg**	Glass support 5201 | B = 100 mm Glass support 0282 | 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
- Materialprüfungsanstalt Universität of Stuttgart, Stuttgart
- Beschussamt Ulm
- KIT Steel & Lightweight Structures Research Center for Steel, Timber & Masonry, Karlsruhe
- Institut für Energieberatung, Tübingen
- Institut für Wärmeschutz, München
- and many more in Europe and overseas.

Overview of all tests and approvals

9.3
2

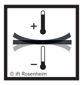
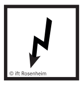
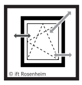
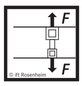
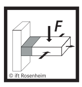
Introduction

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	

Things to Know
Tests / Authorisations / CE Mark

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 authorisations (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 authorisations (abZ); abZ available on request
	**Burglary-resistant facades** **Resistance class RC2 / RC3** according to DIN EN1627		Test reports and expert assessments on request

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 harmonized 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 harmonized standard EN 13830 applies to curtain walls.

Regulation No 89/106 was mainly used to demonstrate to customers that a product conformed to the harmonized 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

BauPV / DOP / ITT / FPC / CE

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).
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 inspection

[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.

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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).

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.

Things to Know
Tests / Authorisations / CE Mark

BauPV / DOP / ITT / FPC / CE

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	0,0dB	
First tests conducted and classification reports prepared by: ift Rosenheim NB no. 0757		Identification number of the certified test laboratory (DoP item 8)

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Declaration of performance template

Declaration of Performance		
LE/DoP no.: 021/CPR/01.07.2013		
1. Product's identification code:		Stabalux (System)
2. Ident.-Number:		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. Harmonized 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	
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 behavior
- Fire spread
- Durability
- Water vapor permeability
- Potential equalization
- 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

DIN EN 13830 / Explanations

planning are stated in the test according to EN 12179. During exposure to the wind loads underlying the planning, 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 $L \leq 3000$ mm
$f \leq 5$ mm $+ L/300$; if 3000 mm $< L < 7500$ mm
$f \leq L/250$; if $L \geq 7500$ 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).

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).

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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 vapor 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 performance profile for this feature, so no accompanying information is required on the CE mark.

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Potential equalization
"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: (k.A) · I1: 200 · I2: · I3: · I4: 700 · I5: 950
4		**Impact resistance** outside with head in mm	(mm)	npd	E0: (k.A) · E1: 200 · E2: · E3: · E4: 700 · E5: 950
5		**Air permeability** with test pressure Pa	(Pa)	npd	A1: 150 · A2: · A3: · A4: 600 · AE: > 600
6		**Watertightness** with test pressure Pa	(Pa)	npd	R4: 150 · R5: · R6: · R7: 600 · RE: > 600
7		**Airborne sound insulation** Rw (C; Ctr)	dB	npd	Rated value
8		**Heat transmittance U_{cw}**	W / m²k	npd	Rated value
9		**Fire resistance** Integrity (E)	(min)	npd	E: 15 · E: 30 · E: 60 · E: 90
10		**Integrity and insulation (EI)**	(min)	npd	EI: 15 · EI: 30 · EI: 60 · EI: 90
11		**Potential equalization**	Ω	npd	Rated value
12		**Resistance to lateral wind load**	kN at m height of the parapet bar	npd	Rated value

Surface coating

Coating of aluminum

In addition to the anodizing anodizing processes, the usual coating methods, such as e.g. air-drying multi-layer paint systems (wet coating) or thermosetting coatings (baked enamel / powder coating) applicable. Due to the different mass distribution, shadow formations in the longitudinal direction are possible with the cover strips DL 5073 and DL 6073. The resulting measures must be taken in coordination with the coater.

Things to Know
Thermal insulation

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 Energy Saving Ordinance (EnEV) 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 optimized 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 AL 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 $U_f \leq 0{,}9$ W/(m² K).

Standards

Index of applicable standards and regulations

EnEV	Ordinance for energy-saving thermal insulation and energy-saving systems in buildings (Energy Saving Ordinance EnEV) dated 01.10.2009.
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:	2013-02, 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 Ucw
DIN EN 673:	2011-04, Glass in building - Determination of thermal transmittance Ug
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-The Uw 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_{Rs} 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 he least favourable point must

Things to Know
Thermal insulation

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

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

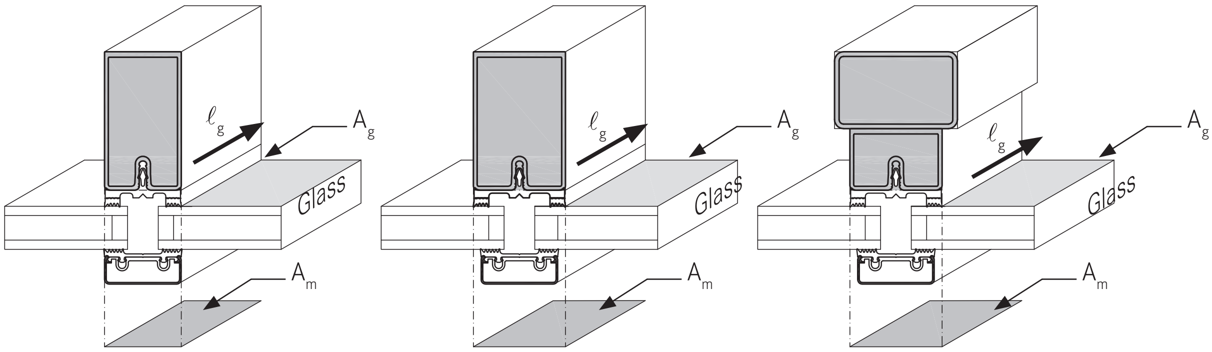
Calculation of the facade surface

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

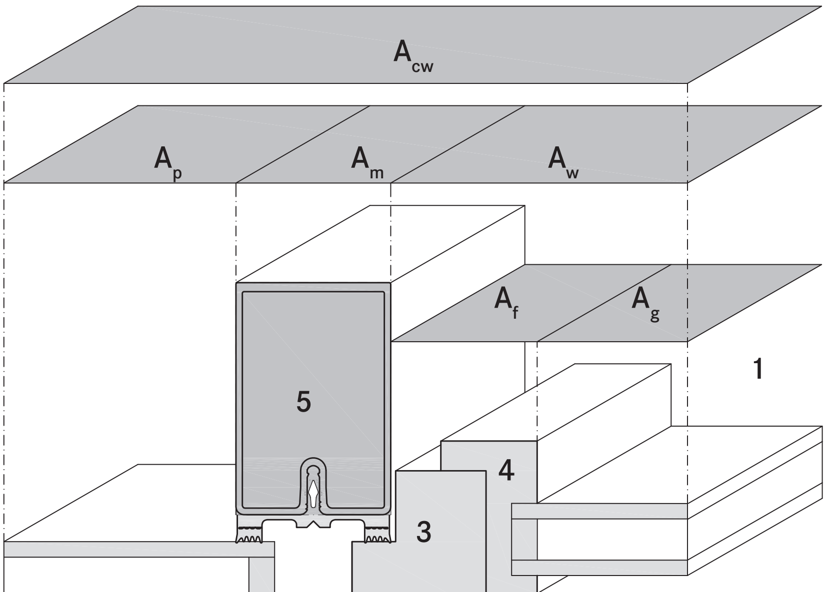
Basis of the calculation

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

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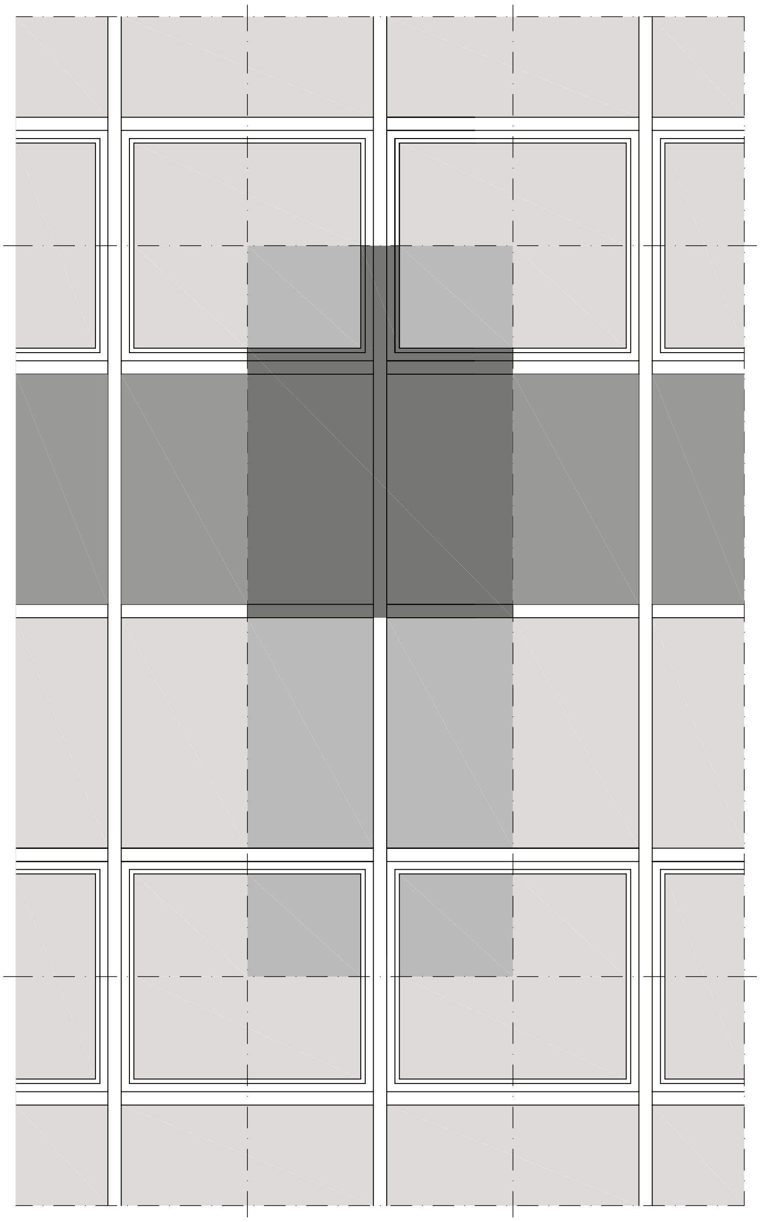
Things to Know
Thermal insulation

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).



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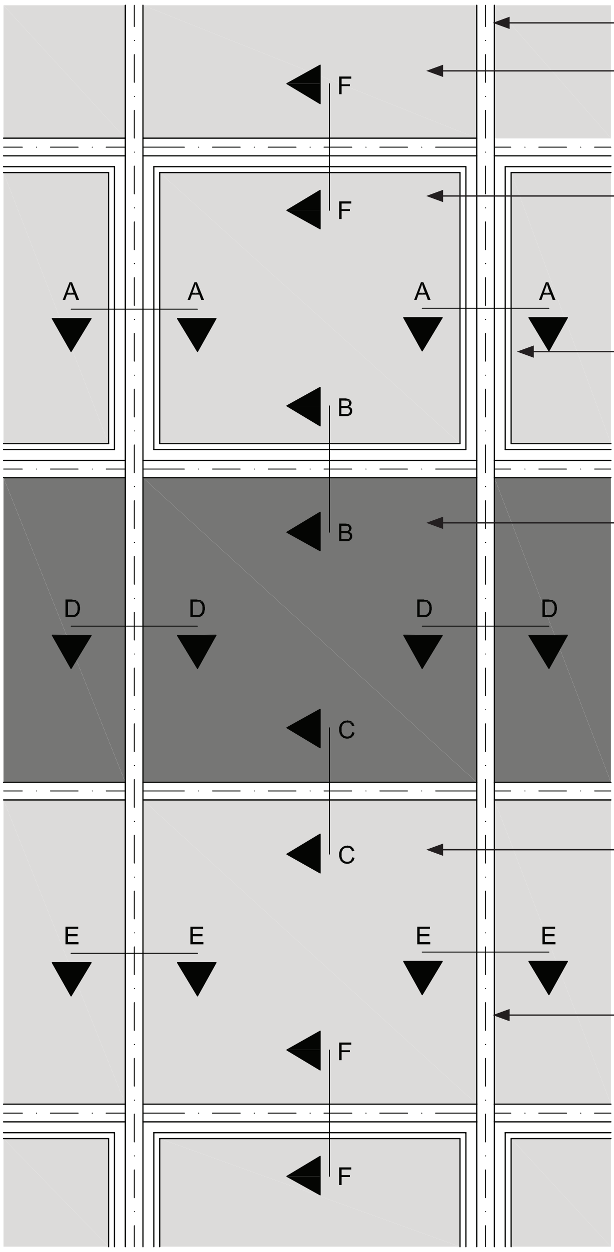
Basis of the calculation

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}.



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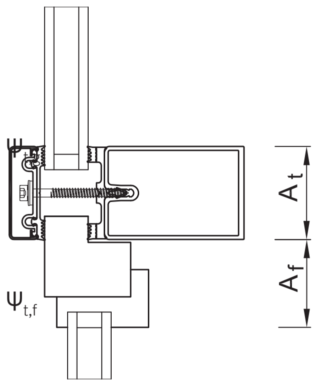
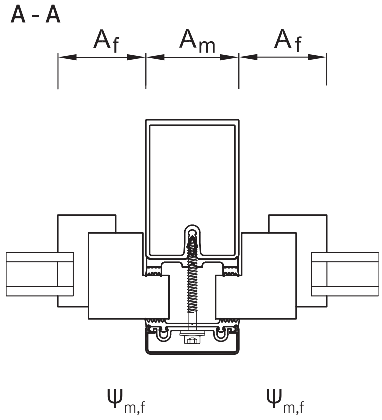
Basis of the calculation

Cuts

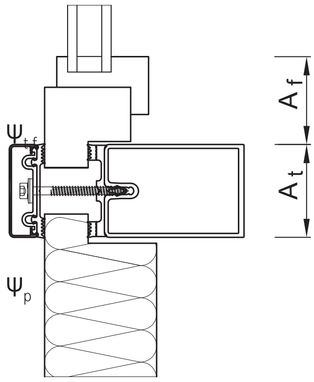
F - F



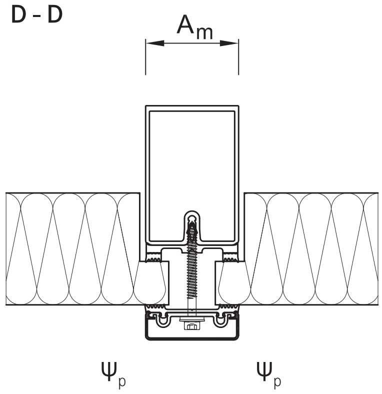
A - A



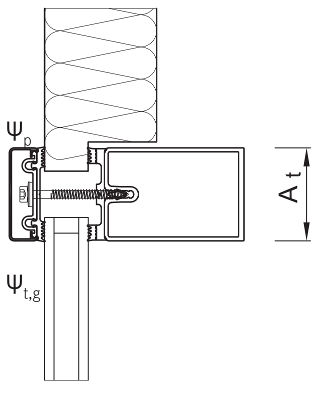
B - B



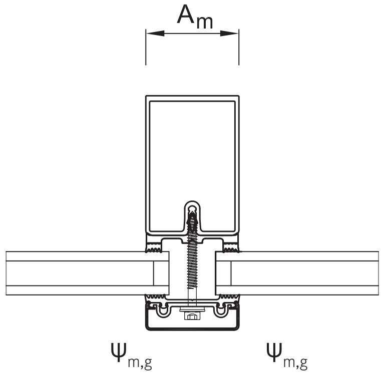
D - D



C - C



E - E



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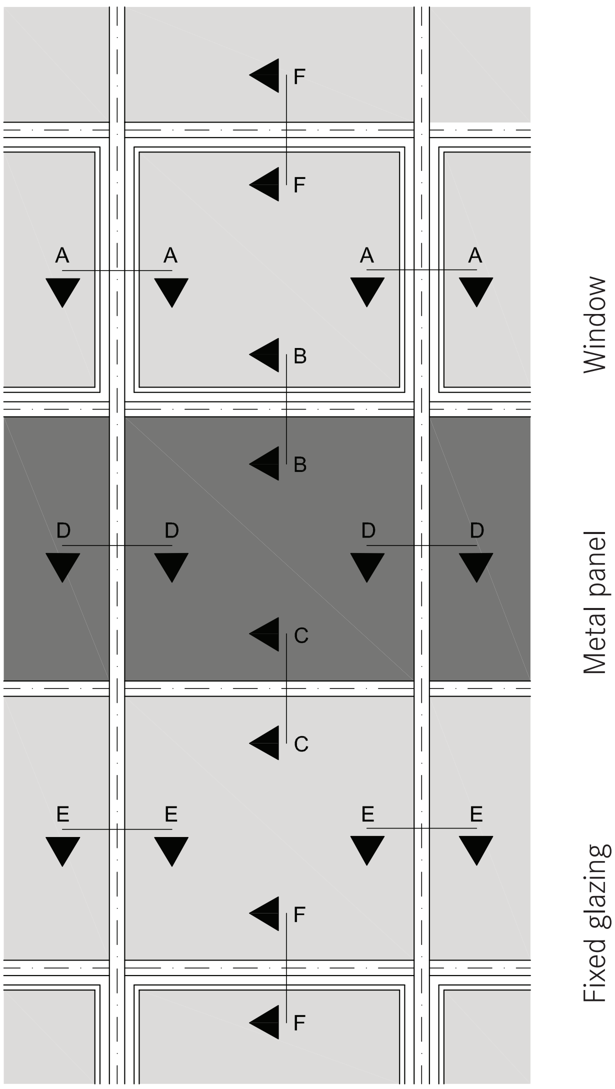
Basis of the calculation

Calculation example

Facade section

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



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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

$A_m = 2 \cdot 3,30 \cdot 0,025 = 0,1650\ m^2$

$A_t = 3 \cdot (1,2 - 2 \cdot 0,025) \cdot 0,025 = 0,1725\ m^2$

$A_f = 2 \cdot 0,08 \cdot (1,20 + 1,10 - 4 \cdot 0,025 - 2 \cdot 0,08) = 0,1650\ m^2$

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 - movable part:

$b = 1,20 - 2 \cdot (0,025 + 0,08) = 0,99\ m$

$h = 1,10 - 2 \cdot (0,025 + 0,08) = 0,89\ m$

$A_{g1} = 0,89 \cdot 0,99 = 0,8811\ m^2$

$l_{g1} = 2 \cdot (0,99 + 0,89) = 3,76\ m$

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 - Typ 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**

$$U_{cw} = \frac{\Sigma A \cdot U + \Sigma \psi \cdot l}{A_{cw}} = \frac{4{,}536 + 2{,}626}{3.96} = 1{,}72 \text{ W/(m2·K)}$$

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	**Aluminum 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

Things to Know
Thermal insulation

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/polycarbon-ate)	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

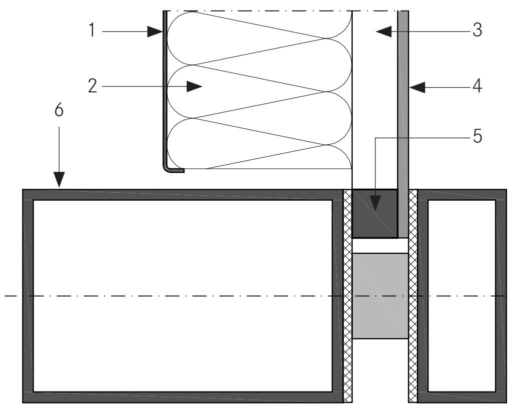
Calculation of the ψ- values according to DIN EN ISO 12631 - 12631 - Annex B - Panels

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: Aluminum/Aluminum Aluminum/Glass Steel/Glass	-	0.13
Panel type 2 with panelling:		
Aluminum/Aluminum	0.2 0.4	0.20 0.29
Aluminum/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.

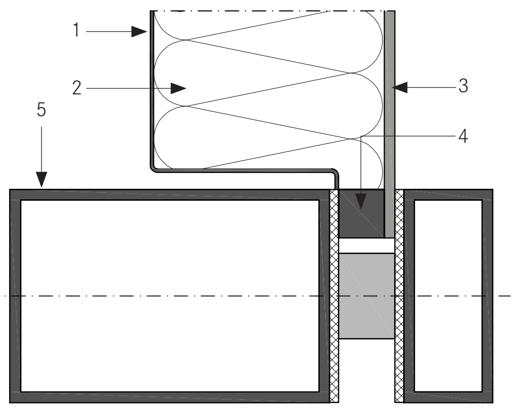
Panel type 1



Caption

1 Aluminum 2,5 mm/Steel 2,0 mm
2 Insulation λ= 0,025 bis 0,04 W/(m·K)
3 Air-filled gap 0 bis 20 mm
4 Aluminum 2,5 mm/Glass 6mm
5 Spacer λ= 0,2 bis 0,4 W/(m·K)
6 Aluminum

Panel type 2



Caption

1 Aluminum 2,5 mm/Steel 2,0 mm
2 Insulation λ= 0,025 bis 0,04 W/(m·K)
3 Aluminum 2,5 mm/Glass 6mm
4 Spacer λ= 0,2 bis 0,4 W/(m·K)
5 Aluminum

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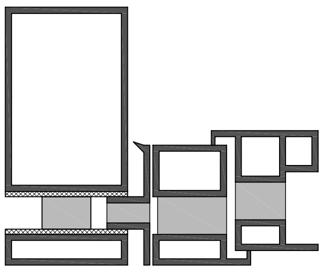
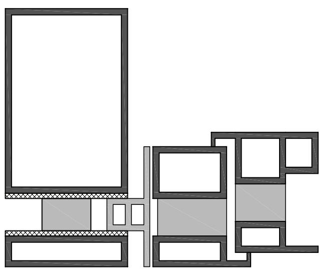
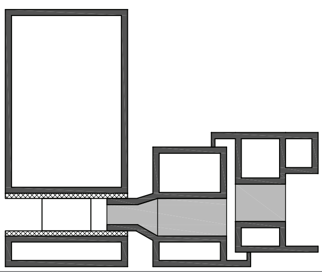
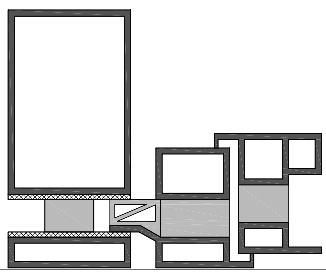
Basis of the calculation

Calculation of the ψ - values according to DIN EN ISO12631 - 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 aluminum 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

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

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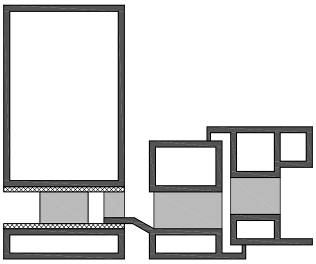
Basis of the calculation

Calculation of the ψ - values according to

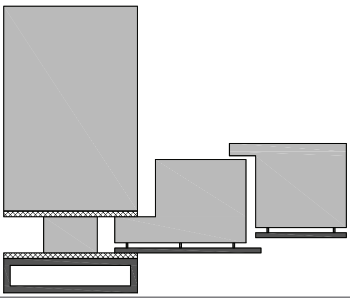
DIN EN ISO 12631 1.2013 - Annex B - Insert elements

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		$U_m \leq$ 2,0 W/(m²·K)	0.04

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Basis of the calculation

Heat transfer coefficient of glass (Ug) 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**	**SF_6****	**Xenon**
Double pane insulating glazing	uncoated glass (Normal glass)	0.89	4-6-4	3.3	3.0	2.8	3.0	2.6
			4-8-4	3.1	2.9	2.7	3.1	2.6
			4-12-4	2.8	2.7	2.6	3.1	2.6
			4-16-4	2.7	2.6	2.6	3.1	2.6
			4-20-4	2.7	2.6	2.6	3.1	2.6
	One pane of coated glass	≤ 0.20	4-6-4	2.7	2.3	1.9	2.3	1.6
			4-8-4	2.4	2.1	1.7	2.4	1.6
			4-12-4	2.0	1.8	1.6	2.4	1.6
			4-16-4	1.8	1.6	1.6	2.5	1.6
			4-20-4	1.8	1.7	1.6	2.5	1.7
	One pane of coated glass	≤ 0.15	4-6-4	2.6	2.3	1.8	2.2	1.5
			4-8-4	2.3	2.0	1.6	2.3	1.4
			4-12-4	1.9	1.6	1.5	2.3	1.5
			4-16-4	1.7	1.5	1.5	2.4	1.5
			4-20-4	1.7	1.5	1.5	2.4	1.5
	One pane of coated glass	≤ 0.10	4-6-4	2.6	2.2	1.7	2.1	1.4
			4-8-4	2.2	1.9	1.4	2.2	1.3
			4-12-4	1.8	1.5	1.3	2.3	1.3
			4-16-4	1.6	1.4	1.3	2.3	1.4
			4-20-4	1.6	1.4	1.4	2.3	1.4
	One pane of coated glass	≤ 0.05	4-6-4	2.5	2.1	1.5	2.0	1.2
			4-8-4	2.1	1.7	1.3	2.1	1.1
			4-12-4	1.7	1.3	1.1	2.1	1.2
			4-16-4	1.4	1.2	1.2	2.2	1.2
			4-20-4	1.5	1.2	1.2	2.2	1.2
Triple-pane insulating glazing	uncoated glass (Normal glass)	0.89	4-6-4-6-4	2.3	2.1	1.8	1.9	1.7
			4-8-4-8-4	2.1	1.9	1.7	1.9	1.6
			4-12-4-12-4	1.9	1.8	1.6	2.0	1.6
	2 panes coated	≤ 0.20	4-6-4-6-4	1.8	1.5	1.1	1.3	0.9
			4-8-4-8-4	1.5	1.3	1.0	1.3	0.8
			4-12-4-12-4	1.2	1.0	0.8	1.3	0.8
	2 panes coated	≤ 0.15	4-6-4-6-4	1.7	1.4	1.1	1.2	0.9
			4-8-4-8-4	1.5	1.2	0.9	1.2	0.8
			4-12-4-12-4	1.2	1.0	0.7	1.3	0.7
	2 panes coated	≤ 0.10	4-6-4-6-4	1.7	1.3	1.0	1.1	0.8
			4-8-4-8-4	1.4	1.1	0.8	1.1	0.7
			4-12-4-12-4	1.1	0.9	0.6	1.2	0.6
	2 panes coated	≤ 0.05	4-6-4-6-4	1.6	1.2	0.9	1.1	0.7
			4-8-4-8-4	1.3	1.0	0.7	1.1	0.5
			4-12-4-12-4	1.0	0.8	0.5	1.1	0.5

* Gas concentration 90%
** The use of SF_6 is prohibited in some countries.

Basis of the calculation

9.4
3

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

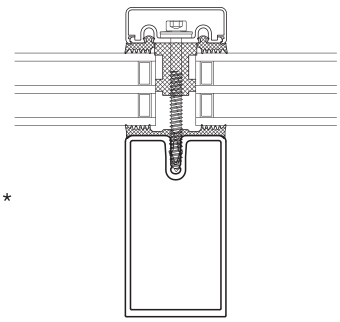
U_f values

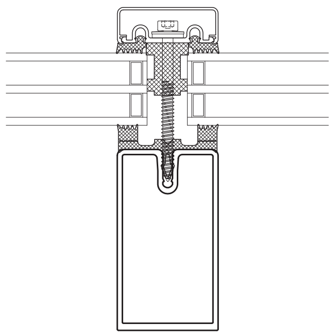
Determination of the U_f values according to DIN EN 10077-2

Stabalux AL

5090
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
AL-5090-**24**-15	(Z0606)	1.022	1.989	1.472	(Z0606)	0.980	1.946	1.513
AL-5090-**26**-15	(Z0606)	0.983	1.949	1.436	(Z0606)	0.951	1.907	1.479
AL-5090-**28**-15	(Z0606)	0.948	1.902	1.394	(Z0606)	0.919	1.862	1.438
AL-5090-**30**-15	(Z0606)	0.916	1.862	1.357	(Z0606)	0.892	1.822	1.402
AL-5090-**32**-15	(Z0606)	0.894	1.833	1.331	(Z0606)	0.876	1.793	1.377
AL-5090-**34**-15	(Z0606)	0.873	1.800	1.302	(Z0605)	0.723	1.761	1.347
AL-5090-**36**-15	(Z0606)	0.859	1.773	1.279	(Z0605)	0.700	1.734	1.325
AL-5090-**38**-15	(Z0605)	0.699	1.747	1.256	(Z0605)	0.675	1.708	1.302
AL-5090-**40**-15	(Z0605)	0.671	1.719	1.230	(Z0605)	0.650	1.679	1.276
AL-5090-**44**-15	(Z0605)	0.634	1.676	1.192	(Z0605)	0.617	1.635	1.237
AL-5090-**48**-15	(Z0605)	0.607	1.640	1.161	(Z0605)	0.594	1.598	1.205
AL-5090-**52**-15	(Z0605)	0.588	1.609	1.134	(Z0605)	0.580	1.566	1.178
AL-5090-**56**-15	(Z0605)	0.575	1.581	1.109	(Z0605)	0.568	1.536	1.152

* **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-AL_9.4_002.dwg

Humidity protection in the glass facade

Humidity protection

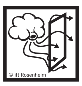
The highest demands are placed in the design of a modern mullion-transom facade, which can only be satisfied through competent planning and careful execution. The physical task of a structurally intact facade is to create a healthy room climate.
Heat insulation properties and humidity protection are 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 AL		Facade 5 mm sealing height	Facades with inclinations up to 20°; overlapping inner sealing	Roof up to 2° inclination
	System widths		**50 mm**	**50 mm**	**50 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:

* Excerpt from DIN 4180-3

Humidity protection in the glass facade

$s_d = \mu \cdot d$*

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.
Used to determine the freedom of fungal growth on window connections. The temperature factor f_{Rs} 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 $\mathbf{f_{Rsi} \geq 0,70}$.

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 4108Thermal 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
- Energy Saving Ordinance (EnEV)
- EnEV Validation of thermal bridges
- DIN EN ISO 10211: Thermal bridges in building construction
- Passive house standard
- DIN EN ISO Thermal and moisture behavior of construction materials and products
- DIN EN 12086 Thermal insulating products for building applications - Determination of water vapour transmission properties

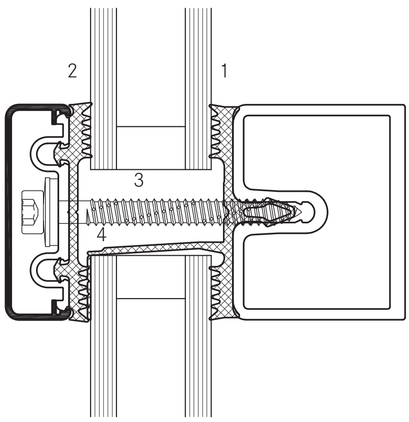
* Excerpt from DIN 4180-3

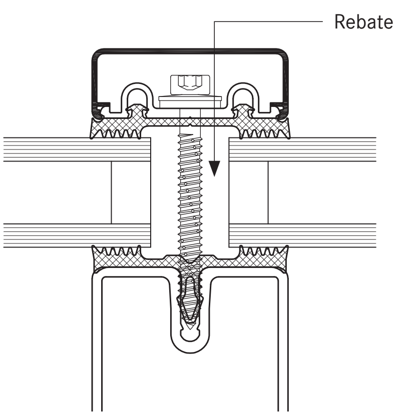
Humidity protection in the glass facade

General requirementsfor glass constructions

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:

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 $S_d \geq 1500$ 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 coefficientμ 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 Sd of no more than 3 m shall be considered vapour-permeable for our constructions.

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 $\ell \geq$ ≥ 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.

The following table shows several examples of materials.

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 a diffusion resistance equal to the component.

Humidity protection in the glass facade

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Design details

Fig. 1 Horizontal wall connection

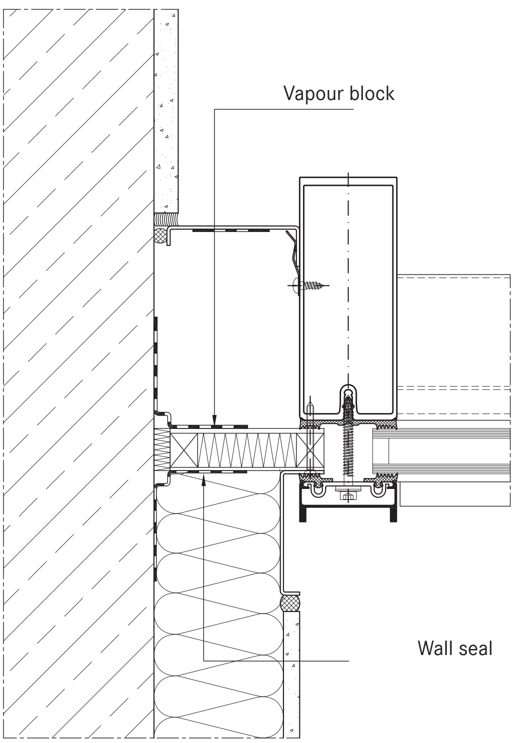


Fig. 2 Ceiling connection

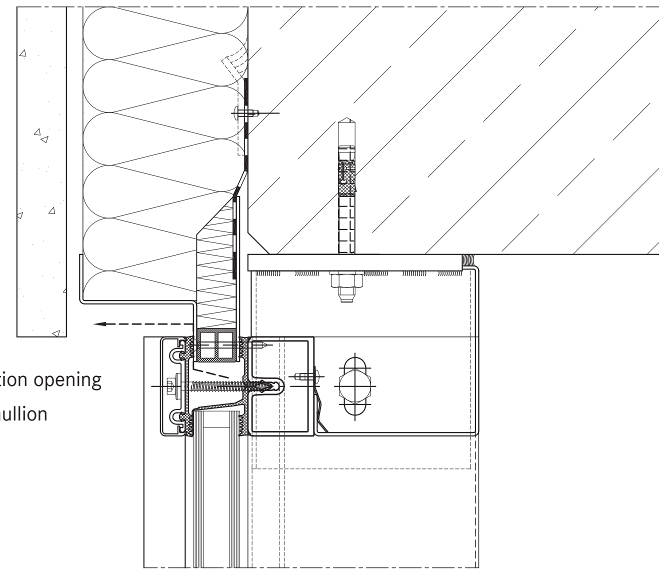
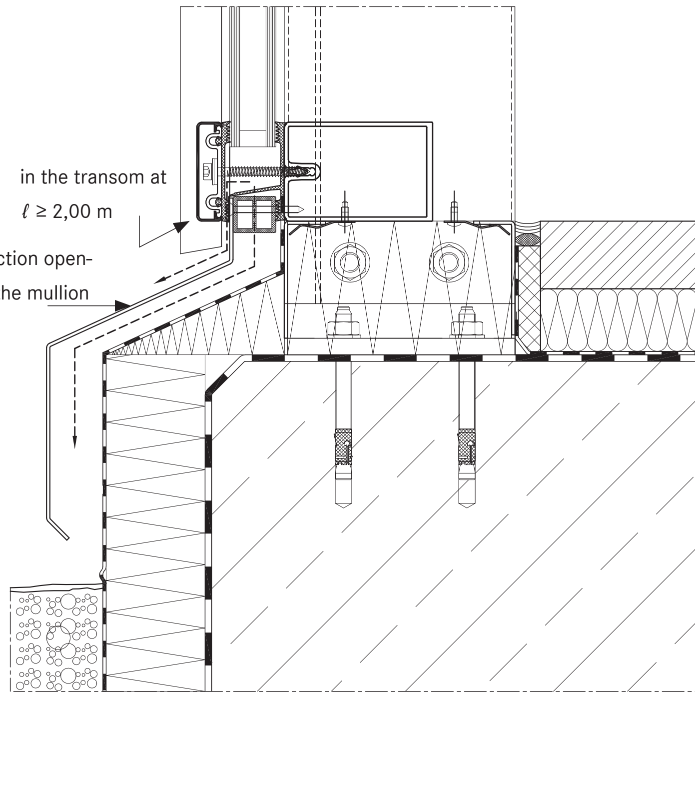


Fig. 3 Foot



Potential equalization and lightning protection of curtain walls

Introduction

Basically, a 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 with each other and connected to the protective potential equalization in order to fulfill an equipotential bonding for personal protection.

Protection against extreme weather conditions is protected by lightning protection systems according to EN 62305. For this an extensive technical planning is necessary.

The planning and design of the equipotential bonding and lightning protection system is not included in the scope of services of the facade manufacturer. The architect / planner must inform himself about the normative requirements of the building. Planning must be provided by the electrical designer in good time. ll standards and regulations must be observed.

Before the initial operation of the electrical system, an acceptance test is required.

Terms

potential equalization

Equipotential bonding is an electrically good conductive connection which is intended to prevent or reduce different electrical potentials and thus electrical voltage between conductive bodies (for example water and heating pipes, antenna installations, electrical equipment). The equipotential bonding should limit all occurring potential differences to a permissible value.

potential differences

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

lightning protection

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

External lightning protection system

The external lightning protection system provides protection against lightning discharges that occur directly in the protective system. It consists of catching device, discharge device and earthing system.

deriving means

The discharge device directs the lightning current from the capture device to the grounding system. It consists of vertical outlets, which are evenly distributed over the circumference of the structure. As discharges both separate lines and sufficiently sized metal parts of the system to be protected can be used.

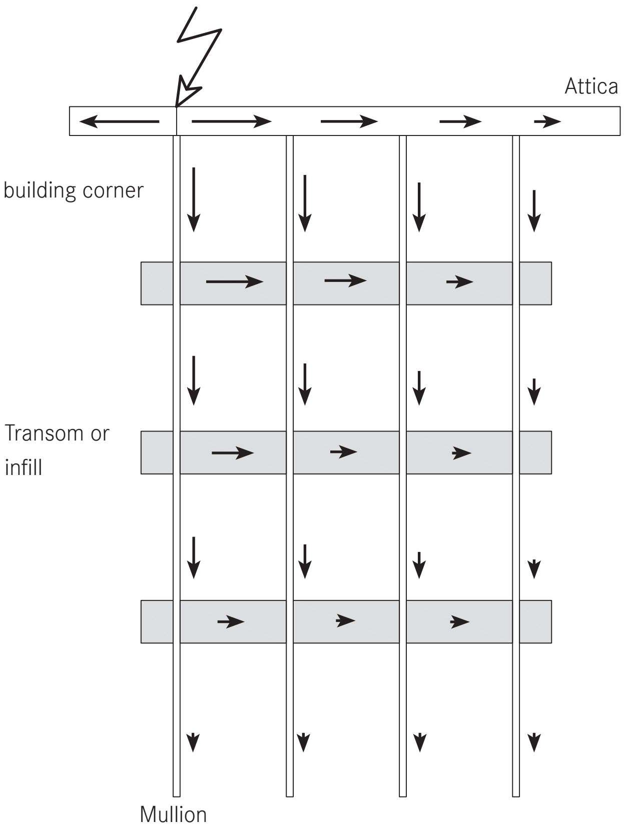
Regulations

- VFF Merkblatt 09.2009 "Potential equalization and lightning protection of curtain walls"
- State building regulations LBO
- Model high-rise guideline MHHR
- EN 13830 - Product standard for curtain walling
- VDE 0100-410: 2007 (IEC 60364-4-41: 2005, modified) - regulates protective measures against electric shock
- VDE 0100-540: 2012-06 (IEC 60364-5-54: 2011, modified) - regulates earthing systems, protective conductors, and protective equipotential bonding conductors
- EN 62305-3 / VDE 0185-305-3: 2011-10 - regulates lightning protection of structures and persons
- EN 62305-4 / VDE 0185-305-4: 2011-10 - regulates advanced measures for construction equipment with requirements against electromagnetic lightning impulses
- VdS 2010: 2015-04 - Risk-oriented lightning and surge protection

Things to Know
Potential equalization / lightning protection

Potential equalization and lightning protection of curtain walls

Distribution of the lightning current in the facade



The lightning strikes preferably at the highest point of the building corner. To prevent damage, the lightning current must be routed to the earthing system via defined discharge devices. For this purpose, electrically conductive components of the building can be used.

Constructive solutions

Equipotential bonding for personal protection

Equipotential bonding must prevent dangerous sparking within the structure which may be due to faulty currents on conductive parts of the system (such as a faulty power line).

A sufficient potential equalization is achieved by the metal frame parts of the facade are electrically connected to each other. Often sufficient for this purpose, the T-joints of the mullion and transom construction.

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

For facade joints that can not be electrically formed, appropriate transition bridges must be used.

Alternatively, a separate discharge device (cables) can be placed in the cavities of the top strips. The minimum cross-sections of the cables must be observed when selecting the top strips.

For component connection of the façade, metallic fasteners of the following minimum cross-sections must be acc. VDE 0100-540 can be applied:

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

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

For connection to the equipotential bonding system, corresponding transfer points must be coordinated and clearly defined during planning. The necessary transfer points can be carried out either on the façade outside or on the façade inside. It is recommended to arrange the connections by floor.

Lightning protection with extended equipotential bonding

Lightning protection equipotential bonding is an extension of equipotential bonding. Lightning protection equipotential bonding is understood to mean the part of the internal lightning protection which, in the event of a lightning discharge into the lightning protection system or into the inserted cables, ensures the safe integration of all externally introduced cables with the equipotential bonding system.

Things to Know
Potential equalization / lightning protection

Potential equalization and lightning protection of curtain walls

If a mullion-and-transom construction is to be used as a natural component of the discharge device, this must be agreed separately and tendered out as a separate item in accordance with the specifications as i.d.R. other connections than otherwise needed.

The equipotential bonding conductors for this connection must be following min. Cross sections acc. EN 62305 have:

Cooper	16 mm^2
Aluminum	25 mm^2
Steel	50 mm^2

Burglary-resistant facades

9.7
1

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 AL	RC 2

Burglary-resistant facades

9.7
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.
- Use of a stainless steel bottom strip for the clamp connection.
- Definition of the screw spacing and the screw depths
- Securing of the screws against loosening.

The appearance of burglar-resistant facades using Stabalux System H 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.
- Stabalux system H preserves all of the benefits thanks to direct screw fittings in the milled groove.

Burglary-resistant facades

9.7
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

Things to Know
Burglary-resistant facades

Burglary-resistant facades - RC2

Resistance class RC2

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

Compared to a normal facade, this only requires a minor additional
manufacturing workload in order to achieve resistance class RC2.

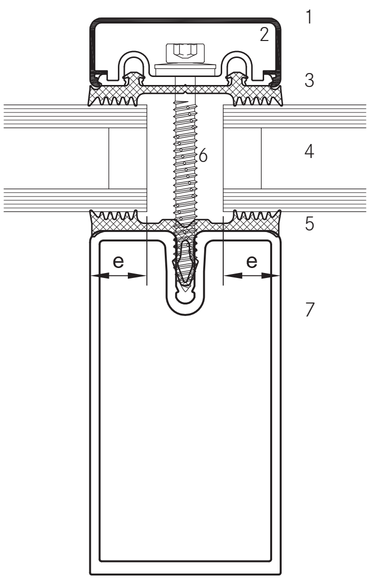
- Securing of the filling elements against lateral displacement.
- Arrangement and selection of the clamping strip screw fittings relative to the permissible axis dimensions in the fields.

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 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

1 Upper strip
2 Stainless steel bottom strip
3 Outer seal
4 Filling element
5 Inner seal
(e.g. with 1 drainage level)
6 System screw fittings
7 Timber support profile

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Things to Know
Burglary-resistant facades

Burglary-resistant facades - RC2

Approved system articles for the Stabalux AL system

System components Stabalux AL	System width 50 mm
Mullion cross-section minimum dimensions	Threaded tube AL 5090
Transom cross-section minimum dimensions	Threaded tube AL 5040
Mullion-transom joint	Bolted transom retainer according to the general building authorisation
Inner seal mullions	e.g. GD 5201, GD 5314
Inner seal transom (with connected transom flag)	e.g. GD 5203, GD 5317
Outer seal mullion	e.g. GD 5024, GD 1932
Outer seal transom	e.g. GD 5054, GD 1932
Clamping strips	UL 5009
Screw fittings for clamping strips	System screws (cylinder head screw with sealing washer , internal hex, stainless steel, e.g. Z 0156)
Glass support	e.g. GH 5101, GH 5201
Lateral blocks	e.g. Z 1061
Screw locks	not neccesary

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.

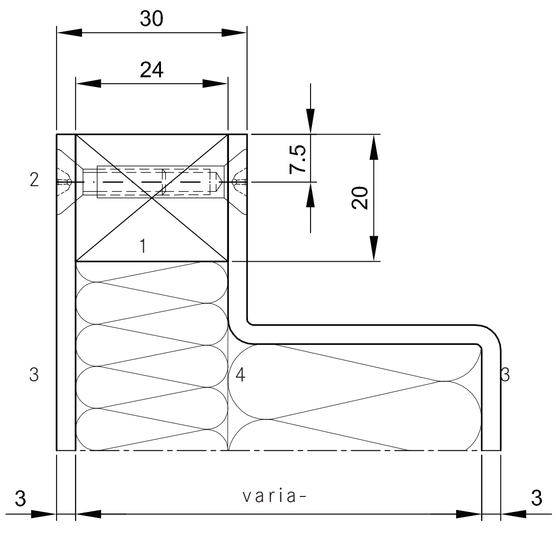
Glass

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.



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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

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

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

STABALUX

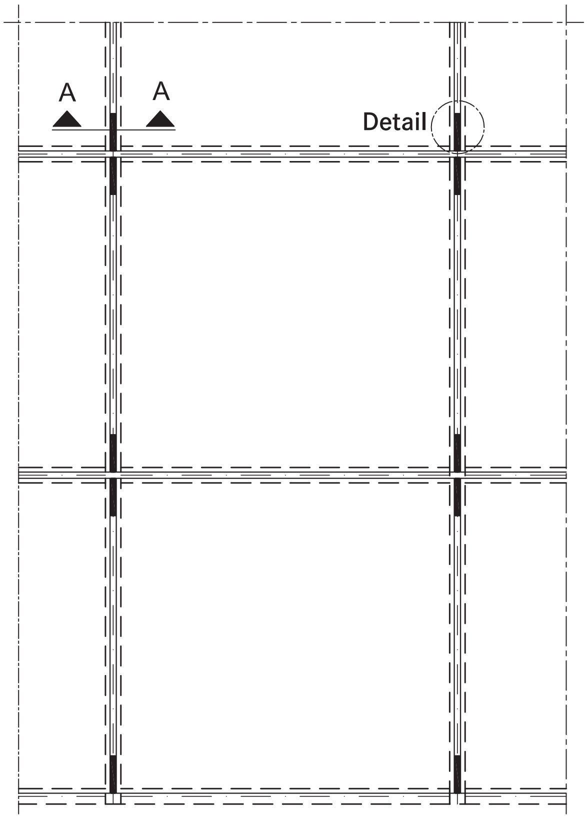
Burglary-resistant facades - RC2

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.

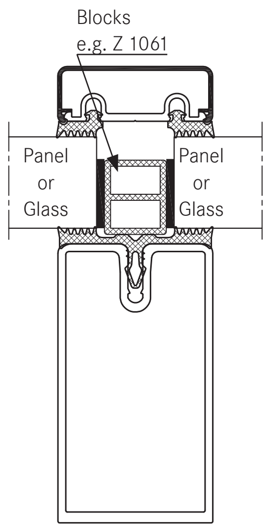
One block must be fitted in each corner of the mullion rebate. The blocks must be glued into the system. The glue used must be compatible with the edge bonding of the filling elements and the blocks. The blocks can also be fixed in place by screwing them to the timber profile.

In addition to the blocks used in the test (art. no. Z 1061, plastic tube h x b x t = 20 mm x 24 mm x 1.0 mm, length ℓ = 120 mm), the blocks can also be cut out of another pressure-resistant, non-absorbent material such as PUR recycling material (e.g. Purenit, Pho notherm).

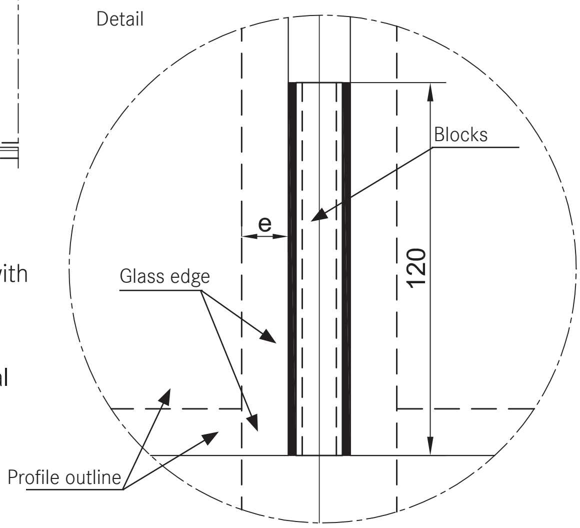


*)Glue in the blocks (the glue must be compatible with the edge bonding of the filling elements)
or
Use fixing screw to secure the position in the central groove

Cut A - A



Detail



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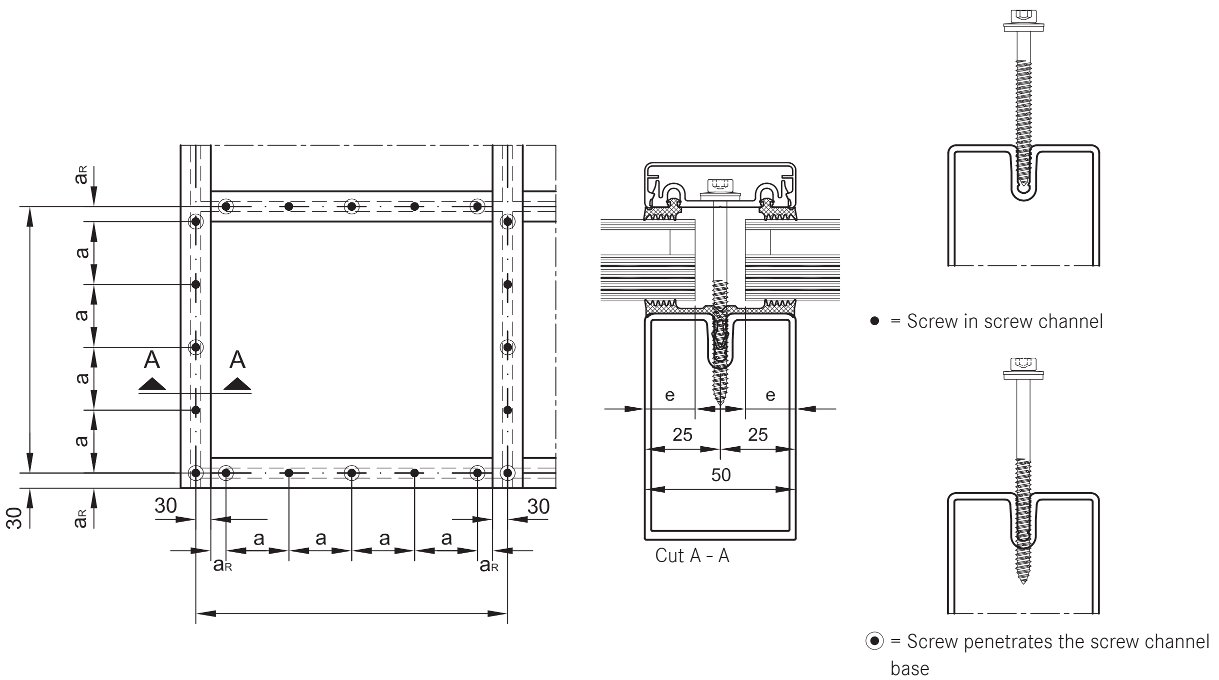
Burglary-resistant facades - RC2

Screw fittings for clamping strips

- 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.

Securing clamping strip screw fittings against loosening

It is not neccesary to secure the clamping strip screw fittings with the Stabalux AL system.



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Burglary-resistant facades - RC2

Assembly instructions

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.

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